MAY 14 2004

L-PI-04-061
TS 5.6.2
ISFSI TS 6.2

U S Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Prairie Island Nuclear Generating Plant Units 1 and 2
Dockets 50-282, 50-306 and 72-10
License Nos. DPR-42, DPR-60 and SNM-2506

2003 Annual Radiological Environmental Monitoring Report

Pursuant to Prairie Island Nuclear Generating Plant Technical Specification (PI TS) 5.6.2, Appendix A to Operating Licenses DPR-42 and DPR-60, and pursuant to Prairie Island Independent Spent Fuel Storage Installation Technical Specification (ISFSI TS) 6.2, Appendix A to Materials License SNM-2506, the Nuclear Management Company, LLC submits one copy of the Annual Radiological Environmental Monitoring Report for the period January 1, 2003 through December 31, 2003.

Summary of Commitments

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

Please address any comments or questions regarding this letter to Mr. Jack Leveille at 651-388-1121.

Richard Graham for

Joseph M. Solymossy
Site Vice-President, Prairie Island Nuclear Generating Plant Units 1 and 2
Nuclear Management Company, LLC

Enclosure (1)

CC Regional Administrator, USNRC, Region III
Project Manager, Prairie Island Nuclear Generating Plant, USNRC, NRR
NRC Resident Inspector – Prairie Island Nuclear Generating Plant
Dr. John House, USNRC, Region III
Director of NMSS, USNRC
Tim Donakowski, State of Minnesota



IE25

ENCLOSURE 1

Annual report to the United States Nuclear Regulatory Commission

Radiation Environmental Monitoring Program

January 1 to December 31, 2003

(64 pages follow)

Environmental, Inc.
Midwest Laboratory
an Allegheny Technologies Co.

700 Landwehr Road • Northbrook, IL 60062-2310
ph. (847) 564-0700 • fax (847) 564-4517

# XCEL ENERGY CORPORATION

## PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket No. 50-282 License No. DPR-42
50-306 DPR-60

ISFSI
Docket No.72-10 SNM-2506

# ANNUAL REPORT
# TO THE
# UNITED STATES NUCLEAR REGULATORY COMMISSION

## Radiation Environmental Monitoring Program

January 1 to December 31, 2003

Prepared under Contract by

ENVIRONMENTAL, Inc.
MIDWEST LABORATORY

Project No. 8010

Approved: _____

Bronia Grob, M.S.
Laboratory Manager

## PREFACE

The staff of Environmental, Inc., Midwest Laboratory was responsible for the acquisition of data presented in this report. Samples were collected by members of the staff of the Prairie Island Nuclear Generating Plant, operated by Nuclear Management Company, LLC for XCEL Energy Corporation. The report was prepared by Environmental, Inc., Midwest Laboratory.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

# 1.0 INTRODUCTION

This report summarizes and interprets results of the Radiation Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory at the Prairie Island Nuclear Generating Plant, Red Wing, Minnesota, during the period January - December, 2003. This program monitors the levels of radioactivity in the air, terrestrial, and aquatic environments in order to assess the impact of the plant on its surroundings.

Tabulations of the individual analyses made during the year are not included in this report. These data are included in a reference document (Environmental, Inc., Midwest Laboratory, 2004b) available at Prairie Island Nuclear Generating Plant.

Prairie Island Nuclear Generating Plant is located on the Mississippi River in Goodhue County, Minnesota, owned by Xcel Energy Corporation and operated by Nuclear Management Company, LLC. The plant has two 575 MWe pressurized water reactors. Unit 1 achieved initial criticality on 1 December 1973. Commercial operation at full power began on 16 December 1973. Unit 2 achieved initial criticality on 17 December 1974. Commercial operation at full power began on 21 December 1974.

## 2.0 SUMMARY

The Radiation Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Prairie Island Nuclear Generating Plant and the Independent Spent Fuel Storage Installation (ISFSI) is described. Results for 2003 are summarized and discussed.

Program findings show background levels of radioactivity in the environmental samples collected in the vicinity of the Prairie Island Nuclear Generating Plant.

## 3.0 RADIATION ENVIRONMENTAL MONITORING PROGRAM (REMP)

### 3.1 Program Design and Data Interpretation

The purpose of the Radiation Environmental Monitoring Program (REMP) at the Prairie Island Nuclear Generating Plant is to assess the impact of the plant on its environment. For this purpose, samples are collected from the air, terrestrial, and aquatic environments and analyzed for radioactive content. In addition, ambient gamma radiation levels are monitored by thermoluminescent dosimeters (TLDs).

Sources of environmental radiation include the following:

(1) Natural background radiation arising from cosmic rays and primordial radionuclides;

(2) Fallout from atmospheric nuclear detonations;

(3) Releases from nuclear power plants;

(4) Industrial and medical radioactive waste; and

(5) Fallout from nuclear accidents.

In interpreting the data, effects due to the plant must be distinguished from those due to other sources.

A major interpretive aid in assessment of these effects is the design of the monitoring program at the Prairie Island Plant which is based on the indicator-control concept. Most types of samples are collected both at indicator locations (nearby, downwind, or downstream) and at control locations (distant, upwind, or upstream). A plant effect would be indicated if the radiation level at an indicator location was significantly larger than that at the control location. The difference would have to be greater than could be accounted for by typical fluctuations in radiation levels arising from other sources.

An additional interpretive technique involves analyses for specific radionuclides present in the environmental samples collected from the plant site. The plant's monitoring program includes analyses for tritium and iodine-131. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, cerium-144, beryllium-7, and potassium-40. The first three gamma-emitting isotopes were selected as radiological impact indicators because of the different characteristic proportions in which they appear in the fission product mix produced by a nuclear reactor and that produced by a nuclear detonation. Each of the three isotopes is produced in roughly equivalent amounts by a reactor: each constitutes about 10% of the total activity of fission products 10 days after reactor shutdown. On the other hand, 10 days after a nuclear explosion, the contributions of zirconium-95, cerium-144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud, 1963). Beryllium-7 is of cosmogenic origin and potassium-40 is a naturally-occurring isotope. They were chosen as calibration monitors and should not be considered radiological impact indicators.

The other group quantified consists of niobium-95, ruthenium-103 and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the final group, manganese-54, iron-59, cobalt-58 and -60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of a nuclear power plant's effluents, but are not produced in significant quantities by nuclear detonations.

3.1 Program Design and Data Interpretation (continued)

Other means of distinguishing sources of environmental radiation are employed in interpreting the data. Current radiation levels are compared with previous levels, including those measured before the Plant became operational. Results of the plant's monitoring program can be related to those obtained in other parts of the world. Finally, results can be related to events known to cause elevated levels of radiation in the environment, e.g., atmospheric nuclear detonations.

3.2 Program Description

The sampling and analysis schedule for the radiation environmental monitoring program at Prairie Island is summarized in Table 5.1 and briefly reviewed below. Table 5.2 defines the sampling location codes used in Table 5.1 and specifies for each location its type (indicator or control) and its distance, direction, and sector relative to the reactor site or ISFSI facility, as appropriate. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Prairie Island Nuclear Generating Plant, 2003). Maps of fixed sampling locations are included in Appendix D.

