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Donald C. Cook Nuclear Plant Units 1 and 2
ANNUAL ENVIRONMENTAL OPERATING REPORT
JANUARY 1, 1997, TO DECEMBER 31, 1997

Attached is the Cook Nuclear Plant Annual Environmental Operating Report for the year 1997. This report was prepared in accordance with procedure 12 PMP 6010 OSD.001, "Offsite Dose Calculation Manual", section 4.8.1, and technical specification, appendix B, part 2, section 5.4.1.

Sincerely,

S Brewer for

E. E. Fitzpatrick
Vice President

/vlb

Attachment

c: J. A. Abramson
A. B. Beach
MDEQ - DW & RPD
NRC Resident Inspector
J. R. Sampson

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Donald C. Cook Nuclear Plant Units 1 & 2

Annual Environmental Operating Report

January 1 through December 31, 1997

Indiana Michigan Power Company
Bridgman, Michigan

Docket Nos. 50-15 & 50-16
License Nos. DPR-58 & DPR-74

9805180427

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I. INTRODUCTION

Procedure 12 PMP 6010 OSD.001, "Offsite Dose Calculation Manual", Section 4.8.1 and Technical Specification, Appendix B, Part 2, Section 5.4.1 require that an annual report, which details the results and findings of ongoing environmental radiological and non-radiological surveillance programs, be submitted to the Nuclear Regulatory Commission. This report serves to fulfill these requirements and represents the Annual Environmental Operating Report for Units 1 and 2 of the Donald C. Cook Nuclear Plant for the operating period from January 1 through December 31, 1997.

During 1997, based on the monthly operating reports for Unit 1 and Unit 2, the annual gross electrical generation, average unit service factors, and capacity factors were:

Parameter	Unit 1	Unit 2
Gross Electrical Generation (MWH)	4,546,279	5,875,213
Unit Service Factor (%)	52.7	65.1
Unit Capacity Factor - MDC* Net (%)	51.9	63.3

II. CHANGES TO THE ENVIRONMENTAL TECHNICAL SPECIFICATIONS

There were no environmental Technical Specification changes in 1997.

III. NON-RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

A. Plant Design and Operation

During 1997, no instances of noncompliance with the Environmental Protection Plan occurred, nor were there any changes in station design, operations, tests, or experiments which involved a potentially significant unreviewed environmental issue.

There were no environmental screenings during the reporting period.

B. Non-Routine Reports

A summary of the 1997 non-routine events is located in Appendix I of this Report. No long-term, adverse environmental effects were noted.

C. Environmental Protection Plan

There were no instances of Environmental Protection Plan noncompliance in 1997.

D. Potentially Significant Unreviewed Environmental Issues

There were no changes in station design, operations, tests or experiments which involved a potentially significant unreviewed environmental issue.

There were no environmental screenings during the reporting period.

E. Environmental Monitoring - Herbicide Application

Technical Specifications Appendix B, Part 2, Section 5.4.1, states that the Annual Environmental Operating Report shall include: summaries and analyses of the results of the environmental protection activities required by Section 4.2 of this Environmental Protection Plan for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous non-radiological environmental monitoring reports, and an assessment of the observed impacts of the plant operation on the environment.

Herbicide applications are the activities monitored in accordance with Section 4.2. There were no preoperational herbicide studies to which comparisons could be made. Herbicide applications are managed by plant procedure 12 PMP 2160 HER.001.

A summary of the 1997 herbicide applications is contained in Appendix III of this report. Based on observations, there were no negative impacts or evidence of trends toward irreversible change to the environment as a result of the herbicide applications. Based on our review of application records and field observations, the applications conformed with EPA and State requirements for the approved use of herbicide.

F. Mollusc Biofouling Monitoring Program

Macrofouler monitoring and control activities continued in 1997. The peak period of abundance of veligers present in the forebay was between August 14 and September 11, with the major peak occurring on August 28. This peak period occurred about one month earlier than is typical for the

lower Great Lakes and immediately preceded the seven week shut down of the chlorination system.

Settlement in the forebay occurred on all sampling dates except May 8. Density data indicate that settlement was low for the first two months and the last two months of the program. Peak settlement was observed between the first part of August and the middle of September. Those observed during the first two months of the program were primarily translocators.

It was fortunate that peak spawning occurred during June and August in 1997 when chlorine was delivered rather than the more typical September-October period. This would have put the peak densities of postveligers in the service water systems during the period when chlorine was not being administered, possibly causing serious clogging problems.

G. Special Reports

Two special reports covering environmental-related activities have been included in Appendix V.

The Pollution Prevention report discusses efforts at the Cook Nuclear Plant in 1997 to prevent generation of waste. The report summarizes the types and amounts of wastes generated on-site and the cost savings attributed to pollution prevention efforts.

The Cook Nuclear Plant Site Survey was produced by a contractor at AEP's request to provide a preliminary review of habitat information to update previous data regarding species and habitats on-site.

To summarize existing habitat conditions at the Cook Nuclear Plant, plant communities have matured and evolved significantly, especially in the areas disturbed by the original construction. Habitat was assessed for two State Threatened species and six Special Concern species thought to occur on or near the site, and all species of concern listed as occurring in Berrien County. Through an analysis of habitat requirements and existing site conditions, some of the listed species known to occur in Berrien County were eliminated from consideration, since appropriate habitat conditions are not present on this site and occurrence is highly unlikely.

IV. RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

The Radiological Environmental Monitoring Program annual report is located in Appendix VI of this report.

The objectives of the operational radiological environmental monitoring program are:

1. Identify and measure radiation and radioactivity in the plant environs for the calculation of potential dose to the population.

2. Verify the effectiveness of in-plant measures used for controlling the release of radioactive material.

3. Provide reasonable assurance that the predicted doses, based on radiological effluent data, have not been substantially underestimated and are consistent with applicable standards.

4. Comply with regulatory requirements and Station Technical Specifications and provide records to document compliance.

A. Changes to the REMP

As indicated in Appendix VI, there were several identified changes to the ODSM during 1997 as follows:

- Deleted Technical Specification Clarification #14, Revision 6,
- Changed compensatory sampling interval,
- Added 25% grace period for surveillance requirements,
- Clarified need for compensatory sampling of ESW system when respective radiation monitors are inoperable unless the containment spray heat exchangers are in service,
- Added note on attachment for determination of start-up flash tank flow rate to improve documentation and changed this flow rate based on estimated steam generator blowdown flow vs. dry value position,
- Incorporated new Eberline liquid radiation monitors that replaced Westinghouse monitors,
- Added table allowing plant to use RMS readings in lieu of sampling gland seal exhaust since operational data indicates routine sampling is non-productive, and
- Added clarification to attachment 3.4 for purging or venting.

B. Radiological Impact of Donald C. Cook Nuclear Plant Operations

This report summarizes the collection and analysis of various environmental sample media in 1997 for the Radiological Monitoring Program for the Donald C. Cook Nuclear Plant.

The various analyses of most sample media suggest that there was no discernible impact of the nuclear plant on the environment. The analysis of air particulate filters, charcoal cartridges, direct radiation by thermoluminescent dosimeters, fish, water, mild and sediments from Lake Michigan, drinking water, and food products, either did not detect any radioactivity or measured only naturally occurring radionuclides at normal background levels.

The only radionuclide which appears attributable to the Donald C. Cook Nuclear Plant operation is tritium, which was measured at low levels in onsite wells.

C. Land Use Census

The Land Use Census is performed to ensure that significant changes in the immediate vicinity of the Donald C. Cook Nuclear Plant are identified. Any identified changes are evaluated to determine whether a modification must be made to the REMP or other related programs. A further discussion of the land use can be found in Appendix VI of this report.

D. Solid, Liquid, and Gaseous Radioactive Waste Treatment Systems

There were no changes in the solid, liquid, or gaseous radioactive waste treatment systems during 1997.

V. CONCLUSION

Based upon the results of the radiological environmental monitoring program and the radioactive effluent release reports for the 1997 reporting year, it can be concluded that there were no adverse affects to the environment or to the general public due to the operation of the Donald C. Cook Nuclear Plant.

APPENDIX I

NON-ROUTINE REPORTS

1997

1997 Non-Routine Events

November 8, 1997 - During continuous Chlorination of the Service Water systems, personnel inadvertently discharged a portion of chlorination Service Water to Outfall 002 for approximately nine hours without performing the required sampling and analysis for Total Residual Oxidant. These samples were missed due to a valve lineup error made during the startup of continuous chlorination after a short shutdown for general maintenance on the circulating water system.

July 13, 1997 - An exceedence occurred during intermittent chlorination when the Outfall 001 analyzer was found to have drifted in a non-conservative direction, resulting in readings actually 20 times lower than they should have been.

APPENDIX II

ENVIRONMENTAL SCREENING REPORTS

1997

There were no environmental screenings to report in 1997.

APPENDIX III

HERBICIDE APPLICATION REPORT

1997

AMERICAN ELECTRIC POWER

Date March 27, 1998

Subject 1997 Herbicide Spray Report - Cook Nuclear Plant

From E. C. Mallen

To J. P. Carlson

The following herbicides were applied on Cook Nuclear Plant property during 1997:

Round –Up Pro
Oust
Howard Johnson's Weed and Feed with Tri-mec
Round - Up
Riverdale Solution
Preen

From June 30, to July 3, 1997, a mixture of Round-Up Pro, Oust, and Riverdale Solution was used for total plant control in the switch yards, railroad right-of-way, around buildings, parking lots, the sewage and absorption ponds, and within the plant's protected area. The application was performed by DeAngelo Brothers, a licensed herbicide applicator on contract to the AEP Western Division. A total of 118.75 ounces of Oust 712.5 ounces of Riverdale Solution, and 142.5 quarts of Round-Up Pro were used for the application and spread over 40.52 acres. The following are the application rates used compared to the allowable application rates.

Product Name	Quantity Used	Quantity Used/Acre	Quantity Allowed/Acre
Round-Up pro	142.5 qt.	3.52 qt.	5 qt. (1)
Riverdale Solution	712.5 oz.	17.58 oz.	45 oz.
Oust	118.75 oz.	2.93 oz.	8 oz.

(1) Based on application rate for Dandelion, Curly dock, woody brush and trees.

On September 9, 1997, the mortality of this herbicide application was assessed at 90%. The following discrepancies were noted:

- Some vegetation growth near the center of fenced-in area at meteorological tower.
- Application not performed in new CESA yard.
- Large tufts of grass south of cable spools in fenced-in area south of Warehouse #6.
- Grape vines and small oaks along inside of fence between 765 & 345 KV yards.
- Small maples in railroad tracks in 765 KV yard, also in SE corner of yard by small transformers.
- Training Building transformer and A/C unit area did not receive an application.
- PM&IS steel yard needs treatment under steel racks; some small trees growing.

Round-Up mixed with water in a backpack sprayer was used to spot spray weeds in the landscaped stone areas around the plant site and under the racks in the PM&IS steel yard. A total of 68 ounces of Round-Up was used for spot spraying in 1997. The applications were performed by a licensed applicator from the Maintenance ANR Buildings and Grounds Crew.

Two applications of Preen were used for weed control in planting beds around the North Guardhouse entrance and Training Building in 1997. Twelve pounds of Preen granules were spread over 2,703 square feet during the first application on June 10, 1997 and twelve pounds were spread over the same area during the second application on October 1, 1997. This amounted to an application rate of 0.71 oz./10sq. ft. per application. The allowed label rate was 1 oz./10sq. ft. per application. The herbicide was applied by a licensed applicator from the Maintenance ANR Buildings and Grounds crew. The herbicide was 90% effective and controlled weeds in the planting beds cutting back on weeding time.

A single application of Howard Johnson's Weed & Feed with Tri-mec was applied to the plant lawns for weed control on May 14, 16, 20, 22, 28, and June 5, and 9, 1997. A total of 1,900 pounds was spread over 12.88 acres. This amounted to an application rate of 3.4lb./1,000 sq. ft. The allowed label rate was 4lb./1,000 sq. ft. The herbicide was applied by the licensed applicator from the Maintenance ANR Buildings & Grounds crew.

The plant lawns were inspected on June 20, and Sept. 9, 1997. The results of the inspection are as follows:

- A patch of clover and two strands of English Ivy were noted on the north side of the plant office buildings.
- A clover patch, dandelion, and crab weed, were present on the south side of the north guardhouse.
- The SGRP (old CESA yard) office building area showed a large reduction in the numbers of dandelions and weeds present from previous years.
- Large patches of clover were noticed on the hill behind the Training Center.
- The lawn between the sidewalks and building on the south side of the Training building (below the library) had dandelions starting and spurge present.

In summary, based upon our review of the application records, manufacturer specifications, material safety data sheets (MSDSs) and observations of the treated areas, the herbicides were applied according to the manufacturer's labeled instructions and according to Federal and State requirements. A certified applicator was used as required. Detailed maps and application records are filed in 12 PMP 2160 HER.001, Guidelines for the Application of Approved Herbicides. No signs of over spray or spillage were observed or noted. No adverse environmental effects occurred.

c: W. Tucker
W. Hannah

APPENDIX IV

SPECIAL REPORTS

APPENDIX IV.A

1997 POLLUTION PREVENTION REPORT

AMERICAN ELECTRIC POWER

DONALD C. COOK NUCLEAR PLANT

1997 POLLUTION PREVENTION REPORT

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Foreword

The Environmental Compliance personnel at the Donald C. Cook Nuclear Plant assembled this Pollution Prevention (P2) report. The waste reduction and cost savings achieved in 1997 reflect the dedication of AEPNG employees' commitment to environmental principals and cost efficiency in pursuit of environmental excellence.

Copies of this report can be obtained by calling (616) 465-5901 ext. 1153 or sending a request to Environmental Compliance, One Cook Place, Bridgman, Michigan, 49106.

American Electric Power Nuclear Generation
1997 Pollution Prevention Report

1.0 EXECUTIVE SUMMARY

1.1 Waste generation data is tracked using the Electric Power Research Institute's Accounting Software Application for Pollution Prevention (ASAPP) to determine trends and assess benefits of pollution prevention efforts and to evaluate reduction goals.

1.2 The AEP Nuclear Generation Group met our goal of reducing hazardous and mixed waste (78% - the highest ranking pollutant according to the Environmental Protection Agency) and used oil (8%) by more than 5% per year in 1997.

1.3 Liquid Industrial Waste (-6%) and Trash (-25%) goals were not met for 1997 due to extended outages and associated work scope increases. However, Liquid Industrial Waste and Trash generation decreased from the baseline by 95% and 41%, respectively.

1.4 Over $823,000 in avoided costs were achieved in 1997 due to hazardous waste and contaminated sewage sludge prevention measures.

2.0 INTRODUCTION

2.1 Policy and Goals

The American Electric Power Nuclear Generation Group (AEPNG) Pollution Prevention (P2) policy is implemented through our Pollution Prevention Plan (12 PMP 2160 CWM.001). Our 1997 goal was to meet the Environmental Protection Agency's (EPA) recommended industry standard of reducing all categories of waste by 5% per year. Our P2 policy states:

> "We will continue to reduce and, where practical, eliminate waste through the use of source reduction, recycle/reuse and treatment techniques. The handling and disposal of all waste will be conducted in a safe and responsible fashion in accordance with regulatory requirements."

Our plan reflects the hierarchy for managing wastes included in the U.S. Pollution Prevention Act of 1990.

MOST PREFERRED	Source Reduction
	Toxicity Reduction
	Reuse
LEAST PREFERRED	Recycling
	Treatment/Volume Reduction
	Disposal

This report documents progress toward our reduction goals and attempts to identify reasons goals were met or not met. Although two refueling outages were planned for 1997, an additional three months of unplanned unit shutdowns contributed to significant increases in several waste streams as discussed under specific sections. Despite the extended outages, many waste streams were reduced significantly despite the added burden of the extended plant shutdown.

2.2 Pollution Prevention Process

No significant changes in our P2 process were implemented from what was discussed in the 1992-1996 Pollution Prevention Report. Twelve high priority waste streams were listed for potential action in 1997. All of these waste streams were evaluated by the recommended lead departments to determine the status of the issues and the need for follow up action. These are discussed under specific waste stream headings.

3.0 GENERIC POLLUTION PREVENTION ACTIVITIES

3.1 1997 Goals

Waste generation was tracked for five categories of waste: hazardous, liquid industrial used oil, low level radioactive and trash (Table 3.1.1 and Figure 3.1.1). In addition, asbestos and radioactive sewage sludge was included in Table 3.1.1. Universal wastes are discussed under Section 9.0.

Table 3.1.1 1992-1997 Total Cook Nuclear Plant Waste Generation

Waste Category	Units	1992	1993	1994	1995	1996	1997	% Reduced 1996 to 1997
Hazardous Waste	Lbs	7,294	8,095	12,358	7,383	6,775	1,595	76%
Mixed Waste	Lbs	3,861	867	617	211	563	27	95%
Hazardous & Mixed	Lbs	11,155	8,962	12,975	7,594	7,338	1,622	78%
Liquid Industrial	Gal	206	2,317	10,813	1,894	2,020	1,716	15%
Radioactive Liq. Ind.	Gal	14,765	42,191	1,940	686	199	644	-324%
Rad & Clean LIW	Gal	14,971	44,508	12,753	2,580	2,219	2,360	-6%
Used Oil	Gal	2,760	3,860	7,105	5,040	5,050	4,915	3%
Rad. Used Oil	Gal		2,255	2,710	1,045	1,485	1,090	27%
Rad & Clean Used Oil	Gal	2,760	6,115	9,815	6,085	6,535	6,005	8%
Low Level Rad.	CuFt	8,000	7,000	3,900	1,467	1,034	1,201	-17%
Trash	CuYd	13,926	11,564	9,406	6,800	6,556	8,192	-25%
Asbestos	CuYd	300	60	215	80	40	40	0%
Rad Sewage Sludge	Gal	0	52,987	48,506	60,000	31,534	0	100%

Shaded areas reflect established baselines to evaluate P2 accomplishments.

The 5% annual reduction goals were achieved for two of the five waste categories including hazardous waste (78%), and used oil (6%). Due to the six months of extended plant outages in 1997, liquid industrial waste, low level radioactive waste and general trash generation increased from 1996 levels.

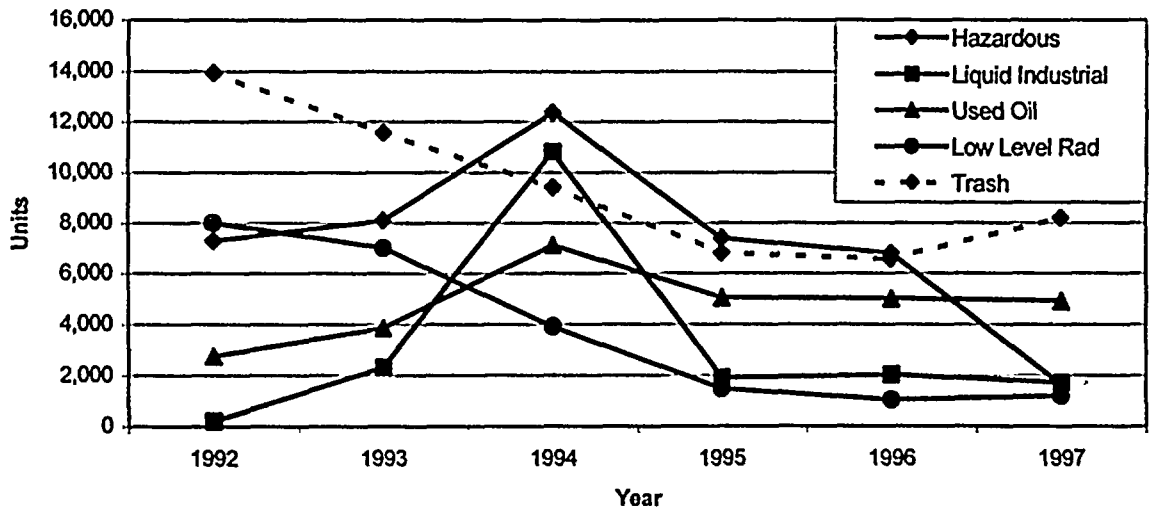
The significant hazardous waste reductions were largely due to the reclassification of lighting waste and batteries as universal wastes. However, when these waste streams are removed from the 1996 and 1997 calculations, we still achieved a 38% reduction for the year as discussed later in Section 4.0. Used oil reductions occurred due to better container management and daily review of used oil generation.

In addition to the standard categories that were reduced, the elimination of 112,000 gallons of radioactive sewage sludge also resulted in savings of at least $320,000.00 in 1997. Reductions in costly radioactive wastes include substantial decreases in both mixed waste and radioactive used oil.

The low level radioactive waste reduction goal would have been met with the exception of the fibrous materials (insulation, etc.) required to be removed from both containment buildings in 1997. The liquid industrial waste reduction goal was not met due to the replacement of non-hazardous solvent in all parts cleaners throughout the plant due to the increased workload associated with the extended outages. Also, office floor stripping solutions are no longer permitted to be discharged to the turbine room sump and now create liquid industrial waste. Over 400 gallons were generated in 1997.

Trash levels increased due to the increased workload associated with the extended outages.

Figure 3.1.1 1992-1997 Waste Generation



Waste goals and tracking have been based on year to year comparison, which do not completely convey the significant progress we have made in the last five years. Table 3.1.2 compares the projected waste reductions from the baseline years, 5% per year, to actual reductions achieved. Future goals may have to be adjusted to reflect the very low levels of generation we have achieved in some categories. Goals relating to specific waste streams may be more appropriate, in some cases.

Table 3.1.2 1992-1997 Projected (5%/Yr) vs. Actual Waste Reductions

Waste Category	Units	1992	1993	1994	1995	1996	1997	Reduction From Baseline
Hazardous & Mixed								
Projected	Lbs			12,975	12,326	11,678	11,029	15%
Actual		11,155	8,962	12,975	7,594	7,338	1,622	87%
Rad & Clean LIW								
Projected	Gal		44,508	42,283	40,057	37,832	35,606	20%
Actual		14,971	44,508	12,753	2,580	2,219	2,099	95%
Rad & Clean Used Oil								
Projected	Gal			9,855	9,362	8,870	8,377	15%
Actual		2,760	6,115	9,855	6,085	6,535	6,133	38%
Low Level Rad.								
Projected	CuFt	8,000	7,600	7,200	6,800	6,400	6,000	25%
Actual		8,000	7,000	3,900	1,467	1,034	1,201	85%
Trash								
Projected	CuYd	13,926	13,230	12,533	11,837	11,141	10,445	25%
Actual		13,926	11,564	9,406	6,800	6,556	8,192	41%

Shaded areas reflect established baselines to evaluate P2 accomplishments

3.2 Training and Awareness

Environmental training related to pollution prevention included contractor orientation during outages. A chemical and waste management guidebook was prepared by the Environmental Affairs Section and distributed to contractor supervisors prior to the outages. The books give guidance on waste minimization, proper disposal, and proper approval and storage of chemicals.

3.3 Projects

Improved pre-planning of projects continues to improve waste management efforts for projects with high generation potential. The construction of the new paint and blast shack will reduce waste and cost by reuse and recycling blast grit. A recyclable steel shot blasting system replaced the previous blast grit system and a solvent recovery system was installed to recycle solvents used for paint gun cleaning.

3.4 Chemical Use Review Board

The Chemical Use Review Board (CURB) reviews all new chemicals before they are brought on site for health hazards, system compatibility, waste disposal, and fire codes. In addition, the CURB addresses issues such as chemical overstocking, alternative uses for chemicals, other facilities that may be able to use a chemical that is no longer used on site, and miscellaneous chemical control issues. These issues are conveyed to the workforce that waste reduction starts at the source.

Efforts continued to reduce the number and toxicity of chemicals used on site. Removal of excessive quantities of chemicals from storage and chemicals no longer needed on site continued with the majority of the materials shipped for beneficial reuse options. Progress was made on flammable solvent usage with the long-term goal to eliminate open-access to bulk drums of solvents including isopropanol and acetone.

3.5 Sequencing Batch Reactor

The new sequencing batch reactor (SBR) allows for digester sludge to be isolated in small batches versus continuous concentration that occurred with the "package plant" digester it replaced. This lowers the concentration of the digester sludge to levels below environmental release limits for radioactivity. Over $320,000 in disposal cost savings were realized in 1997.

3.6 P2 Technology Transfer

The Environmental Affairs Section participated in two workshops to present P2 information in 1997. These included: 1) presenting "Mixed Waste Prevention through Chemical Control Programs: Chemical Use Review Board" at the Electric Power Research Institute's (EPRI) International Low-Level Waste Conference in Providence, Rhode Island, and 2) serving as industrial table facilitator at the annual Michigan Pollution Prevention Roundtable in Lansing, Michigan.

4.0 HAZARDOUS AND MIXED WASTE

4.1 General Description

Total hazardous waste decreased significantly (78%) in 1997 primarily due to the reclassification of lighting waste as a universal waste. However, when hazardous waste totals are adjusted to account for the 4,186 pounds of lighting waste, there is still a 38% decrease in hazardous waste for 1997 from 1996 levels.

The most significant decreases were paint (50%), out-of-spec (OOS) / expired materials (85%), and lead-contaminated clothing (100%). The changes in the firing range to upgrade the bullet

and debris collection system were directly responsible for the reductions in lead-contaminated clothing and debris from 1996 levels. Better chemical control and completion of the major chemical inventory reduction in 1996 also resulted in OOS waste reduction.

Flammable solvent contamination of a parts washer was responsible for the largest quantity of hazardous waste. Since a solvent contamination incident in March 1997, hazardous waste generation has remained under the conditionally exempt limit of 100 kg per month and a change in generator status may occur in the near future.

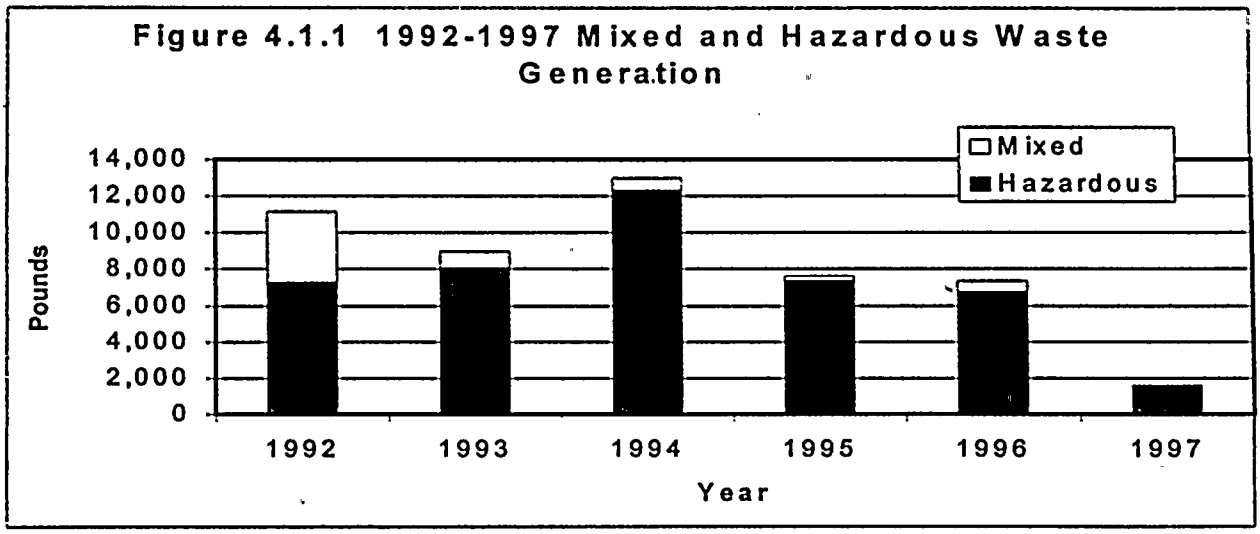
Hazardous waste management costs continued their decline in 1997 to an estimated $16,000 from the $63,000 spent in 1996. The substantial reduction was due to the overall decrease in generation as well as specific reductions in mixed waste; 563 pounds to 27 pounds in 1997.

With no mixed waste being shipped off site during 1997, a significant cost saving was achieved. The current cost of handling mixed waste is approximately $10,000 per shipment.

Table 4.1.1 1992-1997 Hazardous and Mixed Waste Generation and Costs

			Baseline (BL)				Accum.	% in
	1992	1993	1994	1995	1996	1997	Savings	1996/1997
Hazardous (lbs)	7,294	8,095	12,358	7,383	6,775	1,595	$21,321	76%
Mixed Waste (lbs)	[illegible]	867	617	211	563	27	$7,132	95%
Hazardous & Mixed (lbs)	11,155	8,962	12,975	7,594	7,338	1,622	$16,990	78%
Management Costs ($)	$126,327	$102,381	$79,295	$70,585	$63,117	$15,946	$88,537	75%
Avoided Costs ($)	$0	$76,167	$73,123	$93,620	$99,176	$125,457	$467,543	

Shaded areas reflect established baselines to evaluate P2 accomplishments



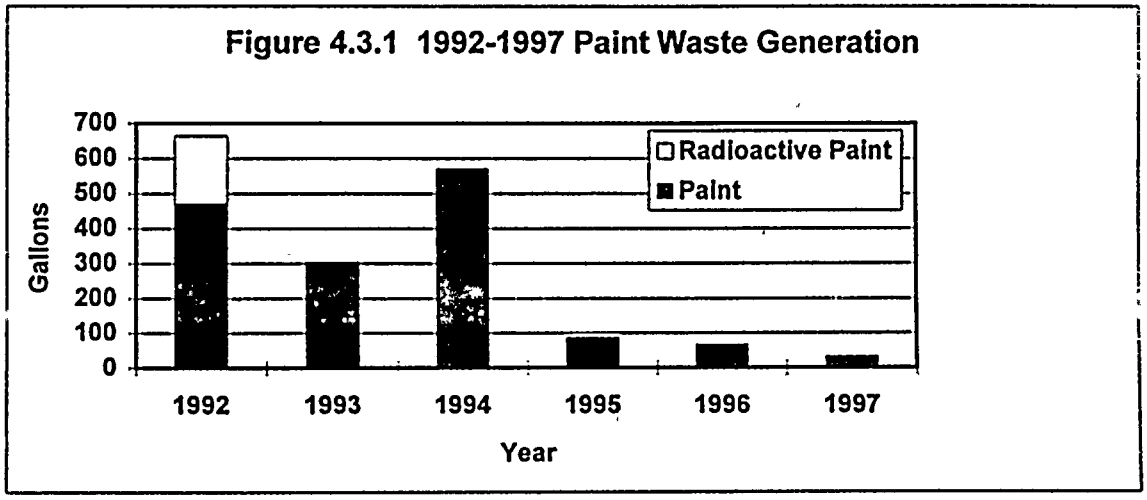
4.2 Flammable Solvents

Solvent contamination of oil and non-hazardous solvents continues to be an issue with 25% of the total hazardous waste generation being caused by isopropanol contamination of non-hazardous parts washer solvent. This is similar to previous years when freon contamination of oil created considerable quantities of hazardous waste. Continued efforts to eliminate employee access and use of bulk solvents (isopropanol and acetone) are being pursued to resolve the issue.

Flammable solvent generation in 1997 increased by more than 100% from 1996 levels due to two incidents where acetone and isopropanol contaminated used oil and a non-hazardous EPA-2000 parts washer. One incident occurred in the screenhouse during traveling water screen maintenance and the other incident occurred performing turbine work.

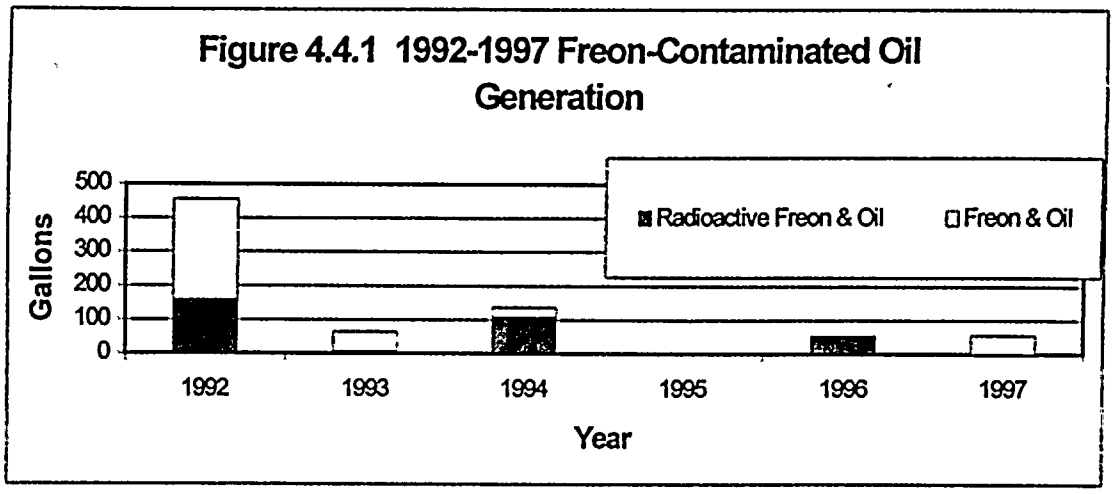
Flammable solvent management costs remained the same as last year at $2,494. Better management of the amount of solvent sent for disposal and waste container size has enabled us to dispose more solvent at the same price.

4.3 Paint-Related Material



Waste paint related material continues to decline due to better managerial techniques such as using scales to weigh out portions of paint kits instead of mixing entire kits (use only what you need concept). In addition, expired nuclear shelf life coatings were at other AEP fossil facilities.

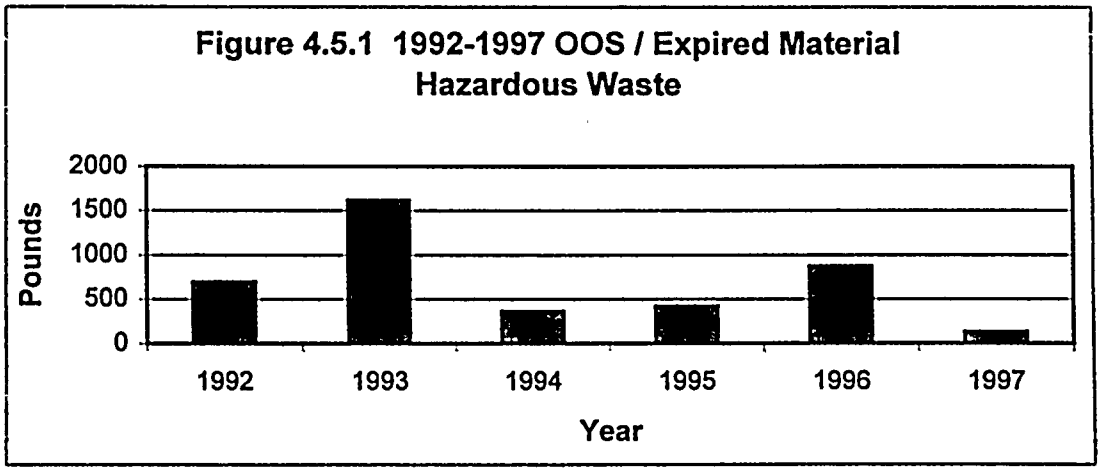
4.4 Laboratory Solvent and Oil



Freon contaminated oil has been reduced since 1992 from 456 gallons to 55 gallons in 1997. Educating the work force involved with Freon contamination has eliminated cross contamination of other waste streams.

Costs associated with Freon management has been reduced from $12,921 in 1992 to $8,723 in 1996 to $1,402 in 1997.

4.5 Out-of-Specification / Expired Shelf-Life Materials



Out of Specification (OOS) material and expired shelf life chemical waste production was reduced to only 12.8 pounds in 1997. The Chemistry department has implemented tighter controls on ordering bulk volume of reagents and extending shelf life when possible to reduce this waste stream. In addition, expired nuclear grade lab reagents, paints, and storeroom supplies were shipped to other divisions of AEP for their use in non-nuclear applications.

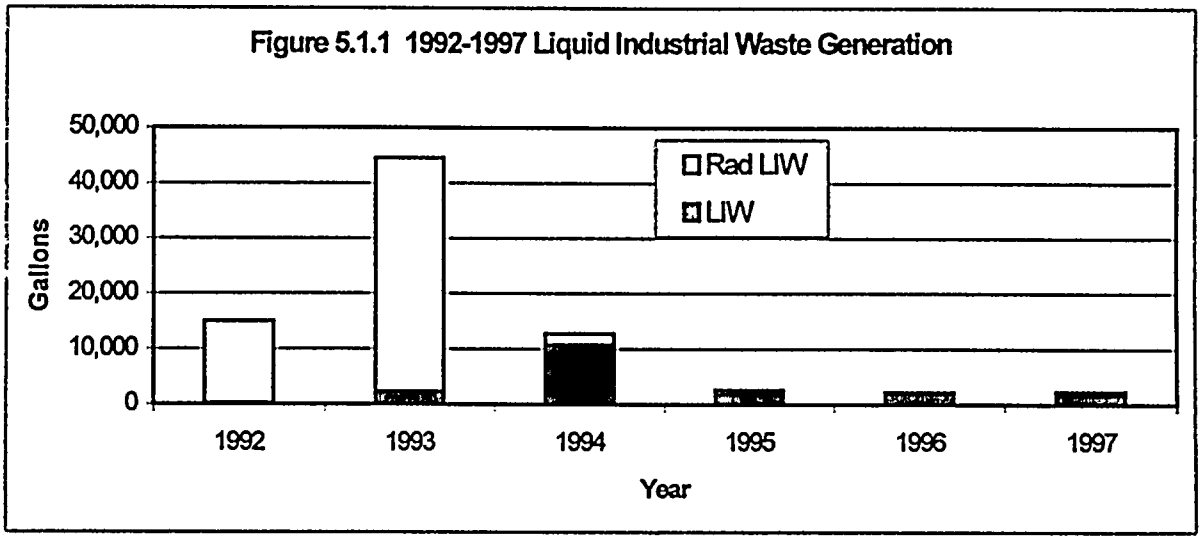
5.0 LIQUID INDUSTRIAL WASTE

5.1 General Description

Table 5.1.1 1992-1997 Liquid Industrial Waste Generation and Costs

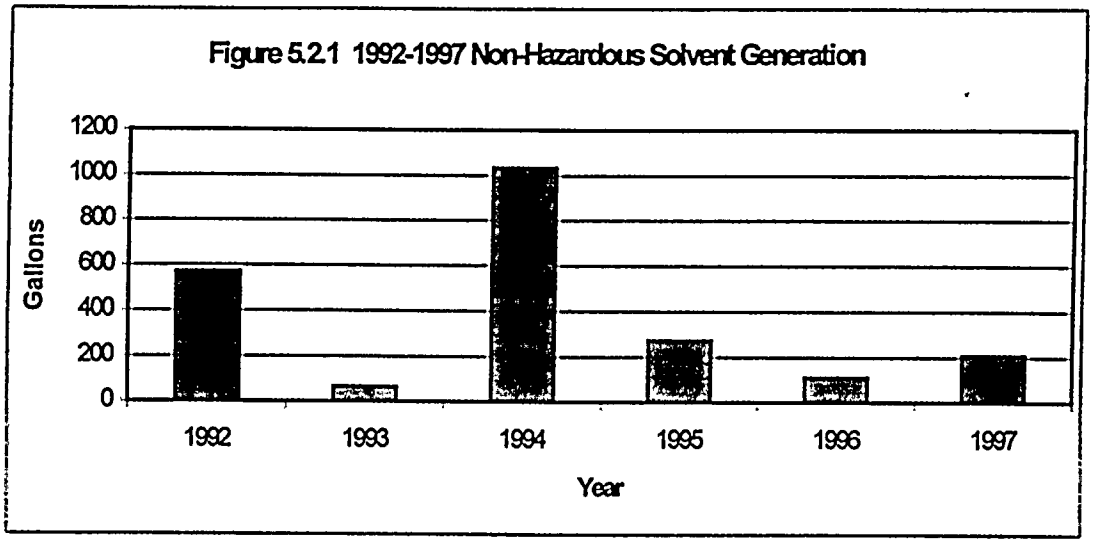
	Baseline (BL)						Reduced	% of	% in
	1992	1993	1994	1995	1996	1997	From BL	BL	1996
Liq. Industrial (gal)	206	2,317	10,813	1,894	2,020	1,716	27,070	13%	7%
Rad LIW (gal)	14,765	42,191	1,940	686	199	644	165,295	2%	324%
Rad & Clean LIW	14,971	44,508	12,753	2,580	2,219	2,360	234,774	5%	5%
Management Costs	$265,116	$775,691	$54,241	$23,903	$14,310	$9,804	$256,312	4%	31%
Avoided Costs	0	($509,575)	$211,875	$242,213	$251,806	$256,312	$452,631		

Shaded areas reflect established baselines to evaluate P2 accomplishments



Liquid industrial waste (LIW) generation increased in 1997 due in part to replacing non-hazardous solvent in all part washers. This represents an increase from 1996 when no parts washer solvent was replaced. In addition, office building stripper was diverted from being discharged to the Turbine Room Sump and now is disposed as LIW increasing the volume by approximately 500 gallons.

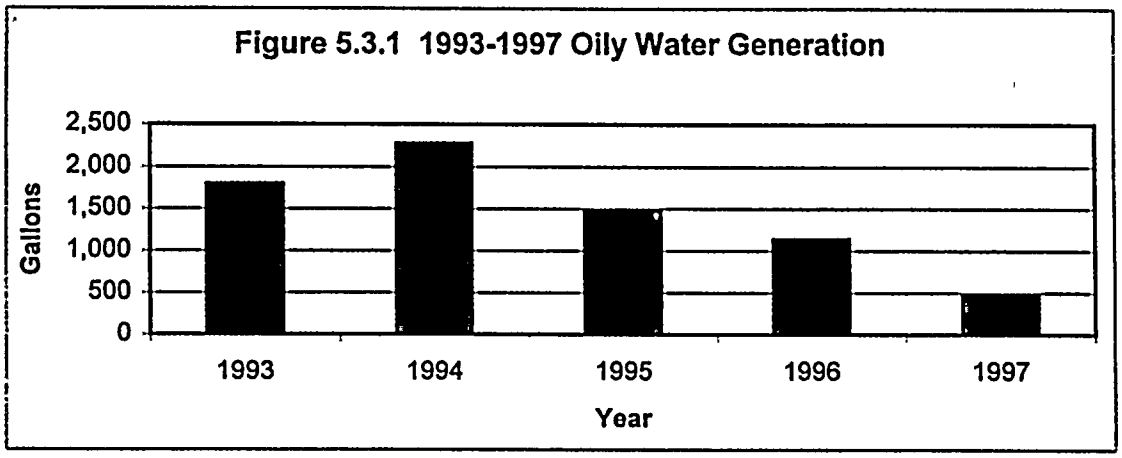
Although the amount of LIW increased in 1997, the cost to dispose of the normally expensive radioactive LIW decreased due to the plant's ability to use the BTU rich non-hazardous solvent as a fuel source in our heating boiler when CAA fuel specifications are met.