To monitor the air environment, airborne particulates are collected on membrane filters by continuous pumping at five locations. Airborne iodine is collected by continuous pumping through charcoal filters at these same locations. Filters are changed and counted weekly. Particulate filters are analyzed for gross beta activity and charcoal filters for iodine-131. Quarterly composites of particulate filters from each location are determined by gamma spectroscopy. One of the five locations is a control (P-1), and four are indicators (P-2, P-3, P-4, and P-6).

Offsite ambient gamma radiation is monitored at thirty-four locations, using $CaSO_4$:Dy dosimeters with four sensitive areas at each location: ten in an inner ring in the general area of the site boundary, fifteen in the outer ring within a 4-5 mile radius, eight at special interest locations, and one control location, 11.1 miles distant from the plant. They are replaced and measured quarterly. Also, a complete emergency set of TLDs for the inner ring, outer ring and special interest locations are placed in the field at the same time as regular sets. The emergency set is returned to EIML quarterly for annealing and repackaging.

Ambient gamma radiation is monitored at the Independent Spent Fuel Storage Installation (ISFSI) Facility by twenty $CaSO_4$:Dy dosimeters. Twelve dosimeters are located inside of the earthen berm in direct line of sight from the storage casks and eight dosimeters are located outside of the earthen berm. They are replaced and measured quarterly.

Milk samples are collected monthly from five farms (four indicator and one control) and analyzed for iodine-131 and gamma-emitting isotopes. The milk is collected biweekly during the growing season (May - October), because the milk animals may be on pasture.

For additional monitoring of the terrestrial environment, green leafy vegetables (cabbage) are collected annually from the highest D/Q garden and a control location (P-38), and analyzed for gamma-emitting isotopes, including iodine-131. Corn is collected annually only if fields are irrigated with river water and analyzed for gamma-emitting isotopes. Well water and ground water are collected quarterly from four locations near the plant and analyzed for tritium and gamma-emitting isotopes.

River water is collected weekly at two locations, one upstream of the plant (P-5) and one downstream (P-6, Lock and Dam No.3). Monthly composites are analyzed for gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

## 3.2 Program Description (continued)

Drinking water is collected weekly from the City of Red Wing well. Monthly composites are analyzed for gross beta, iodine-131, and gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

The aquatic environment is also monitored by semi-annual upstream and downstream collections of fish, periphyton or invertebrates, and bottom sediments. Shoreline sediment is collected semi-annually from one location. All samples are analyzed for gamma-emitting isotopes.

## 3.3 Program Execution

The Program was executed as described in the preceding section with the following exceptions:

(1) A partial air particulate/air iodine sample was collected from location P-1, the week ending 10-14-03. The low volume was due to sampler pump failure.

(2) No air particulate/air iodine sample was available from location P-6 for the week ending 11-14-03, due to a sampler pump failure.

(3) Milk samples were not available from P-37 (Welsch Farm) for the months of January, February and March of 2003.

Deviations from the program are summarized in Table 5.3.

## 3.4 Laboratory Procedures

Analyses for iodine-131 in milk and drinking water utilize a sensitive radiochemical procedure involving the separation of the element by ion-exchange and subsequent beta counting. Gamma-spectroscopic analysis is performed using a high-purity germanium (HPGe) detector. Levels of airborne iodine-131 in charcoal samples are measured by gamma spectroscopy.

Levels of iodine-131 in cabbage are determined by gamma spectrometry.

Tritium levels are determined by liquid scintillation technique.

Analytical Procedures used by Environmental, Inc. are on file and are available for inspection. Procedures are based on those prescribed by the Health and Safety Laboratory of the U.S. Dep't of Energy, Edition 28, 1997, U.S. Environmental Protection Agency for Measurement of Radioactivity in Drinking Water, 1980, and the U.S. Environmental Protection Agency, EERF, Radiochemical Procedures Manual, 1984.

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of the data obtained. Details of the Quality Assurance Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 2003). The program includes participation in Interlaboratory Comparison (Crosscheck) programs and results are presented in Appendix A.

## 3.5 Program Modifications

One extra garden location was sampled for broadleaf vegetation in 2003.

## 3.6 Land Use Census

In accordance with the Prairie Island Nuclear Generating Plant Offsite Dose Calculation Manual, H4, (ODCM) a land use census is conducted in order to identify the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 $ft^2$ producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of 5 miles. This census is conducted at least once per 12 months between the dates of May 1 and October 31. If new locations yield a calculated dose or dose equivalent (via the same exposure pathway) twenty percent greater than the required locations per the ODCM, then the new locations are added to the radiation environmental monitoring program within 30 days, and sampling locations having lower calculated doses or a lower dose commitment may be deleted from this monitoring program after October 31 of the year in which the land use census was conducted.

This land use census insures the updating of the radiation environmental monitoring program should sampling locations change within the 5 mile radius from the plant.

The 2003 Land Use Census was completed in September, 2003. There were no changes in any of the highest D/Q locations for dairy, nearest residence, or garden sites in 2003. The critical receptor location did not change in 2003, based on the results of the land use census.

No downstream irrigation of corn was discovered within 5 miles of the Prairie Island Plant. Therefore, no corn samples were collected for analysis.

## 4.0 RESULTS AND DISCUSSION

All scheduled collections and analyses were made except those listed in Table 5.3.

The results are summarized in Table 5.4 in a format recommended by the Nuclear Regulatory Commission in Regulatory Guide 4.8. For each type of analysis of each sampled medium, this table lists the mean and range for all indicator locations and for all control locations. The locations with the highest mean and range are also shown.

### 4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported atmospheric nuclear tests in 2003. The last reported test was conducted on October 16, 1980 by the People's Republic of China. There were no reported accidents involving a release to the environment at nuclear reactor facilities in 2003.

### 4.2 Summary of Preoperational Data

The following constitutes a summary of preoperational studies conducted at the Prairie Island Nuclear Power Plant during the years 1970 to 1973, to determine background levels expected in the environment, and provided, where applicable, as a means for comparison with present day levels. Strict comparisons, however, are difficult, since background levels of radiation were much higher in these years due to radioactive fallout from the atmosphere. Gross beta measurements in fallout declined yearly from a level of 12,167 pCi/$m^2$ to 1,020 pCi/$m^2$, and these declining values are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.4 mR/4 weeks during preoperational studies. Gross beta in air particulates declined from levels of 0.38 to 0.037 pCi/$m^3$. Average present day levels have stabilized at around 0.025 pCi/$m^3$. Airborne radioiodine remained below detection levels.

In the terrestrial environment of 1970 to 1973, milk, agricultural crops, and soil were monitored. In milk samples, low levels of Cs-137, I-131, and Sr-90 were detected. Cs-137 levels declined from 16.5 to 8.6 pCi/L. Present day measurements for both Cs-137 and I-131 are below detection levels. Agricultural crop measurements averaged 57.7 pCi/g for gross beta and 0.47 pCi/g for Cs-137. Gross beta measured in soil averaged 52 pCi/g .