5.2 Non-Hazardous Solvent

Non-hazardous solvent generation increased as stated earlier in Section 5.1 due to increased outage duration and parts washer use.

5.3 Oily Water



Oily water generation continues to decrease from 1994. Oil/water separation techniques have contributed to the elimination of much of our oily water waste. The use of an oil/water separator installed on the unit one feed pump eliminated a large amount of oily water generation from a

continuous leak. Skimming oil and oil removal techniques continue to be applied in order to reduce the amount of oily water waste generation.

6.0 Used Oil

6.1 General Description

Used oil generation has decreased 62% from the baseline year of 1994 as depicted in the Table 6.1.1 and Figure 6.1.1.

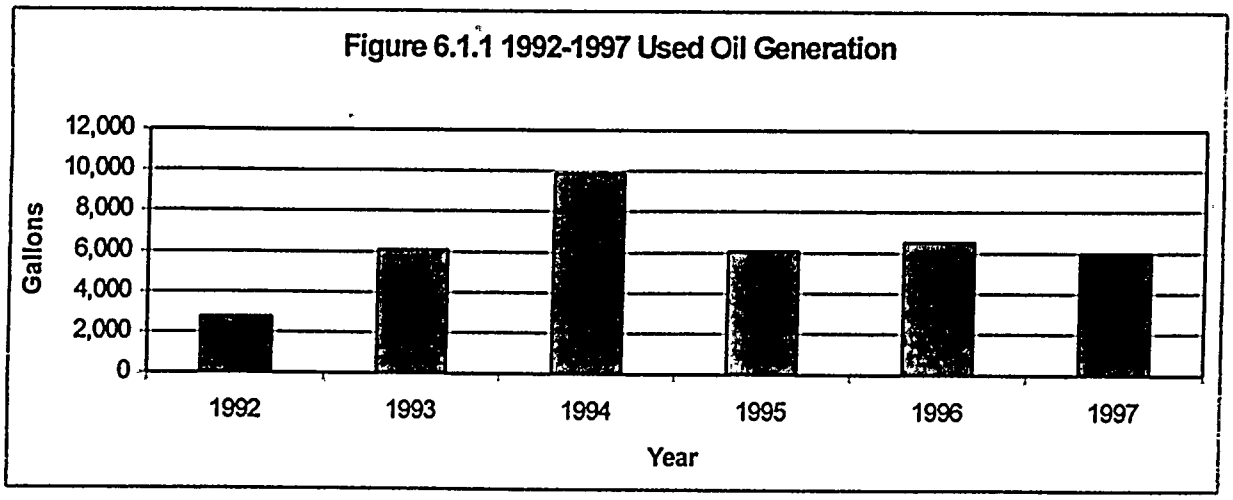
The cost of management of the used oil has reduced by $28, 742 from $61,257 in the year 1994. There was a 14% cost reduction 1997 from 1996.

Table 6.1.1 1992-1997 Used Oil Generation and Costs

			Baseline (BL)				%Reduction in
	1992	1993	1994	1995	1996	1997	1997
Used Oil	2,760	3,860	7,105	5,040	5,050	4,915	3%
Rad. Used Oil		2,255	2,750	1,045	1,485	1,090	27%
Rad/Clean Used Oil	2,760	6,115	9,855	6,085	6,535	6,005	8%
Management Costs	$11,969	$41,631	$61,257	$33,267	$37,920	$32,515	14%
Avoided Costs				$27,990	$23,337	$28,742	

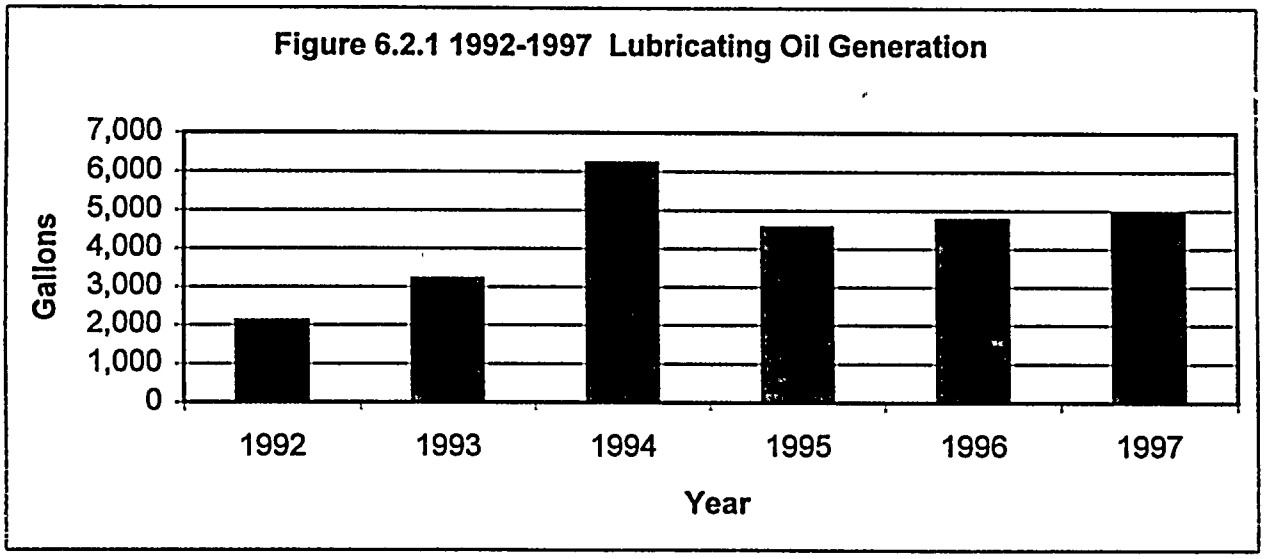
Shaded areas reflect established baselines to evaluate P2 accomplishments

Reduction in used oil generation in 1997 was accomplished by implementation of an aggressive leak control and repair program. Plant management established a zero leak philosophy and the results were seen in both radioactive and non-radioactive oil generations. Environmental performed daily reviews of ongoing work where oil generation could occur to ensure reuse of the oil where possible. In addition, Preventative Maintenance Engineering effectively saved generating radioactive Reactor Coolant Pump used oil by using an innovative filtering technique extending the life of the oil for another 18 month cycle.



6.2 Used Lubricating Oil

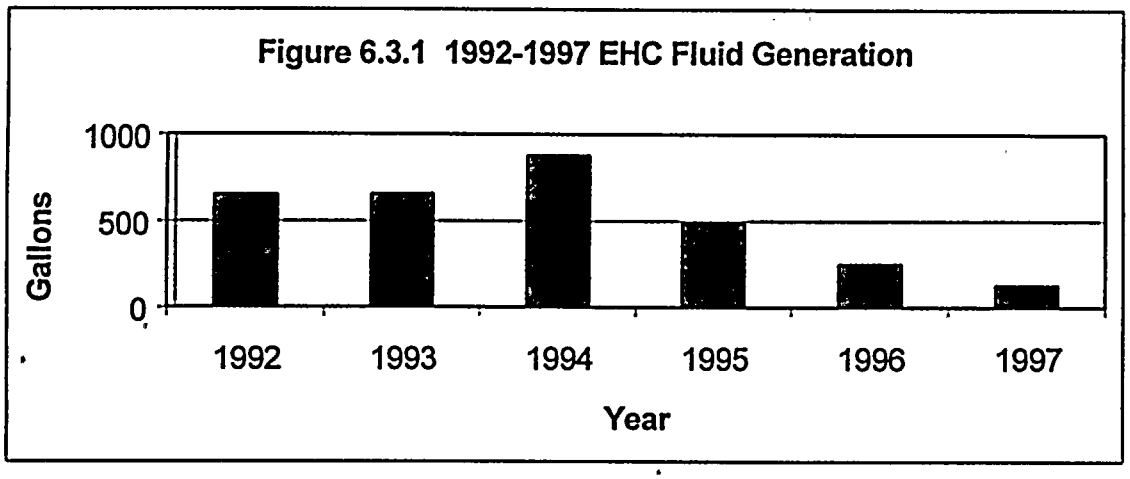
Used oil generation increased slightly in 1997 due to the extended outage and associated work activities performed. However, the increase was limited due to a new program used to store and reuse lubricating oil. The use of 275-gallon intermediate bulk containers was implemented to store oil while maintenance is performed on various systems. The containers are specific to a designated system and can be sealed and stored for reuse when needed.



6.3 Electro-Hydraulic Control (EHC) Fluid

The use of Electro-Hydraulic Control (EHC) fluid was also reduced from about 900 gallons in the year 1994 to 165 gallons in the year 1997. The plant uses approximately 4,000 gallons of synthetic, phosphate-based oil for turbine valve control.

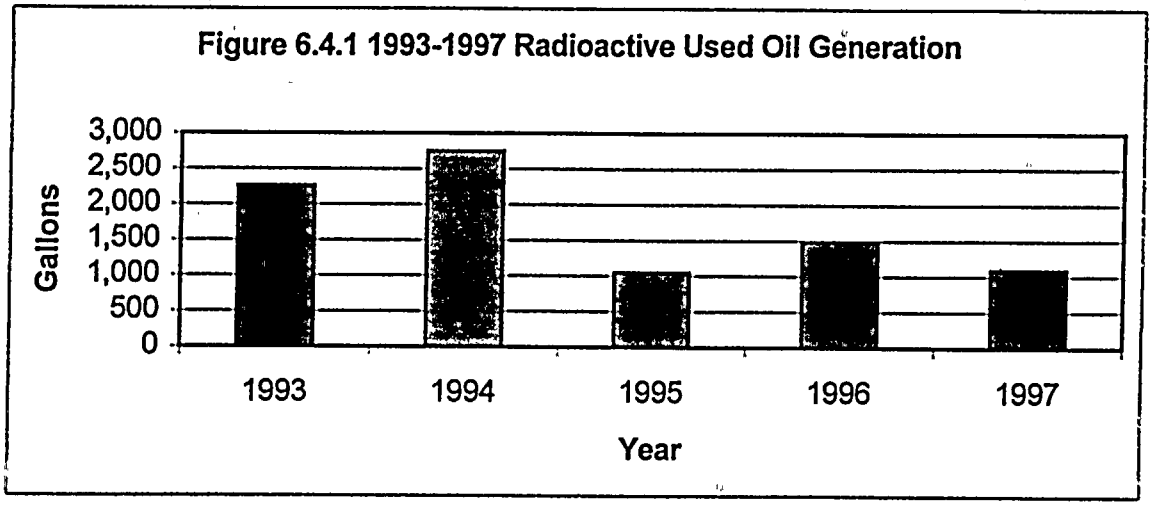
All used EHC fluid is recycled through a supplier-approved vendor. The majority of EHC fluid is generated during outages when the fluid is removed and storage tanks and filters are inspected and cleaned. The value of the recycled fluid normally offsets transportation costs to the recycler. The use of the new Flexsorb filtration system also decreased the generation of EHC fluid in 1997 by extending the fluid's life.



6.4 Radioactive Oil

Radioactive used oil was also reduced 40% from the baseline 2,750 gallons to 1,660 gallons in 1997. There was a 27% reduction from 1996 to 1997. Most of the radioactive used oil came from reactor coolant pump oil change outs, component cooling water pump work, and the restricted area oil collection drum. The engineering oil program optimized the reactor coolant pump oil as previously discussed in 1997.

All radioactive used oil is added to the plant heating boiler fuel oil tanks and burned for energy recovery. The oil is tested to ensure it meets used oil specifications and air permit limits prior to incineration.



7.0 LOW LEVEL RADIOACTIVE WASTE

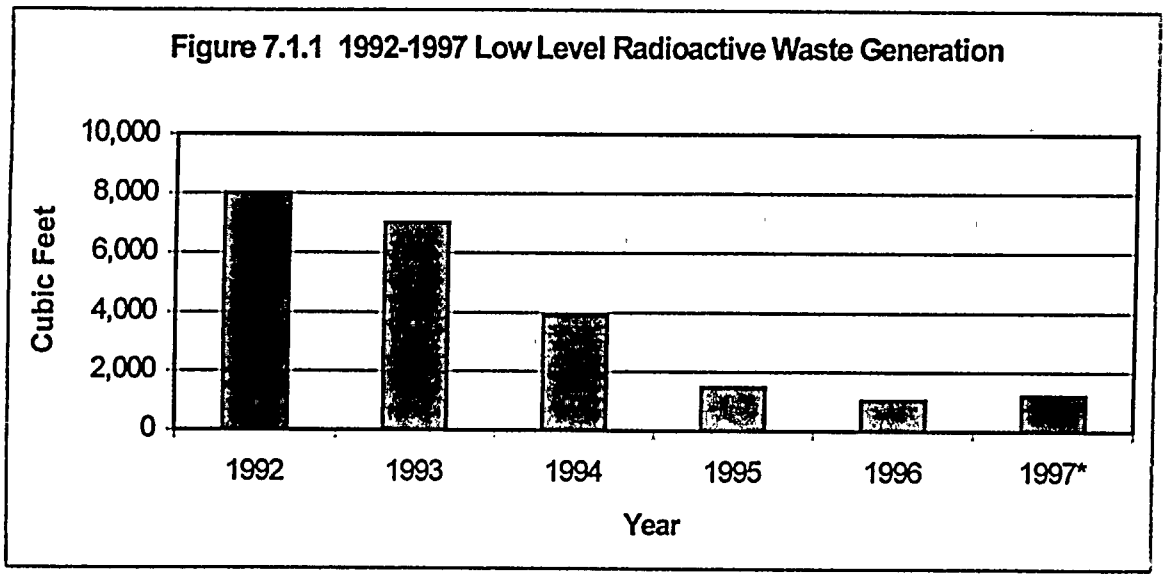
7.1 General Description

Table 7.1.1 1992-1997 Low Level Radioactive Waste Generation and Costs

	Baseline (BL) 1992	1993	1994	1995	1996	1997*	Baseline Reduction	% of BL	% In 1997
Volume (Cu.Ft)	[illegible]	7,000	3,900	1,467	1,034	1,201	6799	15%	-17%
Cost (Thousands)	[illegible]	$4,144	$2,449	$1,118	$881	$1,023	$3665	22%	-17%
Avoided Costs	$0	$544	$2,239	$3,570	$3,807	$3,665	**$13,825**		

*86,000 pounds of generated DAW was adjusted using 71.6 lbs/ft3, which was used in 1996.

Shaded areas reflect established baselines to evaluate P2 accomplishments



Low level radioactive waste (LLW) generation increased slightly in 1997 from 1996 levels. However, levels showed an 85% reduction from 1992 baseline levels of 8000 cubic feet. Increased outage length and insulation removal identified in the Architect and Engineering (A & E) inspection increased LLW generation in 1997. A combination of volume reduction technologies, including source reduction, contributed to these continued low levels of generation.

Source reduction efforts have included replacing disposable items with washable bags, clothing and tarps. Wooden scaffolding has been replaced with metal scaffolding since radioactively contaminated wood cannot be effectively contaminated.

Radioactive low-level wastes are segregated by the Cook Plant Radioactive Materials control section into various categories to optimize management options. Categories have included reusable materials, incinerable trash, metal meltable (scrap metal), compactable, and radioactively clean (Green is clean) materials. Most disposal costs for low level radioactive wastes have historically been based on volume. Off-site incineration, supercompaction, and additional sorting have been used to reduce these volumes as much as possible to reduce cost.

8.0 BULK WASTES

8.1 Trash

Trash generation in 1997 increased 25% from 1996 levels. This increased waste generation is due to the extended outages and work scope increase performed in response to the NRC A & E inspection. Overall, trash generation was reduced by 59% from the baseline year in 1992. Another contributing factor to the increase in trash was the amount of zebra mussels that had to be land filled as a result of forebay cleaning and traveling water screen impingement.

Figure 8.1.1 1992-1997 Trash Generation

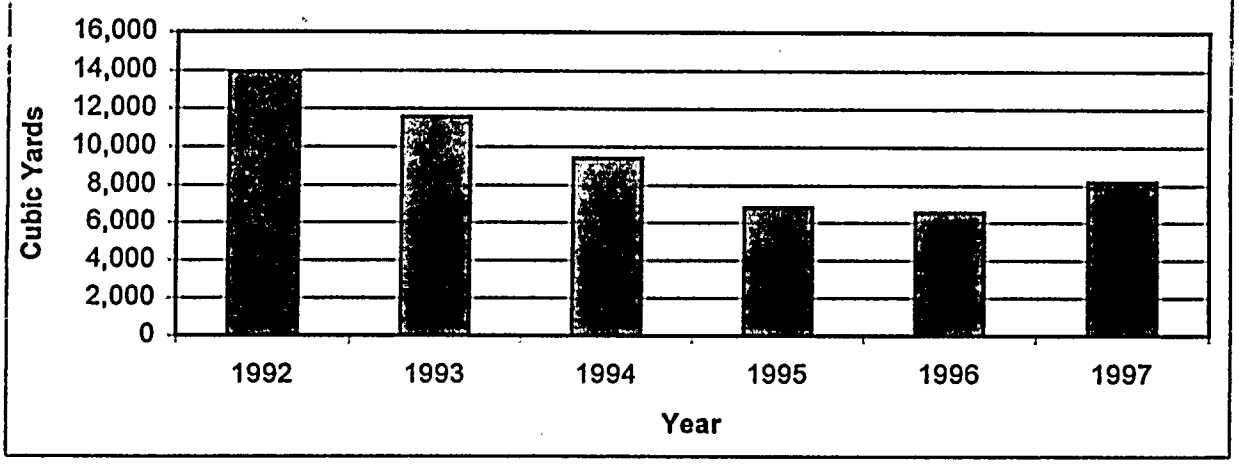


Table 8.1.1 1992-1997 Trash Generation and Costs

	Baseline (BL) 1992	1993	1994	1995	1996	1997	Reduced From BL	% of BL	% in 1997
Trash (Cu. Yds.)	[illegible]	11,564	9,406	6,800	6,556	8,192	5,734	59%	-25%
Management Cost	[illegible]	$107,545	$87,476	$63,240	$60,971	$75,871	$53,641	58%	-24%
Avoided Costs	$0	$21,967	$42,036	$66,272	$68,541	$53,641	$252,457		

Shaded areas reflect established baselines to evaluate P2 accomplishments

8.2 Radioactive Sewage Sludge

The new sequencing batch reactor (SBR) allows for digester sludge to be isolated in small batches which are not contaminated with radioactivity that was generated by the continuous concentration technique used in the old "package plant" it replaced.

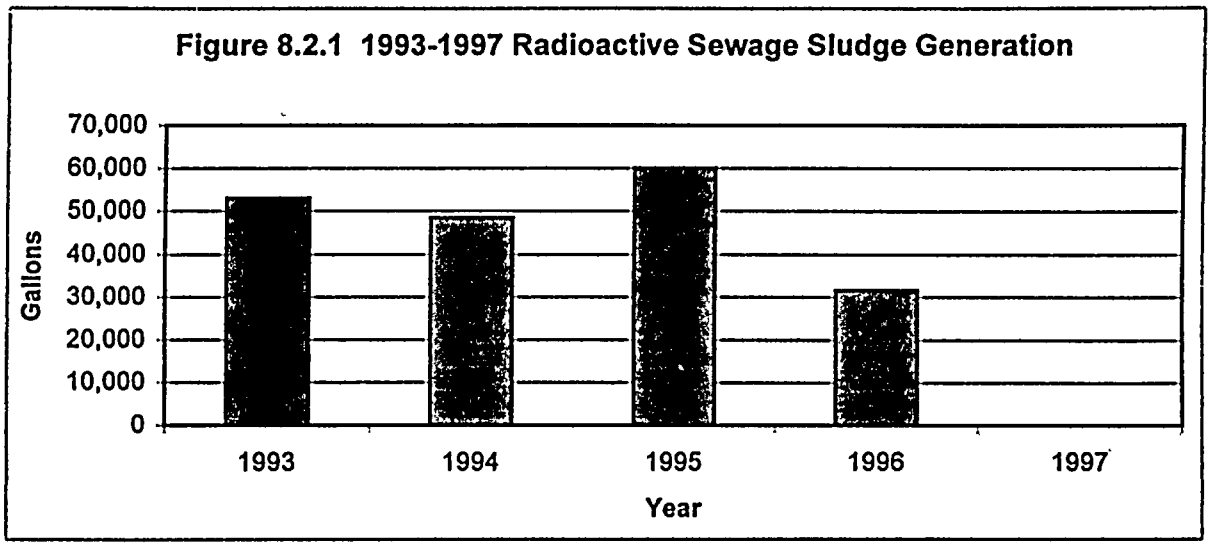


Table 8.2.1 1993-1997 Radioactive Sewage Sludge Generation and Management Costs

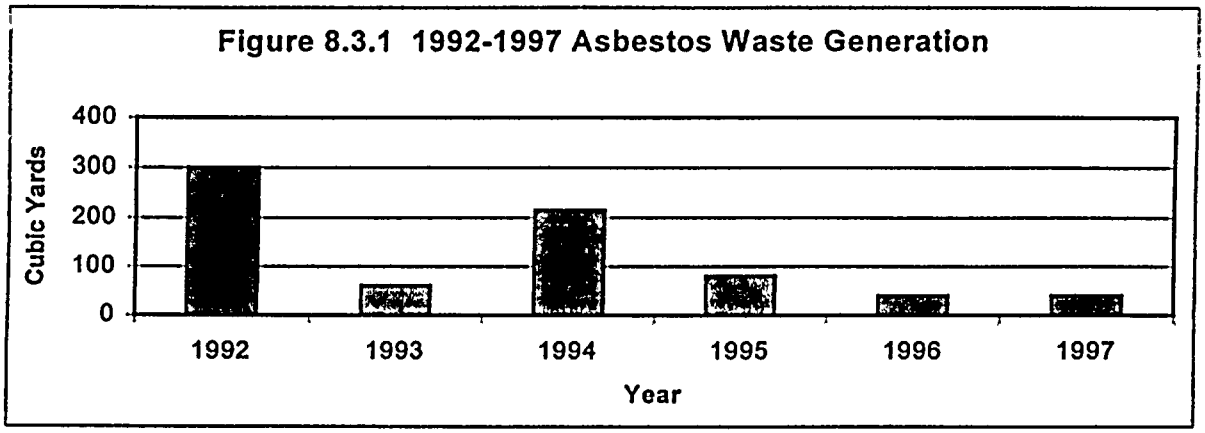
	1993	1994	1995	1996	1997
Rad Sewage Sludge Volume (gal)	[illegible]	48,506	60,000	31,534	0
Management Costs	$177,572	$189,304	$199,670	$168,587	0
Avoided Costs					$320,320

Shaded areas reflect established baselines to evaluate P2 accomplishments

8.3 Asbestos

Asbestos waste generation remained constant for 1997 from 1996 levels. However, there was an 81% reduction from the 1992 baseline figures. Generation is primarily dependent on abatement efforts planned for the outage length and equipment scheduled to be worked.

	1992	1993	1994	1995	1996	1997
Volume (Cu Yds)	300	60	215	80	40	40
Management Costs	$10,452	$1,640	$1,640	$2,900	$1,900	$1,900



Asbestos containing material (ACM) insulation is being replaced with calcium silicate material when the asbestos is damaged or removed for maintenance activities.

8.4 Empty Drums

There was a 32% reduction in empty drum generation from 1996. This effort was led by the Environmental Affairs Section's drum management program and reuseable tote program for lubricating oils discussed earlier in this report. Over $30,000 was saved by reducing the amount of drums being issued and then discarded after use by this program.

Table 8.4.1 1993-1997 Empty Steel Drums and Management Costs

	1993	1994	1995	1996	1997	Reduced From BL	% From BL	% in 1996/1997
Total # of Barrels	**351**	**507**	**348**	**265**	**179**	**328**	**35%**	**32%**
Management Cost	$35,802	$51,744	$35,496	$27,030	$18,258	$33,456	35%	32%
Avoided Costs	$0	$0	$16,218	$24,684	$33,456	$74358		

Another major reduction in empty drum generation resulted from the purchase of intermediate-bulk container by Engineering and Environmental Affairs for system and equipment fluid draining during refueling outages, maintenance and inspections. The use and reuse of intermediate-bulk containers has reduced empty drum waste by up to 75%. Bulk tanks have also been used to successfully replace drums during ice condenser system ethylene glycol draining, saving up to 40 drums per glycol outage.

A new drum management procedure was implemented by Environmental Affairs. The procedure developed to better control issuance and reuse of drums. The program has coordinated job planning; labeling, drum issue, and control of drained fluids to minimize waste generation. The procedure also established for reusing empty waste drums, which reduced usage by 15% in 1997.

9.0 Universal Waste

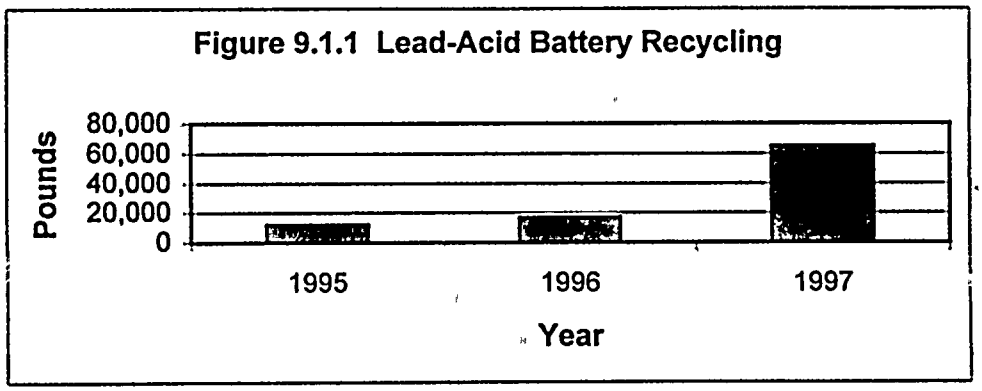
The state of Michigan implemented the federal universal waste regulations in late 1996 and included lead acid batteries, dry cell batteries, nickel-cadmium batteries, lighting waste and mercury as universal wastes. All this waste is sent to a recycle vendor for recycling.

9.1 Lead-Acid Batteries

Table 9.1.1 1995-1997 Lead-Acid Battery Waste Generation

	1995	1996	1997
Lead-Acid Batteries	12,000	16,810	64,900

In 1997, several battery replacement projects took place at the Cook Plant. We replaced the U-2 CD batteries (42,900 lbs.) for the first time in the plant's history. We also replaced 20,000 lbs. of emergency lighting batteries with a longer life battery supplied free by the manufacturer due to short lived battery incidents.



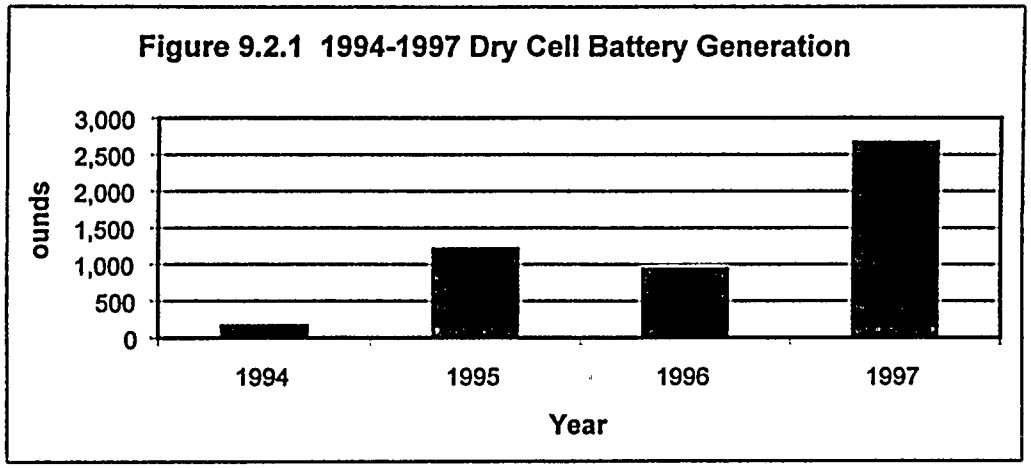
All the lead acid batteries were shipped directly to Exide for recycling. Lead acid battery waste is expected to decline in future years, due to longer life battery installation.

Reusable plastic battery boxes have been purchased to provide safe collection and shipping containers. The boxes also provide spill containment in the event of battery leaks. The boxes are returned after each shipment and reused.

9.2 Dry Cell Batteries

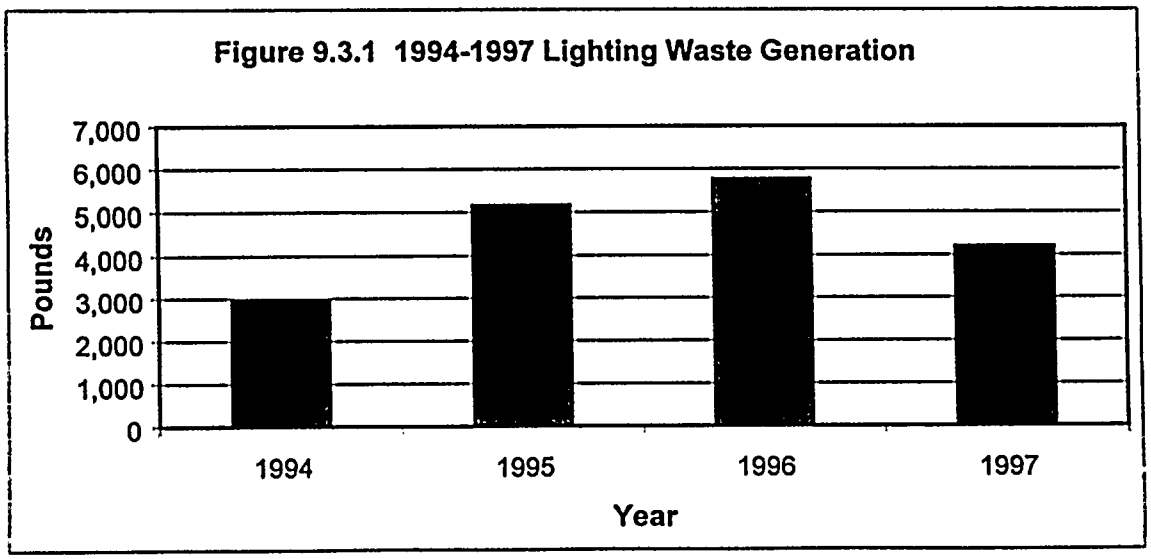
Table 9.2.1 1994-1997 Dry Cell Battery Waste Generation

	1994	1995	1996	1997	% of 1997
Battery Waste	161	1,206	933	2,665	285%



The 1997 increase (285%) in dry cell battery waste is due to accumulation of five months of 1996 generation being added to this total. The shipment of dry cells was delayed for cost saving reasons to enhance two shipments to one. In addition, the 1997 increased outage time and workload added to the waste generation.

9.3 Lighting Waste



Generation of lighting waste now falls under Universal waste category. Lighting waste includes the waste fluorescent light lamps, incandescent light lamps and High Intensity Discharge (HID) lamps. Efforts are in progress to reduce the lighting waste by replacing them with long life lamps, especially in the radiologically controlled areas.

9.4 Nickel-Cadmium batteries

Nickel-Cadmium batteries were also categorized under universal waste rule. Approximately 291 pounds of Nickel-Cadmium battery waste was generated in the year 1997. This generation was primarily due to the elimination of old instrumentation that was powered by Nickel Cadmium batteries.

9.5 Lithium batteries

Lithium battery waste was also counted under universal waste since they are recyclable. Only 23 pounds of Lithium battery waste was generated in the year 1997.

10.0 Recyclable Material

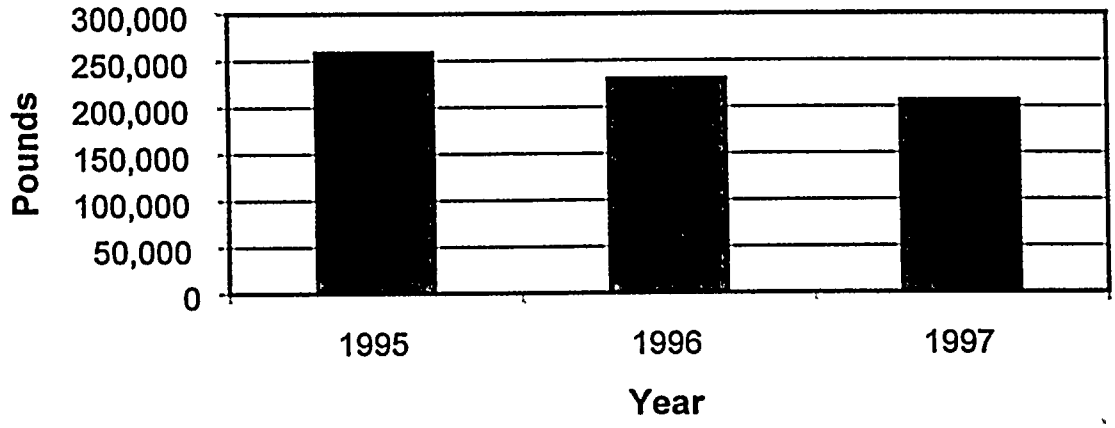
10.1 Scrap Metal

Table 10.1.1 Summary of Scrap Metal Generation

	1995	1996	1997	% from 1997	% from Baseline
Pounds	[redacted]	229,937	205,864	10%	20%

Shaded areas reflect established baselines to evaluate P2 accomplishments

Figure 10.1.1 1995-1997 Scrap Metal Generation



Scrap metal generation decreased by 10% in 1997 from 1996 levels due to less waste metal production in 1997. Scrap metal waste has been reduced from 258,516 pounds in 1995 to 205,864 pounds in 1997. Scrap metal is segregated by metal type, such as electrical cable and stainless steel, in dumpsters set by the scrap metal vendor. Pieces with obvious value are not scrapped. Lead sheets and brass shell casings are still sold for reuse.

10.2 Paper Products

Table 10.2.1 1994-1997 Quarterly Paper Recycling Summary (Pounds)

	1994	1995	1996	1997
Recycled Paper	26,165	230,709	220,881	179,475
Recycled Paper Used		104,398	191,915	205,394
% Recycled Products		83%	87%	88%
Total Cost of Purchased Recycleables				$94,452

American Electric Power is committed to the Environmental Protection Agency WasteWi$e program and encourages paper recycling and use of recycled paper products. Table 10.2.1 shows the amount of paper products recycled in the year 1997. It also shows the amount of recycled paper products purchased by the company for use on site.

The AEP Nuclear Generation Group uses a local paper recycler that employs disabled individuals for the collection, sorting and shipping of our paper. Separate recycle bins have been established for cardboard collection and each office has a separate container for collecting the paper. Employees are encouraged to print double-sided copies and the increased use and distribution of electronic files is having long-term benefits for paper reduction.

10.3 Scrap Tires and Rubber

During 1997 scrap rubber levels increased due to a cleanup of the site and several tires were collected and sent off for recycling. This project will continue in 1998. One of the largest sources of rubber, reactor press ray seals, which at one time had a shelf life has now been eliminated. With no shelf life there will be no more scrap rubber from these seals. Approximately 700 pounds of rubber was recycled in 1997.

APPENDIX V

ANNUAL REPORT:

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1997

DONALD C. COOK NUCLEAR PLANT

UNITS 1 & 2

OPERATIONAL

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1997 ANNUAL REPORT

JANUARY 1 to DECEMBER 31, 1997

Prepared by

Indiana Michigan Power Company

and

Teledyne Brown Engineering

April 15, 1998

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SUMMARY

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK POWER NUCLEAR PLANT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUMMARY

This report summarizes the collection and analysis of various environmental sample media in 1997 for the Radiological Environmental Monitoring Program for the Donald C. Cook Nuclear Plant.

The various analyses of most sample media suggest that there was no discernible impact of the Donald C. Cook Nuclear Plant on the environment. The analysis of air particulate filters, charcoal cartridges, direct radiation by thermoluminescent dosimeters, fish, water, milk and sediments from Lake Michigan, drinking water, and food products, either did not detect any radioactivity or measured only naturally occurring radionuclides at normal background levels.

Tritium, measured at low levels in on-site wells, appears to be the only radionuclide attributable to the plant operations. However, the associated groundwater does not provide a direct dose pathway to man.

I. INTRODUCTION

I. INTRODUCTION

The Donald C. Cook Nuclear Plant's Radiological Environmental Monitoring Program (REMP) is conducted in compliance with NRC Regulatory Guide 1.21 and 4.1, licensing commitments, and Technical Specifications. The REMP was developed in accordance with the NRC Radiological Assessment Branch Technical Position (BTP), Rev. 1, November 1979. A synopsis of the sampling program and maps can be found in Section II, Sampling and Analysis Program. This report represents the Annual Radiological Environmental Operating Report for Units 1 and 2 of the Donald C. Cook Nuclear Plant for the operating period from January 1, 1997 through December 31, 1997.

A. The Donald C. Cook Nuclear Plant of American Electric Power Company is located on the southeastern shore of Lake Michigan approximately one mile northwest of Bridgman, Michigan. The plant consists of two pressurized water reactors, Unit 1, 1030 MWE and Unit 2, 1100 MWE. Unit 1 achieved initial criticality on January 18, 1975 and Unit 2 achieved initial criticality on March 10, 1978.

B. Objectives

The objectives of the operational radiological environmental monitoring program are:

1. Identify and measure radiation and radioactivity in the plant environs for the calculation of potential dose to the population.

2. Verify the effectiveness of in-plant measures used for controlling the release of radioactive materials.

3. Provide reasonable assurance that the predicted doses, based on effluent data, have not been substantially underestimated and are consistent with applicable standards.

4. Comply with regulatory requirements and Station Technical Specifications and provide records to document compliance.

During 1997 the following changes were made to the Offsite Dose Calculation Manual (ODCM)

The following changes became effective on 01/24/97 and included:

* Deleted Technical Specification #14 revision #6 per NS&A request.

* Changed compensatory sampling interval per Chemistry request.

* Added 25% grace period for surveillance requirements.

* Clarified need for compensatory sampling of ESW system when respective radiation monitors are inoperable unless the containment spray heat exchangers are in service, since these are only for post LOCA leak detection and have no associated trip functions.

* Added note on attachment for determination of start-up flash tank flow rate to improve documentation and changed this flow rate based on estimated steam generator blowdown flow vs. DRY value position.

Changes to the ODCM made effective on 10/15/97 included:

* Incorporated new Eberline liquid radiation monitors that replaced Westinghouse monitors.

* Added table allowing plant to use RMS readings in lieu of sampling gland seal exhaust since operational data indicates routine sampling is non-productive.

* Revised attachments to reflect RFC 3076 changes.

Changes to the ODCM made effective on 10/30/97 included:

* Added clarification to attachment 3.4 for purging or venting.

II. SAMPLING AND ANALYSIS PROGRAM

II. SAMPLING AND ANALYSIS PROGRAM

Table 1 summarizes the sampling and analysis program for the Donald C. Cook Nuclear Plant for 1997. For each sample medium, the table lists the sample locations, including distance and direction from the center of the two units, and the station identification. The station identifications for the sampling locations are shown on Figures 1 and 2. Also for each sample medium the sample collection frequency, type of analysis, and frequency of analysis are listed.

TAB

DONALD C. COOK NUCLEAR PLANT- 1997
RADIOLOGICAL SAMPLING STATIONS
DISTANCE AND DIRECTION FROM PLANT AXIS

Location	Station	Distance	Direction	Degrees	Collection Frequency	Analysis/Frequency
Environmental (TLD's)						
ONS-1	(T-01)	1945 ft.		18°	Quarterly	Direct Radiation/Quarterly
ONS-2	(T-02)	2338 ft.		48°		
ONS-3	(T-03)	2407 ft.		90°		
ONS-4	(T-04)	1852 ft.		118°		
ONS-5	(T-05)	1895 ft.		189°		
ONS-6	(T-06)	1917 ft.		210°		
	(T-07)	2103 ft.		36°		
	(T-08)	2208 ft.		82°		
	(T-09)	1368 ft.		149°		
	(T-10)	1390 ft.		127°		
	(T-11)	1969 ft.		11°		
	(T-12)	2292 ft.		63°		
New Buffalo	(NBF)	15.6 mi	SSW			
South Bend	(SBN)	26.2 mi	SE			
Dowagiac	(DOW)	24.3 mi	ENE			
Coloma	(COL)	18.9 mi	NNE			
Intersection of Red Arrow Hwy. & Marquette Woods Rd, Pole #B294-44	(OFT-1)	4.5 mi	NE			
Stevensville Substation	(OFT-2)	3.6 mi	NE			
Pole #B296-13	(OFT-3)	5.1 mi	NE			
Pole #B350-72	(OFT-4)	4.1 mi	E			
Intersection of Shawnee & Cleveland, Pole #B387-32	(OFT-5)	4.2 mi	ESE			
Snow Rd., East of Holden Rd., #B426-1	(OFT-6)	4.9 mi	SE			
Bridgman Substation	(OFT-7)	2.5 mi	S			
California Rd., Pole #B424-20	(OFT-8)	4.0 mi	S			
Ruggles Rd., Pole B369-214	(OFT-9)	4.4 mi	ESE			
Intersection of Red Arrow Hwy., & Hildebrant Rd.,Pole #B422-152	(OFT-10)	3.8 mi	S			
Intersection of Snow Rd. & Baldwin Rd., Pole #B423-12	(OFT -11)	3.8 mi	S			

TABLE [illegible] (Cont.)

DONALD C. COOK NUCLEAR PLANT- 1997

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM PLANT AXIS

Location	Station	Distance	Direction	Degrees	Collection Frequency	Analysis/Frequency
Air Charcoal/Particulates						
ONS-1	(A-1)	1945 ft.		18°	Weekly	Gross Beta/Weekly
ONS-2	(A-2)	2338 ft.		48°		I-131/Weekly
ONS-3	(A-3)	2407 ft.		90°		Gamma Isotopic/
ONS-4	(A-4)	1852 ft.		118°		Quarterly Composite
ONS-5	(A-5)	1895 ft.		189°		
ONS-6	(A-6)	1917 ft.		210°		
New Buffalo	(NBF)	15.6 mi	SSW			
South Bend	(SBN)	26.2 mi	SE			
Dowagiac	(DOW)	24.3 mi	ENE			
Coloma	(COL)	18.9 mi	NNE			
Groundwater						
Onsite	(W-1)	1969 ft.		11°	Quarterly	Gamma Isotopic/Quarterly
Onsite	(W-2)	2292 ft.		63°		Tritium/Quarterly
Onsite	(W-3)	3279 ft.		107°		
Onsite	(W-4)	418 ft.		301°		
Onsite	(W-5)	404 ft.		290°		
Onsite	(W-6)	424 ft.		273°		
Onsite	(W-7)	1895 ft.		189°		
Onsite	(W-8)	1279 ft.		53°		
Onsite	(W-9)	1447 ft.		22°		
Onsite	(W-10)	4216 ft.		129°		
Onsite	(W-11)	3206 ft.		153°		
Onsite	(W-12)	2631 ft.		162°		
Onsite	(W-13)	2152 ft.		182°		
Onsite	(W-14)	1780 ft.		164°		
Steam Generator Groundwater						
Steam Generator Storage Facility	(SG-1)	0.8 mi		95°	Quarterly	Gross Beta/Quarterly
Steam Generator Storage Facility	(SG-2)	0.7 mi		92°		Gross Alpha/Quarterly
Steam Generator Storage Facility	(SG-4)	0.7 mi		93°		Gamma Isotopic/Quarterly
Steam Generator Storage Facility	(SG-5)	0.7 mi		92°		

TABLE (Cont.)

DONALD C. COOK NUCLEAR PLANT- 1997

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM PLANT AXIS

Location	Station	Distance	Direction	Degrees	Collection Frequency	Analysis/Frequency
Drinking Water						
St. Joseph Public Intake	(STJ)	9.0 mi	NE		Daily	Gross Beta/14 Day Composite Gamma Isotopic/14 Day Composite I-131/14 Day Composite
Lake Township Public Intake Station	(LTW)	0.4 mi	S			Tritium/Quarterly Composite
Surface Water						
Condenser Circulating Water Intake	SWL-1	Intake			Daily	Gamma Isotopic/Monthly
Lake Michigan Shoreline	SWL-2	500 ft.	S			Composite
Lake Michigan Shoreline	SWL-3	500 ft.	N			Tritium/Quarterly Composite
Sediment						
Lake Michigan Shoreline	SL-2	500 ft.	S			
Lake Michigan Shoreline	SL-3	500 ft.	N		Semi-annually	Gamma Isotopic/Semi-Annually
Milk-Indicator (a)						
						I-131/Sample
Milk-Background (a)						
Broadleaf Vegetation (a)						
3 Indicator Samples 1 Control Sample	Within 8 miles of plant 15-25 miles distant		Highest D/Q Land Sector Less prevalent wind direction		Monthly when available	Gamma Isotopic/Monthly I-131/Monthly

(a) No milk samples were obtained in 1997 as 2 of 3 indicator farms dropped from program at the end of 1995 and no replacements have been found. Broadleaf vegetation samples were obtained in lieu of milk in 1997.

TABLE (cont.)

DONALD C. COOK NUCLEAR PLANT- 1997

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM PLANT AXIS

Location	Station	Distance	Direction	Degrees	Collection Frequency	Analysis/Frequency
Fish						
Lake Michigan	ONS-N	.3 mi	N		2/year	Gamma Isotopic/
Lake Michigan	ONS-S	.4 mi	S			2 per year
Lake Michigan	OFS-N	3.5mi	N			
Lake Michigan	OFS-S	5.0 mi	S			
Grapes/Broadleaf						
Nearest sample to Plant in highest D/Q land sector containing media.			Sector D		At time of harvest	Gamma Isotopic at time of harvest.
Grapes						
In a land sector containing grapes approximately 20 miles from the Plant in one of the less prevalent D/Q land sectors.			Sector K		At time of harvest	Gamma Isotopic at time of harvest.

* Composite samples of Drinking and Surface water shall be collected at least daily.

* Particulate sample filters should be analyzed for gross beta activity 24 or more hours following filter removal. This will allow for radon and thoron daughter decay. If gross beta activity in air or water is greater than 10 times the yearly mean of control samples for any medium, gamma isotopic analysis should be performed on the individual samples.

Please note the following defenitions:

Weekly - at least once every seven (7) days

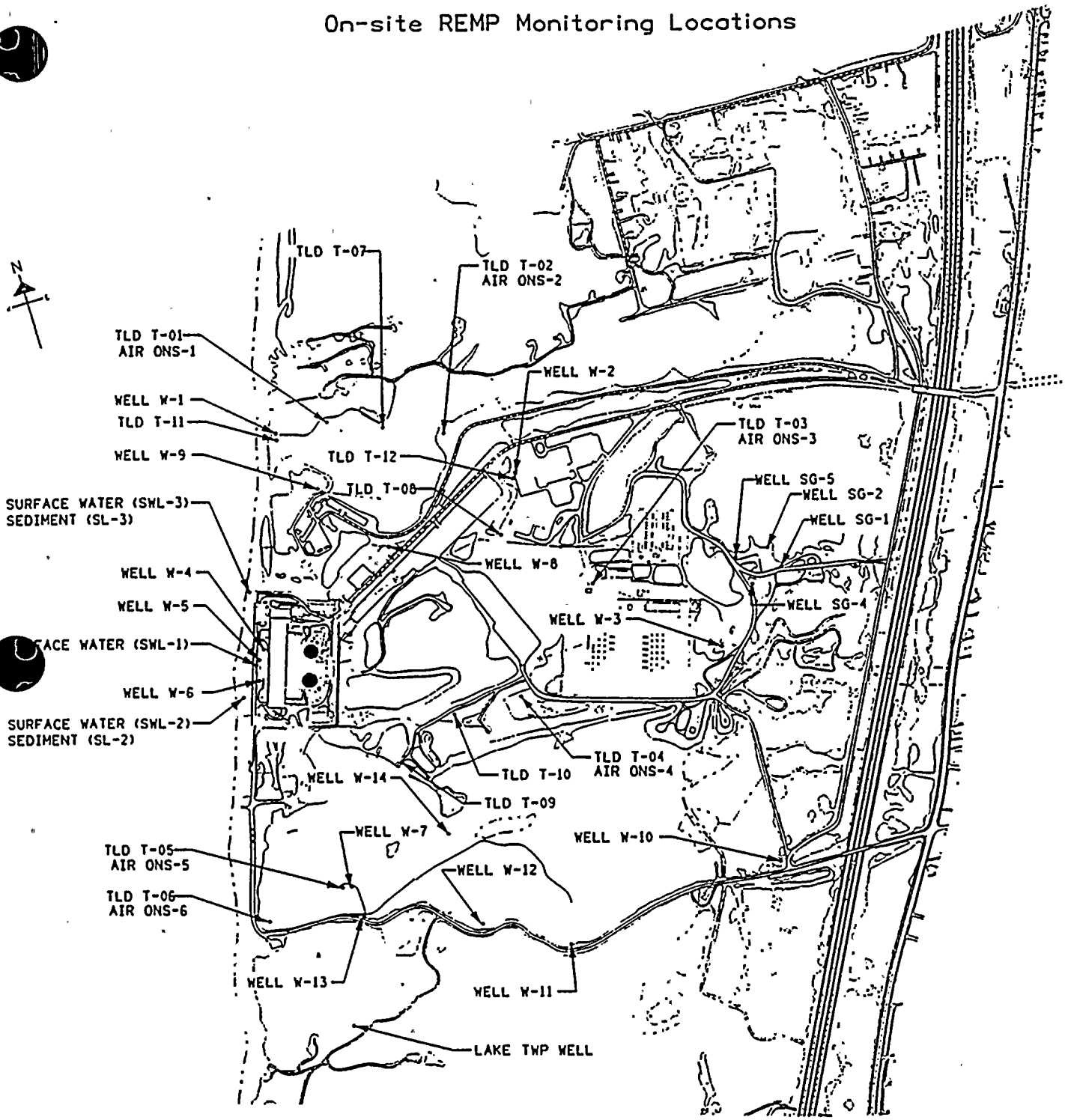
Monthly - at least once every (31) days

Quarterly - at least once every ninety-two (92) days

Semi-annually - at least once every one hundred eighty-four (184) days

Figure 1

On-site REMP Monitoring Locations



LEGEND

ONS-1 - ONS-6: Air Sampling Stations
T-01 - T-12: TLD Sampling Stations
W-1 - W-14: REMP T/S Groundwater Wells
SG-1, SG-2, SG-4, SG-5: REMP Non T/S Groundwater Wells
SWL-1, 2, 3: Surface Water Sampling Stations
SL-2, 3: Sediment Sampling Stations

Figure 2

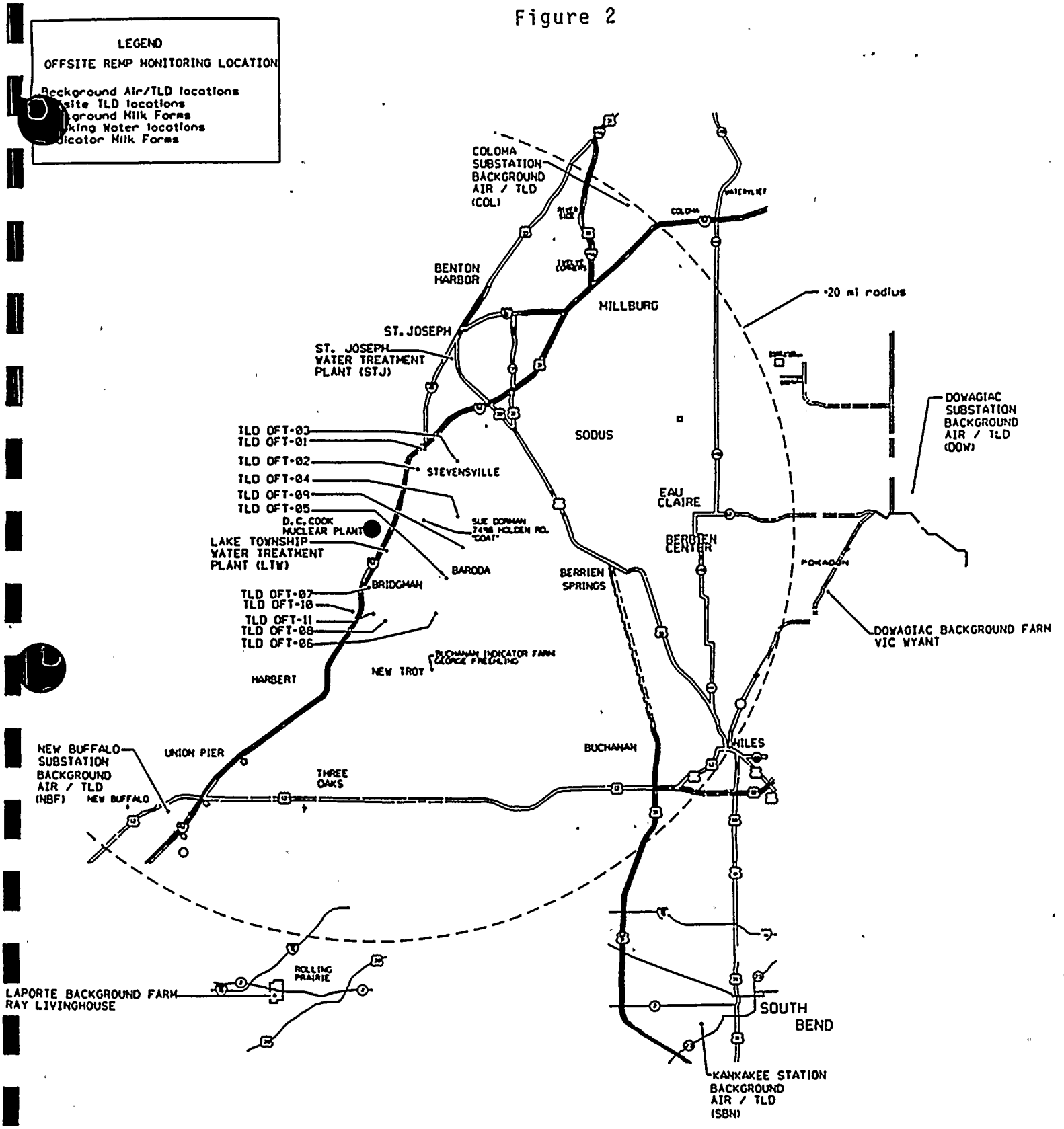
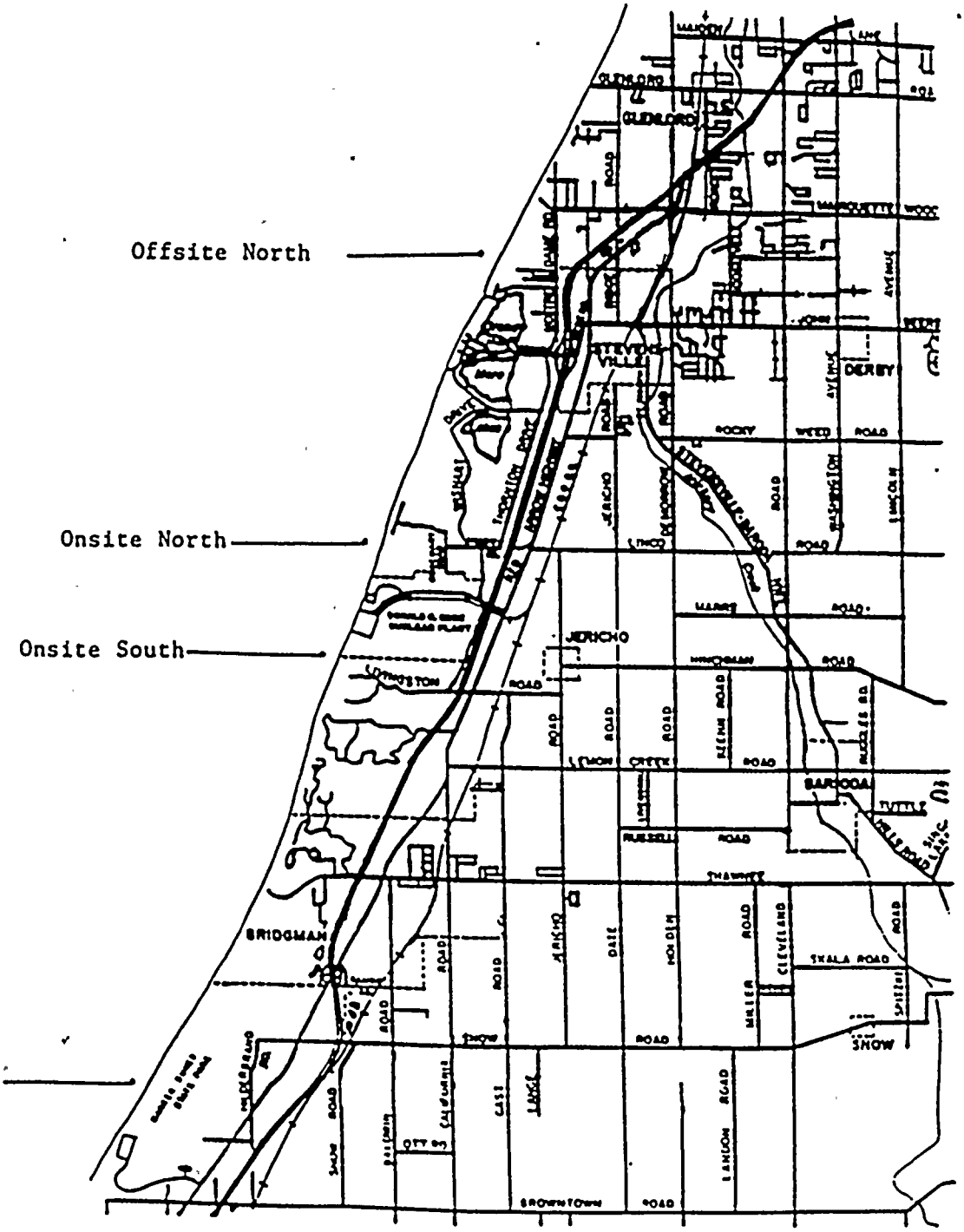

LEGEND
OFFSITE REMP MONITORING LOCATION
Background Air/TLD locations
site TLD locations
ground Milk Forms
king Water locations
icator Milk Forms
COLOMA SUBSTATION BACKGROUND AIR / TLD (COL)
BENTON HARBOR
MILLBURG
ST. JOSEPH
ST. JOSEPH WATER TREATMENT PLANT (STJ)
20 mi radius
DOWAGIAC SUBSTATION BACKGROUND AIR / TLD (DOW)
TLD OFT-03
TLD OFT-01
TLD OFT-02
TLD OFT-04
TLD OFT-09
TLD OFT-05
STEVENSVILLE
SODUS
EAU CLAIRE
D.C. COOK NUCLEAR PLANT
LAKE TOWNSHIP WATER TREATMENT PLANT (LTW)
BARODA
BERRIEN SPRINGS
BERRIEN CENTER
BRIDGMAN
TLD OFT-07
TLD OFT-10
TLD OFT-11
TLD OFT-08
TLD OFT-06
DOWAGIAC BACKGROUND FARM VIC WYANT
NEW TROY
HARBERT
NEW BUFFALO SUBSTATION BACKGROUND AIR / TLD (NBF)
UNION PIER
THREE OAKS
BUCHANAN
NILES
ROLLING PRAIRIE
LAPORTE BACKGROUND FARM RAY LIVINGHOUSE
SOUTH BEND
KANKAKEE STATION BACKGROUND AIR / TLD (SBN)

FIGURE 3

SAMPLING LOCATIONS

FISH COLLECTED FOR RADIOLOGICAL ANALYSIS



III. SUMMARY AND DISCUSSION OF 1997 ANALYTICAL RESULTS

III. SUMMARY AND DISCUSSION OF 1997 ANALYTICAL RESULTS

A discussion of the data from the radiological analyses of environmental media collected during the report period is provided in this section. Analyses of samples for 1997 were analyzed by Teledyne Brown Engineering, Inc. (TI) in Westwood, New Jersey. The procedures and specifications followed at Teledyne Brown Engineering are in accordance with the Teledyne Brown Engineering Quality Assurance Manual and are explained in the Teledyne Brown Engineering Analytical Procedures. A synopsis of analytical procedures used for the environmental samples are proved in Appendix C. In addition to internal quality control measures performed by Teledyne, the laboratory also participates in the Environmental Protection Agency's Interlaboratory Comparison Program. Participation in this program ensures that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples are performed. The results of the EPA Interlaboratory Comparison are provided in Appendix D.

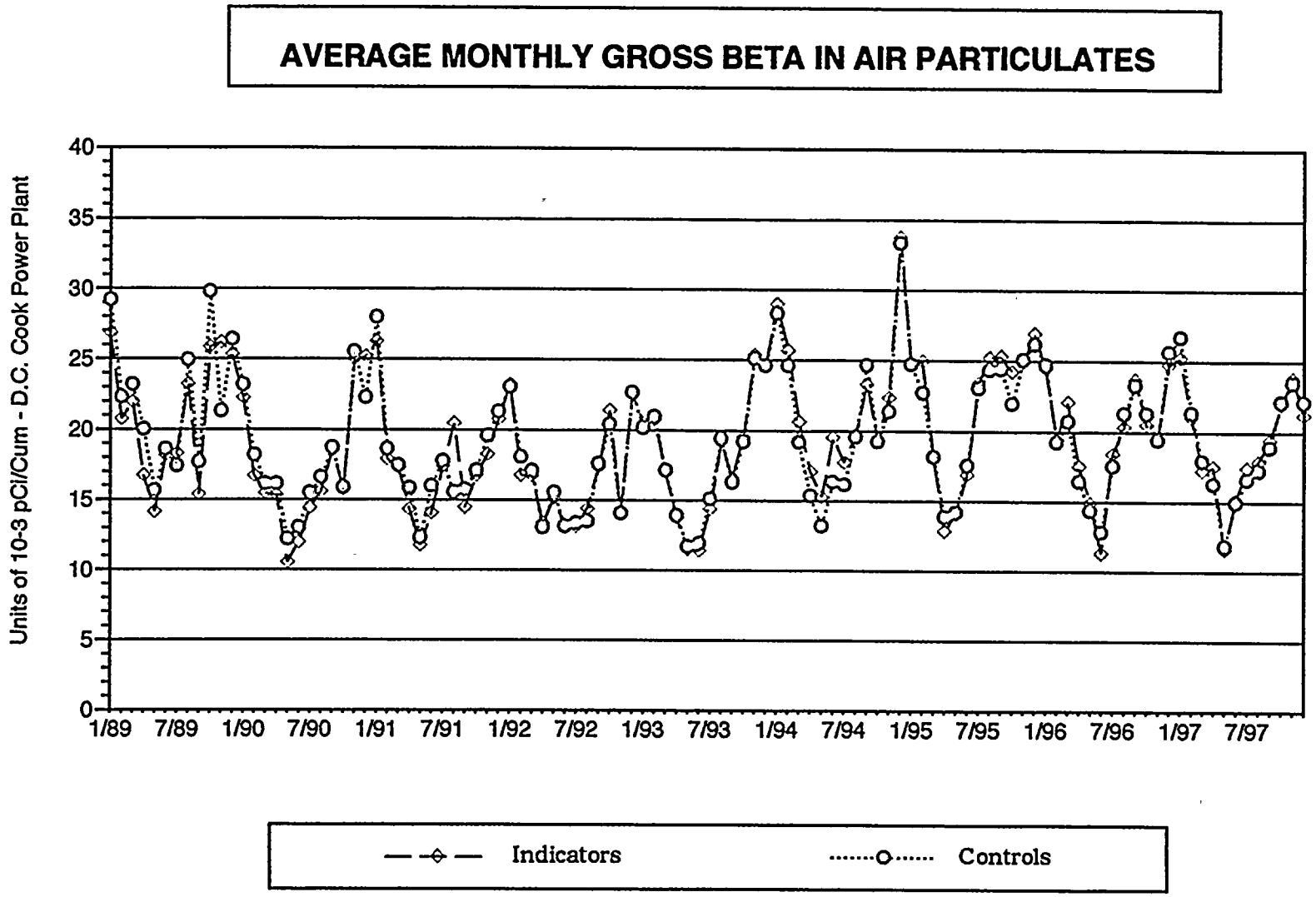
Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. Teledyne Brown Engineering analytical methods meet or exceed the Lower Limit of Detection (LLD) requirements given in Table 2 of the USNRC Branch Technical Position of Radiological Monitoring, Revision 1, November 1979.

The following is a discussion and summary of the results of the environmental measurements performed during the reporting period. Comparison is made where possible with radioactivity concentrations measured in the preoperational period of August 1971 to the initial criticality of Unit 1 on January 12, 1975. A brief summary of the preoperational program is found in Appendix G.

A. Airborne Particulates

Airborne particulate samples are collected with an oil less pump at approximately 56 LPM using a 47 mm particulate filter. Results of

Trending Graph - 1



gross beta activities are presented in Table B-1. The measurement of the gross beta activity on the weekly air particulate filters is a good indication of the levels of natural and or manmade radioactivity in the environment. The average gross beta concentration of the six indicator locations was 0.019 pCi/m^3 with a range of individual values between 0.008 and 0.048 pCi/m^3. The average gross beta concentration of the four control locations was 0.019 pCi/m^3 with a range between 0.008 and 0.051 pCi/m^3. In Trending Graph 1 the monthly average gross beta concentrations for the indicator locations and for the control locations are plotted. The gross beta concentrations in air particulate filters in 1997 were lower than at the end of the preoperational period when the effects of recent atmospheric nuclear tests were being detected.

Air particulate filters were composited by location on a quarterly basis and were analyzed by gamma ray spectroscopy. Results are presented in Table B-2. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation, was measured in all forty samples. The average concentration for the control locations was 0.126 pCi/m^3 and the values ranged from 0.086 to 0.174 pCi/m^3. The average concentration for the indicator locations was 0.125 pCi/m^3 with a range of 0.087 to 0.175 pCi/m^3. These values are typical of beryllium-7 measured at various locations throughout the United States. Naturally occurring potassium-40 was measured in three of the twenty-four indicator quarterly composites with an average concentration of 0.004 pCi/m^3 and a range of 0.003 to 0.007 pCi/m^3. Potassium-40 was measured in six of the sixteen control quarterly composites with a concentration of 0.004 pCi/m^3 and a range of 0.003 to 0.006 pCi/m^3. No other gamma emitting radioactivity was detected.

B. Airborne Iodine

Airborne iodine samples are collected with an oil less pump at approximately 56 LPM using a charcoal filter cartridge. Charcoal cartridges are installed downstream of the particulate filters and are used to collect airborne radioiodine. The results of the weekly analysis of the charcoal cartridges are presented in Table B-3. All results were

below the lower level of detection of 0.07 pCi/m^3 with no positive activity detected.

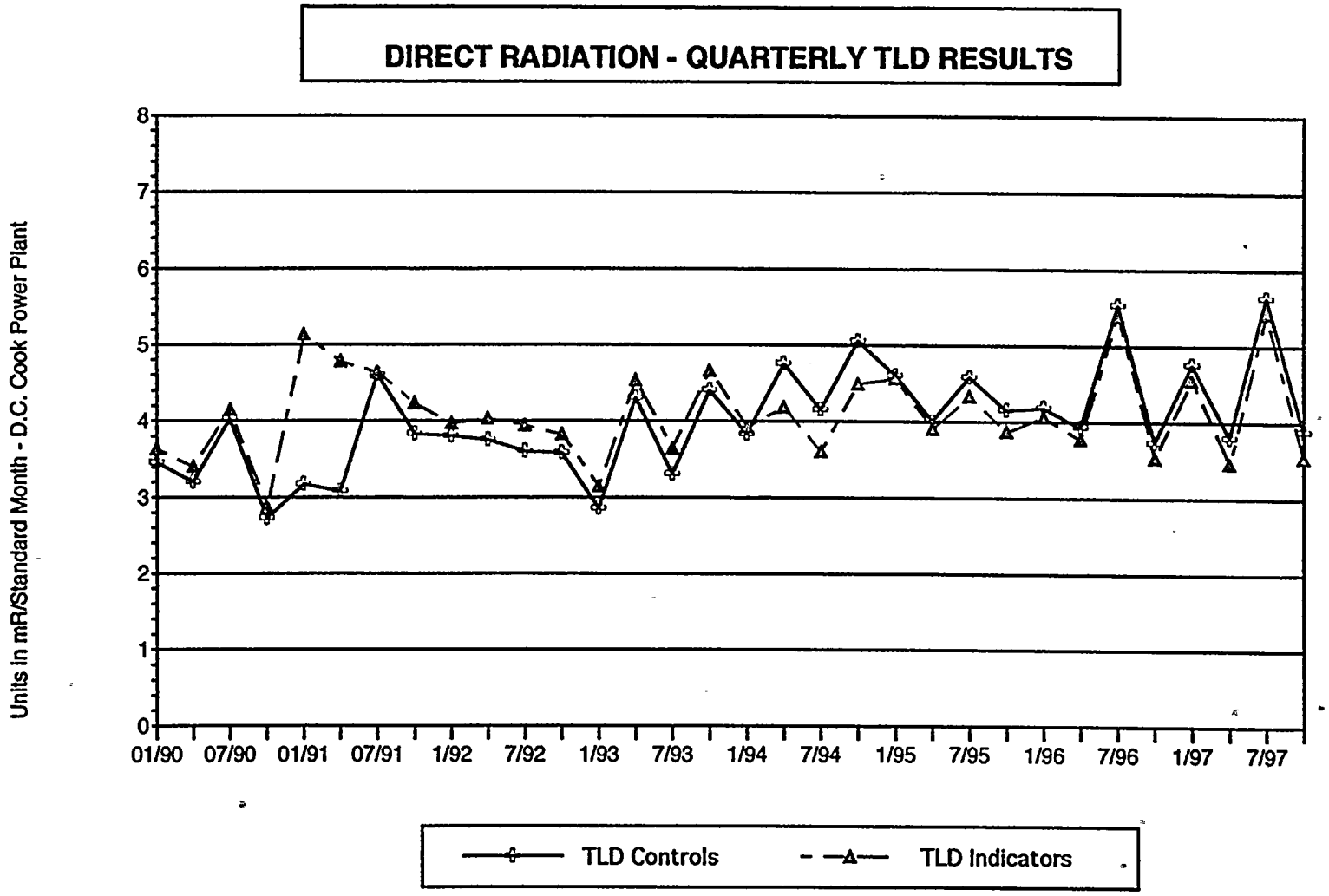
C. Direct Radiation - Thermoluminescent Dosimeters

Thermoluminescent dosimeters (TLDs) measure external radiation exposure from several sources including naturally occurring radionuclides in the air and soil, radiation from cosmic origin, fallout from atomic weapons testing, potential radioactive airborne releases from the power station and direct radiation from the power station. The TLDs record exposure from all of these potential sources. The TLDs are deployed quarterly at 27 locations in the environs surrounding the D. C. Cook Nuclear Plant. The average value of the four areas of each dosimeter (calibrated individually after each field exposure period for response to a known exposure and for transit exposure) are presented in Table B-4. Those exposure rates are quite typical of observed rates at many other locations in the country. The average annual measurement for the control samples was 4.51 mR/standard month with a range of 3.1 to 6.3 mR/standard month. The annual accumulation of indicator samples had a measurement of 4.25 mR/standard month with a range of 2.7 to 6.8 mR/standard month. The 1997 annual average in the environs of the Donald C. Cook Nuclear Plant is at the low range of the exposure rates (1.0 to 2.0 mR/week) measured during the preoperational period. The results of the indicator and control TLDs are in good agreement and are plotted in Trending Graph 2.

D. Surface Water

A 125 milliliter surface water sample is collected from the intake forebay and from two shoreline locations, all within 0.3 mile of the two reactors and were composited daily over a monthly period. The thirty-two samples were analyzed for iodine-131 by the radiochemical technique described on page 76. All results were less than the lower limit of detection of 1 pCi/l. The quarterly composite was analyzed for tritium by liquid scintillation method described on page 75. Results are presented in Table B-5. Tritium was detected in

Trending Graph - 2



5 of the 12 samples analyzed with an average concentration of 1214 pCi/liter and a range of 200 to 4800 pCi/liter. This is higher than the 2 measurements in 1996 which had an average concentration of 520 pCi/liter. During the preoperational period tritium was measured in surface water samples at concentrations of approximately 400 pCi/liter. Naturally occurring potassium-40 and cesium-137 were not measured during 1997. Naturally occurring gamma emitting isotopes were detected using gamma ray spectroscopy.

E. Groundwater

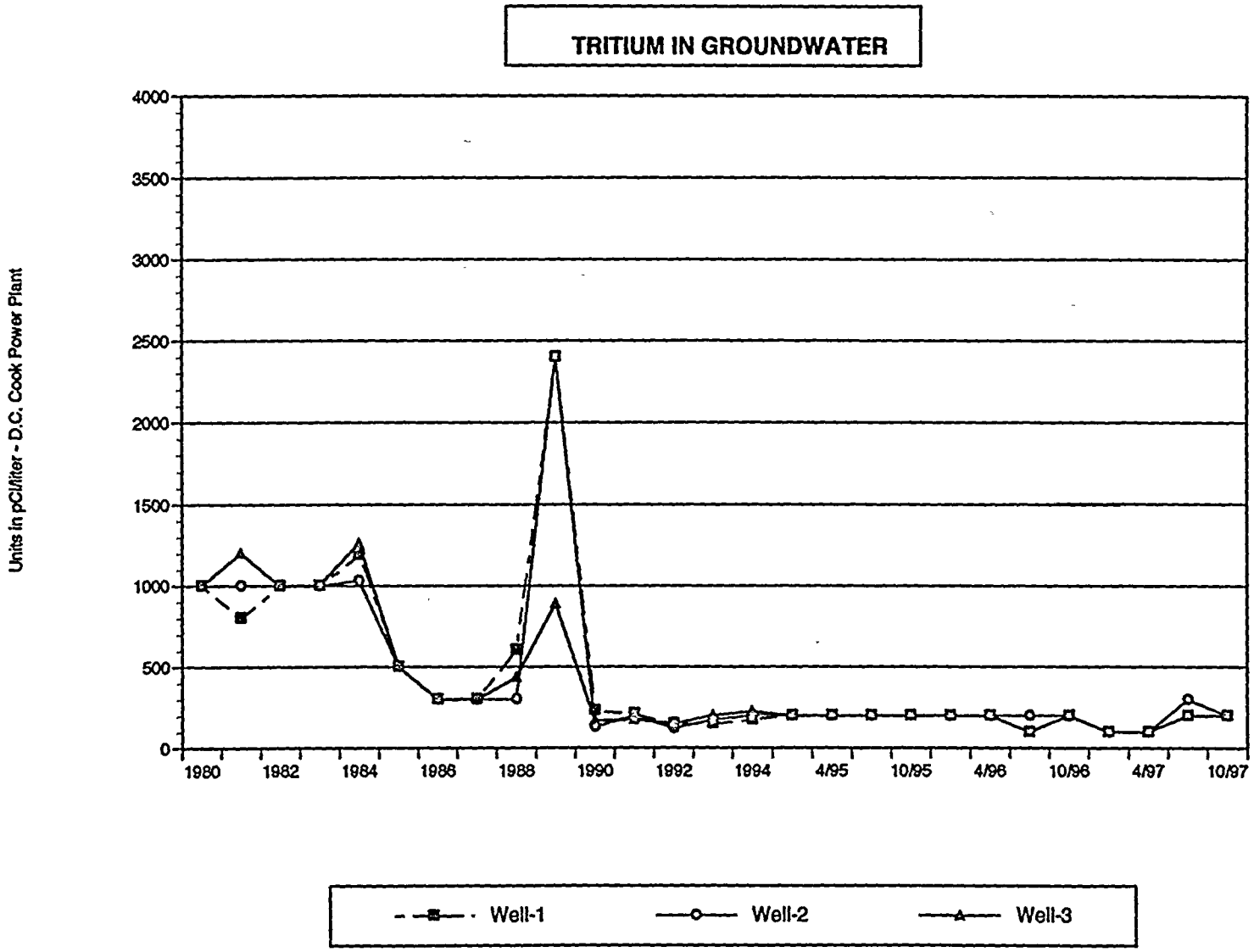
Water samples are collected quarterly from fourteen wells, all within 4300 feet of the reactors. First, a static water elevation is determined and three well bore volumes are purged from the well using a groundwater pump, or equivalent. A two liter sample is then obtained. The samples are analyzed for gamma emitters and tritium. The results are presented in Table B-6. Naturally occurring potassium-40 was measured in one sample with a concentration of 44.4 pCi/liter. There were no other gamma emitting isotopes measured. The groundwater wells W-4, W-5, W-6, and W-14 had measurable tritium activity throughout 1997. Tritium was measured in 16 of the 56 samples at the locations with an average concentration of 3618 pCi/liter and a range of 210 to 19000 pCi/liter. The annual concentrations of tritium in wells W-1 through W-7 are plotted in Trending Graph 3.

Tritium concentration in groundwater wells during the preoperational period typically averaged 400 pCi/liter.

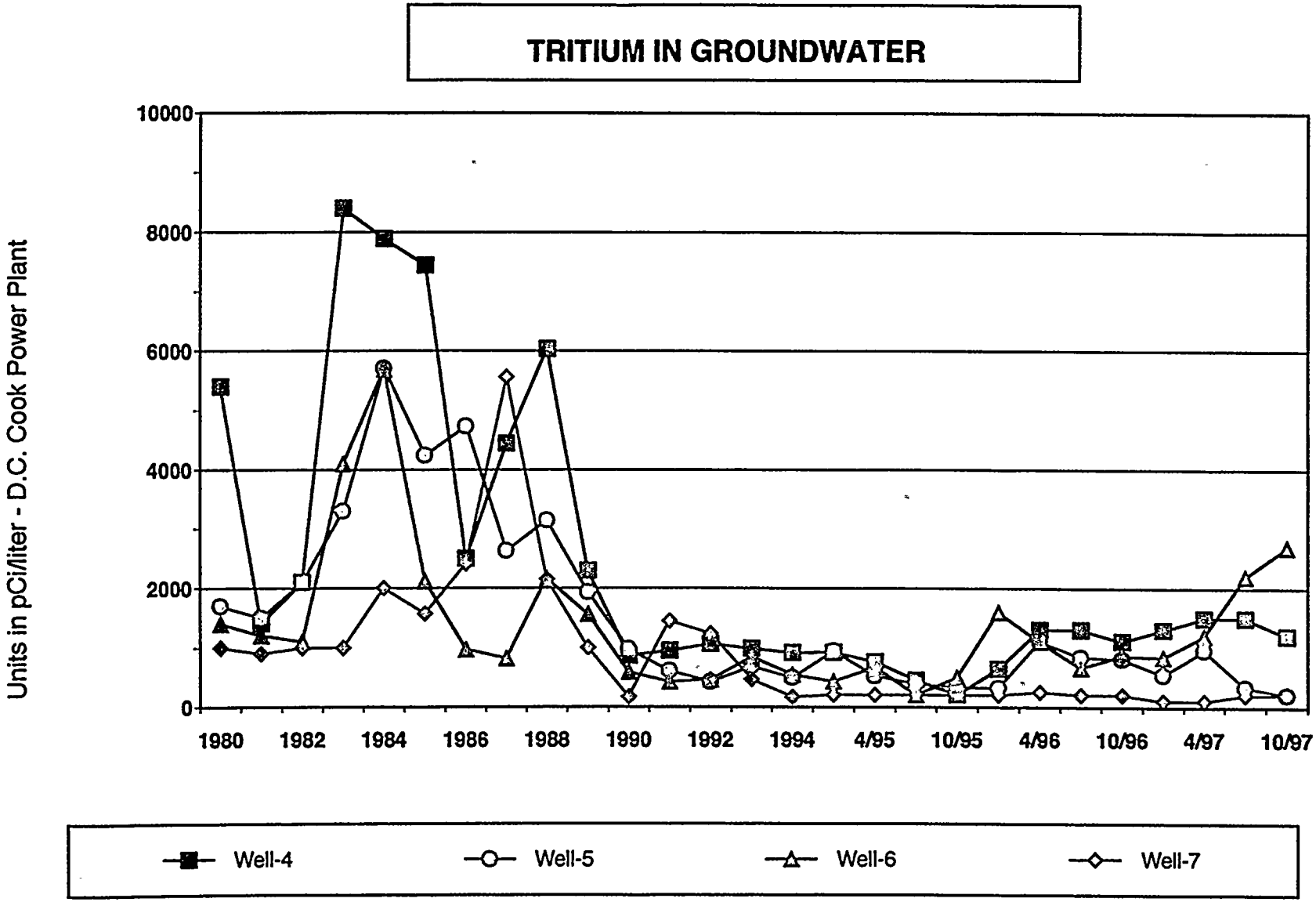
F. Drinking Water

Daily samples are collected at the intake of the purification plants for St. Joseph and Lake Township. The 500 ml daily samples at each location are composited and analyzed for gross beta, iodine-131, and gamma emitters. On a quarterly basis the daily samples are composited and analyzed for tritium. The results of analyses of drinking water samples are shown in Table B-7.

Trending Graph - 3

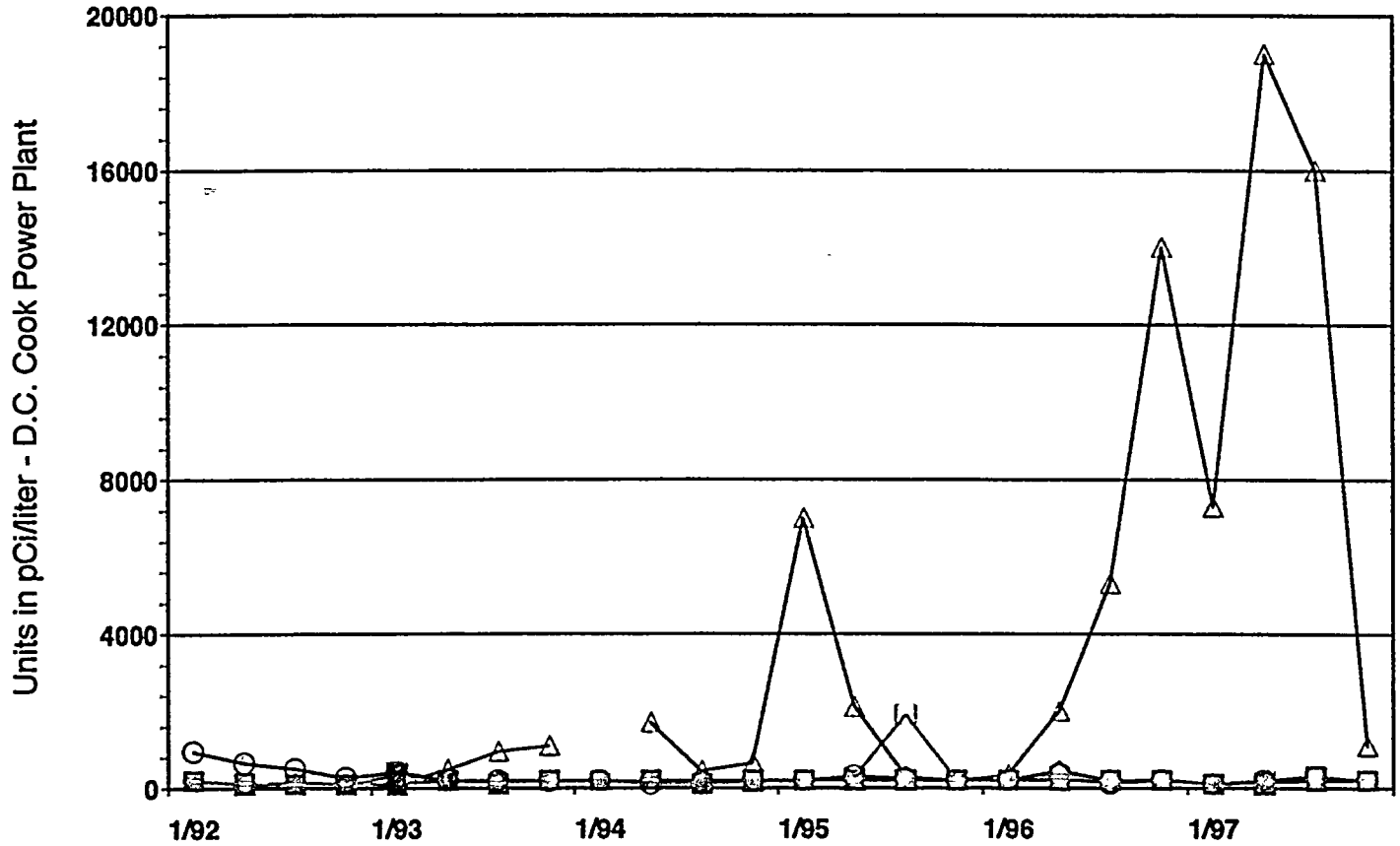


Trending Graph - 3 (Cont.)