The aqueous environment was monitored by testing of river , well and lake waters, bottom sediments, fish , aquatic vegetation and periphyton. Specific location comparison of drinking, river and well water concentrations for tritium and gross beta are not possible. However, tritium background levels, measured at eight separate locations, declined steadily from an average concentration of 1020 pCi/L to 490 pCi/L. Present day environmental levels of tritium are below detection limits. Values for gross beta, measured from 1970 to 1973, averaged 9.9 pCi/L in downstream Mississippi River water, 8.2 pCi/L for well water, and 11.0 pCi/L for lake water. Gamma emitters were below the lower limit of detection (LLD). In bottom sediments, gross beta background levels were determined at 51.0 pCi/g. Cs-137 activity during preoperational studies in 1973 measured 0.25 pCi/g upstream and 0.21 pCi/g downstream. The lower levels occasionally observed today can still be attributed to residual activity from atmospheric fallout. Gross beta in fish, measured in both flesh and skeletal samples, averaged 7.3 and 11.7 pCi/g, respectively. Gross beta background levels in aquatic vegetation, algae and periphyton samples measured 76.0 pCi/g , 46.0 pCi/g, and 13.6 pCi/g, respectively.

## 4.3 Program Findings

Slight tritium activity was detected in two downstream river water composites (pg. 11). It was determined that the collections coincided with planned radioactive discharges from the plant. All other results indicate background levels of radioactivity in environmental samples collected in the vicinity of the Prairie Island Nuclear Generating Plant.

### Ambient Radiation (TLDs)

Ambient radiation was measured in the general area of the site boundary, at the outer ring 4 - 5 mi distant from the Plant, at special interest areas and at one control location. The means ranged from 15.4 mR/91 days at inner ring locations to 16.7 mR/91 days at outer ring locations. The mean at special locations was 15.5 mR/91 days and 16.0 mR/91 days at the control location. The dose rates measured at the inner and outer ring and the control locations were similar to those observed from 1988 through 2002. The results are tabulated below. No plant effect on ambient gamma radiation was indicated (Figure 5-1).

| Year | Average (Inner and Outer Rings) | Control |
|---|---|---|
| 1988 | 15.4 | 16.0 |
| 1989 | 16.5 | 16.7 |
| 1990 | 15.9 | 16.3 |
| 1991 | 14.9 | 14.5 |
| 1992 | 16.3 | 14.8 |
| 1993 | 15.9 | 15.4 |
| 1994 | 15.2 | 16.0 |
| 1995 | 15.6 | 16.6 |
| 1996 | 14.8 | 16.4 |
| 1997 | 15.1 | 16.0 |
| 1998 | 16.7 | 17.3 |
| 1999 | 16.6 | 17.5 |
| 2000 | 17.0 | 17.1 |
| 2001 | 16.8 | 17.2 |
| 2002 | 17.4 | 16.9 |
| 2003 | 16.2 | 16.0 |
| | | |

Ambient gamma radiation as measured by thermoluminescent dosimetry.
Average quarterly dose rates (mR/91 days).

### ISFSI Facility Operations Monitoring

Ambient radiation was measured inside the ISFSI earth berm, outside the ISFSI earth berm and at two special locations between the plant ISFSI and the Prairie Island Indian Community. The mean dose rates measured 79.7 mR/91 days inside the ISFSI earth berm and 18.9 mR/91 days outside the ISFSI earth berm. No additional casks were placed on the ISFSI pad in 2003, a total of seventeen loaded casks remain. The higher levels inside the earth berm are expected, due to the loaded spent fuel casks being in direct line-of-sight of the TLDs. The ambient radiation levels measured outside the earth berm show a slight increase as compared to other offsite dose rates around the plant. If the dose rates outside the earth berm are an indication of gamma skyshine from the casks, they are consistent with predictions given in the ISFSI Safety Analysis Report, Table 7A-7, "Total Skyshine Dose Rate". The cumulative average of the two special Prairie Island Indian Community TLDs measured 14.8 and 14.3 mR/91 days. Although the skyshine neutron dose rates are not directly measured, the neutron levels measured next to the casks are below the levels predicted in the ISFSI SAR Report, Table 7A-4, "TN-40 Dose Rates at Short Distances". Therefore, the skyshine dose rates at farther distances from the casks should be at or below the calculated dose rates. No spent fuel storage effect on offsite ambient gamma radiation was indicated (Fig. 5-1).

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were slightly higher at the indicator versus the control locations (0.027 pCi/$m^3$ and 0.025 pCi/$m^3$, respectively) and similar to levels observed from 1988 through 2002. The results are tabulated below.

| Year | Average of Indicators | Control |
|---|---|---|
| | Concentration (pCi/$m^3$) | |
| 1988 | 0.030 | 0.030 |
| 1989 | 0.028 | 0.027 |
| 1990 | 0.024 | 0.023 |
| 1991 | 0.025 | 0.025 |
| 1992 | 0.023 | 0.021 |
| 1993 | 0.022 | 0.019 |
| 1994 | 0.022 | 0.022 |
| 1995 | 0.022 | 0.022 |
| 1996 | 0.023 | 0.020 |
| 1997 | 0.021 | 0.021 |
| 1998 | 0.022 | 0.018 |
| 1999 | 0.024 | 0.022 |
| 2000 | 0.025 | 0.025 |
| 2001 | 0.023 | 0.023 |
| 2002 | 0.028 | 0.023 |
| 2003 | 0.027 | 0.025 |
| | | |

Average annual gross beta concentrations in airborne particulates.

A spring peak in beta activity had been observed almost annually for many years (Wilson *et al.*, 1969). It had been attributed to fallout of nuclides from the stratosphere (Gold *et al.*, 1964). It was pronounced in 1981, occurred to a lesser degree in 1982, and has not occurred since 1983. Typically, the highest averages for gross beta occur during the months of January and December, and the first and fourth quarters, as in 1988 through 2003.

Two pieces of evidence indicate conclusively that the elevated activity observed during the winter months was not attributable to the Plant operation. In the first place, elevated activity of similar size occurred simultaneously at both indicator and control locations. Secondly, an identical pattern was observed at the Monticello Nuclear Generating Plant, about 100 miles distant from the Prairie Island Nuclear Generating Plant (Xcel Energy Corp., 2004).

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955), was detected in all samples. All other gamma-emitting isotopes were below their respective LLD limits.

Airborne Iodine

Weekly levels of airborne iodine-131 were below the lower limit of detection (LLD) of 0.07 pCi/$m^3$ in all samples. There was no indication of a plant effect.

Milk

Iodine-131 results were below the detection limit of 1.0 pCi/L in all samples. Cs-137 results were below the LLD level of 15 pCi/L in all samples. No other gamma-emitting isotopes, except naturally-occurring potassium-40, were detected in any milk samples. This is consistent with the findings of the National Center for Radiological Health that most radiocontaminants in feed do not find their way into milk due to the selective metabolism of the cow. The common exceptions are radioisotopes of potassium, cesium, strontium, barium, and iodine (National Center for Radiological Health, 1968).

In summary, the milk data for 2003 show no radiological effects of the plant operation.

Drinking Water

In drinking water from the City of Red Wing well, tritium activity measured below the LLD level of 182 pCi/L in all samples.

Gross beta concentrations averaged 9.9 pCi/L throughout the year, ranging from 8.1–14.3 pCi/L. These concentrations were similar to or slightly higher than levels observed from 1988 through 2002. The most likely contribution is the relatively high levels of naturally-occurring radium. Gamma spectroscopy indicates the presence of lead and bismuth isotopes, which are daughters of the radium decay chain. There is no indication from the 2003 data of any effect of plant operation.

| Year | | Gross Beta (pCi/L) |
|---|---|---|
| 1988 | | 8.0 |
| 1989 | | 7.0 |
| 1990 | | 7.0 |
| 1991 | | 8.0 |
| 1992 | | 7.6 |
| 1993 | | 7.5 |
| 1994 | | 5.8 |
| 1995 | | 3.9 |
| 1996 | | 6.3 |
| 1997 | | 5.1 |
| 1998 | | 5.4 |
| 1999 | | 5.3 |
| 2000 | | 10.1 |
| 2001 | | 8.3 |
| 2002 | | 8.7 |
| 2003 | | 9.9 |
| | | |

Average annual concentrations; Gross beta in drinking water.

River Water

For the second and third quarters of 2003, measurable tritium was detected in downstream river water composites, at concentrations of 1135 and 259 pCi/L, respectively. This is well below the Environmental Protection Agency's drinking water standard of 20,000 pCi/L. For the remaining upstream and downstream collections, tritium levels measured below the LLD level of 161 pCi/L.

Gamma-emitting isotopes were below detection limits in all samples.

Well Water

At the control well P-41, Huppert Farm and four indicator wells (P-8, Community Center, P-6, Lock and Dam No. 3, P-9, Plant Well No. 2 and P-24, Suter Farm ) no tritium was detected above the LLD level of 163 pCi/L. Gamma-emitting isotopes were below detection limits in all samples.

In summary, well water data for 2003 show no radiological effects of the plant operation.

Crops

Three samples of broadleaf vegetation, cabbage leaves, were collected in July and analyzed for gamma-emitting isotopes, including iodine-131. The I-131 level was below 0.026 pCi/g wet weight in all samples. With the exception of naturally-occurring potassium-40, all other gamma-emitting isotopes were below their respective detection limits. There was no indication of a plant effect.

Field sampling personnel conducted an annual land use survey and found no river water taken for irrigation into fields within 5 miles downstream from the Prairie Island Plant. The collection and analysis of corn samples was not required.

Fish

Fish samples were collected in May and September, 2003 and analyzed for gamma emitting isotopes. Only naturally-occurring potassium-40 was detected, and there was no significant difference between upstream and downstream results. There was no indication of a plant effect.

Aquatic Insects or Periphyton

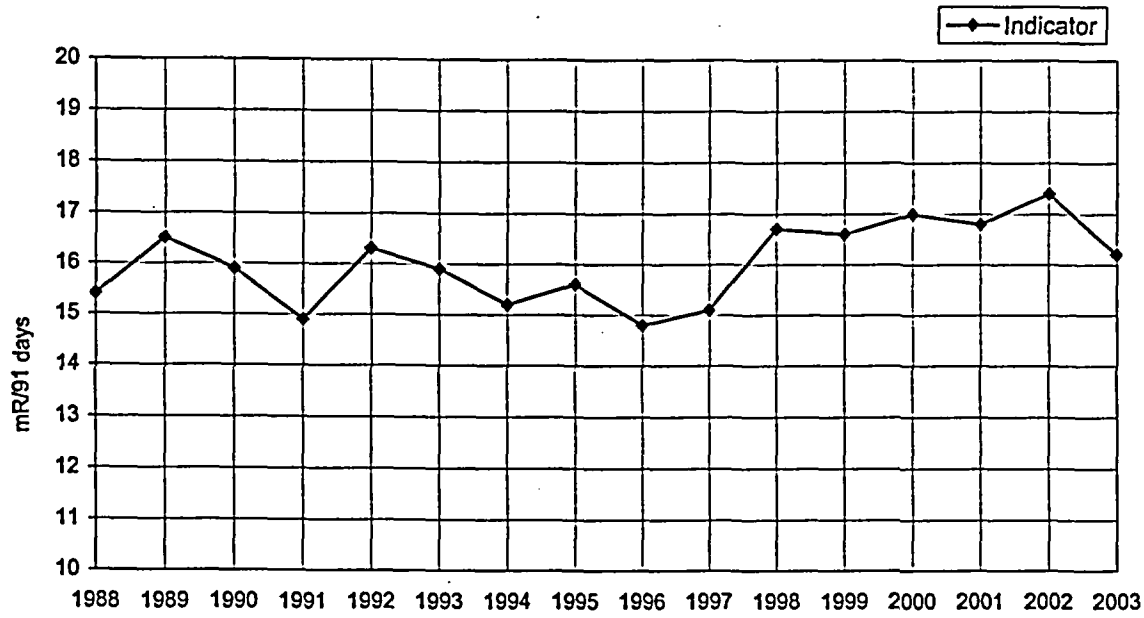
Aquatic insects (invertebrates) or periphyton were collected in May and September, 2003. All gamma-emitting isotopes were below their respective detection limits. There was no indication of a plant effect.

Bottom and Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediment collections were made in May and September, 2003 and analyzed for gamma-emitting isotopes. The only gamma-emitting isotope detected was naturally-occurring potassium-40. There was no indication of a plant effect.

## 5.0 FIGURES AND TABLES

Figure 5-1. Offsite Ambient Radiation (TLDs); average of inner and outer ring indicator locations versus control location.