Trending Graph (Cont.)

TRITIUM IN GROUNDWATER



Well 14 added to the program in 1993.
No sample collected January 1994.

Well-8 Well-9 Well-10 Well-11 Well-12 Well-13 Well-14

Gross beta activity was measured in all twenty-six samples from the Lake Township intake with an average concentration of 2.97 pCi/liter and a range from 2.0 to 3.9 pCi/liter. Gross beta activity was measured in all twenty-six samples from the St. Joseph intake with an average concentration of 2.97 pCi/liter and a range from 1.6 to 5.6 pCi/liter. No gamma emitting isotopes or iodine-131 were detected. Tritium was measured in one of the four samples from the Lake Township location at a concentration of 350 pCi/liter. Tritium was not measured at the St. Joseph intake location. Tritium (or LLD values) in drinking water are plotted in Trending Graph 4.

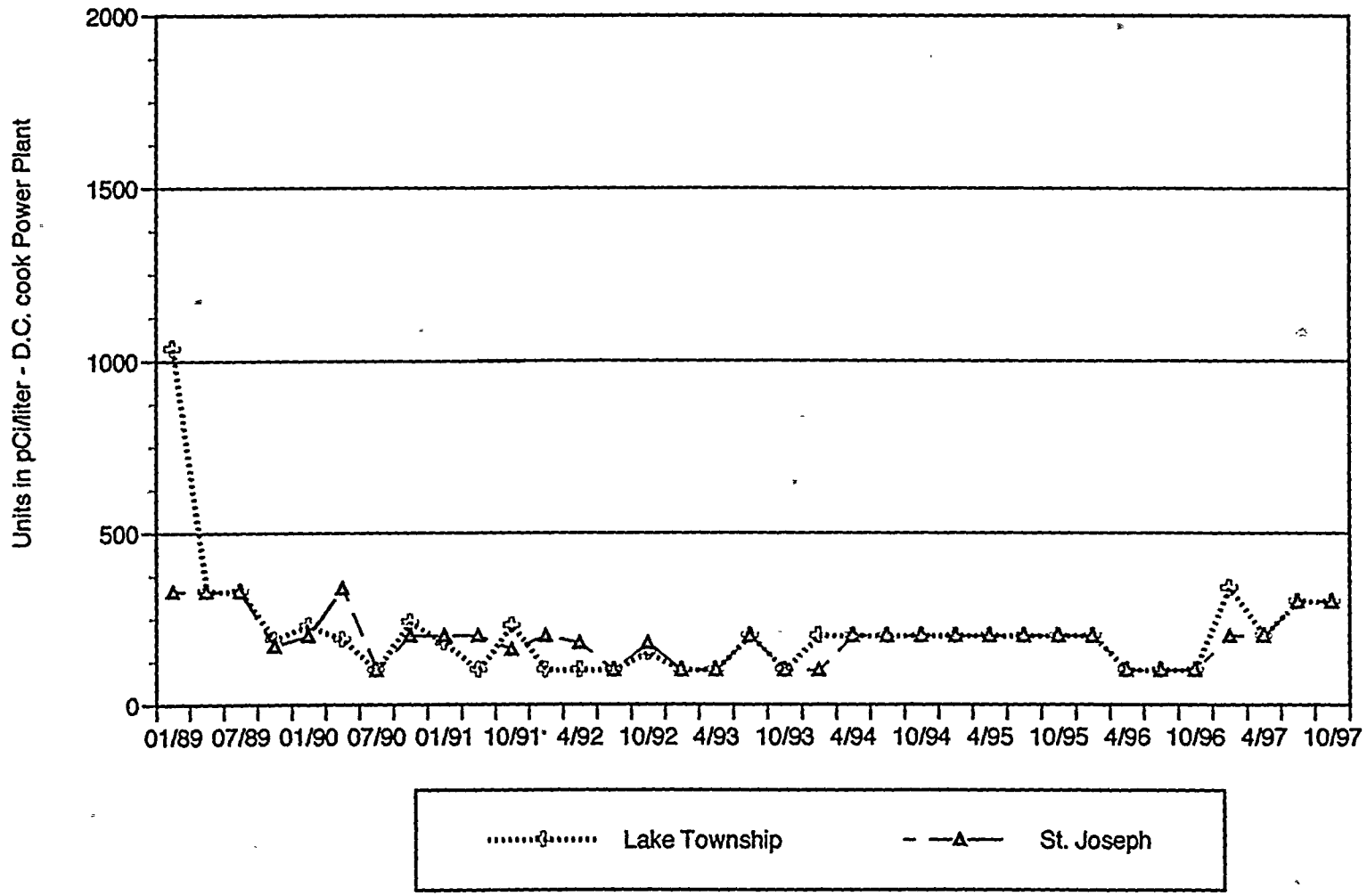
There were no drinking water analyses performed in the preoperational program.

G. Sediment

Sediment samples are collected semiannually along the shoreline of Lake Michigan at the same two locations as the surface water samples. Two liters of lake sediment are collected using a small dredge in an area covered part time by wave action. The sediment samples are analyzed by gamma ray spectroscopy, the results of which are shown in Table B-8. In April one sample was collected from location SL-2 and SL-3. In October, only location SL-2 was sampled as location SL-3 was covered with lake water. Gamma ray spectroscopy detected naturally occurring potassium-40 in all three samples. The average potassium-40 concentration was 4613 pCi/kg (dry weight) with a range from 3190 to 6810 pCi/kg (dry weight). Thorium-228, also naturally occurring was measured in two samples with an average concentration of 478 pCi/kg (dry weight) with a range from 211 to 745 pCi/kg (dry weight). Radium-226 was measured in one sample with an activity of 614 pCi/kg (dry weight). All other gamma emitters were below the lower limits of detection.

Trending Graph - 4

TRITIUM IN DRINKING WATER



H. Milk

During 1997, the requirements of two samples from different locations was not met. The sampling of food samples was increased to offset the milk.

I. Broadleaf Vegetation

Broadleaf vegetation was collected in lieu of milk during 1997. Twenty-four samples were collected and results are presented in Table B-10. Naturally occurring potassium-40 was measured in the six control samples with an average concentration of 5705 pCi/kg (wet weight) and a range of 4750 to 7620 pCi/kg (wet weight). Potassium-40 was measured in the eighteen indicator samples with an average concentration of 3888 pCi/kg (wet weight) and a range of 1770 to 6010 pCi/kg (wet weight). Cosmogenically produced beryllium-7 was measured in the six control samples with an average concentration of 1835 pCi/kg (wet weight) and a range of 548 to 5430 pCi/kg (wet weight). Beryllium-7 was measured in the eighteen indicator samples with an average of 1092 pCi/kg (wet weight) and a range of 382 to 2180 pCi/kg (wet weight). Cesium-137 was not detected during 1997. Radium-226 was measured in one indicator sample at a concentration of 687 pCi/kg (wet weight). Thorium was measured in three indicator samples with an average concentration of 101 pCi/kg (wet weight) and a range of 66.6 to 138 pCi/kg (wet weight).

J. Fish

Using gill nets in approximately twenty feet of water in Lake Michigan, 4.5 pounds of fish are collected 2 times per year from each of four locations. The samples were then analyzed by gamma ray spectroscopy. Results are presented in Table B-11. Naturally occurring potassium-40 was measured in the four control samples with an average concentration of 3075 pCi/kg (wet weight) and a range of 2690 to 3820 pCi/kg (wet weight). Potassium-40 was measured in the four indicator samples with an average concentration of 2998 pCi/kg (wet weight) and a range of 2720 to 3330 pCi/kg (wet

weight). Cesium-137 was measured in one control fish samples with a concentration of 23.5 pCi/kg (wet weight). Cesium-137 was measured in one indicator samples with a concentration of 21.0 pCi/kg (wet weight).

K. Food Products

Food samples are collected annually at harvest, as near the site boundary as possible, and approximately twenty miles from the plant. Each sample consists of 3 pounds of grapes and 3 pounds of broadleaves. There were four food samples collected during 1997 and results are presented in Table B-12. Naturally occurring potassium-40 was measured in the two control samples with an average concentration of 2790 pCi/kg (wet weight) and a range of 1960 to 3620 pCi/kg (wet weight). Potassium-40 was measured in the two indicator food samples with an average concentration of 2920 pCi/kg (wet weight) and a range of 2070 to 3770 pCi/kg (wet weight). Cosmogenically produced beryllium-7 was measured in one indicator sample with a concentration of 3010 pCi/kg (wet weight). Beryllium-7 was also measured in one indicator samples with a concentration of 5140 pCi/kg (wet weight). All other gamma emitters were below the lower limits of detection.

IV. CONCLUSIONS

IV. CONCLUSIONS

The results of the 1997 Radiological Environmental Monitoring Program for the Donald C. Cook Nuclear Plant have been presented. The results were as expected for normal environmental samples. Naturally occurring radioactivity was observed in sample media in the expected activity ranges.

Occasional samples of a few media showed the presence of man-made isotopes. These have been discussed individually in the text. Observed activities were at very low concentrations and had no significant dose consequence. Specific examples of sample media with positive analysis results are discussed below.

Air particulate gross beta concentrations of all the indicator locations for 1997 appear to follow the gross beta concentrations at the control locations. The concentration levels are actually lower than during the preoperational period. Gamma isotopic analysis of the particulate samples identified the gamma emitting isotopes as natural products (beryllium-7 and potassium-40). No man-made activity was found in the particulate media during 1997. No iodine-131 was detected in charcoal filters in 1997.

Thermoluminescent dosimeters (TLDs) measure external gamma radiation from naturally occurring radionuclides in the air and soil, radiation from cosmic origin and fallout from atmospheric nuclear weapons testing, and radioactive airborne releases and direct radiation from the power plant. The average annual TLD results were at normal background exposure levels.

Surface water samples are collected daily from the intake forebay and two locations in Lake Michigan. The samples are analyzed quarterly for tritium, and monthly for gamma emitting isotopes. No gamma emitters were detected during 1997. Tritium was measured in five samples. In four of the five samples the tritium concentration was at a normal background level. One sample had a tritium result of 4800 pCi/liter which is attributed to operation of the plant.

Groundwater samples were collected quarterly at fourteen wells, all within 4300 feet of the reactors. The three wells within 500 feet had measurable tritium which is attributed to the operation of the plant. The

highest concentration measured in 1997 was 19000 pCi/liter while the highest concentration measured during 1996 was 14000 pCi/liter. The increased tritium concentration is attributed to draining portions of the Component Cooling Water (CCW) system to the turbine room sump which discharges into the onsite absorption pond. Well W-14 is adjacent to the pond and monitors the aquifer at this location. Potassium-40, a naturally occurring nuclide was not observed during 1997. No other gamma emitting isotopes were detected.

Samples are collected daily at the intakes of the drinking purification plants for St. Joseph and Lake Township. Samples composited daily over a two week period are analyzed for iodine-131, gross beta, and measured for gamma emitting isotopes. Samples are also analyzed quarterly for tritium. No iodine-131 or gamma emitting isotopes were detected. Gross beta was measured in all fifty-two samples at normal background concentrations. Tritium was measured in one of the eight quarterly composite samples collected during 1997.

Sediment samples can be a sensitive indicator of discharges from nuclear power stations. Sediment samples are collected semiannually along the shoreline of Lake Michigan at two locations in close proximity of the reactors. The samples were analyzed by gamma ray spectroscopy and only naturally occurring gamma emitters were detected. There is no evidence of station discharges affecting Lake Michigan, either in the sediments or in the water, as previously discussed.

Milk samples were not analyzed during 1997 due to lack of participants in the program. Broadleaf sampling was performed in lieu of milk collection in 1997. Cesium-137 was not measured in broadleaf samples during 1997. No other gamma emitting isotopes were measured in broadleaf samples in 1997.

Fish samples collected in Lake Michigan in the vicinity of the nuclear plant were analyzed by gamma ray spectroscopy. The only gamma emitting isotope measured was cesium-137 which was found in low concentrations in two samples.

Food products, consisting of grapes, and broadleaf vegetation were collected and analyzed by gamma ray spectroscopy. The only gamma emitting isotopes measured during 1997 were potassium-40 and beryllium-7.

The results of the analyses have been presented. Based on the evidence of the Radiological Environmental Monitoring Program the Donald C. Cook Nuclear Plant is operating within regulatory limits. Tritium in four on-site wells appears to be the only radionuclide which can be directly correlated with the plant. However the associated groundwater does not provide a direct dose pathway to man.

V. REFERENCES

V. REFERENCES

1. Data Tables from 1985-1988 CEP-AEPSC Annual Radiological Environmental Monitoring Program Reports.

2. Eberline Instrument Company. Indiana Michigan Power Company, "D. C. Cook Nuclear Plant Radiological Environmental Monitoring Program - 1974 Annual Report", May 1975.

3. American Electric Power, 12 PMP 6010 0SD.001, Offsite Dose Calculation Manual.

4. United States Nuclear Regulatory Commission, Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants", December 1975.

5. United States Nuclear Regulatory Commission, Regulatory Guide 1.21 "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, April 1974.

6. United States Nuclear Regulatory Commission, Regulatory Guide 1.4 "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants", April 1975.

7. USNRC Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979.

APPENDIX A
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT DOCKET NO. 50-315/50-316

BERRIEN COUNTY JANUARY 1 to DECEMBER 31, 1997

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		ALL INDICATOR LOCATIONS MEAN (a/b) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Air Iodine (pCi/m^3)	I-131	530	-(0/318) -			-(0/212) -	0
Airborne Particulates (1E-03 pCi/m^3)	Gross Beta (Weekly)	530	19.2(318/318) (7.9-48)	ONS-5 Onsite 1895 ft.	19.9(53/53) (10-48)	19.1(212/212) (8.3-51)	0
	Gamma	40					
	Be-7	40	125(24/24) (87.4-175)	ONS-6 Onsite 1917 ft.	134(4/4) (111-160)	126(16/16) (86.3-174)	0
	K-40	40	4.38(3/24) (2.93-6.94)	ONS-1 Onsite 1945 ft.	6.94(1/4) -	4.31(6/16) (2.68-6.35)	0
Direct Radiation (mR/Standard Month)	Gamma Dose Quarterly	107	4.25(91/91) (2.7-6.8)	SBN 26.2 mi SE	5.28(4/4) (4.4-6.3)	4.51(16/16) (3.1-6.3)	0

(a/b) Ratio of samples with detectable activity to total number of samples analyzed.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT DOCKET NO. 50-315/50-316

BERRIEN COUNTY JANUARY 1 to DECEMBER 31, 1997

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		ALL INDICATOR LOCATIONS MEAN (a/b) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Surface Water (pCi/liter)	Gamma	32	(0/12) -	N/A		(0/20) -	0
	H-3	12	2600(2/4) (400-4800)	SWL-1 Intake	2600(2/4) (400-4800)	290(3/8) (200-390)	0
Groundwater (pCi/liter)	Gamma	56					
	K-40	56	44.4(1/56) -	Well 3 -	44.4(1/4) -	-(0/0) -	0
	Th-228	56	-(0/56) -	N/A		-(0/0) -	0
	H-3	56	3618(16/56) (210-19000)	Well 14 1780 ft.	10850(4/4) (1100-19000)	-(0/0) -	0
Drinking Water (pCi/liter)	Gross Beta	52	2.97(52/52) (1.6-5.6)	St. Joseph 9.0 mi NE	2.97(26/26) (1.6-5.6)	-(0/0)	0
	I-131	52	-(0/52) -	N/A	N/A	-(0/0) -	0
	Gamma	52	-(0/52) -	N/A	N/A	-(0/0) -	0
	H-3	8	350(1/8) -	LTW 0.4 mi S	350(1/4) -	-(0/0) -	0

(a/b) Ratio of samples with detectable activity to total number of samples analyzed.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT DOCKET NO. 50-315/50-316

BERRIEN COUNTY JANUARY 1 to DECEMBER 31, 1997

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		ALL INDICATOR LOCATIONS MEAN (a/b) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Sediment (pCi/kg dry)	Gamma	3					
	K-40	3	4613(3/3) (3190-6810)	SL-3 0.3 mi S	6810(1/1) -	-(0/0) -	0
	Cs-137	3	-(0/3) -	N/A		-(0/0) -	0
	Ra-226	3	614(1/3) -	SL-2 0.2 mi N	614(1/2) -	-(0/0) -	0
	Th-228	3	478(2/3) (211-745)	SL-2 0.2 mi N	478(2/2) (211-745)	-(0/0) -	0
Broadleaf/ Vegetation (pCi/kg wet)	Gamma	24					
	Be-7	24	1092(18/18) (382-2180)	Sector J	1835(6/6) (548-5430)	1835(6/6) (548-5430)	0
	K-40	24	3888(18/18) (1770-6010)	Sector J	5705(6/6) (4750-7620)	5705(6/6) (4750-7620)	0
	Cs-137	24	-(0/18) -	N/A	N/A	-(0/6) -	0
	Ra-226	24	687(1/18) -	Sector A	687(1/24) -	-(0/6) -	0
	Th-228	24	101(3/18) (66.6-138)	Sector A	101(3/24) (66.6-138)	-(0/6) -	0

(a/b) Ratio of samples with detectable activity to total number of samples analyzed.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT DOCKET NO. 50-315/50-316

BERRIEN COUNTY JANUARY 1 to DECEMBER 31, 1997

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		ALL INDICATOR LOCATIONS MEAN (a/b) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Fish (pCi/kg wet)	Gamma	8					
	K-40	8	2998(4/4) (2720-3330)	OFS-South 5.0 mi S	3415(2/2) (3010-3820)	3075(4/4) (2690-3820)	0
	Cs-137	8	21.0(1/4) -	OFS-South 5.0 mi S	23.5(1/2) -	23.5(1/4) -	0
Food/Vegetation (pCi/kg wet)	Gamma	4					
	Be-7	4	5140(1/2) -	Sector D	5140(1/2) -	3010(1/2) -	0
	K-40	4	2920(2/2) (2070-3770)	Sector D	2920(2/2) (2070-3770)	2790(2/2) (1960-3620)	0
	Cs-137	4	-(0/2) -			-(0/2) -	0

(a/b) Ratio of samples with detectable activity to total number of samples analyzed.

APPENDIX B
DATA TABLES

TABLE B-1

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA EMITTERS IN WEEKLY AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL	Average ± 2 s.d.
JANUARY 97											
01/02/97	36 ± 4	37 ± 5	32 ± 4	37 ± 4	35 ± 4	37 ± 5	41 ± 5	59 ± 10 (a)	36 ± 4	38 ± 5	37 ± 5
01/08/97	22 ± 3	25 ± 3	25 ± 3	27 ± 3	23 ± 2	30 ± 3	26 ± 3	27 ± 3	28 ± 3	27 ± 3	26 ± 5
01/15/97	27 ± 2	24 ± 2	22 ± 2	27 ± 2	23 ± 2	24 ± 3	23 ± 2	29 ± 3	29 ± 2	24 ± 2	25 ± 5
01/22/97	25 ± 2	23 ± 2	19 ± 2	22 ± 2	21 ± 2	19 ± 2	23 ± 2	22 ± 2	26 ± 2	24 ± 2	22 ± 5
01/29/97	16 ± 2	15 ± 2	20 ± 2	25 ± 2	17 ± 2	22 ± 2	22 ± 2	20 ± 2	22 ± 2	20 ± 2	20 ± 6
FEBRUARY											
02/05/97	28 ± 2	25 ± 2	20 ± 2	28 ± 2	25 ± 2	23 ± 2	25 ± 2	25 ± 2	27 ± 2	28 ± 2	25 ± 5
02/12/97	18 ± 2	17 ± 2	16 ± 2	19 ± 2	16 ± 2	16 ± 2	18 ± 2	16 ± 2	21 ± 2	18 ± 2	18 ± 3
02/19/97	25 ± 2	20 ± 2	18 ± 2	30 ± 3	24 ± 2	23 ± 2	23 ± 2	21 ± 2	22 ± 2	20 ± 2	23 ± 7
02/26/97	23 ± 2	18 ± 2	18 ± 2	17 ± 2	20 ± 2	17 ± 2	17 ± 2	19 ± 2	21 ± 2	20 ± 2	19 ± 4
MARCH											
03/05/97	16 ± 2	15 ± 2	14 ± 2	15 ± 2	17 ± 2	14 ± 2	18 ± 2	17 ± 2	15 ± 2	15 ± 2	16 ± 3
03/12/97	22 ± 2	20 ± 2	20 ± 2	20 ± 2	22 ± 2	23 ± 2	21 ± 2	23 ± 2	22 ± 2	21 ± 2	21 ± 2
03/19/97	20 ± 2	18 ± 2	19 ± 2	20 ± 2	21 ± 2	18 ± 2	21 ± 2	21 ± 2	20 ± 2	20 ± 2	20 ± 2
03/26/97	15 ± 2	14 ± 2	13 ± 2	14 ± 2	15 ± 2	17 ± 2	12 ± 2	17 ± 2	17 ± 2	16 ± 2	15 ± 4
04/02/97	18 ± 2	16 ± 2	14 ± 2	15 ± 2	17 ± 2	15 ± 2	13 ± 2	16 ± 2	15 ± 2	18 ± 2	16 ± 3
Quarter Avg.	**22 ± 12**	**21 ± 12**	**19 ± 10**	**23 ± 13**	**21 ± 10**	**21 ± 13**	**22 ± 14**	**21 ± 8**	**23 ± 12**	**22 ± 12**	**22 ± 13**

(a) Pump off; reset. Low sample volume and not included in averages.

TABLE B-1 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA EMITTERS IN WEEKLY AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL	Average ± 2 s.d.
APRIL											
04/09/97	18 ± 2	14 ± 2	16 ± 2	18 ± 2	19 ± 2	20 ± 2	13 ± 2	17 ± 2	15 ± 2	18 ± 2	17 ± 5
04/16/97	24 ± 2	20 ± 2	19 ± 2	21 ± 2	20 ± 2	23 ± 2	18 ± 2	18 ± 2	19 ± 2	20 ± 2	20 ± 4
04/23/97	15 ± 2	15 ± 2	14 ± 2	17 ± 2	17 ± 2	17 ± 2	15 ± 2	18 ± 2	17 ± 2	15 ± 2	16 ± 3
04/30/97	14 ± 2	15 ± 2	13 ± 2	15 ± 2	17 ± 2	19 ± 2	14 ± 2	15 ± 2	14 ± 2	14 ± 2	15 ± 4
MAY											
05/07/97	16 ± 2	14 ± 2	< 2	18 ± 2	16 ± 2	15 ± 2	17 ± 2	18 ± 2	14 ± 2	16 ± 2	16 ± 3
05/14/97	11 ± 2	12 ± 2	11 ± 2	13 ± 2	13 ± 2	11 ± 1	11 ± 2	13 ± 2	11 ± 2	12 ± 2	12 ± 2
05/21/97	9.3 ± 1.5	9.7 ± 1.5	7.9 ± 1.4	10 ± 1	11 ± 2	9.6 ± 1.4	9.0 ± 1.4	12 ± 2	10 ± 2	9.5 ± 1.5	9.8 ± 2.2
05/28/97	11 ± 2	9.9 ± 1.5	9.3 ± 1.5	9.1 ± 1.4	10 ± 2	9.0 ± 1.4	8.4 ± 1.4	9.5 ± 1.5	10 ± 2	8.3 ± 1.4	9.4 ± 1.6
JUNE											
06/04/97	13 ± 2	13 ± 2	11 ± 2	14 ± 2	12 ± 2	13 ± 2	13 ± 2	11 ± 2	12 ± 2	13 ± 2	13 ± 2
06/11/97	15 ± 2	16 ± 2	15 ± 2	16 ± 2	18 ± 2	16 ± 2	15 ± 2	16 ± 2	14 ± 2	14 ± 2	16 ± 2
06/18/97	13 ± 2	14 ± 2	10 ± 2	13 ± 2	13 ± 2	12 ± 2	14 ± 2	14 ± 2	13 ± 2	11 ± 2	13 ± 3
06/25/97	19 ± 2	17 ± 2	15 ± 2	18 ± 2	19 ± 2	17 ± 2	17 ± 2	18 ± 2	18 ± 2	18 ± 2	18 ± 2
07/02/97	16 ± 2	15 ± 2	15 ± 2	18 ± 2	19 ± 2	18 ± 2	18 ± 2	18 ± 2	16 ± 2	15 ± 2	17 ± 3
Quarter Avg.	**15 ± 8**	**14 ± 6**	**13 ± 6**	**15 ± 7**	**16 ± 7**	**15 ± 8**	**14 ± 6**	**15 ± 6**	**14 ± 6**	**14 ± 7**	**15 ± 7**

TABLE B-1 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA EMITTERS IN WEEKLY AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL	Average ± 2 s.d.
JULY											
07/09/97	11 ± 2	10 ± 2	8.7 ± 1.6	13 ± 2	13 ± 2	11 ± 2	12 ± 2	14 ± 2	12 ± 2	11 ± 2	12 ± 3
07/16/97	18 ± 2	19 ± 2	17 ± 2	17 ± 2	20 ± 2	13 ± 2	16 ± 2	16 ± 2	15 ± 2	15 ± 2	17 ± 4
07/23/97	20 ± 2	18 ± 2	21 ± 2	21 ± 2	23 ± 2	19 ± 2	18 ± 2	19 ± 2	18 ± 2	18 ± 2	20 ± 3
07/30/97	24 ± 2	15 ± 2	20 ± 2	22 ± 2	22 ± 2	22 ± 2	16 ± 2	23 ± 2	21 ± 2	21 ± 2	21 ± 6
AUGUST											
08/06/97	23 ± 2	22 ± 2	26 ± 2	23 ± 2	25 ± 2	22 ± 2	21 ± 2	22 ± 2	21 ± 2	19 ± 2	22 ± 4
08/13/97	16 ± 2	16 ± 2	17 ± 2	16 ± 2	17 ± 2	15 ± 2	17 ± 2	15 ± 2	15 ± 2	15 ± 2	16 ± 2
08/20/97	20 ± 2	15 ± 2	14 ± 2	14 ± 2	17 ± 2	13 ± 2	16 ± 2	12 ± 2	13 ± 2	14 ± 2	15 ± 5
08/27/97	21 ± 2	20 ± 2	17 ± 2	15 ± 2	19 ± 2	19 ± 2	21 ± 2	19 ± 2	16 ± 2	18 ± 2	19 ± 4
09/03/97	16 ± 2	16 ± 2	14 ± 2	16 ± 2	15 ± 2	17 ± 2	20 ± 2	19 ± 2	16 ± 2	15 ± 2	16 ± 4
SEPTEMBER											
09/10/97	26 ± 2	23 ± 2	23 ± 2	23 ± 2	21 ± 2	21 ± 2	22 ± 2	22 ± 2	21 ± 2	20 ± 2	22 ± 3
09/17/97	25 ± 2	24 ± 2	22 ± 2	24 ± 2	25 ± 2	24 ± 2	28 ± 2	28 ± 2	24 ± 2	24 ± 2	25 ± 4
09/24/97	13 ± 2	12 ± 2	13 ± 2	15 ± 2	14 ± 2	15 ± 2	14 ± 2	14 ± 2	14 ± 2	12 ± 2	13 ± 2
10/01/97	16 ± 2	17 ± 2	15 ± 2	19 ± 2	20 ± 2	16 ± 2	16 ± 2	16 ± 2	15 ± 2	14 ± 2	16 ± 4
Quarter Avg.	**19 ± 9**	**17 ± 8**	**17 ± 9**	**18 ± 8**	**19 ± 8**	**18 ± 8**	**18 ± 8**	**18 ± 9**	**17 ± 7**	**17 ± 7**	**18 ± 8**

TABLE B-1 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA EMITTERS IN WEEKLY AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL	Average ± 2 s.d.
OCTOBER											
10/08/97	34 ± 2	28 ± 3	33 ± 2	33 ± 2	34 ± 2	32 ± 2	35 ± 2	34 ± 2	33 ± 2	33 ± 2	33 ± 4
10/15/97	24 ± 2	25 ± 2	23 ± 2	22 ± 2	25 ± 2	23 ± 2	26 ± 2	25 ± 2	23 ± 2	19 ± 2	23 ± 4
10/22/97	14 ± 2	15 ± 2	16 ± 2	14 ± 2	17 ± 2	14 ± 2	16 ± 2	16 ± 2	12 ± 2	15 ± 2	15 ± 3
10/29/97	17 ± 2	16 ± 2	16 ± 2	17 ± 2	18 ± 2	16 ± 2	18 ± 2	18 ± 2	16 ± 2	15 ± 2	17 ± 2
NOVEMBER											
11/05/97	13 ± 2	16 ± 2	17 ± 2	17 ± 2	17 ± 2	16 ± 2	15 ± 2	14 ± 2	16 ± 2	13 ± 2	15 ± 3
11/12/97	13 ± 2	15 ± 2	15 ± 2	14 ± 2	15 ± 2	14 ± 2	17 ± 2	15 ± 2	15 ± 2	15 ± 2	15 ± 2
11/19/97	22 ± 2	21 ± 2	22 ± 2	23 ± 2	21 ± 2	20 ± 2	17 ± 2	19 ± 2	18 ± 2	20 ± 2	20 ± 4
11/26/97	48 ± 3	46 ± 3	45 ± 3	47 ± 3	48 ± 3	48 ± 3	47 ± 3	51 ± 3	47 ± 3	44 ± 3	47 ± 4
12/03/97	20 ± 2	21 ± 2	20 ± 2	20 ± 2	21 ± 2	19 ± 2	23 ± 2	19 ± 2	22 ± 2	22 ± 2	21 ± 3
DECEMBER											
12/10/97	9.2 ± 1.6	10 ± 2	9.6 ± 1.6	10 ± 2	11 ± 2	9.1 ± 1.5	12 ± 2	11 ± 2	10 ± 2	9.6 ± 1.6	10 ± 2
12/17/97	28 ± 2	29 ± 2	31 ± 2	28 ± 2	32 ± 2	29 ± 2	33 ± 2	31 ± 2	32 ± 3	30 ± 2	30 ± 4
12/24/97	24 ± 2	26 ± 2	25 ± 2	24 ± 2	26 ± 2	27 ± 2	27 ± 2	25 ± 2	24 ± 2	26 ± 2	25 ± 2
12/31/97	19 ± 2	21 ± 2	20 ± 2	21 ± 2	19 ± 2	21 ± 2	21 ± 2	22 ± 2	21 ± 2	19 ± 2	20 ± 2
Quarter Avg.	22 ± 21	22 ± 18	23 ± 19	22 ± 19	23 ± 20	22 ± 20	24 ± 20	23 ± 21	22 ± 20	22 ± 19	22 ± 19
Annual Avg.	20 ± 14	19 ± 13	18 ± 14	20 ± 14	20 ± 13	19 ± 14	19 ± 15	19 ± 14	19 ± 14	19 ± 14	19 ± 14

TABLE B-2

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN QUARTERLY COMPOSITES OF AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

Stations	Nuclides	First Quarter 12/30/96-04/02/97	Second Quarter 04/02/97-07/02/97	Third Quarter 07/02/97-10/01/97	Fourth Quarter 10/01/97-12/31/97	Average ±2 s.d.
ONS-1	Be-7	105 ± 10	150 ± 15	137 ± 14	87.4 ± 8.7	120 ± 57
	K-40	< 4	6.94 ± 2.44	< 5	< 4	6.94 ± 2.44
	Cs-134	< 0.2	< 0.3	< 0.3	< 0.3	-
	Cs-137	< 0.2	< 0.3	< 0.3	< 0.3	-
ONS-2	Be-7	114 ± 11	175 ± 18	119 ± 12	88.0 ± 8.8	124 ± 73
	K-40	< 5	< 4	< 7	< 7	-
	Cs-134	< 0.3	< 0.2	< 0.3	< 0.3	-
	Cs-137	< 0.2	< 0.2	< 0.2	< 0.3	-
ONS-3	Be-7	101 ± 10	159 ± 16	127 ± 13	88.6 ± 8.9	119 ± 62
	K-40	< 7	< 5	< 10	< 10	-
	Cs-134	< 0.3	< 0.2	< 0.3	< 0.3	-
	Cs-137	< 0.3	< 0.3	< 0.3	< 0.3	-
ONS-4	Be-7	112 ± 11	156 ± 16	138 ± 14	105 ± 11	128 ± 47
	K-40	2.93 ± 1.59	< 9	< 4	< 4	2.93 ± 1.59
	Cs-134	< 0.2	< 0.4	< 0.2	< 0.2	-
	Cs-137	< 0.3	< 0.3	< 0.2	< 0.3	-
ONS-5	Be-7	101 ± 10	159 ± 16	138 ± 14	93.9 ± 9.4	123 ± 62
	K-40	< 5	3.27 ± 1.71	< 6	< 5	3.27 ± 1.71
	Cs-134	< 0.2	< 0.3	< 0.2	< 0.2	-
	Cs-137	< 0.2	< 0.3	< 0.2	< 0.2	-

* Typical LLDs are found in Table B-12. All other gamma emitters were <LLD.

TABLE B-2 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN QUARTERLY COMPOSITES OF AIRBORNE PARTICULATES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

Stations	Nuclides	First Quarter 12/30/96-04/02/97	Second Quarter 04/02/97-07/02/97	Third Quarter 07/02/97-10/01/97	Fourth Quarter 10/01/97-12/31/97	Average ±2 s.d.
ONS-6	Be-7	111 ± 11	160 ± 16	153 ± 15	111 ± 11	134 ± 53
	K-40	< 4	< 5	< 5	< 5	-
	Cs-134	< 0.2	< 0.3	< 0.3	< 0.3	-
	Cs-137	< 0.3	< 0.3	< 0.3	< 0.3	-
NBF	Be-7	102 ± 10	144 ± 14	147 ± 15	97.5 ± 9.8	123 ± 53
	K-40	4.24 ± 2.31	< 6	4.23 ± 1.96	< 4	4.24 ± 0.01
	Cs-134	< 0.4	< 0.2	< 0.2	< 0.2	-
	Cs-137	< 0.3	< 0.2	< 0.2	< 0.2	-
SBN	Be-7	114 ± 11	168 ± 17	138 ± 14	89.6 ± 9.0	127 ± 67
	K-40	< 7	< 9	< 4	2.68 ± 1.57	2.68 ± 1.57
	Cs-134	< 0.3	< 0.3	< 0.2	< 0.3	-
	Cs-137	< 0.3	< 0.3	< 0.2	< 0.2	-
DOW	Be-7	124 ± 12	174 ± 17	124 ± 12	86.3 ± 8.6	127 ± 72
	K-40	< 5	< 4	4.37 ± 1.94	< 7	4.37 ± 1.94
	Cs-134	< 0.2	< 0.2	< 0.2	< 0.2	-
	Cs-137	< 0.2	< 0.3	< 0.2	< 0.3	-
COL	Be-7	115 ± 11	169 ± 17	121 ± 12	94.9 ± 9.5	125 ± 63
	K-40	6.35 ± 2.42	< 5	4.01 ± 2.04	< 5	5.18 ± 3.31
	Cs-134	< 0.3	< 0.2	< 0.2	< 0.2	-
	Cs-137	< 0.2	< 0.2	< 0.3	< 0.3	-

* Typical LLDs are found in Table B-12. All other gamma emitters were <LLD.

TABLE B-3

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE-131 IN WEEKLY AIR CARTRIDGE SAMPLES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL
JANUARY 97										
01/02/97	< 30	< 30	< 30	< 30	< 10	< 30	< 30	< 50 (a)	< 30	< 30
01/08/97	< 20	< 10	< 10	< 20	< 7	< 8	< 8	< 9	< 8	< 6
01/15/97	< 10	< 10	< 10	< 10	< 6	< 10	< 8	< 8	< 7	< 5
01/22/97	< 8	< 8	< 8	< 8	< 6	< 8	< 8	< 9	< 8	< 6
01/29/97	< 10	< 10	< 10	< 10	< 5	< 7	< 7	< 8	< 7	< 5
FEBRUARY										
02/05/97	< 10	< 10	< 10	< 10	< 7	< 8	< 8	< 8	< 8	< 5
02/12/97	< 10	< 10	< 10	< 10	< 8	< 7	< 7	< 7	< 7	< 5
02/19/97	< 9	< 8	< 8	< 10	< 7	< 9	< 8	< 9	< 9	< 6
02/26/97	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 8
MARCH										
03/05/97	< 10	< 10	< 10	< 10	< 6	< 8	< 7	< 8	< 7	< 6
03/12/97	< 20	< 20	< 20	< 20	< 10	< 20	< 20	< 20	< 20	< 10
03/19/97	< 20	< 10	< 20	< 20	< 7	< 9	< 9	< 9	< 9	< 6
03/26/97	< 9	< 9	< 9	< 9	< 6	< 10	< 10	< 10	< 10	< 8
04/02/97	< 10	< 10	< 10	< 10	< 10	< 8	< 8	< 8	< 8	< 6

(a) Power off; reset. Low sample volume.

TABLE B-3 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE-131 IN WEEKLY AIR CARTRIDGE SAMPLES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL
APRIL										
04/09/97	< 10	< 9	< 10	< 10	< 8	< 9	< 10	< 10	< 9	< 8
04/16/97	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10
04/23/97	< 8	< 8	< 9	< 9	< 6	< 10	< 10	< 10	< 10	< 7
04/30/97	< 10	< 10	< 10	< 10	< 7	< 9	< 8	< 9	< 8	< 6
MAY										
05/07/97	< 10	< 10	< 10	< 10	< 8	< 10	< 10	< 20	< 10	< 7
05/14/97	< 10	< 10	< 10	< 10	< 9	< 6	< 7	< 10	< 5	< 7
05/21/97	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 20	< 20	< 7
05/28/97	< 20	< 20	< 20	< 10	< 8	< 8	< 9	< 9	< 7	< 6
JUNE										
06/04/97	< 20	< 20	< 10	< 10	< 8	< 8	< 9	< 9	< 10	< 6
06/11/97	< 20	< 20	< 20	< 20	< 9	< 10	< 10	< 10	< 30	< 8
06/18/97	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 9
06/25/97	< 10	< 10	< 10	< 10	< 7	< 8	< 8	< 8	< 8	< 6
07/02/97	< 20	< 20	< 20	< 20	< 10	< 20	< 20	< 20	< 20	< 10

TABLE B-3 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE-131 IN WEEKLY AIR CARTRIDGE SAMPLES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL
JULY										
07/09/97	< 10	< 10	< 10	< 10	< 6	< 7	< 8	< 7	< 10	< 5
07/16/97	< 20	< 10	< 10	< 10	< 7	< 9	< 9	< 9	< 9	< 6
07/23/97	< 8	< 8	< 8	< 8	< 5	< 10	< 10	< 10	< 10	< 9
07/30/97	< 10	< 10	< 10	< 10	< 6	< 7	< 7	< 7	< 7	< 5
AUGUST										
08/06/97	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 8
08/13/97	< 10	< 10	< 10	< 10	< 7	< 10	< 10	< 10	< 10	< 9
08/20/97	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 9
08/27/97	< 10	< 10	< 10	< 10	< 7	< 10	< 10	< 10	< 10	< 6
SEPTEMBER										
09/03/97	< 8	< 8	< 8	< 9	< 7	< 8	< 9	< 8	< 9	< 6
09/10/97	< 10	< 10	< 10	< 10	< 7	< 10	< 10	< 10	< 10	< 9
09/17/97	< 10	< 10	< 10	< 10	< 6	< 7	< 7	< 7	< 8	< 5
09/24/97	< 10	< 10	< 9	< 10	< 7	< 10	< 10	< 10	< 10	< 7
10/01/97	< 8	< 7	< 8	< 9	< 7	< 8	< 8	< 9	< 9	< 7

TABLE B-3 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE-131 IN WEEKLY AIR CARTRIDGE SAMPLES

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

COLLECTION DATES	STATION CODES ONS-1	ONS-2	ONS-3	ONS-4	ONS-5	ONS-6	NBF	SBN	DOW	COL
OCTOBER										
10/08/97	< 10	< 20	< 10	< 10	< 7	< 10	< 10	< 10	< 10	< 9
10/15/97	< 10	< 10	< 10	< 10	< 7	< 20	< 20	< 20	< 20	< 10
10/22/97	< 8	< 7	< 8	< 8	< 6	< 9	< 8	< 10	< 9	< 6
10/29/97	< 10	< 10	< 20	< 20	< 7	< 20	< 20	< 20	< 20	< 8
NOVEMBER										
11/05/97	< 10	< 20	< 20	< 20	< 7	< 10	< 9	< 10	< 10	< 7
11/12/97	< 10	< 10	< 20	< 20	< 7	< 9	< 9	< 9	< 9	< 6
11/19/97	< 8	< 8	< 9	< 9	< 6	< 8	< 8	< 9	< 9	< 6
11/26/97	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
12/03/97	< 8	< 7	< 8	< 8	< 5	< 10	< 10	< 10	< 10	< 8
DECEMBER										
12/10/97	< 10	< 10	< 10	< 10	< 6	< 10	< 10	< 10	< 10	< 9
12/17/97	< 10	< 10	< 10	< 10	< 5	< 6	< 6	< 7	< 7	< 4
12/24/97	< 7	< 7	< 7	< 7	< 5	< 6	< 6	< 6	< 6	< 5
12/31/97	< 20	< 20	< 20	< 20	< 9	< 20	< 20	< 20	< 10	< 9

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

DIRECT RADIATION MEASUREMENTS - QUARTERLY TLD RESULTS

Results in Units of mR/standard month

STATION CODES	FIRST QUARTER 01/02/97-04/02/97	SECOND QUARTER 04/02/97-07/02/97	THIRD QUARTER (b) 07/02/97-10/01/97	FOURTH QUARTER 10/01/97-01/05/98	AVERAGE ± 2 s.d.
T-01	4.2 ± 0.5	3.3 ± 0.4	5.1 ± 0.1	3.4 ± 0.2	4.0 ± 1.7
T-02	4.4 ± 0.2	3.3 ± 0.4	5.1 ± 0.3	3.4 ± 0.3	4.1 ± 1.7
T-03	4.1 ± 0.6	2.9 ± 0.2	4.7 ± 0.3	3.1 ± 0.2	3.7 ± 1.7
T-04	4.3 ± 0.1	3.5 ± 0.5	5.2 ± 0.8	3.3 ± 0.3	4.1 ± 1.7
T-05	4.5 ± 0.1	3.3 ± 0.2	5.3 ± 0.2	3.4 ± 0.4	4.1 ± 1.9
T-06	4.4 ± 0.4	3.3 ± 0.5	5.2 ± 0.2	3.3 ± 0.2	4.1 ± 1.9
T-07	4.1 ± 0.4	3.2 ± 0.4	5.2 ± 0.3	3.2 ± 0.2	3.9 ± 1.9
T-08	4.4 ± 0.4	3.6 ± 0.5	5.2 ± 0.7	3.4 ± 0.3	4.2 ± 1.6
T-09	4.3 ± 0.3	3.2 ± 0.2	5.2 ± 0.4	3.3 ± 0.1	4.0 ± 1.9
T-10	4.2 ± 0.2	2.7 ± 0.4	4.7 ± 0.4	3.0 ± 0.3	3.7 ± 1.9
T-11	4.5 ± 0.2	3.4 ± 0.3	5.4 ± 0.5	3.4 ± 0.2	4.2 ± 1.9
T-12	4.9 ± 0.4	3.5 ± 0.4	5.5 ± 0.4	3.7 ± 0.7	4.4 ± 1.9
OFT-1	4.4 ± 0.3	(a)	5.2 ± 0.7	3.3 ± 0.3	4.3 ± 1.9
OFT-2	4.3 ± 0.1	3.2 ± 0.3	5.1 ± 0.3	3.6 ± 0.2	4.1 ± 1.7
OFT-3	4.7 ± 0.4	3.2 ± 0.3	5.6 ± 0.6	3.7 ± 0.4	4.3 ± 2.1
OFT-4	4.5 ± 0.2	3.7 ± 0.6	5.4 ± 0.5	3.6 ± 0.5	4.3 ± 1.7
OFT-5	4.7 ± 0.3	3.6 ± 0.5	5.9 ± 0.7	3.8 ± 0.3	4.5 ± 2.1
OFT-6	5.3 ± 1.6	4.3 ± 0.7	6.8 ± 0.7	4.3 ± 0.5	5.2 ± 2.4
OFT-7	4.5 ± 0.1	3.5 ± 0.4	5.4 ± 0.5	3.5 ± 0.1	4.2 ± 1.8
OFT-8	5.4 ± 0.4	4.1 ± 0.5	6.3 ± 0.7	4.2 ± 0.7	5.0 ± 2.1
OFT-9	4.9 ± 0.5	3.7 ± 0.5	5.7 ± 0.3	3.9 ± 0.5	4.6 ± 1.9
OFT-10	4.3 ± 0.4	3.3 ± 0.3	5.2 ± 0.5	3.4 ± 1.0	4.1 ± 1.8
OFT-11	5.3 ± 0.7	4.3 ± 0.7	6.2 ± 0.3	4.3 ± 0.4	5.0 ± 1.8
NBF	4.9 ± 0.5	3.9 ± 0.3	5.9 ± 0.4	4.2 ± 0.2	4.7 ± 1.8
SBN	5.6 ± 0.5	4.8 ± 0.4	6.3 ± 0.4	4.4 ± 0.1	5.3 ± 1.7
DOW	4.4 ± 0.1	3.4 ± 0.5	5.3 ± 0.4	3.7 ± 0.7	4.2 ± 1.7
COL	4.1 ± 0.7	3.1 ± 0.3	5.0 ± 0.5	3.2 ± 0.2	3.9 ± 1.8
Average ± 2 s.d.	**4.6 ± 0.8**	**3.5 ± 0.9**	**5.4 ± 1.0**	**3.6 ± 0.8**	**4.3 ± 1.8**

- Standard month = 30.4 days.