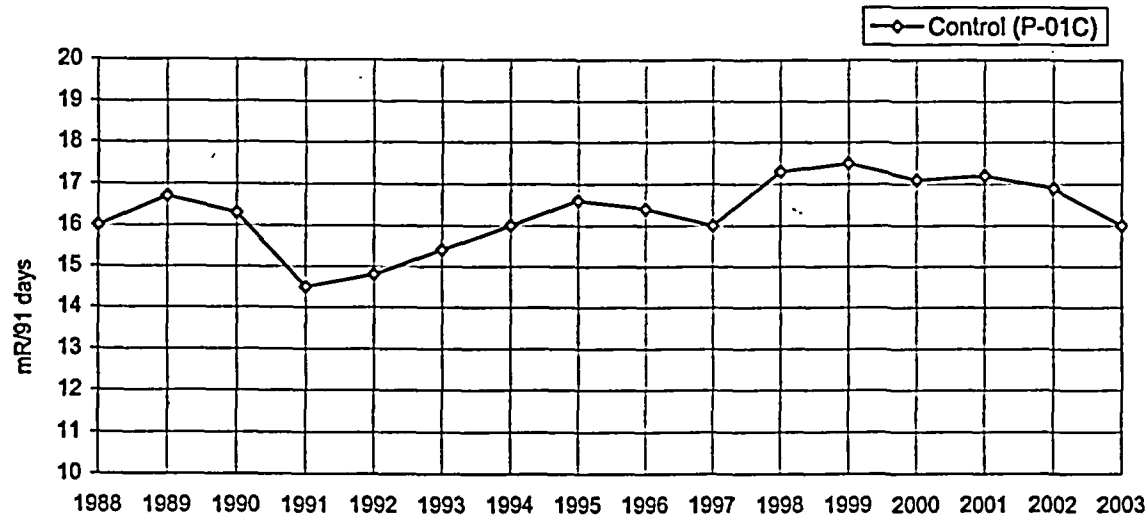
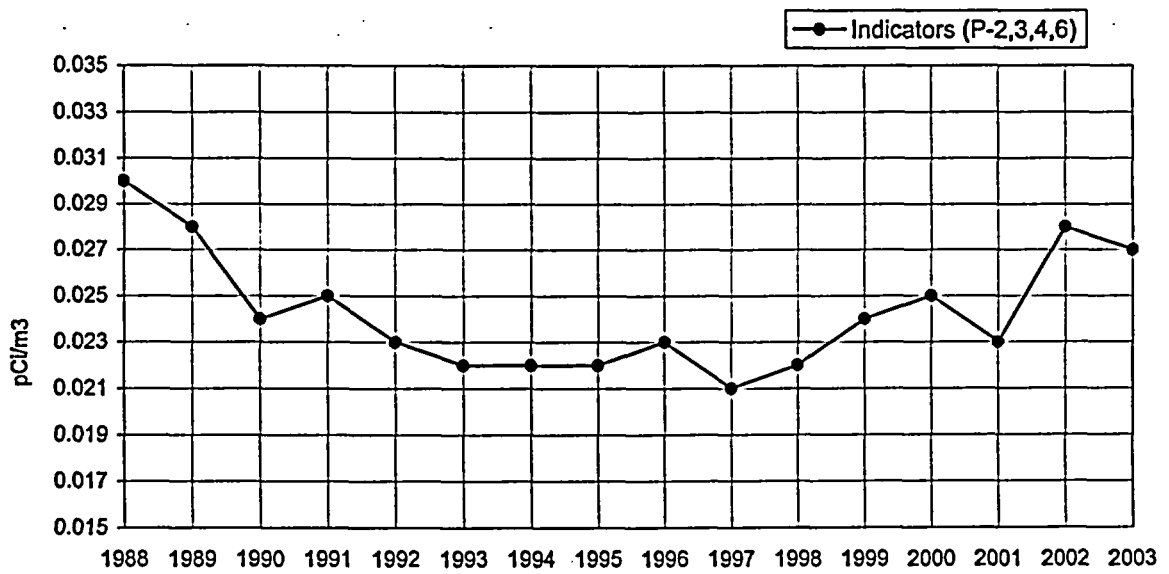
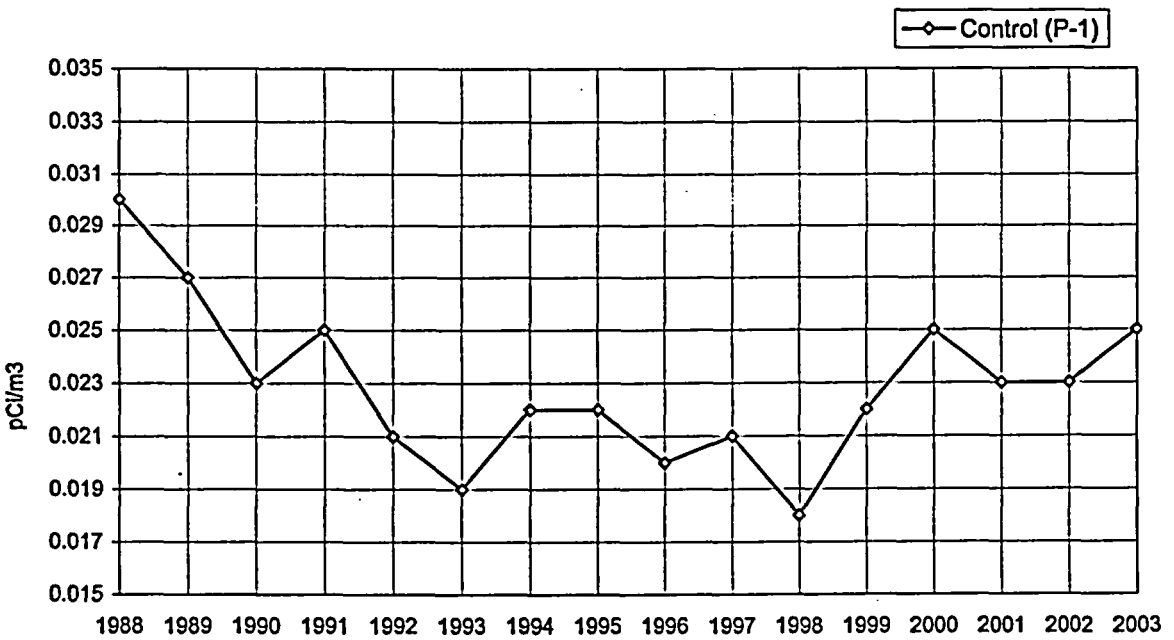



Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.



## PRAIRIE ISLAND

Table 5.1. Sample collection and analysis program, Prairie Island Nuclear Generating Plant.

| Medium | Location No. | Location Codes (and Type)[a] | Collection Type and Frequency[b] | Analysis Type and Frequency[c] |
|---|---|---|---|---|
| Ambient radiation (TLD's) | 54 | P-01A - P-10A<br>P-01B - P-15B<br>P-01S - P-08S<br>P-01IA - P-08IA<br>P-01IB - P-08IB<br>P-01IX- P-04IX, P-01C | C/Q | Ambient gamma |
| Airborne Particulates | 5 | P-1(C), P-2,<br>P-3, P-4, P-6 | C/W | GB, GS (QC of each location) |
| Airborne Iodine | 5 | P-1(C), P-2, P-3, P-4, P-6 | C/W | I-131 |
| Milk | 5 | P-14, P-18, P-37, P-41 (C), P-42 | G/M[d] | I-131, GS |
| River water | 2 | P-5(C), P-6 | G/W | GS(MC), H-3(QC) |
| Drinking water | 1 | P-11 | G/W | GB(MC), I-131(MC)<br>GS (MC), H-3 (QC) |
| Well water | 5 | P-6, P-8, P-9, P-24, P-41 (C) | G/Q | H-3, GS |
| Edible cultivated crops - leafy green vegetables | 2 | P-38(C), P-24 | G/A | GS (I-131) |
| Fish (one species, edible portion) | 2 | P-19(C), P-13 | G/SA | GS |
| Periphyton or invertebrates | 2 | P-40(C), P-6 | G/SA | GS |
| Bottom sediment | 2 | P-20(C), P-6 | G/SA | GS |
| Shoreline sediment | 1 | P-12 | G/SA | GS |

[a] Location codes are defined in Table D-2. Control stations are indicated by (C). All other stations are indicators.