(a) TLD missing.

(b) Transit dose not subtracted from totals as transit had not been placed in shielded TLD holder.

TABLE B-5

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE, TRITIUM AND GAMMA EMITTERS* IN SURFACE WATER

Results in Units of pCi/liter ± 2 sigma

STATION	Collection Date	I-131	K-40	Tritium
SWL-1 (Condenser Circ.)	01/31/97	< 1	< 50	4800 ± 300
	02/28/97	< 0.9	< 60	
	03/31/97	< 1	< 60	
	04/30/97	< 0.5	< 70	400 ± 150
	05/31/97	< 0.9	< 50	
	06/30/97	< 0.5	< 50	
	07/31/97	< 0.5	< 100	< 200
	08/31/97	< 0.5	< 50	
	09/30/97	< 1	< 90	
	10/31/97	< 0.6	< 80	< 300
	11/30/97	< 1	< 50	
	12/31/97	< 1	< 70	
SWL-2 (South Comp)	01/31/97	(a)		< 200
	02/28/97	(a)		
	03/31/97	< 1	< 70	
	04/30/97	< 0.5	< 100	390 ± 150
	05/31/97	< 1	< 50	
	06/30/97	< 0.7	< 60	
	07/31/97	< 0.6	< 50	200 ± 120
	08/31/97	< 0.5	< 90	
	09/30/97	< 1	< 50	
	10/31/97	< 0.5	< 100	280 ± 180
	11/30/97	< 1	< 100	
	12/31/97	< 1	< 50	

(a) Sample not collected.
* Typical LLDs are found in Table B-12. All other gamma emitters were below <LLD.

TABLE B-5 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE, TRITIUM AND GAMMA EMITTERS* IN SURFACE WATER

Results in Units of pCi/liter ± 2 sigma

STATION	Collection Date	I-131	K-40	Tritium
SWL-3 (North Comp)	01/31/97	(a)		< 200
	02/28/97	(a)		
	03/31/97	< 1	< 90	
	04/30/97	< 0.7	< 50	< 200
	05/31/97	< 0.9	< 60	
	06/30/97	< 0.5	< 50	
	07/31/97	< 1	< 50	< 200
	08/31/97	< 0.5	< 100	
	09/30/97	< 1	< 70	
	10/31/97	< 0.6	< 40	< 300
	11/30/97	< 1	< 50	
	12/31/97	< 0.5	< 40	

(a) Sample not collected.
* Typical LLDs are found in Table B-12. All other gamma emitters were below <LLD.

TABLE B-6

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS* IN GROUNDWATER

Results in Units of pCi/liter ± 2 sigma

STATION	Collection Date	I-131	K-40	Tritium
Well W-1	01/23/97	< 0.4	< 50	< 100
	04/24/97	< 0.4	< 40	< 100
	07/25/97	< 0.4	< 50	< 200
	10/23/97	< 0.4	< 50	< 200
Well W-2	01/23/97	< 0.3	< 60	< 100
	04/24/97	< 0.4	< 50	< 100
	07/24/97	< 0.4	< 60	< 300
	10/23/97	< 0.4	< 50	< 200
Well W-3	01/23/97	< 0.3	< 90	< 100
	04/24/97	< 0.5	< 90	< 100
	07/24/97	< 0.4	< 40	< 200
	10/23/97	< 0.3	44.4 ± 24.8	< 200
Well W-4	01/27/97	< 0.2	< 50	1300 ± 100
	04/24/97	< 0.4	< 70	1500 ± 100
	07/25/97	< 0.8	< 100	1500 ± 200
	10/23/97	< 0.4	< 50	1200 ± 200
Well W-5	01/27/97	< 0.3	< 60	540 ± 80
	04/24/97	< 0.4	< 50	960 ± 120
	07/25/97	< 0.3	< 100	340 ± 90
	10/23/97	< 0.4	< 60	210 ± 130
Well W-6	01/27/97	< 0.3	< 50	840 ± 100
	04/24/97	< 0.5	< 100	1200 ± 100
	07/25/97	< 0.4	< 60	2200 ± 200
	10/23/97	< 0.4	< 50	2700 ± 200

* Footnotes located at end of table.

TABLE B-6 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS* IN GROUNDWATER

Results in Units of pCi/liter ± 2 sigma

STATION	Collection Date	I-131	K-40	Tritium
Well W-7	01/23/97	< 0.4	< 100	< 100
	04/24/97	< 0.6	< 70	< 100
	07/24/97	< 0.4	< 80	< 200
	10/23/97	< 0.4	< 100	< 200
Well W-8	01/24/97	< 0.4	< 90	< 100
	04/24/97	< 0.6	< 60	< 100
	07/25/97	< 0.5	< 50	< 300
	10/23/97	< 0.4	< 90	< 200
Well W-9	01/23/97	< 0.5	< 60	< 100
	04/24/97	< 0.6	< 50	< 100
	07/25/97	< 0.3	< 50	< 200
	10/23/97	< 0.4	< 70	< 200
Well W-10	01/23/97	< 0.4	< 70	< 100
	04/24/97	< 0.5	< 50	< 200
	07/24/97	< 0.4	< 50	< 200
	10/23/97	< 0.4	< 50	< 200
Well W-11	01/23/97	< 0.4	< 50	< 100
	04/24/97	< 0.6	< 60	< 200
	07/24/97	< 0.5	< 50	< 300
	10/23/97	< 0.4	< 50	< 200
Well W-12	01/23/97	< 0.4	< 100	< 100
	04/24/97	< 0.6	< 90	< 200
	07/24/97	< 0.5	< 100	< 300
	10/23/97	< 0.3	< 50	< 200

* Footnotes located at end of table.

TABLE B-6 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS* IN GROUNDWATER

Results in Units of pCi/liter ± 2 sigma

STATION	Collection Date	I-131	K-40	Tritium
Well W-13	01/23/97	< 0.4	< 40	< 100
	04/24/97	< 0.6	< 50	< 200
	07/24/97	< 0.5	< 90	< 300
	10/23/97	< 0.4	< 50	< 200
Well W-14	01/23/97	< 0.4	< 50	7300 ± 200
	04/24/97	< 0.4	< 60	19000 ± 1000
	07/24/97	< 0.5	< 60	16000 ± 1000
	10/23/97	< 0.6	< 100	1100 ± 100
Average ± 2 s.d.			44.4 ± 24.8	3618 ± 11376

* Typical LLDs are found in Table B-12. All other gamma emitters were LLD.

TABLE B-7

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA, IODINE, TRITIUM AND GAMMA EMITTERS* IN DRINKING WATER

Results in Units of pCi/liter ± 2 sigma

COLLECTION DATE	Gross Beta	Gamma Spec	Iodine-131	Tritium
LTW				
01/15/97	3.2 ± 1.1	< LLD	< 0.3	350 ± 140
01/29/97	3.1 ± 1.1	< LLD	< 0.2	
02/12/97	3.6 ± 1.0	< LLD	< 0.3	
02/26/97	3.7 ± 0.9	< LLD	< 0.3	
03/12/97	2.6 ± 0.9	< LLD	< 0.3	
03/26/97	3.9 ± 1.0	< LLD	< 0.3	
04/09/97	3.8 ± 1.0	< LLD	< 0.5	< 200
04/23/97	3.5 ± 1.0	< LLD	< 0.4	
05/07/97	3.7 ± 1.0	< LLD	< 0.3	
05/21/97	3.3 ± 1.0	< LLD	< 0.4	
06/04/97	2.1 ± 1.0	< LLD	< 0.4	
06/18/97	2.4 ± 0.9	< LLD	< 0.4	
07/02/97	2.5 ± 0.9	< LLD	< 0.8	< 300
07/16/97	2.9 ± 1.0	< LLD	< 0.2	
07/30/97	3.2 ± 1.0	< LLD	< 0.4	
08/13/97	2.6 ± 1.0	< LLD	< 1	
08/27/97	2.0 ± 0.9	< LLD	< 0.3	
09/10/97	2.8 ± 1.0	< LLD	< 0.4	
09/24/97	2.5 ± 1.0	< LLD	< 0.3	
10/08/97	2.7 ± 1.0	< LLD	< 0.3	< 300
10/22/97	3.1 ± 0.9	< LLD	< 0.5	
11/05/97	2.5 ± 0.9	< LLD	< 0.5	
11/19/97	2.9 ± 0.9	< LLD	< 0.4	
12/03/97	2.8 ± 0.9	< LLD	< 0.3	
12/17/97	3.1 ± 0.8	< LLD	< 0.4	
12/31/97	2.6 ± 0.9	< LLD	< 0.4	
Average ± 2 s. d.	**3.0 ± 1.0**			

* Typical LLDs are found in table B-12.

TABLE 7 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GROSS BETA, IODINE, TRITIUM AND GAMMA EMITTERS* IN DRINKING WATER

Results in Units of pCi/liter ± 2 sigma

COLLECTION DATE	Gross Beta	Gamma Spec	Iodine-131	Tritium
STJ				
01/15/97	4.2 ± 1.1	< LLD	< 0.3	< 200
01/29/97	5.6 ± 1.3	< LLD	< 0.4	
02/12/97	2.6 ± 0.9	< LLD	< 0.3	
02/26/97	3.1 ± 0.9	< LLD	< 0.3	
03/12/97	4.9 ± 1.1	< LLD	< 0.3	
03/26/97	2.5 ± 0.9	< LLD	< 0.2	
04/09/97	4.3 ± 1.0	< LLD	< 0.3	< 200
04/23/97	3.2 ± 1.0	< LLD	< 0.4	
05/07/97	4.1 ± 1.0	< LLD	< 0.2	
05/21/97	2.9 ± 1.0	< LLD	< 0.4	
06/04/97	2.0 ± 1.0	< LLD	< 0.4	
06/18/97	2.5 ± 0.9	< LLD	< 0.4	
07/02/97	2.1 ± 0.9	< LLD	< 0.6	
07/16/97	2.6 ± 0.9	< LLD	< 0.2	< 300
07/30/97	2.0 ± 0.9	< LLD	< 0.4	
08/13/97	2.4 ± 1.0	< LLD	< 0.9	
08/27/97	3.1 ± 1.0	< LLD	< 0.5	
09/10/97	2.4 ± 1.0	< LLD	< 0.4	
09/24/97	1.6 ± 0.9	< LLD	< 0.4	
10/08/97	2.1 ± 1.0	< LLD	< 0.3	< 300
10/22/97	3.6 ± 1.0	< LLD	< 0.3	
11/05/97	2.3 ± 0.9	< LLD	< 0.4	
11/19/97	2.6 ± 0.9	< LLD	< 0.4	
12/03/97	2.5 ± 0.9	< LLD	< 0.3	
12/17/97	3.1 ± 0.9	< LLD	< 0.4	
12/31/97	2.9 ± 1.0	< LLD	< 0.3	
Average ± 2 s. d.	3.0 ± 1.9			

* Typical LLDs are found in table B-12.

TABLE B-8

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN SEDIMENT

Results in Units of pCi/kg (dry) ± 2 sigma

Station	Collection Date	Be-7	K-40	Cs-137	Ra-226	Th-228
SL-2	04/18/97	< 200	3840 ± 380	< 30	< 400	211 ± 23
SL-3	04/18/97	< 200	6810 ± 680	< 30	< 400	< 50
SL-2	10/16/97	< 200	3190 ± 320	< 20	614 ± 292	745 ± 74
SL-3	10/16/97 (a)					
Average ± 2 s.d.			**4613 ± 3860**		**614 ± 292**	**478 ± 755**

(a) Sample not collected.
* Typical LLDs are found in table B-12. All other gamma emitters were <LLD.

TABLE B-9

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF IODINE AND GAMMA EMITTERS* IN MILK

Results in Units of pCi/liter ± 2 sigma

COLLECTION DATES	ANALYSIS	STATION CODES

There were no milk analyses completed during 1997 due to lack of participants to meet the minimum requirements of the REMP program. In lieu of milk, broadleaf vegetation samples were collected.

TABLE B-10

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN BROADLEAF VEGETATION COLLECTED IN LIEU OF MILK

Results in Units of pCi/kg (wet) ± 2 sigma

COLLECTION DATE	Station	Description	Be-7	K-40	I-131	Cs-137
05/28/97	Sector-J	Broadleaf	548 ± 138	5600 ± 560	< 10	< 20
05/28/97	Sector-A	Broadleaf	462 ± 93	5450 ± 550	< 10	< 10
05/28/97	Sector-A	Broadleaf	385 ± 90	5020 ± 500	< 7	< 10
05/28/97	Sector-A	Broadleaf	424 ± 110	5380 ± 540	< 9	< 20
06/25/97	Sector-A	Broadleaf	382 ± 93	3500 ± 350	< 50	< 10
06/25/97	Sector-A	Broadleaf	439 ± 71	6010 ± 600	< 20	< 10
06/25/97	Sector-A	Broadleaf	864 ± 86	3190 ± 320	< 20	< 10
06/25/97	Sector-J	Broadleaf	976 ± 120	5690 ± 570	< 10	< 20
07/23/97	Sector-J	Broadleaf	733 ± 86	5610 ± 560	< 10	< 10
07/23/97	Sector-A	Broadleaf	780 ± 125	2240 ± 220	< 20	< 20
07/23/97	Sector-A	Broadleaf	704 ± 86	4270 ± 430	< 10	< 10
07/23/97	Sector-A	Broadleaf	818 ± 97	2950 ± 290	< 10	< 10
08/20/97	Sector-J	Broadleaf	2010 ± 200	7620 ± 760	< 20	< 8
08/20/97	Sector-A	Broadleaf	1680 ± 170	1770 ± 180	< 20	< 10
08/20/97	Sector-A	Broadleaf	1920 ± 190	4820 ± 480	< 20	< 20
08/20/97	Sector-A	Broadleaf	2180 ± 220	5530 ± 550	< 20	< 20
09/17/97	Sector-J	Broadleaf	1310 ± 130	4960 ± 500	< 20	< 20
09/17/97 (a)	Sector-A	Broadleaf	1220 ± 120	3200 ± 320	< 10	< 10
09/17/97 (b)	Sector-A	Broadleaf	626 ± 128	3830 ± 380	< 20	< 20
09/17/97 (c)	Sector-A	Broadleaf	1960 ± 200	2630 ± 260	< 30	< 30
10/15/97	Sector-J	Broadleaf	5430 ± 540	4750 ± 480	< 20	< 10
10/15/97	Sector-A	Broadleaf	1880 ± 190	2370 ± 240	< 20	< 20
10/15/97	Sector-A	Broadleaf	1380 ± 140	3970 ± 400	< 20	< 20
10/15/97	Sector-A	Broadleaf	1550 ± 160	3850 ± 380	< 20	< 10
Average ± 2 s.d.			**1278 ± 2130**	**4342 ± 2867**		

(a) Radium-226 was measured at 687 ± 164 and thorium-228 was measured at 99.3 ± 11.8 pCi/kg (wet).
(b) Thorium-228 was measured at 66.6 ± 28.8 pCi/kg (wet).
(c) Thorium-228 was measured at 138 ± 31.
* Typical LLDs are found in table B-12. All other gamma emitters were <LLD.

TABLE B-11

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN FISH

Results in Units of pCi/kg (wet) ± 2 sigma

Collection Date	Station	Description	Be-7	K-40	Cs-137	Ra-226	Th-228
08/01/97	OFS-N	Sucker	< 100	2780 ± 280	< 20	< 300	< 30
07/31/97	ONS-N	Sucker	< 100	2940 ± 290	< 10	< 200	< 20
08/01/97	ONS-S	Walleye	< 100	3330 ± 330	< 10	< 200	< 20
08/01/97	OFS-S	Sucker	< 200	3820 ± 380	< 20	< 300	< 30
08/26/97	OFS-N	Drum	< 100	2690 ± 270	< 10	< 200	< 20
08/26/97	ONS-N	Sucker	< 100	3000 ± 300	< 10	< 300	< 20
08/26/97	ONS-S	Drum	< 100	2720 ± 270	21.0 ± 9.4	< 300	< 30
08/26/97	OFS-S	Sucker	< 100	3010 ± 300	23.5 ± 11.2	< 200	< 20
Average ± 2 s.d.				**3036 ± 755**	**22.3 ± 3.5**		

* Typical LLDs are found in table B-12. All other gamma emitters were <LLD.

TABLE B-12

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

CONCENTRATIONS OF GAMMA EMITTERS* IN FOOD/VEGETATION

Results in Units of pCi/kg (wet) ± 2 sigma

COLLECTION DATE	Station	Description	Be-7	K-40	I-131	Cs-137
09/25/97	Sector-J	Grapes	< 30	1960 ± 200	< 6	< 4
09/25/97	Sector-D	Grapes	< 50	2070 ± 210	< 9	< 5
09/25/97	Sector-J	Leaves	3010 ± 300	3620 ± 360	< 30	< 10
09/25/97	Sector-D	Leaves	5140 ± 510	3770 ± 380	< 20	< 10
Average ± 2 s.d.			**4075 ± 3012**	**2855 ± 1857**		

* Typical LLDs are found in table B-12. All other gamma emitters were <LLD.

TABLE B-13

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

GAMMA SPECTROMETRY LOWER LIMITS OF DETECTION AND REPORTING LEVELS

Isotope	TI LLD	ODCM LLD	Rept Level	TI LLD	ODCM LLD	Rept Level
	Vegetation - pCi/Kg-wet			Water - pCi/liter		
Cerium-144	60	N/A	N/A	30	N/A	N/A
Barium/La-140	10	N/A	N/A	50/10	60/15	200
Cesium-134	10	60	1000	7	15	30
Ru,Rh-106	80	N/A	N/A	50	N/A	N/A
Cesium-137	10	60	2000	6	18	50
Zr,Nb-95	10	N/A	N/A	10/15	30/15	400
Manganese-54	10	N/A	N/A	5	15	1000
Iron-59	15	N/A	N/A	15	30	400
Zinc-65	20	N/A	N/A	10	30	300
Cobalt-60	10	N/A	N/A	5	15	300
Cobalt-58	10	N/A	N/A	5	15	1000
Iodine-131	20	60	100	10	1	2
Iodine-131 (a)				1	1	
	Milk - pCi/liter			Air Filter - pCi/m3		
Cerium-144	30	N/A	N/A	0.007	N/A	N/A
Barium/La-140	50/10	60/15	300	0.005	N/A	N/A
Cesium-134	7	15	60	0.002	0.06	10
Ru,Rh-106	50	N/A	N/A	0.010	N/A	N/A
Cesium-137	6	18	70	0.002	0.06	20
Zr,Nb-95	20	N/A	N/A	0.002	N/A	N/A
Manganese-54	5	N/A	N/A	0.002	N/A	N/A
Iron-59	15	N/A	N/A	0.002	N/A	N/A
Zinc-65	10	N/A	N/A	0.002	N/A	N/A
Cobalt-60	5	N/A	N/A	0.002	N/A	N/A
Cobalt-58	5	N/A	N/A	0.002	N/A	N/A
Iodine-131	10	1	3	0.040	0.07	0.9
Iodine-131 (a)	1	1				

(a) Analysis by radiochemistry and based on the assumptions in Procedure PRO-032-11.
* Charcoal Trap

TABLE B-13 (Cont.)

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

GAMMA SPECTROMETRY LOWER LIMITS OF DETECTION AND REPORTING LEVELS

Isotope	TI LLD	ODCM LLD	Rept Level	TI LLD	ODCM LLD	Rept Level
	FISH - pCi/Kg-wet (b)			Sediment/Soil - pCi/Kg-dry		
Cerium-144	200	N/A	N/A	150	N/A	N/A
Barium/La-140	200	N/A	N/A	5	N/A	N/A
Cesium-134	20	130	1000	30	150	N/A
Ru,Rh-106	200	N/A	N/A	200	N/A	N/A
Cesium-137	20	150	2000	30	180	N/A
Zr,Nb-95	40	N/A	N/A	40	N/A	N/A
Manganese-54	20	130	30000	9	N/A	N/A
Iron-59	40	260	10000	50	N/A	N/A
Zinc-65	40	260	20000	60	N/A	N/A
Cobalt-60	20	130	10000	20	N/A	N/A
Cobalt-58	20	130	30000	20	N/A	N/A
Iodine-131	100	N/A	N/A	30	N/A	N/A

Gross Beta/Tritium LLDs and Reporting Levels

	Gross Beta		
Air Particulates	0.01 pCi/m^3	0.01 pCi/m^3	N/A
Drinking Water	2 pCi/l	4.0 pCi/l	N/A
	Tritium - pCi/l		
Surface Water	200	2000	20,000
Ground Water	200	2000	20,000
Drinking Water	200	2000	20,000

(b) Based on the assumptions in procedure PRO-042-5.

APPENDIX C
ANALYTICAL PROCEDURES SYNOPSIS

ANALYTICAL PROCEDURES SYNOPSIS

Appendix C is a synopsis of the analytical procedures performed during 1997 on samples collected for the Donald C. Cook Nuclear Plant's Radiological Environmental Monitoring Program. All analyses have been mutually agreed upon by American Electric Power and Teledyne Brown Engineering and include those recommended by the USNRC Regulatory Guide 4.8,BTP, Rev. 1, November 1979.

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GROSS BETA ANALYSIS OF SAMPLES

Airborne Particulates

After a delay of five or more days, allowing for the radon-222 and radon-220 (thoron) daughter products to decay, the filters are counted in a gas-flow proportional counter. An unused air particulate filter, supplied by the customer, is counted as the blank.

Calculations of the results, the two sigma error and the lower limit of detection (LLD):

RESULT (pCi/m^3) = $((S/T) - (B/t))/(2.22\ V\ E)$

TWO SIGMA ERROR (pCi/m^3) = $2((S/T^2) + (B/t^2))^{1/2}/(2.22\ V\ E)$

LLD (pCi/m^3) = $4.66\ (B/t/T)^{1/2}/(2.22\ V\ E)$

where:

S = Gross counts of sample including blank
B = Counts of blank
E = Counting efficiency
T = Number of minutes sample was counted
t = Number of minutes blank was counted
V = Sample aliquot size (cubic meters)

DETERMINATION OF GROSS BETA ACTIVITY IN WATER SAMPLES

1.0 INTRODUCTION

The procedures described in this section are used to measure the overall radioactivity of water samples without identifying the radioactive species present. No chemical separation techniques are involved.

One liter of the sample is evaporated on a hot plate. A smaller volume may be used if the sample has a significant salt content. If requested by the customer, the sample is filtered through No. 54 filter paper before evaporation, removing particles greater than 30 microns in size.

After evaporating to a small volume in a beaker, the sample is rinsed into a 2-inch diameter stainless steel planchet which is stamped with a concentric ring pattern to distribute residue evenly. Final evaporation to dryness takes place under heat lamps.

Residue mass is determined by weighing the planchet before and after mounting the sample. The planchet is counted for beta activity on an automatic proportional counter. Results are calculated using empirical self-absorption curves which allow for the change in effective counting efficiency caused by the residue mass.

2.0 DETECTION CAPABILITY

Detection capability depends upon the sample volume actually represented on the planchet, the background and the efficiency of the counting instrument, and upon self-absorption of beta particles by the mounted sample. Because the radioactive species are not identified, no decay corrections are made and the reported activity refers to the counting time.

The minimum detectable level (MDL) for water samples is nominally 1.6 picocuries per liter for gross beta at the 4.66 sigma level (1.0 pCi/l at the 2.83 sigma level), assuming that 1 liter of sample is used and that $\frac{1}{2}$ gram of sample residue is mounted on the planchet. These figures are based upon a counting time of 50 minutes and upon representative values of counting efficiency and background of 0.2 and 1.2 cpm, respectively.

The MDL becomes significantly lower as the mount weight decreases because of reduced self-absorption. At a zero mount weight, the 4.66 sigma MDL for gross beta is 0.9 picocuries per liter. These values reflect a beta counting efficiency of 0.38.

ANALYSIS OF SAMPLES FOR TRITIUM

(Liquid Scintillation)

Water

Ten milliliters of water are mixed with 10 ml of a liquid scintillation "cocktail" and then the mixture is counted in an automatic liquid scintillator.

Calculation of the results, the two sigma error and the lower limit detection (LLD) in pCi/l:

RESULT = $(N-B)/(2.22\ V\ E)$

TWO SIGMA ERROR = $2((N + B)/\Delta t)^{1/2}/\ (2.22\ V\ E)$

LLD = $4.66\ (B/\Delta t)^{1/2}/(2.22\ V\ E)$

where:

N	=	the gross cpm of the sample
B	=	the background of the detector in cpm
2.22	=	conversion factor changing dpm to pCi
V	=	volume of the sample in ml
E	=	efficiency of the detector
Δt	=	counting time for the sample

ANALYSIS OF SAMPLES FOR IODINE-131

Milk or Water

Two liters of sample are first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin is used to remove iodine from the sample. The iodine is then stripped from the resin with sodium hypochlorite solution, reduced with hydroxylamine hydrochloride and extracted into toluene as free iodine. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting. The chemical yield is corrected by measuring the stable iodide content of the milk or the water with a specific ion electrode.

Calculations of results, two sigma error and the lower limit of detection (LLD) in pCi/l:

RESULT		=	$(N/\Delta t-B)/(2.22\ E\ V\ Y\ DF)$
TWO SIGMA ERROR		=	$2((N/\Delta t+B)/\Delta t)^{1/2}(2.22\ E\ V\ Y\ DF)$
LLD		=	$= 4.66(B/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$
where:	N	=	total counts from sample (counts)
	Δt	=	counting time for sample (min)
	B	=	background rate of counter (cpm)
	2.22	=	dpm/pCi
	V	=	volume or weight of sample analyzed
	Y	=	chemical yield of the mount or sample counted
	DF	=	decay factor from the collection to the counting date
	E	=	efficiency of the counter for I-131, corrected for self absorption effects by the formula
	E	=	$E_s(\exp-0.0085M)/(\exp-0.0085M_s)$
	E_s	=	efficiency of the counter determined from an I-131 standard mount
	Ms	=	mass of PdI_2 on the standard mount, mg
	M	=	mass of PdI_2 on the sample mount, mg

GAMMA SPECTROMETRY OF SAMPLES

Milk and Water

A 1.0 liter Marinelli beaker is filled with a representative aliquot of the sample. The sample is then counted for approximately 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Dried Solids other than Soils and Sediments

A large quantity of the sample is dried at a low temperature, less than 100°C. As much as possible (up to the total sample) is loaded into a tared 1-liter Marinelli and weighed. The sample is then counted for approximately 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Fish

As much as possible (up to the total sample) of the edible portion of the sample is loaded into a tared Marinelli and weighed. The sample is then counted for approximately 1000 minutes with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Soils and Sediments

Soils and sediments are dried at a low temperature, less than 100°C. The soil or sediment is loaded fully into a tared, standard 300 cc container and weighed. The sample is then counted for approximately six hours with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

Charcoal Cartridges (Air Iodine)

Charcoal cartridges are counted up to five at a time, with one positioned on the face of a Ge(Li) detector and up to four on the side of the Ge(Li) detector. Each Ge(li) detector is calibrated for both positions. The detection limit for I-131 of each charcoal cartridge can be determined

(assuming no positive I-131) uniquely from the volume of air which passed through it. In the event I-131 is observed in the initial counting of a set, each charcoal cartirdge is then counted separately, positioned on the face of the detector.

Airborne Particulates

The thirteen airborne particulate filters for a quarterly composite for each field station are aligned one in front of another and then counted for at least six hours with a shielded Ge(Li) detector coupled to a mini-computer-based data acquisition system which performs pulse height analysis.

A mini-computer software program defines peaks by certain changes in the slope of the spectrum. The program also compares the energy of each peak with a library of peaks for isotope identification and then performs the radioactivity calculation using the appropriate fractional gamma ray abundance, half life, detector efficiency, and net counts in the peak region. The calculation of results, two sigma error and the lower limit of detection (LLD) in pCi/volume of pCi/mass:

RESULT		=	$(S-B)/2.22\ t\ E\ V\ F\ DF)$
TWO SIGMA ERROR		=	$2(S+B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$
LLD		=	$4.66(B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$
where:	S	=	Area, in counts, of sample peak and background (region of spectrum of interest)
	B	=	Background area, in counts, under sample peak, determined by a linear interpolation of the representative backgrounds on either side of the peak
	t	=	length of time in minutes the sample was counted
	2.22	=	dpm/pCi
	E	=	detector efficiency for energy of interest and geometry of sample
	V	=	sample aliquot size (liters, cubic meters, kilograms, or grams)
	F	=	fractional gamma abundance (specific for each emitted gamma)
	DF	=	decay factor from the mid-collection date to the counting date

ENVIRONMENTAL DOSIMETRY

Teledyne Brown Engineering uses a $CaSO_4$:Dy thermoluminescent dosimeter (TLD) which the company manufactures. This material has a high light output, negligible thermally induced signal loss (fading), and negligible self dosing. The energy response curve (as well as all other features) satisfies NRC Reg. Guide 4.13. Transit doses are accounted for by use of separate TLDs.

Following the field exposure period the TLDs are placed in a Teledyne Isotopes Model 8300. One fourth of the rectangular TLD is heated at a time and the measured light emission (luminescence) is recorded. The TLD is then annealed and exposed to a known Cs-137 dose; each area is then read again. This provides a calibration of each area of each TLD after every field use. The transit controls are read in the same manner.

Calculations of results and the two sigma error in net milliRoentgen (mR):

RESULT $D = (D_1+D_2+D_3+D_4)/4$

TWO SIGMA ERROR $= 2((D_1-D)^2+(D_2-D)^2+(D_3-D)^2+(D_4-D)^2)/3)^{1/2}$

WHERE:

D_1	=	the net mR of area 1 of the TLD, and similarly for D_2, D_3, and D_4
$D1$	=	$I_1\ K/R_1 - A$
I_1	=	the instrument reading of the field dose in area 1
K	=	the known exposure by the Cs-137 source
R_1	=	the instrument reading due to the Cs-137 dose on area 1
A	=	average dose in mR, calculated in similar manner as above, of the transit control TLDs
D	=	the average net mR of all 4 areas of the TLD.

APPENDIX D
SUMMARY OF EPA INTERLABORATORY COMPARISONS

EPA Interlaboratory Comparison Program

Teledyne Brown Engineering participates in the US EPA Interlaboratory Comparison Program to the fullest extent possible. That is, we participate in the program for all radioactive isotopes prepared and at the maximum frequency of availability. Beginning with 1997, the US EPA discontinued providing milk and air particulate filter samples. For replacements, we have purchased comparable spiked samples from Analytics, Inc.

In this section 1997 data summary tables are presented for isotopes in the various sample media applicable to the Donald C. Cook Nuclear Plant's Radiological Environmental Monitoring Program. The footnotes of the table discuss investigations of problems encountered in a few cases and the steps taken to prevent reoccurrence.

EPA INTERLABORATORY COMPARISON PROGRAM 1997
Environmental

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Brown Engineering Result(b)		Deviation(c)	
01/17/97	Water	Sr-89	12.0 ±	5.0	10.00 ±	1.00	-0.69	
		Sr-90	25.0 ±	5.0	25.00 ±	1.00	0.00	
01/31/97	Water	Gross Alpha	5.2 ±	5.0	8.10 ±	0.89	1.00	
		Gross Beta	14.7 ±	5.0	15.00 ±	1.00	0.10	
02/07/97	Water	I-131	86.0 ±	9.0	106.00 ±	4.36	3.85	(d)
02/14/97	Water	Ra-226	5.9 ±	0.9	5.27 ±	0.23	-1.22	
		Ra-228	8.2 ±	2.1	8.40 ±	0.30	0.16	
03/07/97	Water	H-3	7900.0 ±	790.0	7366.67 ±	378.59	-1.17	
04/15/97	Water	Gr-Beta	102.1 ±	15.3	103.33 ±	5.77	0.14	
		Sr-89	24.0 ±	5.0	23.00 ±	1.00	-0.35	
		Sr-90	13.0 ±	5.0	12.67 ±	1.15	-0.12	
		Co-60	21.0 ±	5.0	22.67 ±	0.58	0.58	
		Cs-134	31.0 ±	5.0	28.67 ±	0.58	-0.81	
		Cs-137	22.0 ±	5.0	24.67 ±	1.53	0.92	
		Gr-Alpha	48.0 ±	12.0	54.67 ±	1.53	0.96	
		Ra-226	13.0 ±	2.0	13.00 ±	1.00	0.00	
		Ra-228	3.1 ±	0.8	4.87 ±	0.12	3.82	(e)
06/06/97	Water	Co-60	18.0 ±	5.0	19.00 ±	0.00	0.35	
		Zn-65	100.0 ±	10.0	99.33 ±	1.15	-0.12	
		Cs-134	22.0 ±	5.0	18.67 ±	1.15	-1.15	
		Cs-137	49.0 ±	5.0	48.67 ±	0.58	-0.12	
		Ba-133	25.0 ±	5.0	22.33 ±	2.52	-0.92	
06/13/97	Water	Ra-226	3.0 ±	0.5	3.43 ±	0.49	1.50	
		Ra-228	3.1 ±	0.8	3.43 ±	0.23	0.72	
06/18/97	Water	Gr-Alpha	3.1 ±	5.0	2.93 ±	0.25	-0.06	
		Gr-Beta	15.1 ±	5.0	14.00 ±	1.00	0.38	
07/11/97	Water	Sr-89	44.0 ±	5.0	38.33 ±	1.53	-1.96	
		Sr-90	16.0 ±	5.0	25.00 ±	0.00	3.12	(f)
08/08/97	Water	H-3	11010 ±	1101.0	12000.00 ±	0.00	1.56	
09/12/97	Water	Ra-226	20.0 ±	3.0	20.00 ±	1.73	0.00	
		Ra-228	8.0 ±	2.0	7.40 ±	0.17	-0.52	
09/19/97	Water	I-131	10.0 ±	6.0	11.00 ±	0.00	0.29	

* Footnotes are located at end of table.

EPA INTERLABORATORY COMPARISON PROGRAM 1997
Environmental

Collection Date	Media	Nuclide	EPA Result(a)		Teledyne Brown Engineering Result(b)		Deviation(c)
10/21/97	Water	Gr-Beta	143.4 ±	21.5	136.67 ±	5.77	-0.54
		Sr-89	36.0 ±	5.0	36.00 ±	1.00	0.00
		Sr-90	22.0 ±	5.0	21.67 ±	2.08	-0.12
		Co-60	10.0 ±	5.0	10.67 ±	0.58	0.23
		Cs-134	41.0 ±	5.0	41.33 ±	0.58	0.12
		Cs-137	34.0 ±	5.0	36.00 ±	1.00	0.69
		Gr-Alpha	49.9 ±	12.5	45.67 ±	1.15	-0.59
		Ra-226	5.0 ±	0.8	5.90 ±	0.10	1.95
		Ra-228	5.0 ±	1.3	4.27 ±	0.12	-0.98
10/31/97	Water	Gr-Alpha	14.7 ±	5.0	19.67 ±	1.53	1.72
		Gr-Beta	48.9 ±	5.0	50.67 ±	3.51	0.61
11/07/97	Water	Co-60	27.0 ±	5.0	25.00 ±	1.00	-0.69
		Zn-65	75.0 ±	8.0	71.00 ±	3.61	-0.87
		Cs-134	10.0 ±	5.0	10.67 ±	0.58	0.23
		Cs-137	74.0 ±	5.0	76.00 ±	1.00	0.69
		Ba-133	99.0 ±	10.0	78.67 ±	0.58	-3.52 (g)

Footnotes:

(a) EPA Results-Expected laboratory precision (1 sigma). Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(b) Teledyne Results - Average ± one sigma. Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters.

(c) Normalized deviation from the known.

(d) Erroneously high reading of the stable iodine content by ion specific electrode occurred, causing an erroneously low chemical yield. If the electrode reading is ignored, the average I-131 result becomes 90 pCi/l, in good agreement with the given value. An erroneous electrode reading can be caused by certain chemical species in the sample, such as sulfide. We will investigate suspiciously high electrode readings by performing a gravimetric yield on the sample without the addition of iodide carrier or the I-131 content of active samples can also be verified by performing a gamma spectral analysis.

(e) An investigation discovered a low chemical yield on one sample and the loss of another during analysis. In the future we will repeat analyses of samples with yields less than 85%.

(f) Error apparently caused by insufficient training. The strontium separation chemistry was performed on 7/22/97 by a summer employee. Initial results for the three samples did not agree well, so all were remilked by a senior analyst. This was insufficient to correct the problem. In-house QC samples showed satisfactory results at this time. There will be additional qualification of analysts according to performance on in-house blanks and spikes.

(g) No apparent cause for the discrepancy could be identified. No corrective action has been taken. The investigation is continuing. An update will be provided, if a cause is determined and corrective action taken.

ANALYTICS CROSS CHECK COMPARISON PROGRAM 1997

Sample ID	Media	Nuclide	Teledyne Brown Engineering Result (a)		Analytics Result		Ratio (b)	
E0975-396	Milk	I-131	18 ±	1	20 ±	1	0.90	
TI #41238		Ce-141	L.T. 1.		232 ±	12	-	
03/20/97		Cr-51	381 ±	38	387 ±	19	0.98	
		Cs-134	132 ±	13	143 ±	7	0.92	
		Cs-137	128 ±	13	114 ±	6	1.12	
		Co-58	89 ±	9	79 ±	4	1.13	
		Mn-54	195 ±	20	176 ±	9	1.11	
		Fe-59	161 ±	16	144 ±	7	1.12	
		Zn-65	171 ±	17	165 ±	8	1.04	
		CO-60	179 ±	18	176 ±	9	1.02	
E0976-396	Milk	Sr-89	13 ±	3	25 ±	1	0.52	(c)
TI #41239		Sr-90	16 ±	1	19 ±	1	0.84	
03/20/97								
E1092-396	Air Filter	Ce-141	143 ±	8	132 ±	7	1.08	
TI #49899-901		Cr-51	229 ±	17	198 ±	10	1.16	
06/19/97		Cs-134	74 ±	4	81 ±	4	0.91	
		Cs-137	143 ±	8	115 ±	6	1.24	
		Co-58	89 ±	5	77 ±	4	1.16	
		Mn-54	102 ±	6	84 ±	4	1.21	
		Fe-59	98 ±	6	75 ±	4	1.31	
		Zn-65	188 ±	11	139 ±	7	1.35	
		Co-60	113 ±	7	104 ±	5	1.09	
EI093-396	Cartridge	I-131	106 ±	6	88 ±	4	1.20	
TI #49902-04								
06/19/97								
E1094-396	Air Filter	Sr-90	88 ±	5	96 ±	5	0.92	
TI #49893-95								
06/19/97								
E1095-396	Air Filter	Gross Alpha	103 ±	6	93 ±	5	1.11	
TI #49896-98		Gross Beta	210 ±	6	193 ±	10	1.09	
06/19/97								
E1204-396	Milk	I-131	97 ±	10	87 ±	4	1.11	
TI #57520		Ce-141	83 ±	8	77 ±	4	1.08	
09/18/97		Cr-51	323 ±	40	304 ±	15	1.06	
		Cs-134	98 ±	10	102 ±	5	0.96	
		Cs-137	117 ±	12	107 ±	5	1.09	
		Co-58	64 ±	6	60 ±	3	1.07	
		Mn-54	99 ±	10	88 ±	4	1.13	
		Fe-59	132 ±	13	119 ±	6	1.11	
		Zn-65	218 ±	22	196 ±	10	1.11	
		Co-60	209 ±	21	197 ±	10	1.06	

ANALYTICS CROSS CHECK COMPARISON PROGRAM 1997

Sample ID	Media	Nuclide	Teledyne Brown Engineering Result (a)	Analytics Result	Ratio (b)
E1203-396	Milk	Sr-89	14 ± 1	15 ± 1	0.93
TI #57517		Sr-90	18 ± 1	14 ± 1	1.29
09/18/97					

Footnotes:

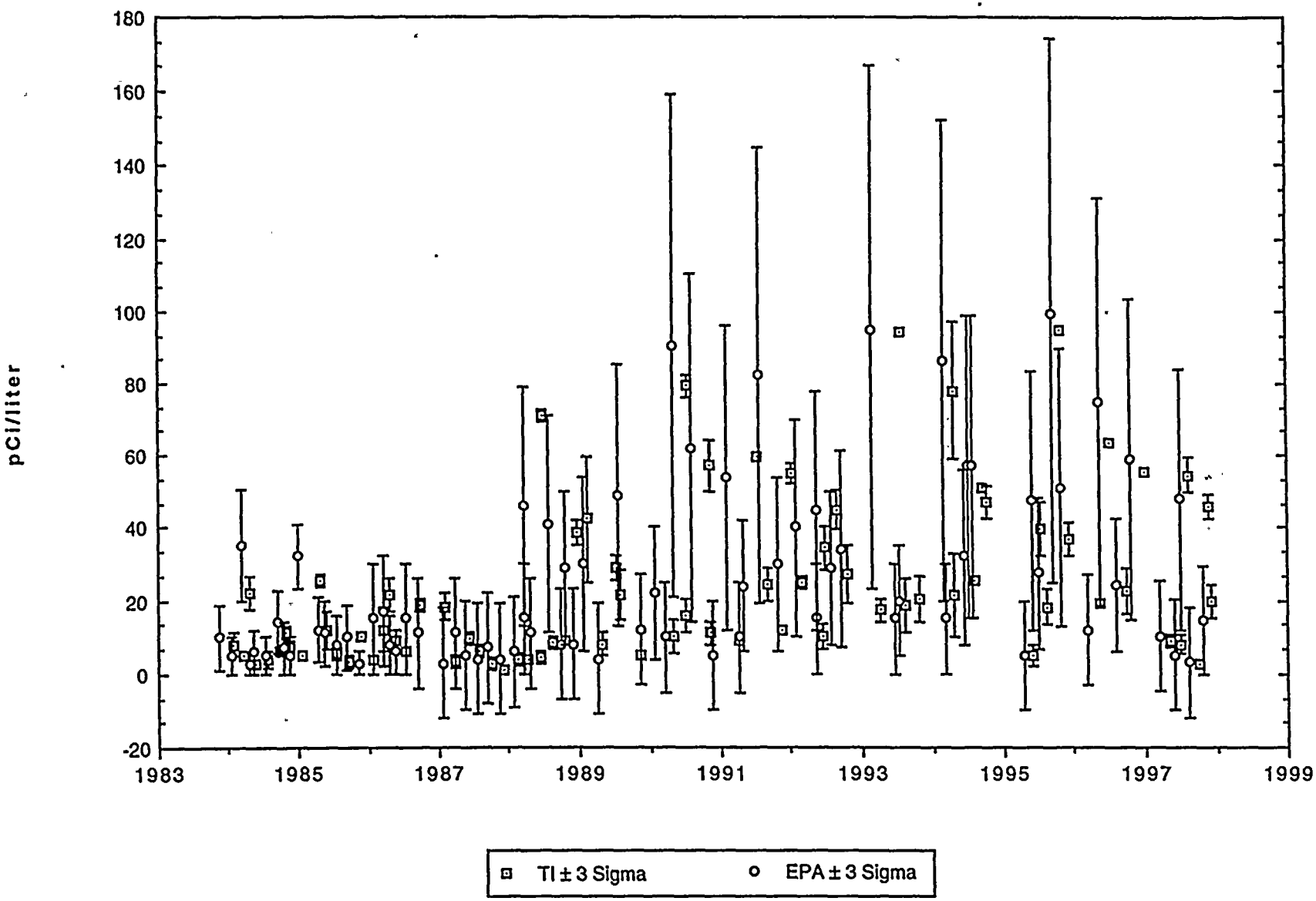
(a) Teledyne Results - counting error is two standard deviations. Units are pCi/liter for water and milk. For gamma results, if two standard deviations are less than 10%, then a 10% eror is reported. Units are total pCi for air particulate filters.

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

(c) Caused by incorrect rinsing of the strontium extraction column. Additional training was conducted on 9/5/97 and was documented in the analyst's training file. Subsequent tests on two milk samples spiked with Sr-89 produced good results.

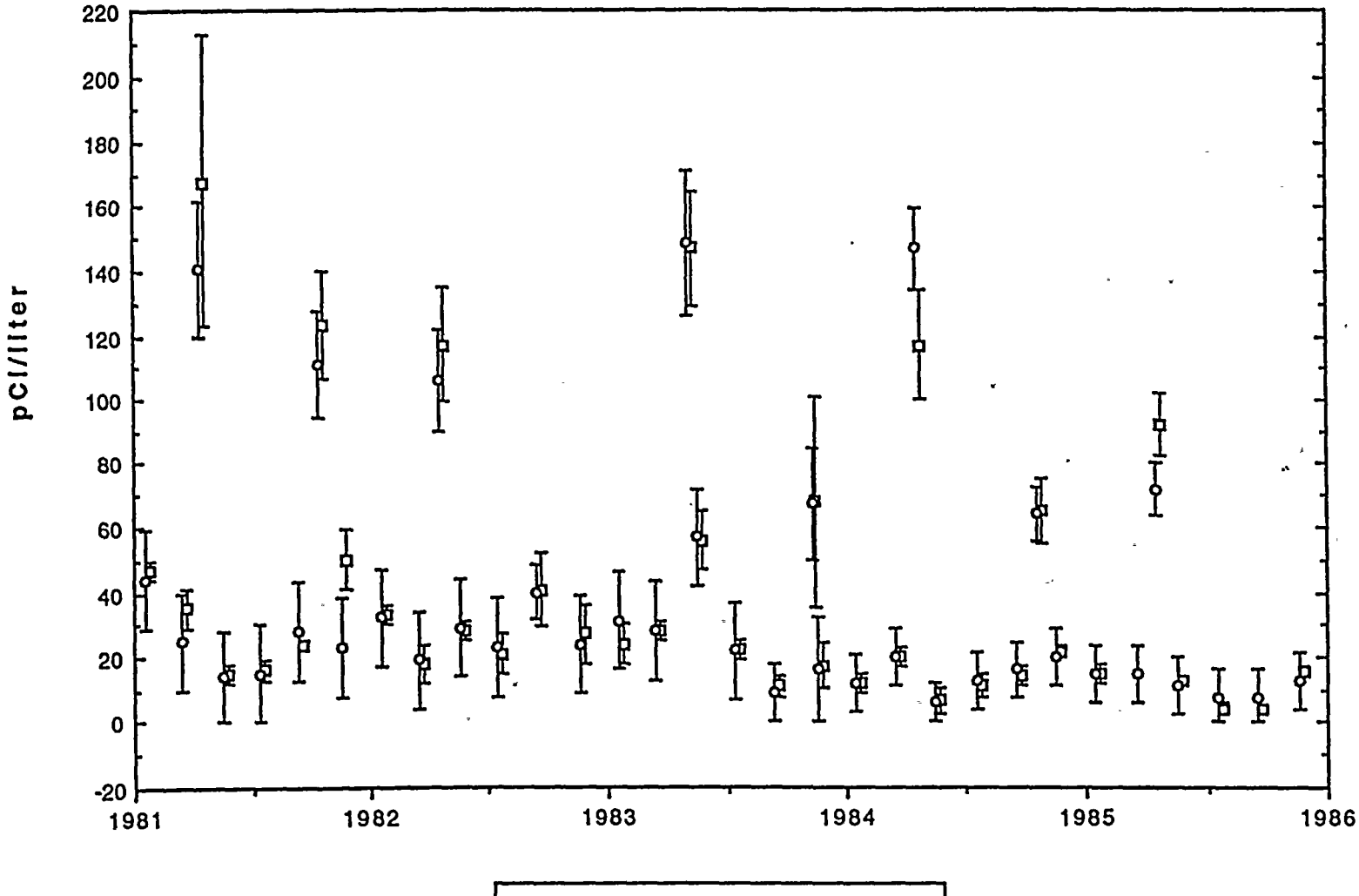
EPA CROSS CHECK PROGRAM

GROSS ALPHA IN WATER (pg. 1 of 1)



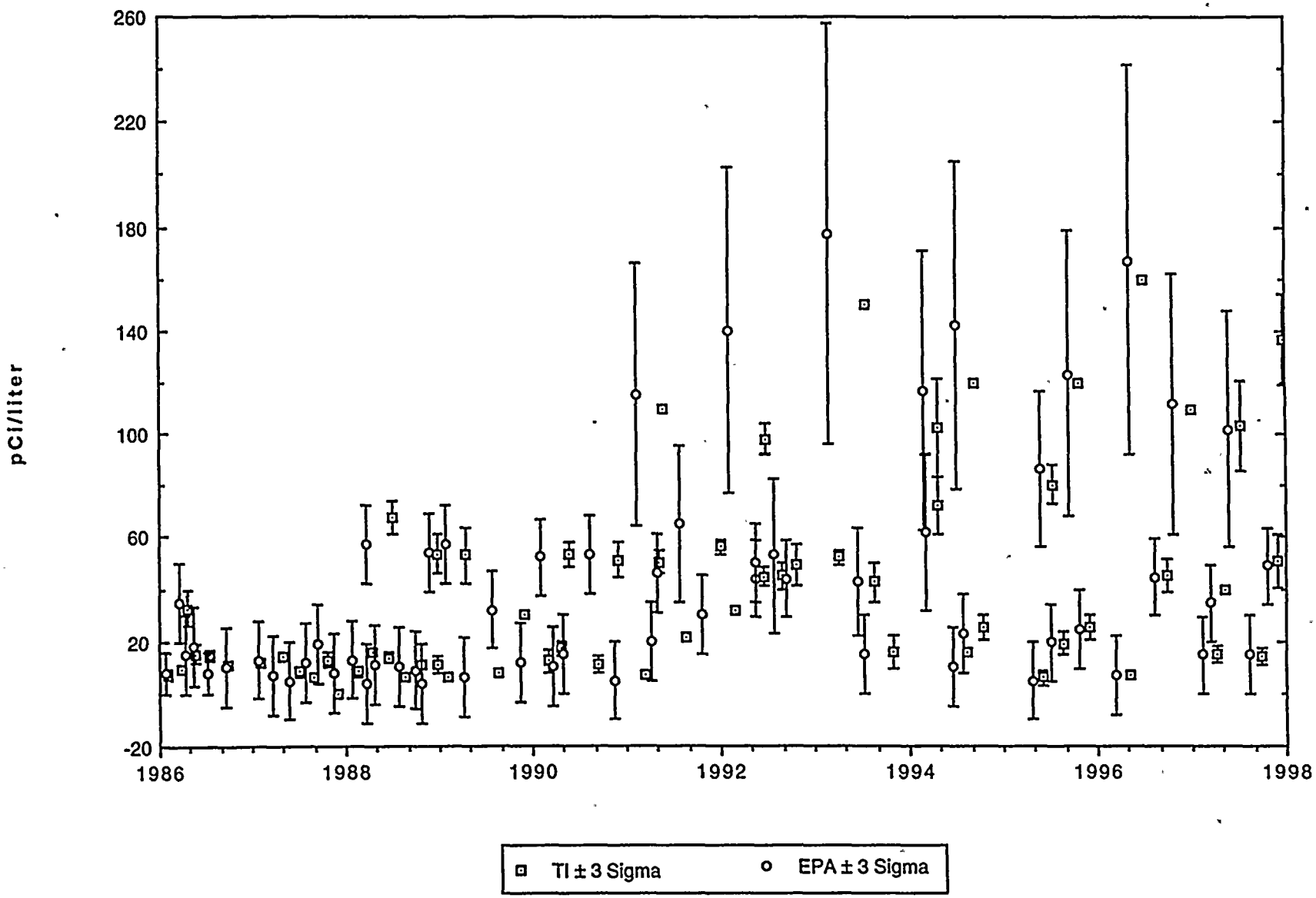
EPA CROSS CHECK PROGRAM

GROSS BETA IN WATER (pg. 1 of 2)



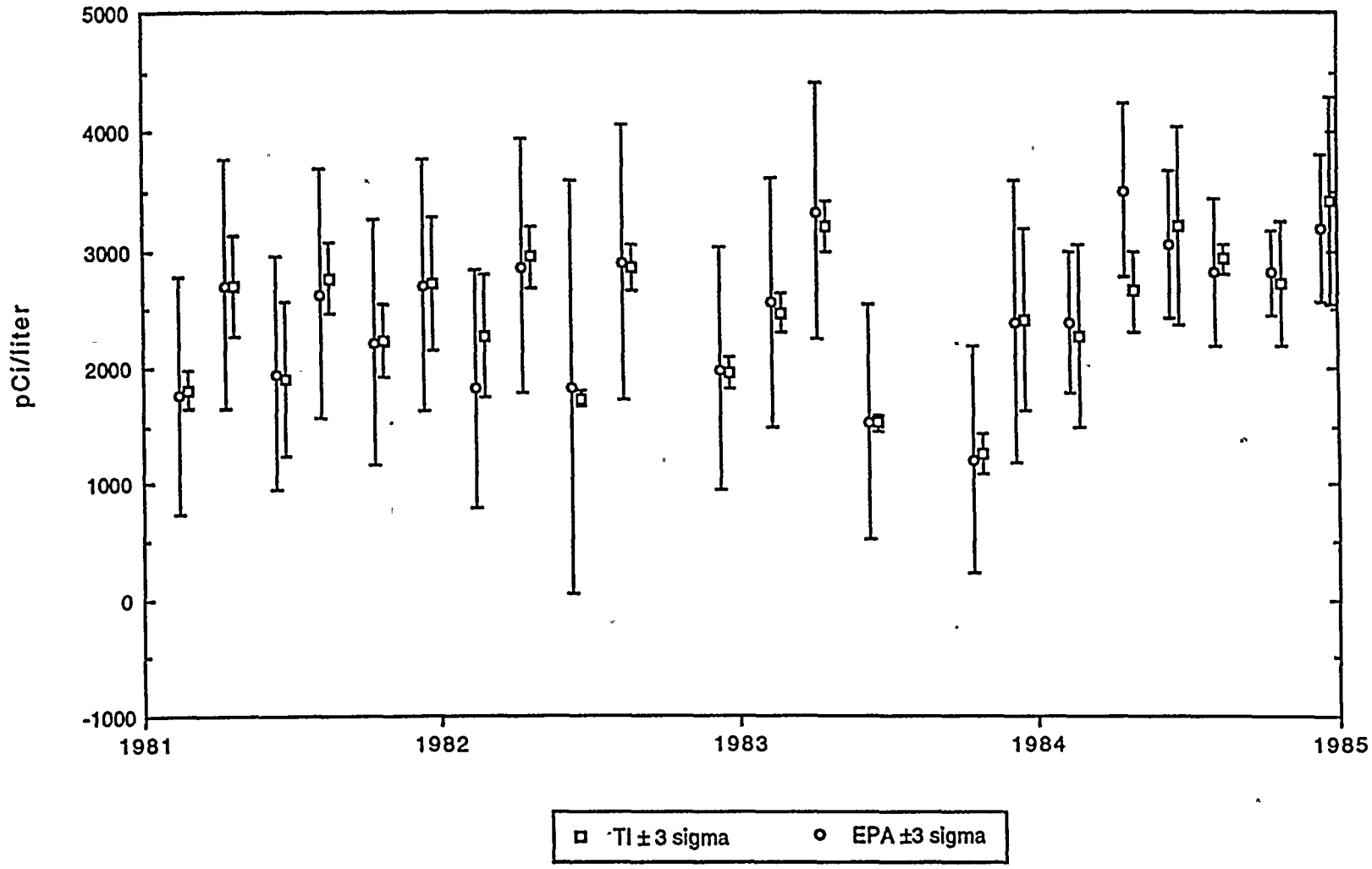
EPA CROSS CHECK PROGRAM

GROSS BETA IN WATER (pg. 2 of 2)



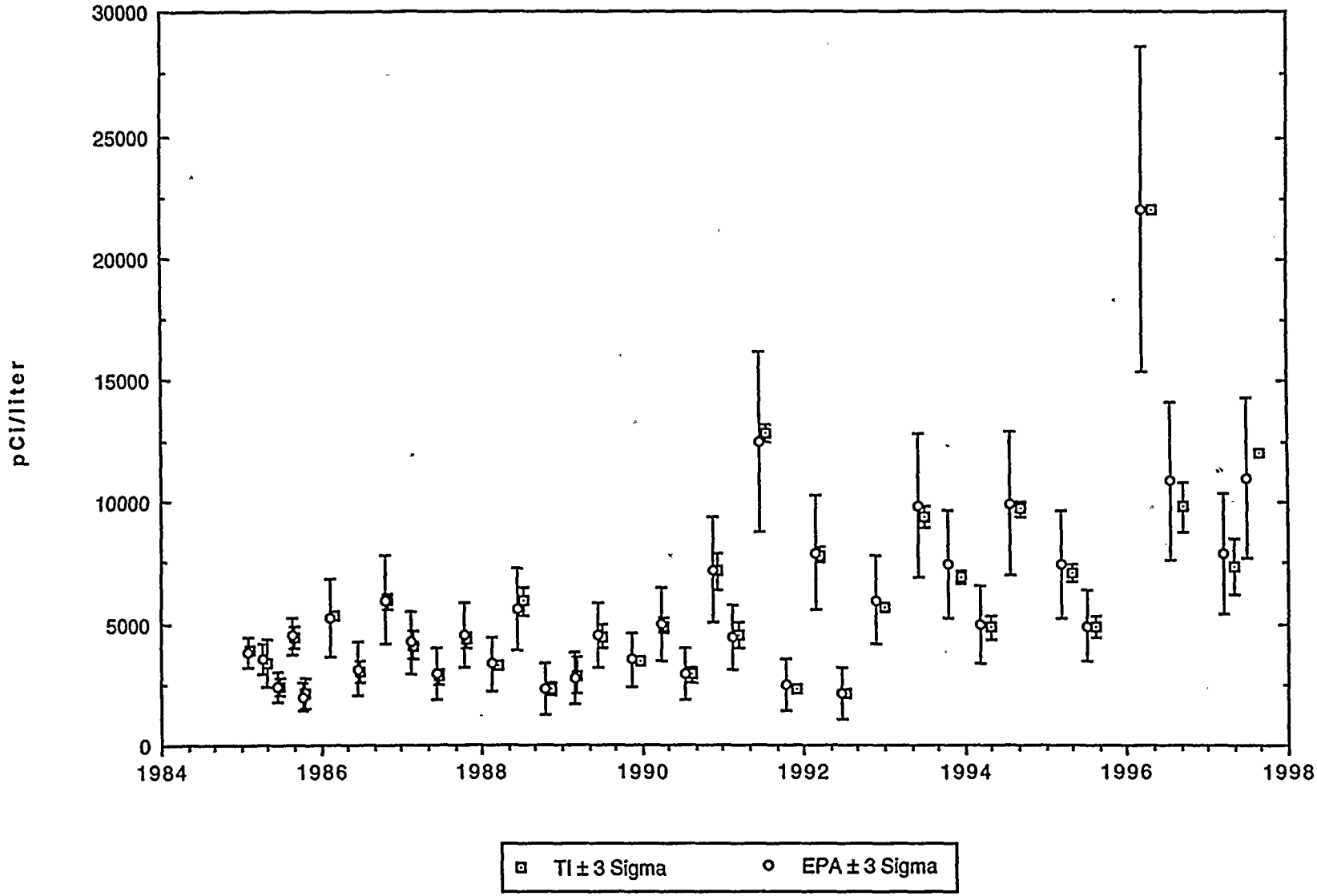
EPA CROSS CHECK PROGRAM

TRITIUM IN WATER (pg. 1 of 2)



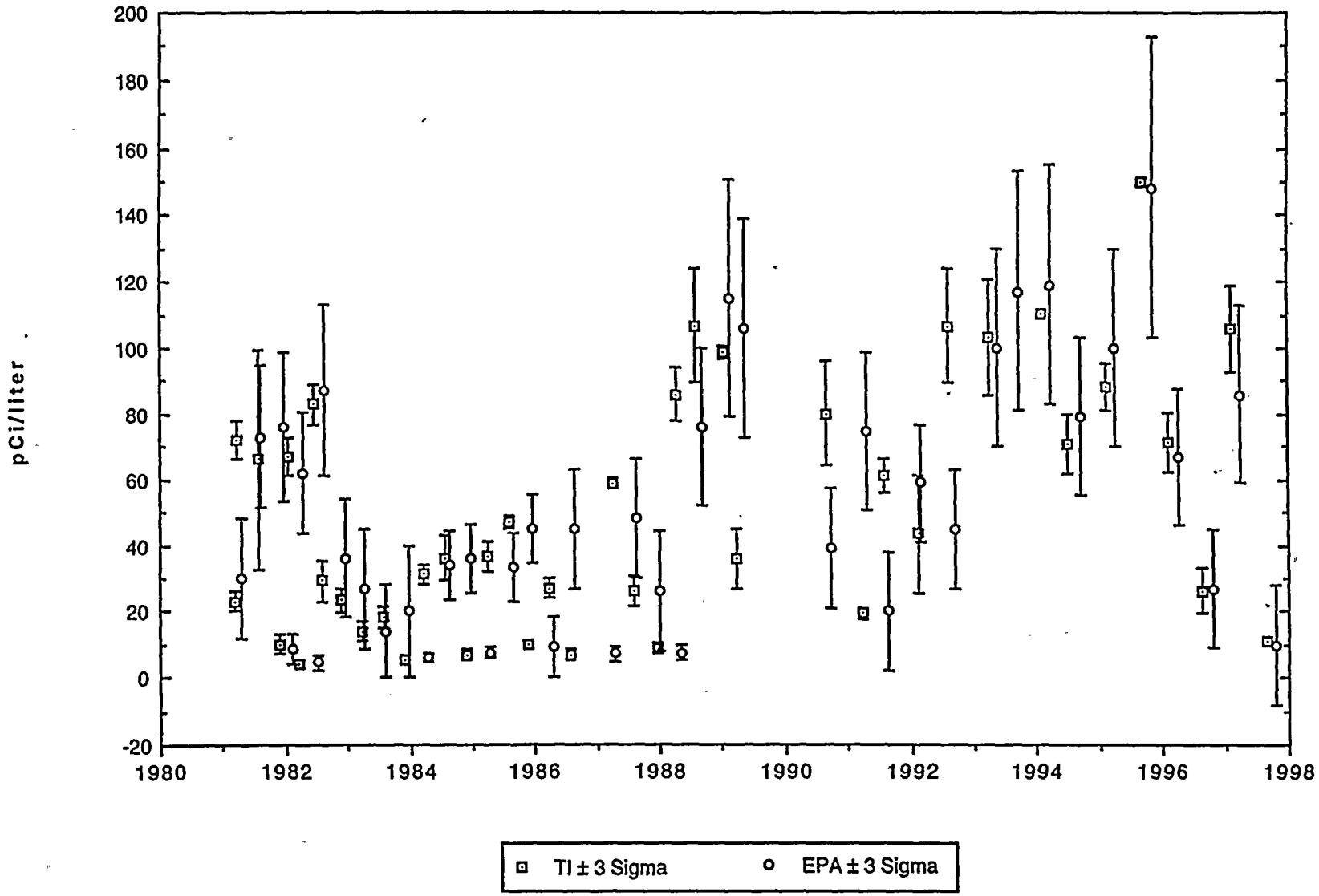
EPA CROSS CHECK PROGRAM

TRITIUM IN WATER (pg. 2 of 2)



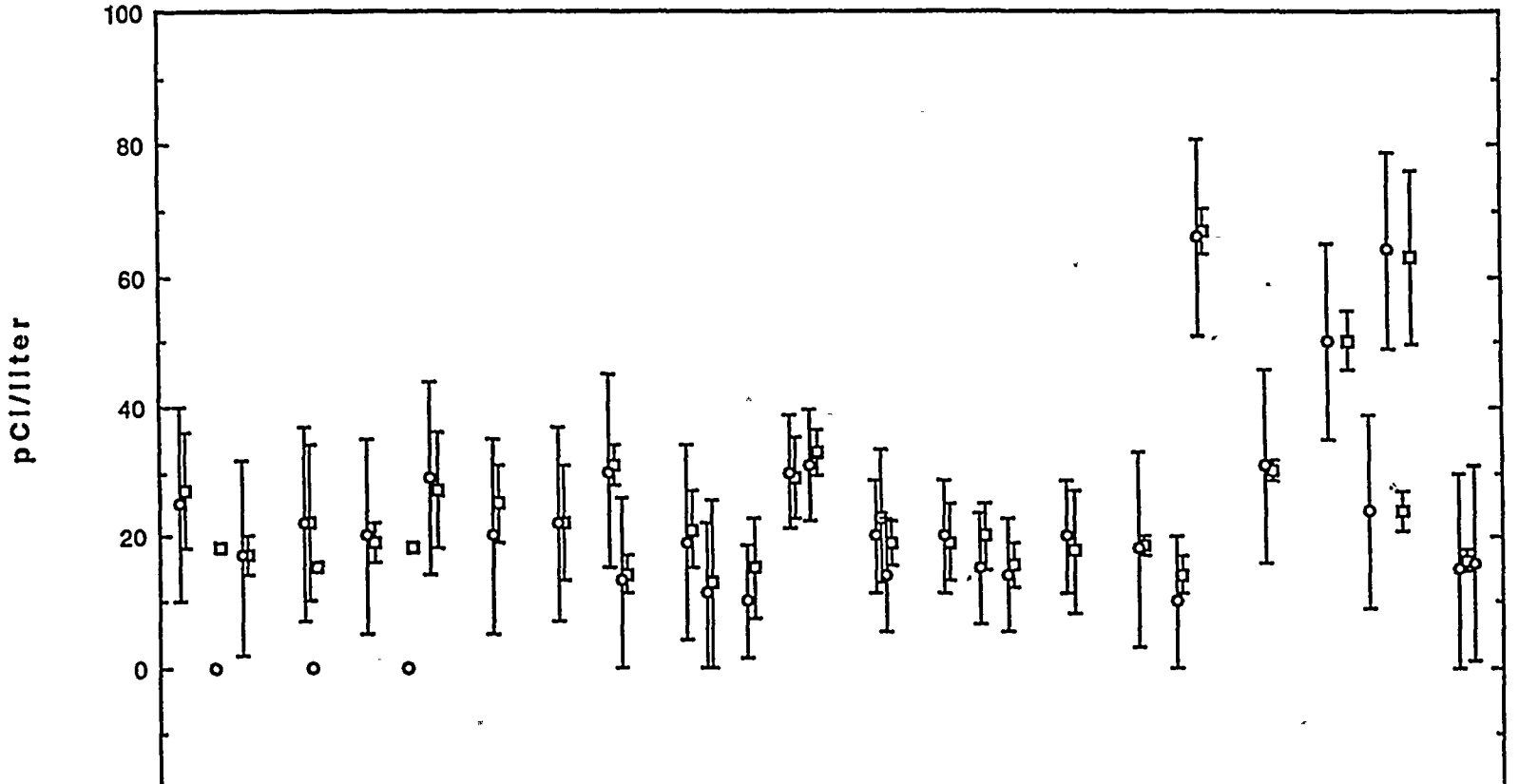
EPA CROSS CHECK PROGRAM

IODINE-131 IN WATER (pg. 1 of 1)



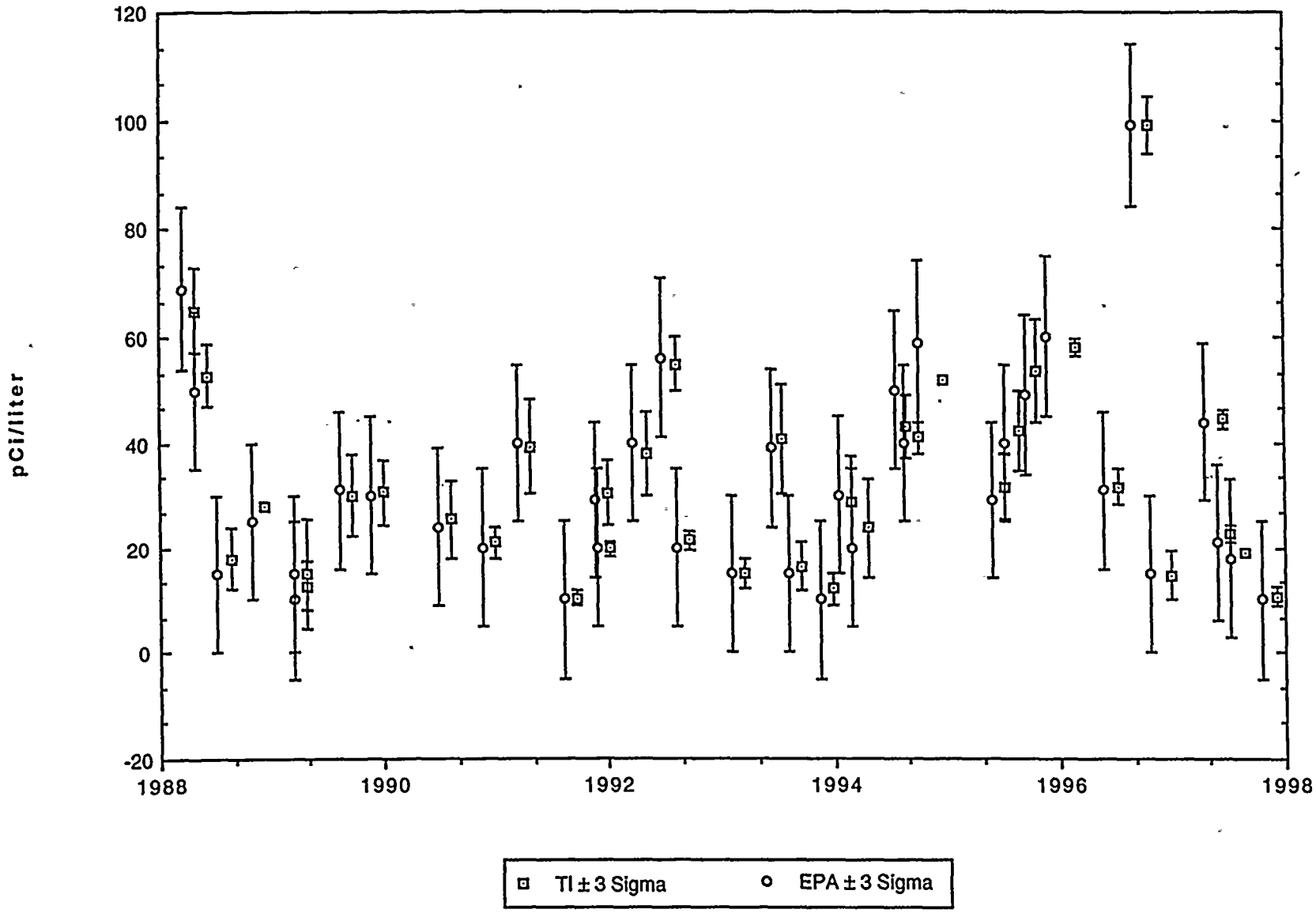
EPA CROSS CHECK PROGRAM

COBALT-60 IN WATER (pg 1 of 2)



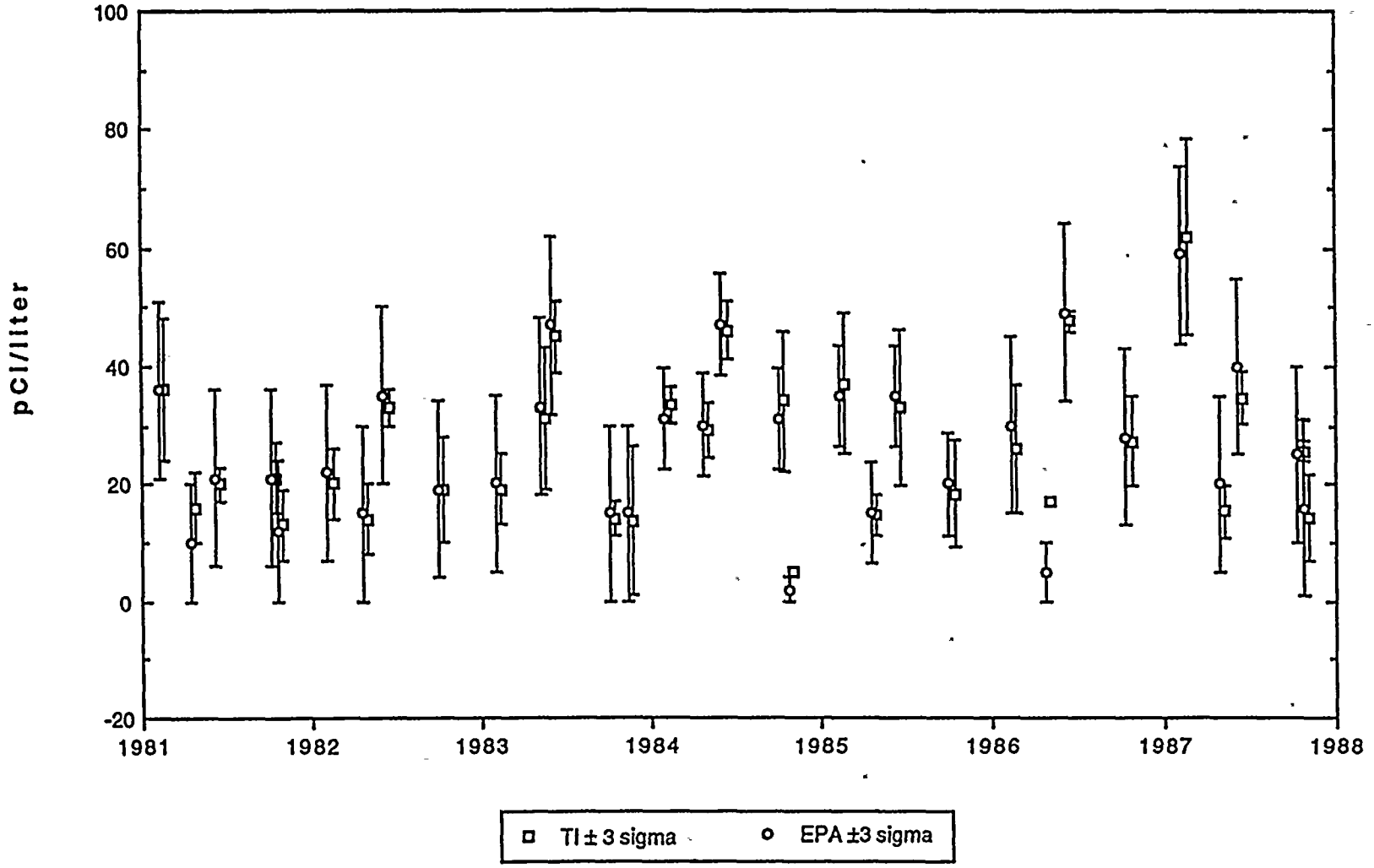
EPA CROSS CHECK PROGRAM

COBALT-60 IN WATER (pg. 2 of 2)



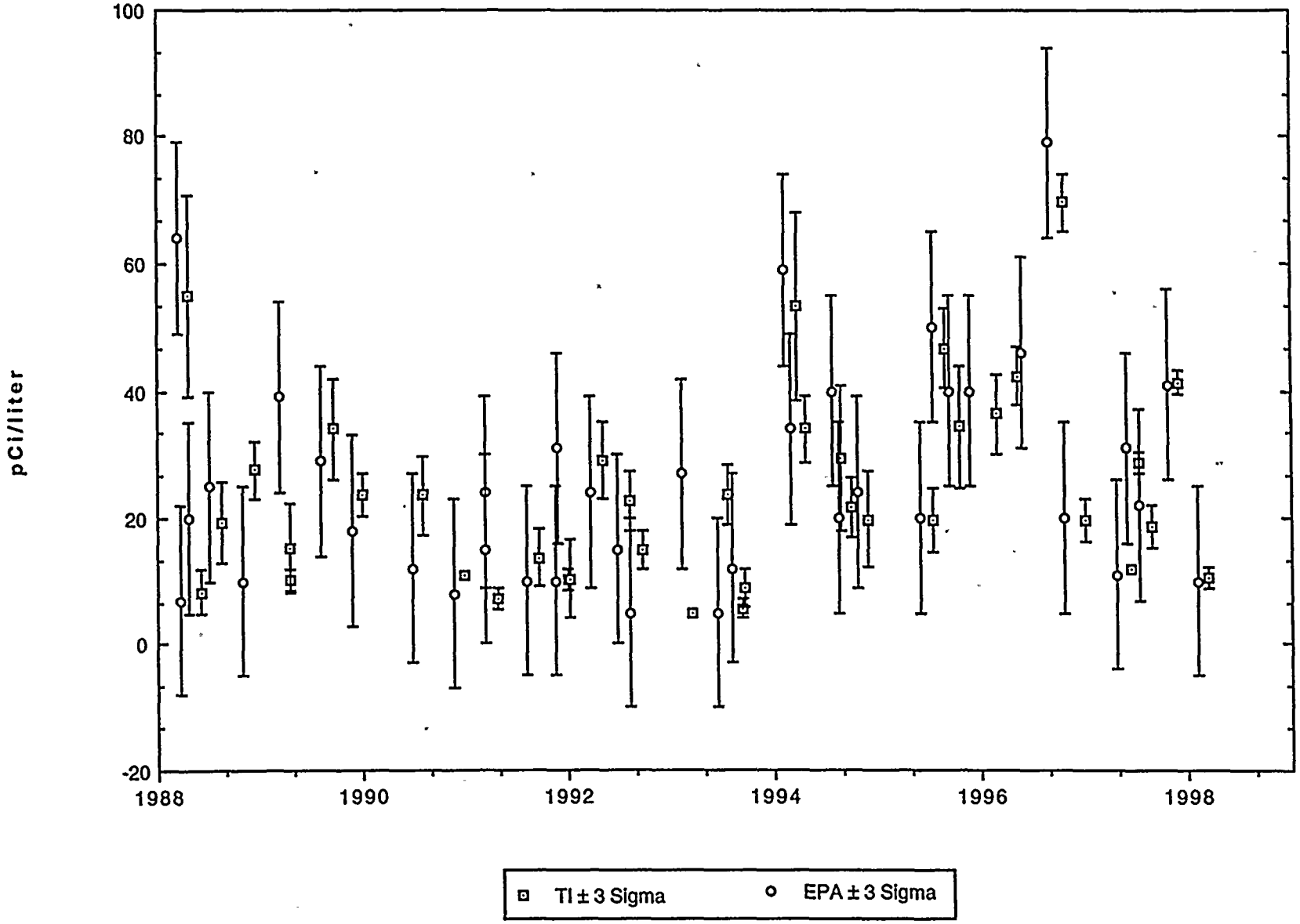
EPA CROSS CHECK PROGRAM

CESIUM-134 IN WATER (pg. 1 of 2)



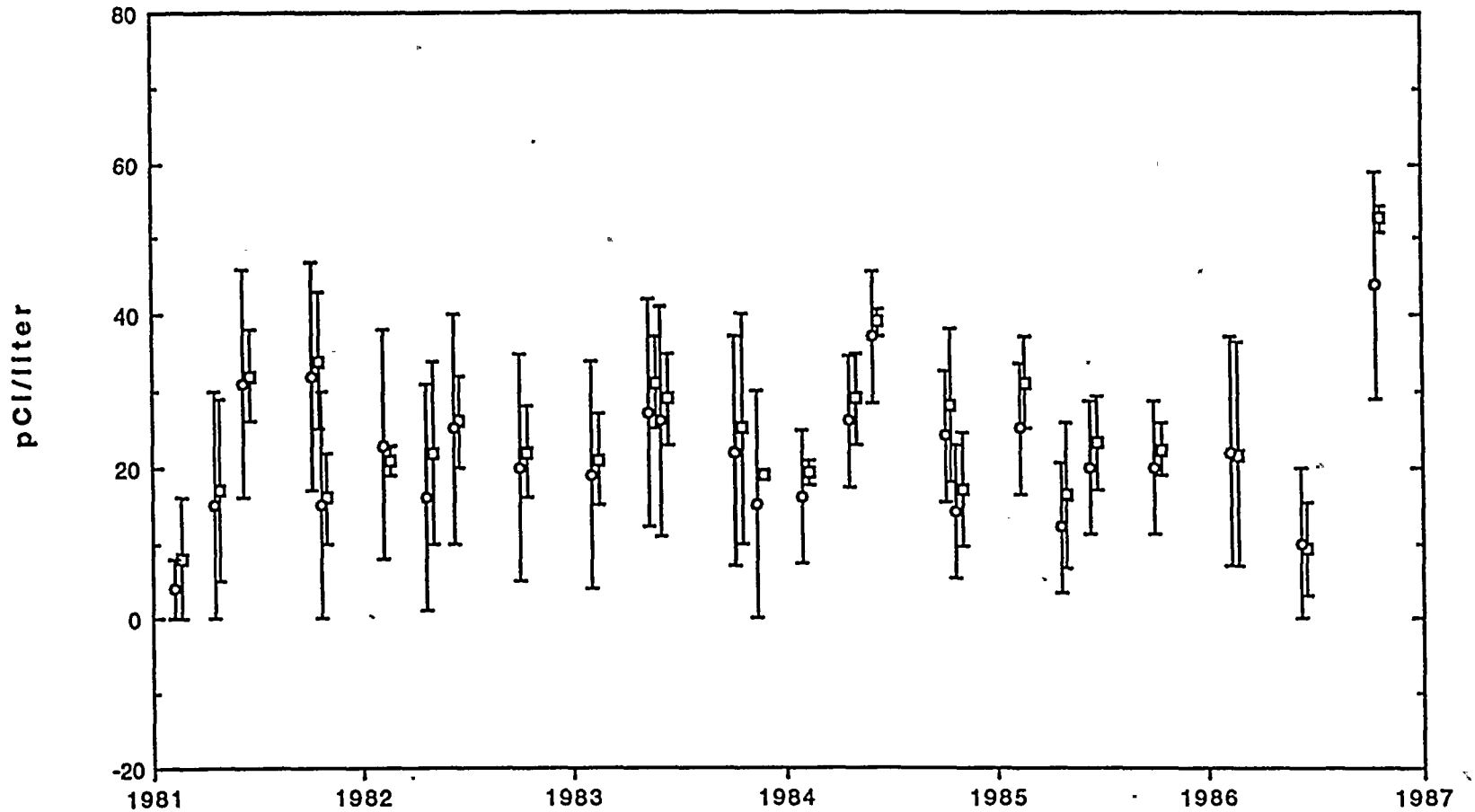
EPA CROSS CHECK PROGRAM

CESIUM-134 IN WATER (pg. 2 of 2)