[b] Collection type is coded as follows: C/ = continuous, G/ = grab. Collection frequency is coded as follows:
W= weekly, M = monthly, Q = quarterly, SA = semiannually, A = annually.

[c] Analysis type is coded as follows: GB = gross beta, GS = gamma spectroscopy, H-3 = tritium, I-131 = iodine-131.
Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.

[d] Milk is collected biweekly during the grazing season (May - October).

## PRAIRIE ISLAND

Table 5.2. Sampling locations, Prairie Island Nuclear Generating Plant.

| Code | Type[a] | Collection Site | Sample Type[b] | Distance and Direction from Reactor |
|---|---|---|---|---|
| P-1 | C | Air Station P-1 | AP, AI | 11.8 mi @ 316°/NNW |
| P-2 | | Air Station P-2 | AP, AI | 0.5 mi @ 294°/WNW |
| P-3 | | Air Station P-3 | AP, AI | 0.8 mi @ 313°/NW |
| P-4 | | Air Station P-4 | AP, AI | 0.4 mi @ 359°/N |
| P-5 | C | Upstream of Plant | RW | 1.8 mi @ 11°/N |
| P-6 | | Lock and Dam #3 & Air Station P-6 | AP, AI, RW WW, BS, BO[c] | 1.6 mi @ 129°/SE |
| P-8 | | Community Center | WW | 1.0 mi @ 321°/WNW |
| P-9 | | Plant Well #2 | WW | 0.3 mi @ 306°/NW |
| P-11 | | Red Wing Service Center | DW | 3.3 mi @ 158°/SSE |
| P-12 | | Downstream of Plant | SS | 3.0 mi @ 116°/ESE |
| P-13 | | Downstream of Plant | F[c] | 3.5 mi @ 113°/ESE |
| P-14 | | Gustafson Farm | M | 2.3 mi @ 173°/S |
| P-18 | | Christiansen Farm | M | 3.8 mi @ 88°/E |
| P-19 | C | Upstream of Plant | F[c] | 1.3 mi @ 0°/N |
| P-20 | C | Upstream of Plant | BS | 0.9 mi @ 45°/NE |
| P-24 | | Suter Residence | VE, WW | 0.6 mi @ 158°/SSE |
| P-37 | | Welsch Farm | M | 4.1 mi @ 87°/E |
| P-38 | C | Cain Residence | VE | 14.2 mi @ 359°/N |
| P-40 | C | Upstream of Plant | BO[c] | 0.4 mi @ 0°/N |
| P-41 | C | Huppert Farm | M, WW | 13.8 mi @ 354°/N |
| P-42 | | Rother Farm | M | 4.3 mi. @ 264°/W |
| General Area of the Site Boundary | | | | |
| P-01A | | Property Line | TLD | 0.4 mi @ 359°/N |
| P-02A | | Property Line | TLD | 0.3 mi @ 10°/N |
| P-03A | | Property Line | TLD | 0.5 mi @ 183°/S |
| P-04A | | Property Line | TLD | 0.4 mi @ 204°/SWW |
| P-05A | | Property Line | TLD | 0.4 mi @ 225°/SW |
| P-06A | | Property Line | TLD | 0.4 mi @ 249°/WSW |
| P-07A | | Property Line | TLD | 0.4 mi @ 268°/W |
| P-08A | | Property Line | TLD | 0.4 mi @ 291°/WNW |
| P-09A | | Property Line | TLD | 0.7 mi @ 317°/NW |
| P-10A | | Property Line | TLD | 0.5 mi @ 333°/NNW |

Table 5.2. Sampling locations, Prairie Island Nuclear Generating Plant, (continued).

| Code | Type[a] | Collection Site | Sample Type[b] | Distance and Direction from Reactor |
|---|---|---|---|---|
| Approximately 4 to 5 miles Distant from the Plant | | | | |
| P-01B | | Thomas Killian Residence | TLD | 4.7 mi @ 355°/N |
| P-02B | | Roy Kinneman Residence | TLD | 4.8 mi @ 17°/NNE |
| P-03B | | Wayne Anderson Farm | TLD | 4.9 mi @ 46°/NE |
| P-04B | | Nelson Drive (Road) | TLD | 4.2 mi @ 61°/ENE |
| P-05B | | County Road E and Coulee | TLD | 4.2 mi @ 102°/ESE |
| P-06B | | William Hauschildt Residence | TLD | 4.4 mi @ 112°/ESE |
| P-07B | | Red Wing Public Works | TLD | 4.7 mi @ 140°/SE |
| P-08B | | David Wnuk Residence | TLD | 4.1 mi @ 165°/SSE |
| P-09B | | Highway 19 South | TLD | 4.2 mi @ 187°/S |
| P-10B | | Cannondale Farm | TLD | 4.9 mi @ 200°/SSW |
| P-11B | | Wallace Weberg Farm | TLD | 4.5 mi @ 221°/SW |
| P-12B | | Ray Gergen Farm | TLD | 4.6 mi @ 251°/WSW |
| P-13B | | Thomas O'Rourke Farm | TLD | 4.4 mi @ 270°/W |
| P-14B | | David J. Anderson Farm | TLD | 4.9 mi @ 306°/NW |
| P-15B | | Holst Farms | TLD | 3.8 mi @ 345°/NNW |
| Special Interest Locations | | | | |
| P-01S | | Federal Lock & Dam #3 | TLD | 1.6 mi @ 129°/SE |
| P-02S | | Charles Suter Residence | TLD | 0.5 mi @ 155°/SSE |
| P-03S | | Carl Gustafson Farm | TLD | 2.2 mi @ 173°/S |
| P-04S | | Richard Burt Residence | TLD | 2.0 mi @ 202°/SSW |
| P-05S | | Kinney Store | TLD | 2.0 mi @ 270°/W |
| P-06S | | Earl Flynn Farm | TLD | 2.5 mi @ 299°/WNW |
| P-07S | | Indian Community | TLD | 0.7 mi @ 271°/W |
| P-08S | | Indian Community | TLD | 0.7 mi @ 287°/NWW |
| P-01C | C | Robert Kinneman Farm | TLD | 11.1 mi @ 331°/NNW |

Table 5.2. Sampling locations, Prairie Island Nuclear Generating Plant, (continued).