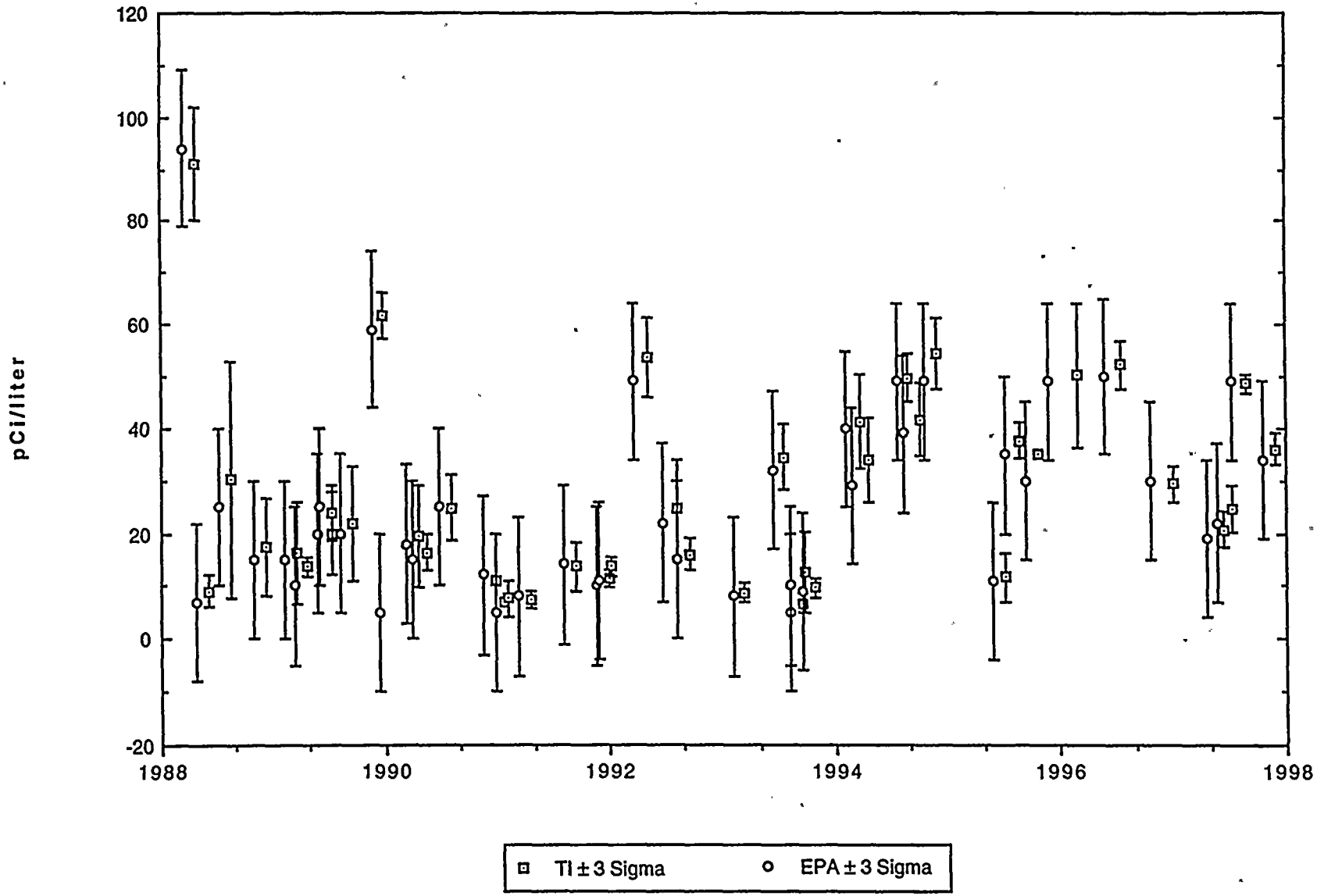
EPA CROSS CHECK PROGRAM

CESIUM-137 IN WATER (pg. 1 of 2)



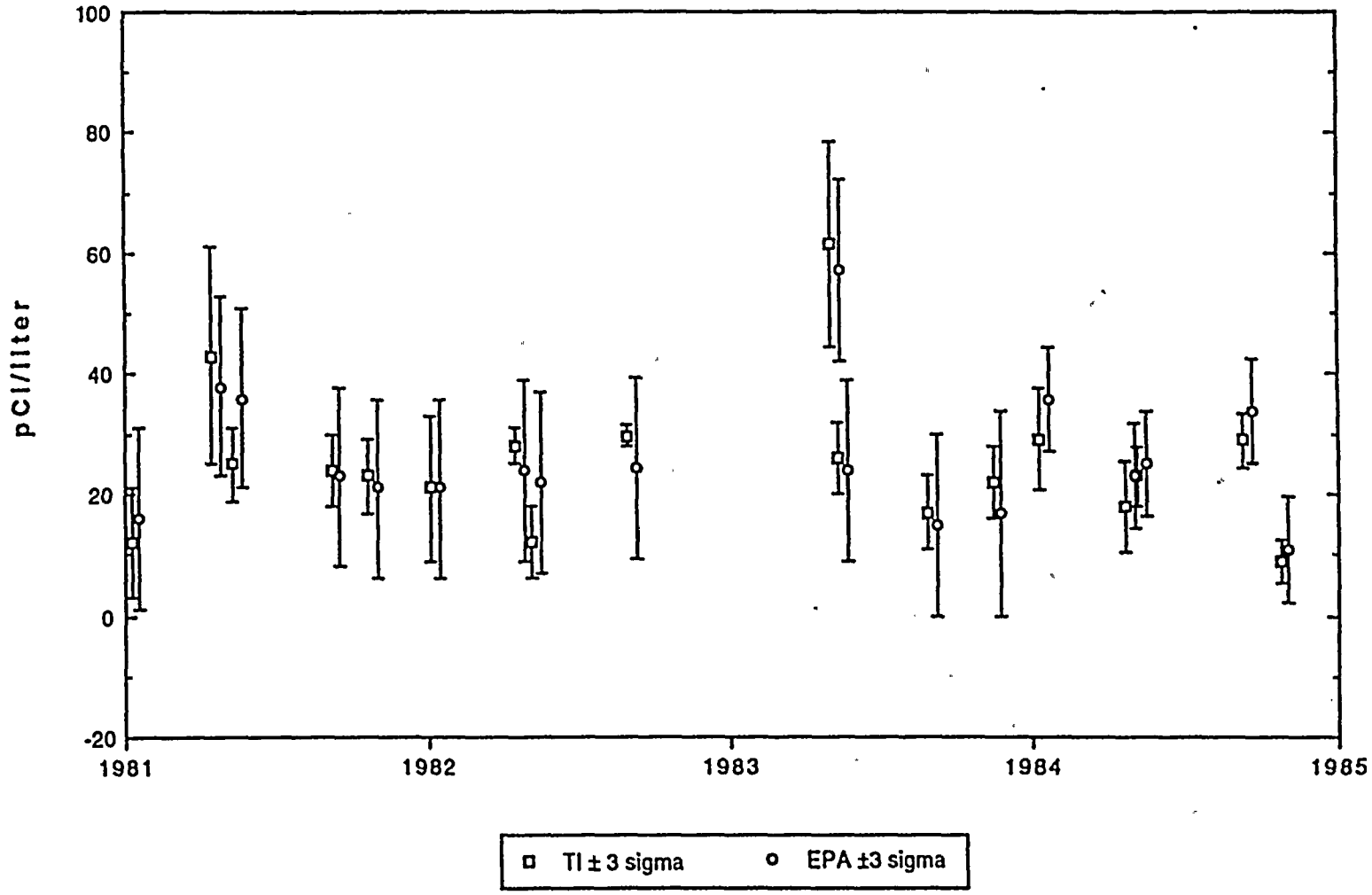
EPA CROSS CHECK PROGRAM

CESIUM-137 IN WATER (pg. 2 of 2)



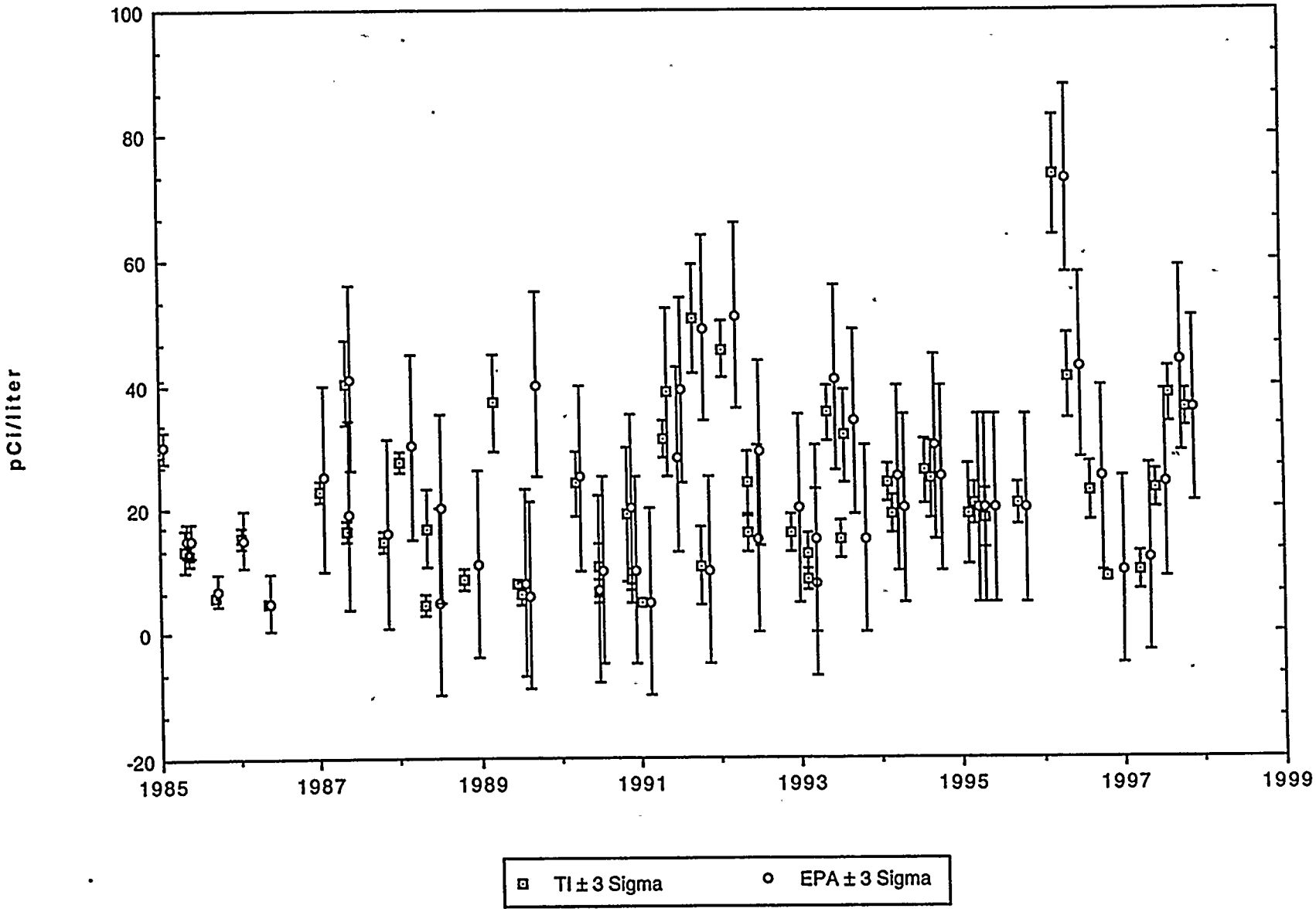
EPA CROSS CHECK PROGRAM

STRONTIUM-89 IN WATER (pg. 1 of 2)



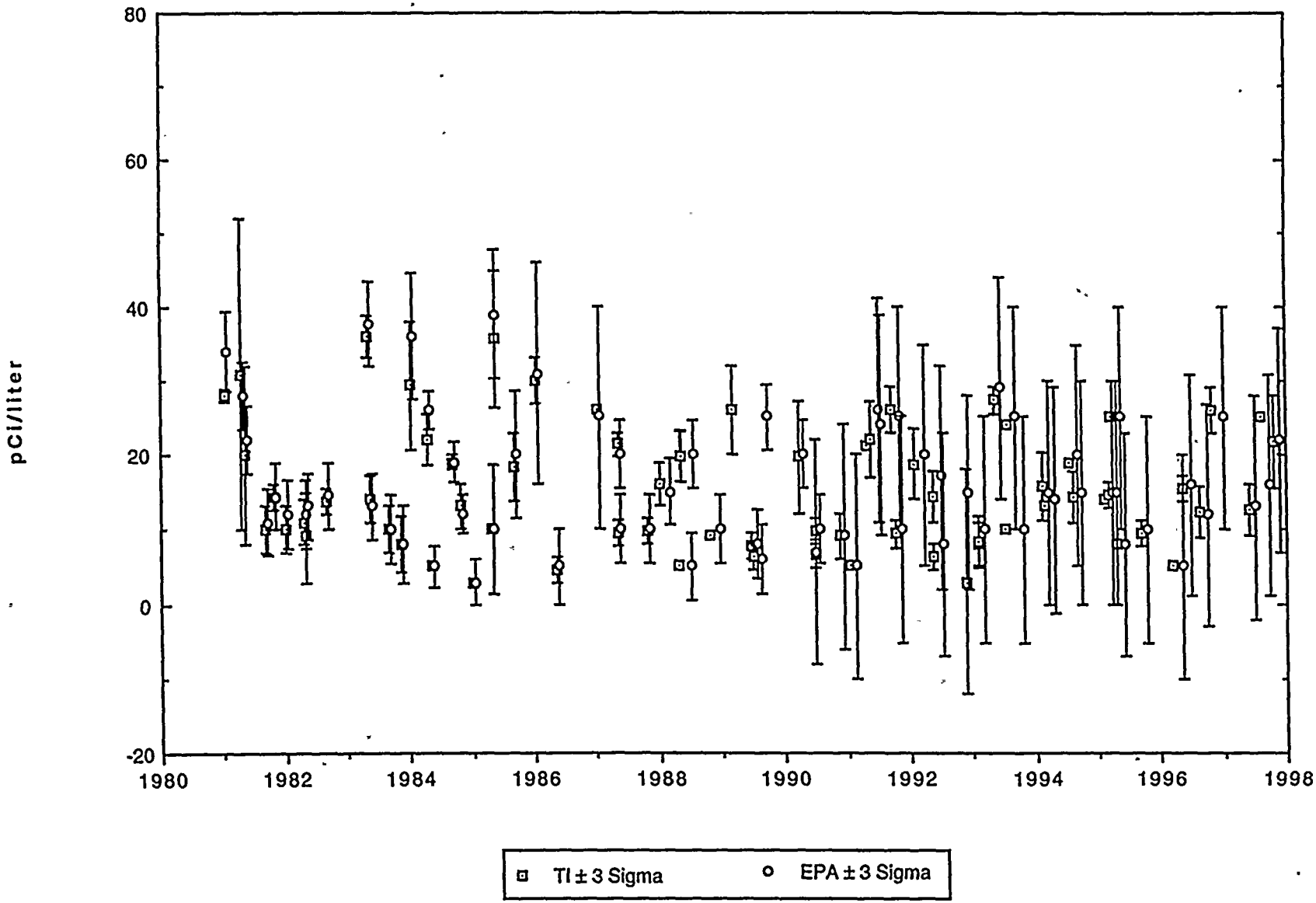
EPA CROSS CHECK PROGRAM

STRONTIUM-89 IN WATER (pg. 2 of 2)



EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN WATER (pg. 1 of 1)



APPENDIX E
REMP SAMPLING AND ANALYTICAL EXCEPTIONS

PROGRAM EXCEPTIONS

AIR PARTICULATES

On 1/02/97, the South Bend air station was found off after a pump run time of only 26 hours, 40 minutes. On 1/15/97, electric power was found off at air station ONS-6 after a run time of 105 hours, 9 minutes. This was due to a tripped breaker. In both cases, sample results were not considered valid.

On 5/7/97, the ONS-3 sample result was considered to be invalid as the filter media was found off-center.

On 10/8/97, the ONS-2 sample was considered invalid as the flow rate indicated was 81 LPM and the run time was only 28 hours, 13 minutes. The actual total volume could not be determined.

Throughout the year the air particulate gross beta results did not meet the ODCM LLD of .01 pCi/m3. This is consistent with historical results.

SURFACE WATER

Winter icing conditions on Lake Michigan prevented surface water sample collections at beach locations (SWL-2 and 3) from 01/01/97 - 03/04/97. Winter ice cleared and sampling resumed again on 03/05/97. Other dates when surface water samples were not collected because of inclement weather conditions included:

SWL-2: 03/06, 03,15, 04/07, 04/08, 04/09, 05/01, 05/15, 09/10, 09/25, 09/30, 12/06

SWL-3: 03/07, 03/08, 03/16, 03/17, 03/18, 03/23, 04/07, 04/08, 04/09, 05/01, 05/15, 09/10, 09/25, 09/30, 12/06

The first quarter tritium result from SWL-1 was 4,800 pCi/l which exceeded the ODCM LLD of 2,000 pCi/l.

GROUND WATER

On 01/23/97 well samples W4, W5, W6, and W7 were not collected due to inclement weather. All were subsequently sampled within the 25% grace period.

Gross beta results from SG1, 2, 4, and 5 on 01/24 were >ODCM LLD of 4.0 pCi/l. This is consistent with historical data.

On 01/23/97, groundwater well W-14 had a tritium result of 7,300 pCi/l which exceeded the ODCM LLD of 2,000 pCi/l.

On 04/24/97, groundwater well W-14 had a tritium measurement of 19,000 pCi/l which exceeded the ODCM LLD of 2,000 pCi/l.

On 07/24/97, groundwater well W-14 had a tritium result of 16,000 pCi/l and Well-6 had a measurement of 2,200 pCi/l which exceeded the ODCM LLD of 2,000 pCi/l.

DRINKING WATER

On different occasions the gross beta LLD failed to meet the ODCM LLD of 4.0 pCi/l at the St. Joseph and Lake Township facilities. This is consistent with historical information Specific dates were:

- 12/31/96-01/15/97 St. Joseph composite sample
- 01/16/97-01/29/97 St. Joseph composite sample
- 02/26/97-03/12/97 St. Joseph composite sample
- 03/26/97-04/09/97 St. Joseph composite sample
- 04/23/97-05/07/97 St. Joseph composite sample

The 12/31/96-01/15/97 composite sample from the St. Joseph location exceeded the 14 day collection day frequency but was within the 25% grace period.

The Lake Township drinking water samples from 05/15/97 and 09/15/97 and the 11/13/97 St. Joseph sample were not collected. In all cases the sample collector failed to obtain the samples and the incidents were attributed to water lab technician oversight.

LAKE SEDIMENT

The 10/16/97 lake sediment sample from location SL-3 was unable to be collected due to the sample area being submerged in approximately 6 feet, of water and covered with rocks. At the latter part of 1997, Lake Michigan waters were high and there was no beach area from the plant centerline to approximately 0.5 north of the plant.

BROADLEAF SAMPLES IN LIEU OF MILK SAMPLES

During 1997 milk samples were not obtained since no replacement farms were found for the two indicator farms which dropped from the program in 1996. However, per ODCM, broadleaf samples were obtained in lieu of milk samples. Monthly broadleaf samples were not obtained during the first quarter of 1997 and in April, due to season unavailability. In May, broadleaf sampling resumed.

Broadleaf samples were unavailable in November and December due to end of season.

TLDs

Location OFT-1 was found to be missing in the second quarter, the cause of incident was attributed to vandalism.

The transit does was not subtracted from totals for the third quarter. The transit TLD was inadvertently not placed in the shielded TLD holder.

APPENDIX F
1997 LAND USE CENSUS

APPENDIX F
SUMMARY OF THE 1997 LAND USE CENSUS

The Land Use Census is performed to ensure that significant changes in the areas in the immediate vicinity of the plant site are identified. Any identified changes are evaluated to determine whether modifications must be made to the REMP or other related programs. The following is a summary of the 1997 results.

Milk Farm Survey

The milk farm survey is performed to update the list of milk farms located in the plant area, to identify the closest milk farm in each land sector, and to identify the nearest milk animal whose milk is used for human consumption. The milk farm survey for the Donald C. Cook Nuclear Plant was conducted on August 4, 1997.

In 1997 there were four deletions to the Michigan Department of Agriculture's list of dairy farms in Berrien County Michigan. One of the deleted farms had previously participated in the REMP Milk Sampling Program.

The previously identified milk animal, a goat owned by Sue Dorman continues to be the closest milk producing animal to the Donald C. Cook Nuclear Plant whose milk is used for human consumption. The closest edge of the animals pasture is 13,425 feet from the Plant's centerline axis.

Residential Survey

The residential survey was performed to identify the closest residence in each land sector surrounding the Donald C. Cook Nuclear Plant. The residential survey was completed on August 4, 1997. There were three new residential building permits issued by Lake Township between 06/01/96 and 06/01/1997. In addition a door-to-door survey was then conducted using a local area map. The closest residence to the Donald C. Cook Nuclear Plant in each sector remains unchanged from the previous year except for Sector G where the previous closest residence burned to the ground.

Broadleaf Survey

In accordance with Offsite Dose Calculation Manual, broadleaf vegetation sampling is performed in lieu of a garden census. Broadleaf sampling is performed to monitor for plant impact on the environment. The samples are obtained at the site boundary. The broadleaf analytical results for 1997 were less than ODCM LLDs.

Figure 4

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

Milk Farm Survey - 1997

Sector	Survey Year	Distance Miles	Name	Address
A	a	N/A	No milk farms	N/A
	b	N/A	No milk farms	N/A
B	a	N/A	No milk farms	N/A
	b	N/A	No milk farms	N/A
C	a	N/A	No milk farms	N/A
	b	N/A	No milk farms	N/A
D	a	13.9	William Nimtz	3445 Park Rd., Eau Claire
	b	13.9	William Nimtz	3445 Park Rd., Eau Claire
E	a	10.5	Andrews University	Berrien Springs
	b	10.5	Andrews University	Berrien Springs
F	a	8.5	Keith & Charles Brohman	1637 Mt. Tabor Rd., Berrien Springs
	b	6.8	Lee Nelson	RFD 1, Box 390A, Snow Rd. Baroda
G	a	4.1	G. G. Shuler & Sons	RFD 1, Snow Rd., Baroda
	b	4.1	G. G. Shuler & Sons	RFD 1, Snow Rd., Baroda
H	a	7.0	George Freehling	2221 W. Glendora Rd., Buchana
	b	7.0	George Freehling	2221 W. Glendora Rd., Buchana
J	a	7.7	Jerry Warmbein	14143 Mill Rd., Three Oaks
	b	7.7	Jerry Warmbein	14143 Mill Rd., Three Oaks
K	a	N/A	No milk farms	N/A
	b	12	Kenneth Tappan	Rt. 2, Kruger Rd, Three Oaks

All other sectors are over water.
(a) Reporting Year
(b) Year prior to reporting year.

Figure 5

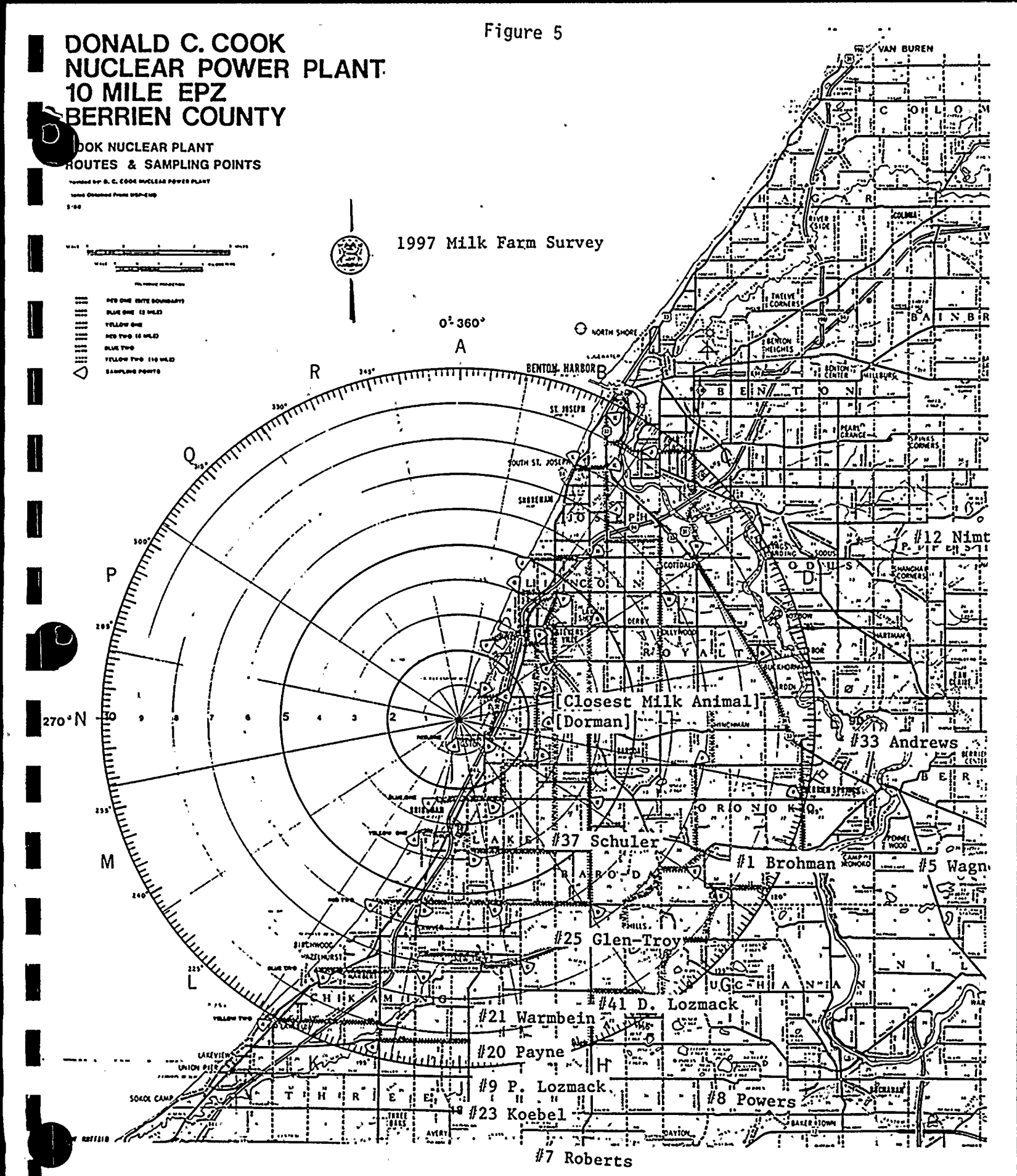
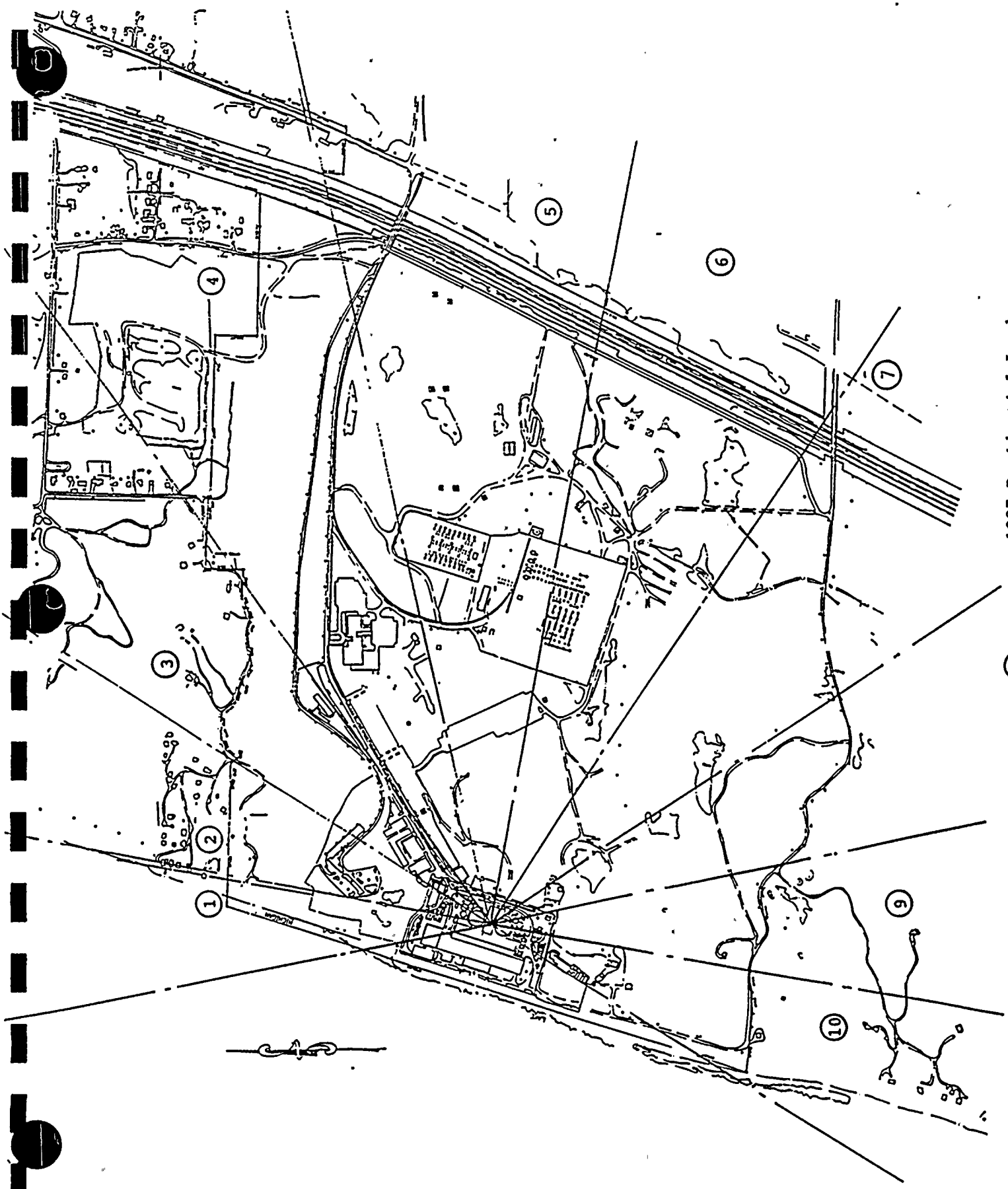

DONALD C. COOK
NUCLEAR POWER PLANT
10 MILE EPZ
BERRIEN COUNTY
COOK NUCLEAR PLANT
ROUTES & SAMPLING POINTS
1997 Milk Farm Survey
0°-360°
270° N
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
BENTON HARBOR
ST. JOSEPH
SOUTH ST. JOSEPH
VAN BUREN
NORTH SHORE
[Closest Milk Animal]
[Dorman]
#12 Nimt
#33 Andrews
#37 Schuler
#1 Brohman
#5 Wagn
#25 Glen-Troy
#41 D. Lozmack
#21 Warmbein
#20 Payne
#9 P. Lozmack
#8 Powers
#23 Koebel
#7 Roberts

Figure 6



1997 Residential Land Use Survey

Figure 7

INDIANA MICHIGAN POWER COMPANY - DONALD C. COOK NUCLEAR PLANT

Residential Land Use Survey - 1997

Sector	Year	House (1)	In Feet	Property #	Street Address
A	a	1	2161	11-11-0006-0004-01-7	Iler Drive, Rosemary Beach
	b	1	2161	11-11-0006-0004-01-7	Iler Drive, Rosemary Beach
B	a	2	2165	11-11-0006-0004-09-2	Iler Drive, Rosemary Beach
	b	2	2165	11-11-0006-0004-09-2	Iler Drive, Rosemary Beach
C	a	3	3093	11-11-6800-0028-00-0	Lake Road, Rosemary Beach
	b	3	3093	11-11-6800-0028-00-0	Lake Road, Rosemary Beach
D	a	4	5733	11-11-0005-0036-01-8	7500 Thorton Drive
	b	4	5733	11-11-0005-0036-01-8	7500 Thorton Drive
E	a	5	5631	11-11-0005-0009-07-0	7927 Red Arrow Highway
	b	5	5631	11-11-0005-0009-07-0	7927 Red Arrow Highway
F	a	6	5392	11-11-0008-0015-03-1	8197 Red Arrow Highway
	b	6	5392	11-11-0008-0015-03-1	8197 Red Arrow Highway
G	a	7	5382	11-11-0008-0010-03-0	8345 Red Arrow Highway
	b	7	3728	11-11-0007-0013-01-4	Livingston Road
H	a	8	4944	11-11-8600-0004-00-1	Wildwood
	b	8	4944	11-11-8600-0004-00-1	Wildwood
J	a	9	3366	11-11-0007-0010-02-3	Livingston Hills
	b	9	3366	11-11-0007-0010-02-3	Livingston Hills
K	a	10	3090	11-11-0007-0010-03-1	Livingston Hills
	b	10	3090	11-11-0007-0010-03-1	Livingston Hills

(1) House # indicated is the reference number used on map when obtaining the raw field data.
(a) Reporting Year
(b) Year prior to reporting year.

APPENDIX G
SUMMARY OF THE PRE-OPERATIONAL RADIOLOGICAL MONITORING PROGRAM

SUMMARY OF THE PREOPERATIONAL RADIOLOGICAL MONITORING PROGRAM

A preoperational radiological environmental monitoring program was performed for the Donald C. Cook Nuclear Plant from August 1971 until the initial criticality of Unit 1 on January 18, 1975. The analyses of samples collected in the vicinity of the Donald C. Cook Nuclear Plant were performed by Eberline Instrument Corporation. The summary of the preoperational program presented in this appendix is based on the seven semi-annual reports covering the period. The purpose of this summary is to provide a comparison of the radioactivity measured in the environs of the Donald C. Cook Nuclear Plant during the pre-start up of Unit 1 and the radioactivity measured in 1997.

As stated in the report for the period of July 1 to December 31, 1971, the purposes of a preoperational radiological monitoring program include:

(a) "To yield average values of radiation levels and concentrations of radioactive material in various media of the environment.

(b) To identify sample locations and/or types of samples that deviate from the averages.

(c) To document seasonal variations that could be erroneously interpreted when the power station is operating.

(d) To indicate the range of values that should be considered "background" for various types of samples.

(e) To "proof test" the environmental monitoring equipment and procedures prior to operation of the nuclear power station.

(h) To provide baseline information that will yield estimates of the dose to man, if any, which will result from plant operation."

The discussion that follows is for the various sample media collected and analyzed in both the preoperational period and during

1997. Analyses performed during the preoperational but not required in 1997, are not discussed.

The gross beta activity in air particulate filters ranged from 0.01 to 0.17 pCi/m^3 from the middle of 1971 to the middle of 1973. In June of 1973 and in June of 1974 the People's Republic of China detonated atmospheric nuclear tests. As a result there were periods during which the gross beta results were elevated to as high as 0.45 pCi/m^3 with no statistically significant differences between indicator and background stations. By the end of the preoperational period the values were approximately 0.06 pCi/m^3.

The gamma ray analyses of composited air particulate filters showed "trace amounts" of fission products, Ce-144, Ru-106, Ru-103, Zr-95, and Nb-95, the results of fallout from previous atmospheric nuclear tests. Cosmogenically produced beryllium-7 was also detected.

The direct radiation background as measured by thermoluminescent dosimeters (TLD) ranged between 1.0 and 2.0 mrem/week during the three and one-half years period.

Milk samples during the preoperational period were analyzed for iodine-131 and by gamma ray spectroscopy (and for strontium-89 and strontium-90). All samples had naturally occurring potassium-40 with values ranging between 520 and 2310 pCi/liter. Cesium-137 was measured in many samples after the two atmospheric nuclear tests mentioned above. The cesium-137 activity ranged from 8 to 33 pCi/liter. Iodine-131 was measured in four milk samples collected July 9, 1974. The values ranged between 0.2 and 0.9 pCi/liter.

Lake water samples were collected and analyzed for tritium and by gamma ray spectroscopy. Tritium activities were below 1000 pCi/liter and typically averaged about 400 pCi/liter. No radionuclides were detected by gamma ray spectroscopy.

Gamma ray spectroscopy analyses of lake sediment detected natural abundances of potassium-40, uranium and thorium daughters, and traces of cesium-137 below 0.1 pCi/g which is attributed to fallout.

Gamma spectroscopy analyses of fish detected natural abundances of potassium-40 and traces of cesium-137, the latter attributed to fallout.

Drinking water analysis was not part of the preoperational program.

APPENDIX H
SUMMARY OF THE SPIKE AND BLANK SAMPLE PROGRAM

TELEDYNE BROWN ENGINEERING QUALITY CONTROL PROGRAM

The goal of the quality control program at Teledyne Brown Engineering is to produce analytical results which are accurate, precise and supported by adequate documentation. The program is based on the requirements of 10CFR50, Appendix B, Nuclear Regulatory Guide 4.15 and the program as described in Quality Assurance Manual IWL-0032-395 and Quality Control Manual IWL-0032-365.

All measuring equipment is calibrated for efficiency at least annually using standard reference material traceable to NIST. For alpha and beta counting, check sources are prepared and counted every day the counter is in use. Control charts are maintained with three sigma limits specified. Control of the alpha-beta counting equipment is described in procedure PRO-032-27, "Calibration and Control of Alpha/Beta Counters". Backgrounds are usually measured at least once per week.

The gamma spectrometers are calibrated annually with a NIST traceable standard reference material selected to cover the energy range of the nuclides to be monitored and to include all of the geometries measured. Backgrounds are determined every other week and check sources are counted weekly. The energy resolution and efficiency were plotted at two energy levels on charts and held within three sigma control limits. From January 1, 1996 December 31, 1996 the energy levels were 59.5 and 1332 KeV. This procedure is described in PRO-042-44, "Calibration and Control of Gamma Ray Spectrometers".

The efficiency of the liquid scintillation counters is determined at least annually by counting NIST traceable standards which have been diluted in a known amount of distilled water and various amounts of quenching agent. The procedure is described in PRO-052-35, "Determination of Tritium by Liquid Scintillation". The background of each counter is measured with each batch of samples. A control chart is maintained for the background and check source measurements as a stability check.

Preparation of carrier solutions and acceptability criteria are contained in procedure PRO-032-49 "Standardization of Radio-chemical Carrier

Solutions". Preparation of efficiency calibration standards and check sources is described in procedure PRO-032-27, "Calibration and Control of Alpha/Beta Counters".

Results are reviewed before being entered into the data system by the Quality Assurance or Laboratory Manager, or supervisors for reasonableness of the parameters (background, efficiency, decay, etc.). Any results which are suspect, being higher or lower than results in the past, are returned to the laboratory for recount. If a longer count, decay check, recount on another system or recalculation does not give acceptable results based on experience, a new aliquot is analyzed. The complete information about the sample is contained on the work sheet(s).

No deviations from written procedures occurred during 1997.

Results of Duplicate Analyses for 1997

Sample Type	Analysis	First Analysis	Second Analysis
Air Particulates Results in Units of 10^{-3} pCi/m^3	Gr-Beta	3.6 ± 0.4 E-02	3.6 ± 0.5 E-02
	"	2.9 ± 0.3 E-02	1.6 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	2.3 ± 0.2 E-02
	"	1.8 ± 0.2 E-02	2.0 ± 0.2 E-02
	"	1.8 ± 0.2 E-02	1.8 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	2.0 ± 0.2 E-02
	"	1.4 ± 0.2 E-02	1.4 ± 0.2 E-02
	"	1.9 ± 0.2 E-02	1.9 ± 0.2 E-02
	"	1.7 ± 0.2 E-02	1.5 ± 0.2 E-02
	"	1.7 ± 0.2 E-02	1.4 ± 0.2 E-02
	"	1.2 ± 0.2 E-02	1.2 ± 0.2 E-02
	"	1.2 ± 0.2 E-02	1.3 ± 0.2 E-02
	"	1.1 ± 0.2 E-02	1.1 ± 0.2 E-02
	"	1.6 ± 0.2 E-02	1.7 ± 0.2 E-02
	"	1.9 ± 0.2 E-02	1.8 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	1.9 ± 0.2 E-02
	"	1.5 ± 0.2 E-02	1.6 ± 0.2 E-02
	"	1.5 ± 0.2 E-02	1.6 ± 0.2 E-02
	"	2.1 ± 0.2 E-02	2.1 ± 0.2 E-02
	"	1.5 ± 0.2 E-02	1.5 ± 0.2 E-02
	"	3.5 ± 0.2 E-02	3.4 ± 0.2 E-02
	"	1.6 ± 0.2 E-02	1.6 ± 0.2 E-02
	"	1.6 ± 0.2 E-02	1.6 ± 0.2 E-02
	"	1.6 ± 0.2 E-02	1.7 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	2.0 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	2.3 ± 0.2 E-02
	"	2.9 ± 0.2 E-02	3.0 ± 0.2 E-02
	"	2.0 ± 0.2 E-02	1.9 ± 0.2 E-02
Air Particulates/ Charcoal Filters Results in Units of 10^{-3} pCi/m^3	Iodine-131	L. T. 3. E-02	L. T. 2. E-02
	"	L. T. 8. E-03	L. T. 1. E-02
	"	L. T. 5. E-03	L. T. 8. E-03
	"	L. T. 1. E-02	L. T. 7. E-03
	"	L. T. 1. E-02	L. T. 1. E-02
	"	L. T. 2. E-02	L. T. 1. E-02
	"	L. T. 9. E-03	L. T. 2. E-02
	"	L. T. 8. E-03	L. T. 2. E-02
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 2. E-02	L. T. 2. E-02
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 9. E-03	L. T. 1. E-02
	"	L. T. 2. E-02	L. T. 1. E-02
	"	L. T. 1. E-02	L. T. 1. E-02

* Footnotes located at end of table.

Results of Duplicate Analyses for 1997 (Cont.)

Sample Type	Analysis	First Analysis	Second Analysis
Air Particulates/ Charcoal Filters Results in Units of 10^{-3} pCi/m^3	Iodine-131	L. T. 1. E-02	L. T. 1. E-02
	"	L. T. 1. E-02	L. T. 8. E-03
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 7. E-03	L. T. 9. E-03
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 1. E-02	L. T. 1. E-02
	"	L. T. 1. E-02	L. T. 7. E-03
	"	L. T. 1. E-02	L. T. 1. E-02
	"	L. T. 6. E-03	L. T. 7. E-03
	"	L. T. 8. E-03	L. T. 5. E-03
	"	L. T. 1. E-02	L. T. 2. E-02
	"	L. T. 2. E-02	L. T. 1. E-02
Surface Water Results in Units of pCi/liter	H-3	L. T. 2. E 02	2.2 ± 1.2 E 02
	Gamma	(a)	(a)
	Gamma	(a)	(a)
Ground Water Results in Units of pCi/liter	Gamma	(a)	(a)
	H-3	L. T. 1. E 02	L. T. 2. E 02
	Gr-Alpha	(a)	(a)
	Gamma	(a)	(a)
	Gamma	(a)	(a)
	H-3	1.5 ± 0.2 E 03	1.3 ± 0.2 E 03
Drinking Water Results in Units of pCi/liter	Gr-Beta	3.9 ± 1.0 E 00	2.5 ± 0.9 E 00
	I-131	(a)	(a)
	Gamma	(a)	(a)
	Gr-Beta	2.4 ± 1.0 E 00	2.7 ± 1.0 E 00
	I-131	(a)	(a)
	Gamma	(a)	(a)
	Gr-Beta	2.6 ± 0.9 E 00	3.5 ± 1.0 E 00

* Footnotes located at end of table.

Results of Duplicate Analyses for 1997 (Cont.)

Sample Type	Analysis	First Analysis	Second Analysis
Food	Gamma	(a)	(a)
Results in Units of	I-131	L. T. 2. E 01	L. T. 6. E 01
pCi/kg (wet)	Be-7	2.01 ± 0.20 E 03	1.57 ± 0.16 E 03
	K-40	7.62± 0.76 E 03	6.53 ± 0.65 E 03
	Be-7	7.58 ± 0.88 E 02	3.28 ± 0.91 E 02
	Cs-137	(b)	(b)

(a) All gamma results less than the detection limit (LLD).
(b) Result positive but associated error made it suspect.
(c) Confirmed by a reanalysis.

Teledyne Brown Engineering In-House Spiked Sample Results - 1997

Water

Analysis	Spike Levels (pCi/L)	Acceptable Range (pCi/l)
Gross Beta	2.2 ± 0.7 E 01	1.5 - 2.9 E 01
Gamma (Cs-137)	2.0 ± 0.3 E 04	1.7 - 2.3 E 04
H-3 (LS)	1.4 ± 0.4 E 03	1.0 - 1.8 E 03
H-3 (LS)	1.7 ± 0.5 E 03	1.2 - 2.2 E 03 (11/19/97)

TI #	Analysis Date	Gross Beta Activity (pCi/l)
34189	01/02/97	2.5 ± 0.2 E 01
34785	01/08/97	2.1 ± 0.2 E 01
35543	01/15/97	2.4 ± 0.2 E 01
36158	01/22/97	2.4 ± 0.2 E 01
37933	02/12/97	2.1 ± 0.1 E 01
38440	02/19/97	2.2 ± 0.2 E 01
39038	02/26/97	1.8 ± 0.1 E 01
39759	03/05/97	2.2 ± 0.1 E 01
40212	03/12/97	1.9 ± 0.1 E 01
40954	03/19/97	2.2 ± 0.1 E 01
41553	03/26/97	2.2 ± 0.1 E 01
42142	04/02/97	2.2 ± 0.1 E 01
43031	04/09/97	1.9 ± 0.1 E 01
43702	04/16/97	1.8 ± 0.1 E 01
44448	04/23/97	1.8 ± 0.1 E 01
45448	04/30/97	1.6 ± 0.1 E 01
45942	05/07/97	2.0 ± 0.1 E 01
46576	05/14/97	2.2 ± 0.1 E 01
47795	05/21/97	1.9 ± 0.1 E 01
47773	05/28/97	1.8 ± 0.1 E 01
48303	06/04/97	2.0 ± 0.2 E 01
49030	06/11/97	2.2 ± 0.1 E 01
49537	06/18/97	2.2 ± 0.2 E 01
50124	06/25/97	2.3 ± 0.2 E 01
50765	07/02/97	2.3 ± 0.1 E 01
51130	07/09/97	2.2 ± 0.1 E 01
51817	07/16/97	2.2 ± 0.1 E 01
52390	07/23/97	1.7 ± 0.1 E 01
53126	07/30/97	2.5 ± 0.2 E 01
53640	08/06/97	2.2 ± 0.2 E 01
54225	08/13/97	2.4 ± 0.2 E 01
54778	08/20/97	2.2 ± 0.1 E 01
55392	08/27/97	1.9 ± 0.1 E 01
55773	09/03/97	2.4 ± 0.2 E 01

TI #	Analysis Date	Gross Beta Activity (pCi/l)
56366	09/10/97	1.8 ± 0.1 E 01
57064	09/17/97	2.6 ± 0.2 E 01
57712	09/24/97	2.4 ± 0.2 E 01
58418	10/01/97	2.2 ± 0.2 E 01
59200	10/08/97	2.3 ± 0.2 E 01
59741	10/15/97	2.1 ± 0.2 E 01
60440	10/22/97	2.3 ± 0.2 E 01
61039	10/29/97	2.2 ± 0.2 E 01
61492	11/05/97	1.9 ± 0.1 E 01
62298	11/12/97	1.9 ± 0.1 E 01
62816	11/19/97	2.0 ± 0.1 E 01
63311	11/26/97	2.0 ± 0.1 E 01
63776	12/03/97	2.2 ± 0.2 E 01
64245	12/10/97	2.0 ± 0.2 E 01
64812	12/17/97	2.1 ± 0.2 E 01

SPIKES - GAMMA (Cs-137)

TI #	Analysis Date	Activity (pCi/l)
34186	01/02/97	2.11 ± 0.21 E 04
34781	01/08/97	2.08 ± 0.21 E 04
35540	01/15/97	2.12 ± 0.21 E 04
36155	01/22/97	2.10 ± 0.21 E 04
37930	02/12/97	2.09 ± 0.21 E 04
38437	02/19/97	2.05 ± 0.21 E 04
39035	02/26/97	2.03 ± 0.20 E 04
39756	03/05/97	2.02 ± 0.20 E 04
40209	03/12/97	2.05 ± 0.21 E 04
40951	03/19/97	2.06 ± 0.21 E 04
41550	03/26/97	2.06 ± 0.21 E 04
42139	04/02/97	2.02 ± 0.20 E 04
43028	04/09/97	2.02 ± 0.38 E 04
43699	04/16/97	2.07 ± 0.21 E 04
44445	04/23/97	2.00 ± 0.20 E 04
45445	04/30/97	2.08 ± 0.21 E 04
45939	05/07/97	2.08 ± 0.21 E 04
46573	05/14/97	2.05 ± 0.21 E 04
47792	05/21/97	2.09 ± 0.21 E 04
47770	05/28/97	2.12 ± 0.21 E 04
48300	06/04/97	2.08 ± 0.21 E 04
49027	06/11/97	2.05 ± 0.21 E 04
49534	06/18/97	2.05 ± 0.21 E 04
50121	06/25/97	2.09 ± 0.21 E 04
50762	07/02/97	2.09 ± 0.21 E 04

SPIKES - GAMMA (Cs-137)

TI #	Analysis Date	Activity (pCi/l)
51127	07/09/97	2.06 ± 0.21 E 04
51814	07/16/97	2.02 ± 0.20 E 04
52387	07/23/97	2.04 ± 0.20 E 04
53123	07/30/97	2.07 ± 0.21 E 04
53637	08/06/97	2.00 ± 0.20 E 04
54222	08/13/97	2.07 ± 0.21 E 04
54775	08/20/97	2.05 ± 0.21 E 04
55389	08/27/97	2.05 ± 0.21 E 04
55770	09/03/97	2.08 ± 0.21 E 04
56363	09/10/97	2.05 ± 0.21 E 04
57061	09/17/97	2.04 ± 0.20 E 04
57709	09/24/97	2.11 ± 0.21 E 04
58415	10/01/97	2.05 ± 0.21 E 04
59197	10/08/97	2.08 ± 0.21 E 04
59738	10/15/97	2.02 ± 0.20 E 04
60437	10/22/97	2.05 ± 0.21 E 04
61036	10/29/97	2.06 ± 0.21 E 04
61489	11/05/97	2.14 ± 0.21 E 04
62295	11/12/97	2.05 ± 0.21 E 04
62813	11/19/97	1.98 ± 0.20 E 04
63308	11/26/97	2.11 ± 0.21 E 04
64242	12/10/97	2.10 ± 0.21 E 04
64809	12/17/97	2.05 ± 0.21 E 04
65877	12/24/97	2.08 ± 0.21 E 04

SPIKES - TRITIUM - (H-3) 10ml

TI #	Analysis Date	Activity (pCi/l)
34193	01/02/97	1.51 ± 0.17 E 03
34789	01/08/97	1.50 ± 0.17 E 03
35547	01/15/97	1.38 ± 0.17 E 03
36162	01/22/97	1.28 ± 0.16 E 03
37937	02/12/97	1.53 ± 0.18 E 03
38444	02/19/97	1.22 ± 0.17 E 03
39042	02/26/97	1.43 ± 0.17 E 03
39763	03/05/97	1.41 ± 0.18 E 03
40216	03/12/97	1.57 ± 0.18 E 03
40958	03/19/97	1.70 ± 0.20 E 03
41557	03/26/97	1.47 ± 0.18 E 03
42146	04/02/97	1.34 ± 0.13 E 03
43035	04/09/97	1.64 ± 0.18 E 03
43706	04/16/97	1.47 ± 0.20 E 03
44452	04/23/97	1.51 ± 0.22 E 03
45452	04/30/97	1.86 ± 0.23 E 03

SPIKES - TRITIUM - (H-3) 10ml

TI #	Analysis Date	Activity (pCi/l)
45946	05/07/97	1.57 ± 0.21 E 03
46580	05/14/97	1.47 ± 0.20 E 03
47799	05/21/97	1.55 ± 0.20 E 03
47777	05/28/97	1.51 ± 0.21 E 03
48307	06/04/97	1.52 ± 0.21 E 03
49034	06/11/97	1.45 ± 0.22 E 03
49541	06/18/97	1.43 ± 0.21 E 03
50128	06/25/97	1.47 ± 0.22 E 03
50769	07/02/97	1.82 ± 0.22 E 03
51134	07/09/97	1.45 ± 0.20 E 03
51821	07/16/97	1.40 ± 0.20 E 03
52394	07/23/97	1.55 ± 0.22 E 03
53130	07/30/97	1.50 ± 0.21 E 03
53644	08/06/97	1.39 ± 0.22 E 03
54229	08/13/97	1.27 ± 0.21 E 03
54782	08/20/97	1.51 ± 0.22 E 03
55396	08/27/97	1.59 ± 0.21 E 03
55777	09/03/97	1.50 ± 0.20 E 03
56370	09/10/97	1.58 ± 0.22 E 03
57068	09/17/97	1.44 ± 0.21 E 03
57716	09/24/97	1.59 ± 0.23 E 03
58422	10/01/97	1.53 ± 0.22 E 03
59204	10/08/97	1.45 ± 0.22 E 03
59745	10/15/97	1.40 ± 0.24 E 03
60444	10/22/97	1.35 ± 0.22 E 03
61043	10/29/97	1.30 ± 0.22 E 03
61496	11/05/97	1.30 ± 0.23 E 03
62302	11/12/97	1.34 ± 0.22 E 03
62820	11/19/97	2.02 ± 0.25 E 03
63315	11/26/97	2.10 ± 0.25 E 03
63780	12/03/97	1.44 ± 0.23 E 03
64249	12/10/97	1.93 ± 0.25 E 03
64816	12/17/97	1.50 ± 0.23 E 03
65884	12/24/97	1.78 ± 0.25 E 03

Teledyne Brown Engineering In-House Blanks Sample Results - 1997
Water

GROSS BETA BLANKS

TI #	Analysis Date	Gross Beta Activity (pCi/l)
34188	01/02/97	L. T. 1. E 00
34784	01/08/97	L. T. 1. E 00
35542	01/15/97	L. T. 8. E-01
36157	01/22/97	L. T. 8. E-01
37932	02/12/97	L. T. 7. E-01
38439	02/19/97	L. T. 1. E 00
39037	02/26/97	L. T. 7. E-01
39758	03/05/97	L. T. 7. E-01
40211	03/12/97	L. T. 8. E-01
40953	03/19/97	L. T. 8. E-01
41552	03/26/97	L. T. 8. E-01
42141	04/02/97	L. T. 8. E-01
43030	04/09/97	L. T. 7. E-01
43701	04/16/97	L. T. 7. E-01
44447	04/23/97	L. T. 1. E 00
45447	04/30/97	L. T. 8. E-01
45941	05/07/97	L. T. 8. E-01
46575	05/14/97	L. T. 8. E-01
47794	05/21/97	L. T. 7. E-01
47772	05/28/97	L. T. 9. E-01
48302	06/04/97	L. T. 1. E 00
49029	06/11/97	L. T. 7. E-01
49536	06/18/97	L. T. 1. E 00
50123	06/25/97	L. T. 1. E 00
50764	07/02/97	L. T. 7. E-01
51129	07/09/97	L. T. 7. E-01
51816	07/16/97	L. T. 6. E-01
52389	07/23/97	L. T. 7. E-01
53125	07/30/97	L. T. 1. E 00
53639	08/06/97	L. T. 1. E 00
54224	08/13/97	L. T. 8. E-01
54777	08/20/97	L. T. 8. E-01
55391	08/27/97	L. T. 1. E 00
55772	09/03/97	L. T. 1. E 00
56365	09/10/97	L. T. 8. E-01
57063	09/17/97	L. T. 1. E 00
57711	09/24/97	L. T. 9. E-01
58417	10/01/97	L. T. 8. E-01
59199	10/08/97	L. T. 1. E 00
59740	10/15/97	L. T. 9. E-01
61038	10/29/97	L. T. 7. E-01

GROSS BETA - BLANKS (Cont.)

TI #	Analysis Date	Gross Beta Activity (pCi/l)
61491	11/05/97	L. T. 8. E-01
62297	11/12/97	L. T. 7. E-01
62815	11/19/97	L. T. 7. E-01
63310	11/26/97	L. T. 8. E-01
63775	12/03/97	L. T. 1. E 00
64244	12/10/97	L. T. 6. E-01
64811	12/17/97	1.9 ± 0.2E 01 (a)

TRITIUM - (H-3) - BLANKS

TI #	Analysis Date	Activity (pCi/l)
34191	01/02/97	L. T. 1.70 E 02
34787	01/08/97	L. T. 1.74 E 02
35545	01/15/97	L. T. 1.61 E 02
36160	01/22/97	L. T. 1.50 E 02
37935	02/12/97	L. T. 1.65 E 02
38442	02/19/97	L. T. 1.68 E 02
39040	02/26/97	L. T. 1.68 E 02
39761	03/05/97	L. T. 1.78 E 02
40214	03/12/97	L. T. 1.69 E 02
40956	03/19/97	L. T. 2.13 E 02
41555	03/26/97	L. T. 1.86 E 02
42144	04/02/97	L. T. 1.40 E 02
43033	04/09/97	L. T. 2.24 E 02
43704	04/16/97	L. T. 2.07 E 02
44450	04/23/97	L. T. 2.23 E 02
45450	04/30/97	L. T. 2.09 E 02
45944	05/07/97	L. T. 2.26 E 02
46578	05/14/97	L. T. 2.17 E 02
47775	05/28/97	L. T. 2.35 E 02
47797	05/21/97	L. T. 1.87 E 02
48305	06/04/97	L. T. 2.18 E 02
49032	06/11/97	L. T. 2.36 E 02
49539	06/18/97	L. T. 2.34 E 02
50126	06/25/97	L. T. 2.39 E 02
50767	07/02/97	L. T. 2.00 E 02
51132	07/09/97	L. T. 2.12 E 02
51819	07/16/97	L. T. 2.46 E 02
52392	07/23/97	L. T. 2.24 E 02
53128	07/30/97	L. T. 2.21 E 02
53642	08/06/97	L. T. 2.45 E 02

(a) Teledyne sample #64811 was inadvertently spiked. A blank was not performed.

TRITIUM - (H-3) - BLANKS (Cont.)

TI #	Analysis Date	Activity (pCi/l)
54227	08/13/97	L. T. 2.44 E 02
54780	08/20/97	L. T. 2.34 E 02
55394	08/27/97	L. T. 2.49 E 02
55775	09/03/97	L. T. 3. E 02
56368	09/10/97	L. T. 2.24 E 02
57066	09/17/97	L. T. 2.46 E 02
57714	09/24/97	L. T. 2.46 E 02
58420	10/01/97	L. T. 2.21 E 02
59202	10/08/97	L. T. 2.2 E 02
59743	10/15/97	L. T. 2.75 E 02
60442	10/22/97	L. T. 2.31 E 02
61041	10/29/97	L. T. 2.58 E 02
61494	11/05/97	L. T. 2.64 E 02
62300	11/12/97	L. T. 2.50 E 02
62818	11/19/97	L. T. 2.39 E 02
63313	11/26/97	L. T. 2.29 E 02
63778	12/03/97	L. T. 2.60 E 02
64247	12/10/97	L. T. 2.54 E 02
64814	12/17/97	L. T. 2.61 E 02
65882	12/24/97	L. T. 2.74 E 02

APPENDIX I
TLD QUALITY CONTROL PROGRAM

TLD QUALITY CONTROL PROGRAM

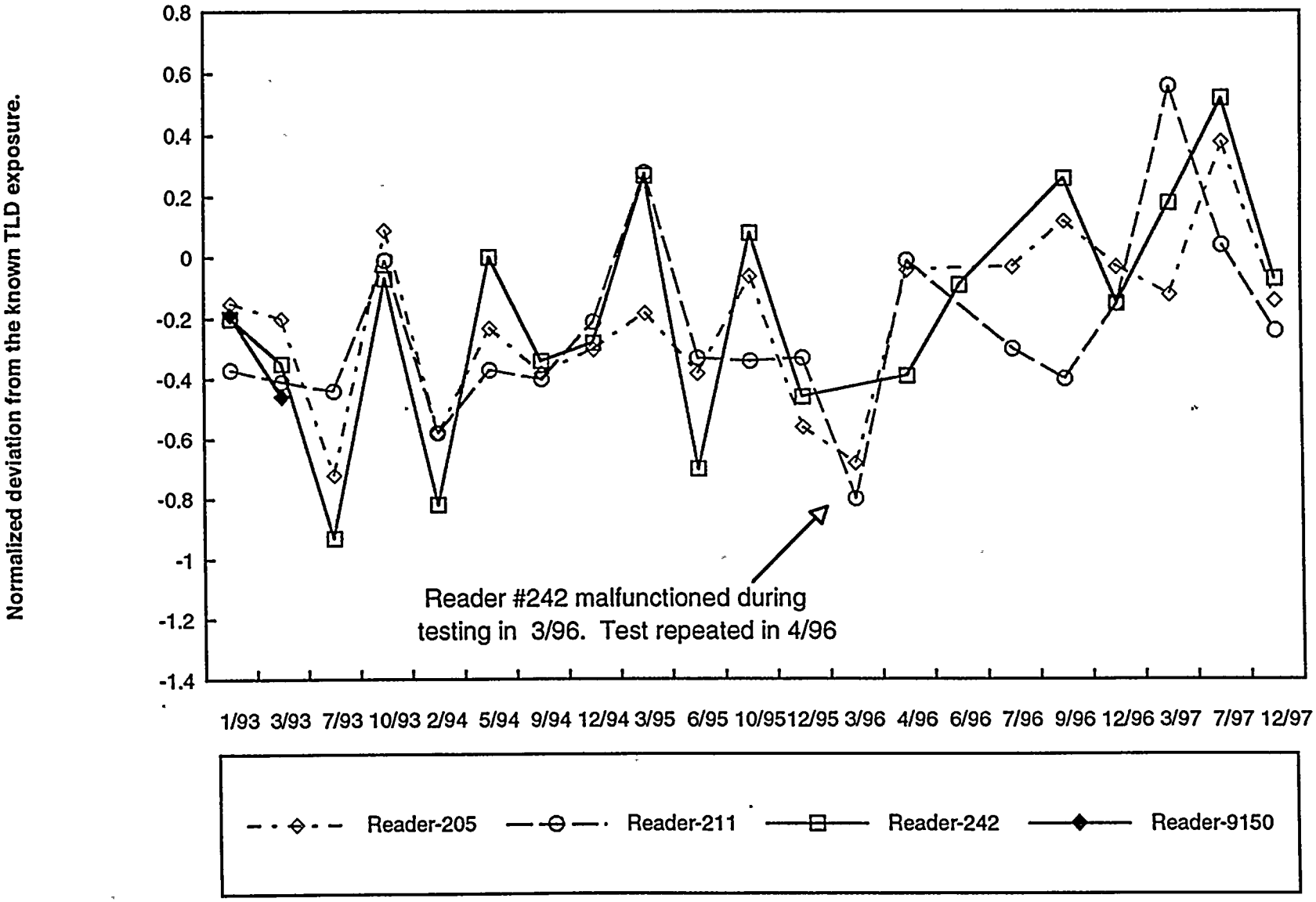
Teledyne Brown Engineering performs an in-house quality assurance testing program for the environmental TLD laboratory. On a quarterly basis the QA manager or a qualified designate exposes groups of TLDs to three different doses using a known exposure rate from a cesium-137 source.

Typical exposures are between 20 and 80 mR. The TLDs are read on each of the three Model 8300 Readers in the environmental TLD laboratory and the calculated results are reported to the QA manager. The QA manager evaluates the results and writes a report discussing the performance of the laboratory.

For 1997 all results were within the requirements of Regulatory Guide 4.13, Section C. The standard deviations of three measurements at each exposure for each reader was less than 7.5%. The percent deviation of the average of the three measurements from the known exposure at each exposure for each reader was less than 30%. The accompanying graphs indicate the normalized deviations of the average measurements from the known exposures at each exposure for each reader.

QUALITY CONTROL - TLDs

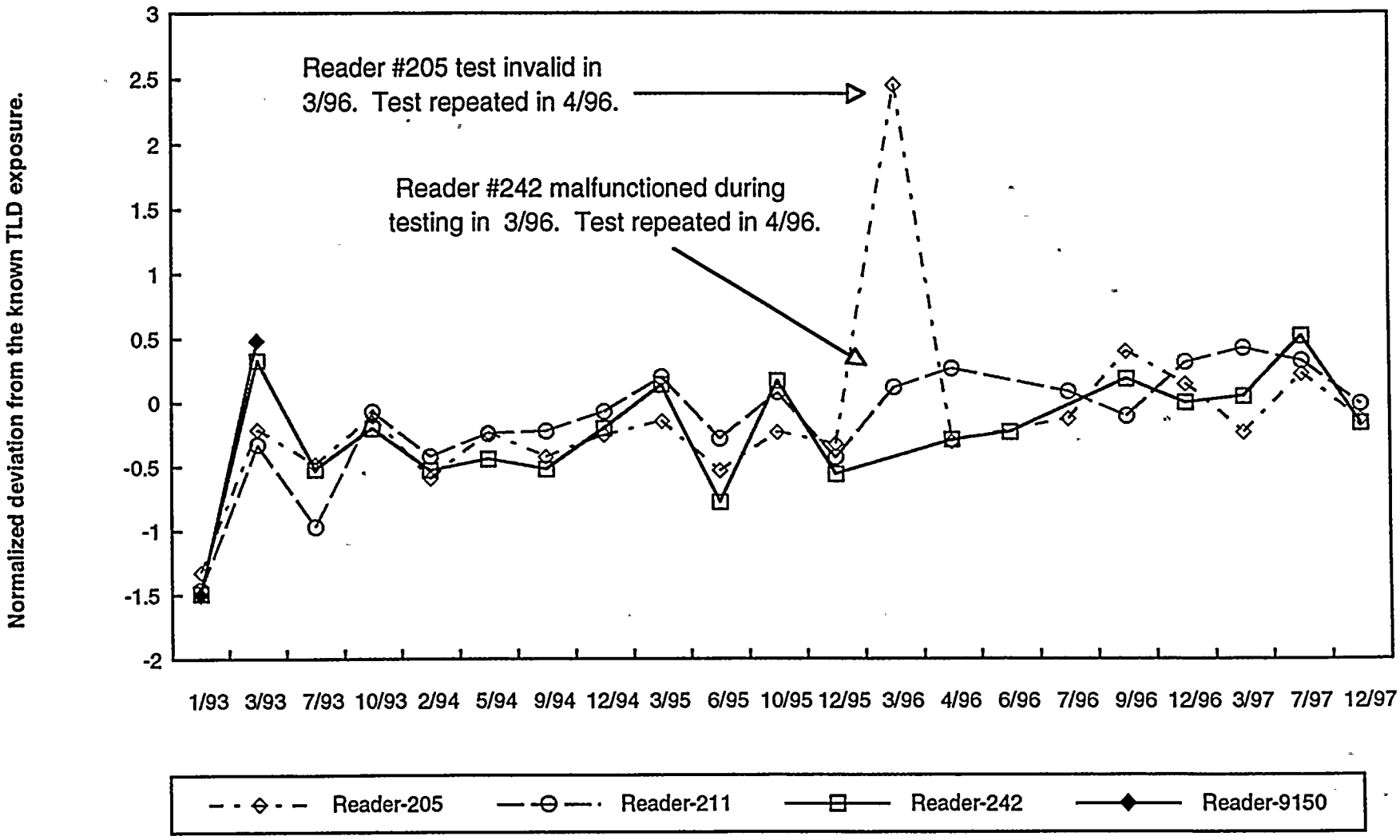
HIGH DOSE



Reader-9150 permanently removed from service during the first quarter 1993.

QUALITY CONTROL - TLDs

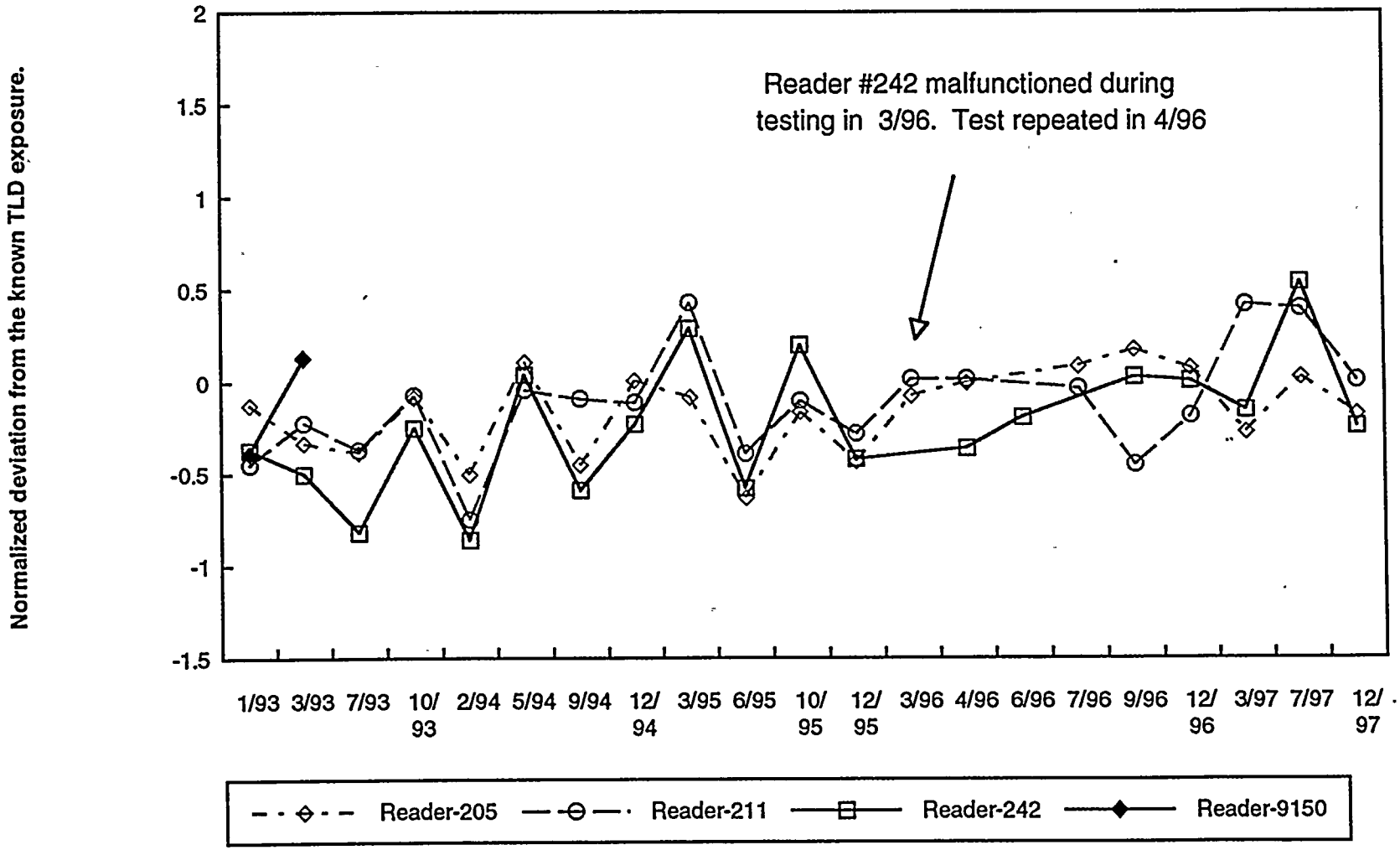
LOW DOSE



Reader-9150 was permanently removed from service during the first quarter 1993.

QUALITY CONTROL - TLDs

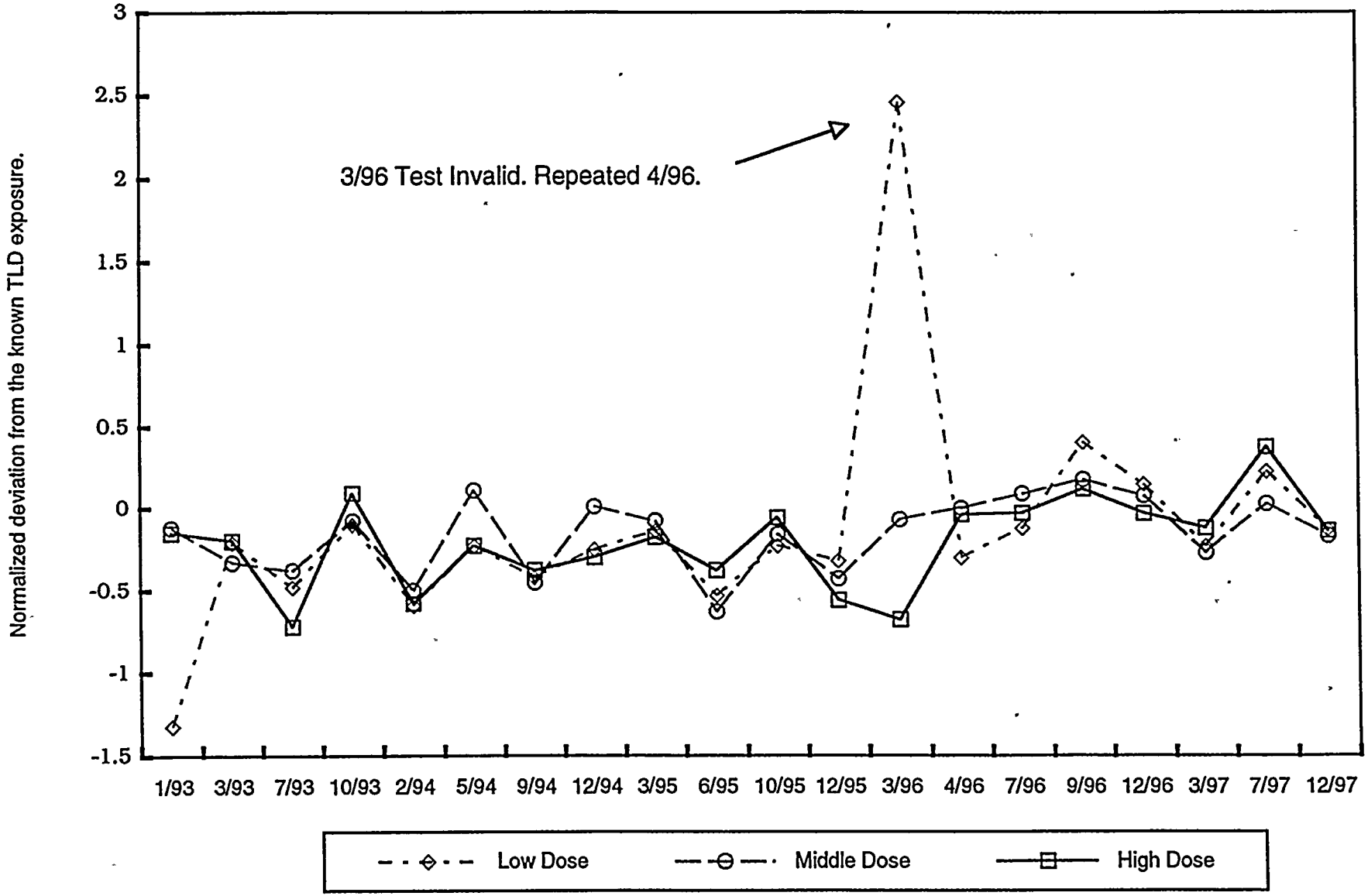
MIDDLE DOSE



Reader-9150 was permanently removed from service during the first quarter 1993.

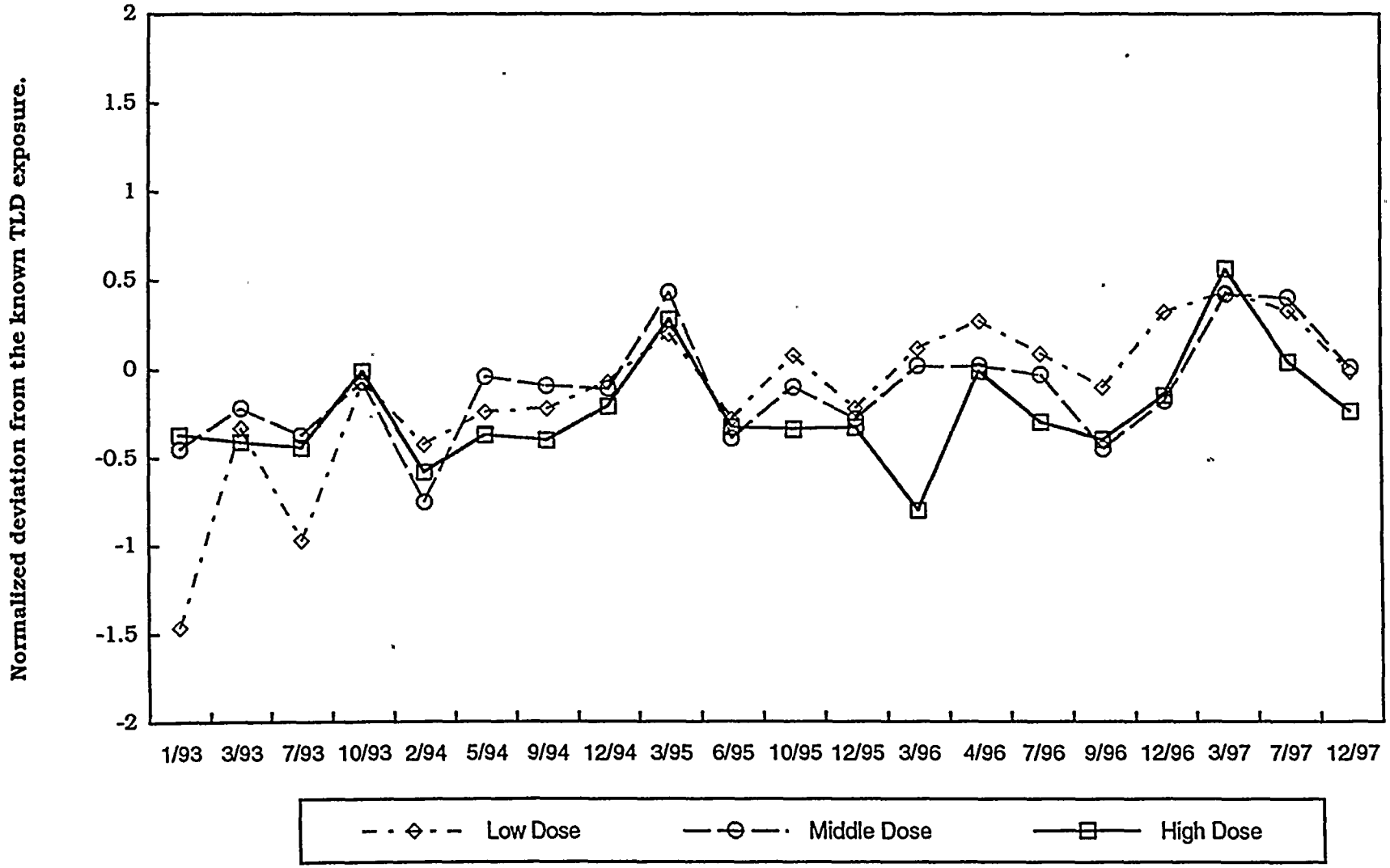
QUALITY CONTROL - TLDS

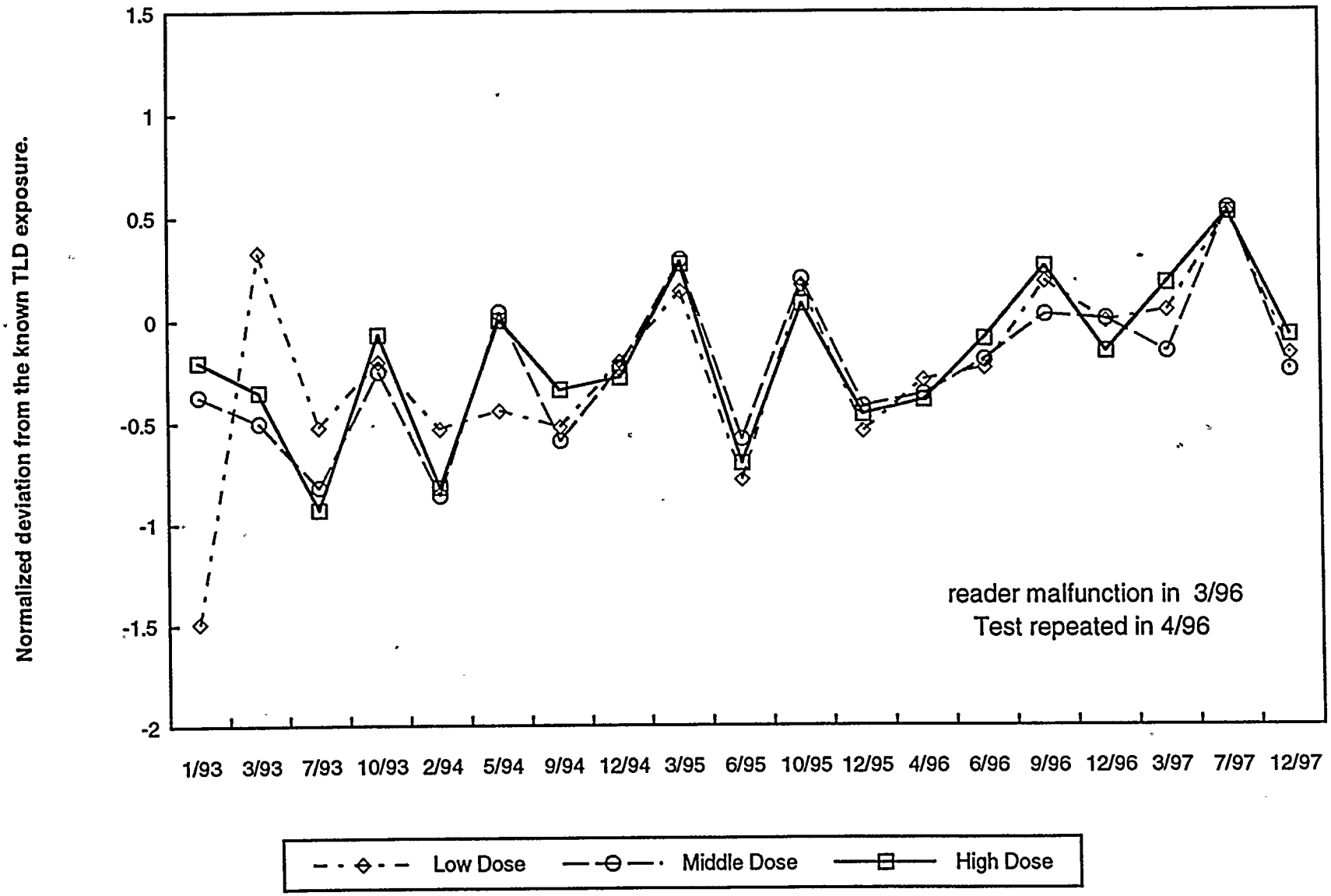
TLD READER 205



QUALITY CONTROL - TLDS

TLD READER 211



QUALITY CONTROL - TLDs

TLD READER 242