| Code | Type[a] | Collection Site | Type of Sample[b] | Approximate Distance and Direction from ISFSI Center. |
|---|---|---|---|---|
| ISFSI Area Inside Earth Berm | | | | |
| P-01IA | | ISFSI Nuisance Fence | TLD | 190' @ 45°/NE |
| P-02IA | | ISFSI Nuisance Fence | TLD | 360' @ 82°/E |
| P-03IA | | ISFSI Nuisance Fence | TLD | 370' @ 100°/E |
| P-04IA | | ISFSI Nuisance Fence | TLD | 200' @ 134°/SE |
| P-05IA | | ISFSI Nuisance Fence | TLD | 180' @ 219°/SW |
| P-06IA | | ISFSI Nuisance Fence | TLD | 320' @ 258°/WSW |
| P-07IA | | ISFSI Nuisance Fence | TLD | 320' @ 281°/WNW |
| P-08IA | | ISFSI Nuisance Fence | TLD | 190' @ 318°/NW |
| P-01IX | | ISFSI Nuisance Fence | TLD | 140' @ 180°/S |
| P-02IX | | ISFSI Nuisance Fence | TLD | 310' @ 270°/W |
| P-03IX | | ISFSI Nuisance Fence | TLD | 140' @ 0°/N |
| P-04IX | | ISFSI Nuisance Fence | TLD | 360' @ 90°/E |
| ISFSI Area Outside Earth Berm | | | | |
| P-01IB | | ISFSI Berm Area | TLD | 340' @ 3°/N |
| P-02IB | | ISFSI Berm Area | TLD | 380' @ 28°/NNE |
| P-03IB | | ISFSI Berm Area | TLD | 560' @ 85°/E |
| P-04IB | | ISFSI Berm Area | TLD | 590' @ 165°/SSE |
| P-05IB | | ISFSI Berm Area | TLD | 690' @ 186°/S |
| P-06IB | | ISFSI Berm Area | TLD | 720' @ 201°/SSW |
| P-07IB | | ISFSI Berm Area | TLD | 610' @ 271°/W |
| P-08IB | | ISFSI Berm Area | TLD | 360' @ 332°/NNW |

[a] "C" denotes control location. All other locations are indicators.

[b] Sample Codes:

| | | | |
|---|---|---|---|
| AP | Airborne particulates | F | Fish |
| AI | Airborne Iodine | M | Milk |
| BS | Bottom (river) sediments | SS | Shoreline Sediments |
| BO | Bottom organisms (periphyton or macroinvertebrates) | SW | Surface Water |
| | | VE | Vegetation/vegetables |
| DW | Drinking water | WW | Well water |

[c] Distance and direction data for fish and bottom organisms are approximate since availability of sample specimen may vary at any one location.

Table 5.3. Missed collections and analyses at the Prairie Island Nuclear Generating Plant.

*All required samples were collected and analyzed as scheduled with the following exceptions:*

| Sample Type | Analysis | Location | Collection Date or Period | Reason for not conducting REMP as required | Plans for Preventing Recurrence |
|---|---|---|---|---|---|
| MI | Gamma, I-131 | P-37 | 1/15/2003 through 3/4/2003 | Welsch farm temporarily out of dairy business. | Welsch will inform the PINGP upon resumption of operation in Spring, 2003. |
| AP/AI | Beta, I-131 | P-01 | 10/14/2003 | Partial sample collected; low volume due to open fuse. | Sampler pump was replaced. |
| AP/AI | Beta, I-131 | P-06 | 11/14/2003 | Sampler pump failure; open fuse. | Sampler pump was replaced. |

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station — Docket No.: 50-282, 50-306
Location of Facility: Goodhue, Minnesota (County, State) — Reporting Period: January-December, 2003

| Sample Type (Units) | Type and Number of Analyses[a] | LLD[b] | Indicator Locations Mean (F)[c] Range[c] | Location with Highest Annual Mean: Location[d] | Location with Highest Annual Mean: Mean (F)[c] Range[c] | Control Locations Mean (F)[c] Range[c] | Number Non-Routine Results[e] |
|---|---|---|---|---|---|---|---|
| TLD (Inner Ring, Area at Site Boundary) mR/91 days) | Gamma 40 | 3.0 | 15.4 (40/40) ( 12.7-17.5) | P-06A 0.4 mi @ 249° /WSW | 16.2 (4/4) (14.5-17.5) | (See Control below.) | 0 |
| TLD (Outer Ring, 4-5 mi. distant) mR/91 days) | Gamma 60 | 3.0 | 16.7 (60/60) ( 12.9-20.1) | P-02B, Roy Kinneman, 4.8 mi @ 17° /NNE | 18.9 (4/4) (18.0-19.9) | (See Control below.) | 0 |
| TLD (Special Interest Areas) mR/91 days) | Gamma 32 | 3.0 | 15.5 (32/32) ( 12.6-20.2) | P-03S, Gustafson Farm, 2.2 mi @ 173° /S | 18.5 (4/4) (16.6-20.2) | (See Control below.) | 0 |
| TLD (Control) mR/91 days) | Gamma 4 | 3.0 | None | P-01C, R. Kinneman, 11.1 mi @ 331° /NNW | 16.0 (4/4) (15.0-17.0) | 16.0 (4/4) (15.0-17.0) | 0 |
| Airborne Particulates (pCi/m$^3$) | GB 259 | 0.005 | 0.027 (207/207) (0.005-0.049) | P-06, Air Station 1.6 mi @ 129° /SE | 0.028 (51 /51) (0.014-0.048) | 0.025 (52/52) (0.011-0.047) | 0 |
| | GS 20 | | | | | | |
| | Be-7 | 0.015 | 0.064 (16/16) (0.036-0.083) | P-06, Air Station 1.6 mi @ 129° /SE | 0.067 (4/4) (0.051-0.076) | 0.055 (4/4) (0.034-0.067) | 0 |
| | Mn-54 | 0.0007 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 0.0006 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 0.0007 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 0.0011 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 0.0010 | < LLD | - | - | < LLD | 0 |
| | Ru-103 | 0.0007 | < LLD | - | - | < LLD | 0 |
| | Ru-106 | 0.0063 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 0.0007 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 0.0006 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 0.0016 | < LLD | - | - | < LLD | 0 |
| | Ce-141 | 0.0014 | < LLD | - | - | < LLD | 0 |
| | Ce-144 | 0.0039 | < LLD | - | - | < LLD | 0 |
| Airborne Iodine (pCi/m$^3$) | I-131 259 | 0.07 | < LLD | - | - | < LLD | 0 |

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station
Docket No.: 50-282, 50-306
Location of Facility: Goodhue, Minnesota
Reporting Period: January-December, 2003
( County, State )

| Sample Type (Units) | Type and Number of Analyses[a] | LLD[b] | Indicator Locations Mean (F)[c] Range[c] | Location with Highest Annual Mean | | Control Locations Mean (F)[c] Range[c] | Number Non-Routine Results[e] |
|---|---|---|---|---|---|---|---|
| | | | | Location[d] | Mean (F)[c] Range[c] | | |
| Milk (pCi/L) | I-131 87 | 1.0 | < LLD | - | - | < LLD | 0 |
| | GS 87 | | | | | | |
| | K-40 | 200 | 1403 (69/69) (1197-1602) | P-37, Welsch Farm 4.1 mi @ 87° /E | 1439 (15 /15) (1275-1602) | 1381 (18/18) (1202-1584) | 0 |
| | Cs-134 | 15 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 15 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 15 | < LLD | - | - | < LLD | 0 |
| River Water (pCi/L) | H-3 8 | 161 | 697 (2/4) (259-1135) | P-6, Lock and Dam #3 1.6 mi @ 129°/SE | 697 (2/4) (259-1135) | < LLD | 0 |
| | GS 24 | | | | | | |
| | Mn-54 | 15 | < LLD | - | - | < LLD | 0 |
| | Fe-59 | 30 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 15 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 15 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 30 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 15 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 15 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 18 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 15 | < LLD | - | - | < LLD | 0 |
| | Ce-144 | 57 | < LLD | - | - | < LLD | 0 |

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station
Location of Facility: Goodhue, Minnesota (County, State)
Docket No.: 50-282, 50-306
Reporting Period: January-December, 2003

| Sample Type (Units) | Type and Number of Analyses[a] | LLD[b] | Indicator Locations Mean (F)[c] Range[c] | Location with Highest Annual Mean | | Control Locations Mean (F)[c] Range[c] | Number Non-Routine Results[e] |
|---|---|---|---|---|---|---|---|
| | | | | Location[d] | Mean (F)[c] Range[c] | | |
| Drinking Water (pCi/L) | GB 12 | 1.0 | 9.9 (12/12) (8.1-14.3) | P-11, Red Wing S.C. 3.3 mi @ 158° /SSE | 9.9 (12/12) (8.1-14.3) | None | 0 |
| | I-131 12 | 1.0 | < LLD | - | - | None | 0 |
| | H-3 4 | 161 | < LLD | - | - | None | 0 |
| | GS 12 | | | | | | |
| | Mn-54 | 15 | < LLD | - | - | None | 0 |
| | Fe-59 | 30 | < LLD | - | - | None | 0 |
| | Co-58 | 15 | < LLD | - | - | None | 0 |
| | Co-60 | 15 | < LLD | - | - | None | 0 |
| | Zn-65 | 30 | < LLD | - | - | None | 0 |
| | Zr-Nb-95 | 15 | < LLD | - | - | None | 0 |
| | Cs-134 | 10 | < LLD | - | - | None | 0 |
| | Cs-137 | 18 | < LLD | - | - | None | 0 |
| | Ba-La-140 | 15 | < LLD | - | - | None | 0 |
| | Ce-144 | 57 | < LLD | - | - | None | 0 |
| Well Water (pCi/L) | H-3 20 | 163 | < LLD | - | - | < LLD | 0 |
| | GS 20 | | | | | | |
| | Mn-54 | 15 | < LLD | - | - | < LLD | 0 |
| | Fe-59 | 30 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 15 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 15 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 30 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 15 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 10 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 18 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 15 | < LLD | - | - | < LLD | 0 |
| | Ce-144 | 55 | < LLD | - | - | < LLD | 0 |
| Crops - Cabbage (pCi/gwet) | I-131 3 | 0.026 | < LLD | - | - | < LLD | 0 |

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station
Location of Facility: Goodhue, Minnesota (County, State)
Docket No.: 50-282, 50-306
Reporting Period: January-December, 2003

| Sample Type (Units) | Type and Number of Analyses[a] | LLD[b] | Indicator Locations Mean (F)[c] Range[c] | Location with Highest Annual Mean Location[d] | Location with Highest Annual Mean Mean (F)[c] Range[c] | Control Locations Mean (F)[c] Range[c] | Number Non-Routine Results[e] |
|---|---|---|---|---|---|---|---|
| Fish | GS 4 | | | | | | |
| (pCi/g wet) | K-40 | 0.10 | 2.84 (2/2) (2.39-3.29) | P-19, Upstream 1.3 mi. @ 0° /N | 2.86 (2/2) (2.59-3.13) | 2.86 (2/2) (2.59-3.13) | 0 |
| | Mn-54 | 0.016 | < LLD | - | - | < LLD | 0 |
| | Fe-59 | 0.046 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 0.015 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 0.016 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 0.042 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 0.025 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 0.020 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 0.017 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 0.19 | < LLD | - | - | < LLD | 0 |
| Invertebrates | GS 4 | | | | | | |
| (pCi/g wet) | Be-7 | 0.44 | < LLD | - | - | < LLD | 0 |
| | K-40 | 0.98 | < LLD | P-40, Upstream 0.4 mi @ 0°/N | 1.59 (1/2) - | 1.59 (1/2) - | 0 |
| | Mn-54 | 0.045 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 0.049 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 0.044 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 0.080 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 0.060 | < LLD | - | - | < LLD | 0 |
| | Ru-103 | 0.058 | < LLD | - | - | < LLD | 0 |
| | Ru-106 | 0.32 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 0.045 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 0.039 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 0.26 | < LLD | - | - | < LLD | 0 |
| | Ce-141 | 0.079 | < LLD | - | - | < LLD | 0 |
| | Ce-144 | 0.20 | < LLD | - | - | < LLD | 0 |

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station — Docket No.: 50-282, 50-306
Location of Facility: Goodhue, Minnesota (County, State) — Reporting Period: January-December, 2003

| Sample Type (Units) | Type and Number of Analyses[a] | LLD[b] | Indicator Locations Mean (F)[c] Range[c] | Location with Highest Annual Mean: Location[d] | Location with Highest Annual Mean: Mean (F)[c] Range[c] | Control Locations Mean (F)[c] Range[c] | Number Non-Routine Results[e] |
|---|---|---|---|---|---|---|---|
| Bottom and Shoreline Sediments | GS 6 | | | | | | |
| | Be-7 | 0.18 | < LLD | - | - | < LLD | 0 |
| (pCi/g dry) | K-40 | 0.10 | 6.96 (4/4) (5.89-7.85) | P-20, Upstream 0.9 mi. @ 45° /NE | 9.05 (2/2) (8.79-9.30) | 9.05 (2/2) (8.79-9.30) | 0 |
| | Mn-54 | 0.022 | < LLD | - | - | < LLD | 0 |
| | Co-58 | 0.026 | < LLD | - | - | < LLD | 0 |
| | Co-60 | 0.016 | < LLD | - | - | < LLD | 0 |
| | Zn-65 | 0.063 | < LLD | - | - | < LLD | 0 |
| | Zr-Nb-95 | 0.040 | < LLD | - | - | < LLD | 0 |
| | Ru-103 | 0.027 | < LLD | - | - | < LLD | 0 |
| | Ru-106 | 0.17 | < LLD | - | - | < LLD | 0 |
| | Cs-134 | 0.028 | < LLD | - | - | < LLD | 0 |
| | Cs-137 | 0.020 | < LLD | - | - | < LLD | 0 |
| | Ba-La-140 | 0.17 | < LLD | - | - | < LLD | 0 |
| | Ce-141 | 0.047 | < LLD | - | - | < LLD | 0 |
| | Ce-144 | 0.11 | < LLD | - | - | < LLD | 0 |

[a] GB = gross beta, GS = gamma scan.
[b] LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample.
[c] Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).
[d] Locations are specified: (1) by name, and/or station code (Table 2) and (2) by distance (miles) and direction relative to reactor site.
[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten time the typical preoperational value for the medium or location.

## 6.0 REFERENCES CITED


Arnold, J. R. and H. A. Al-Salih. 1955. Beryllium-7 Produced by Cosmic Rays. Science 121: 451-453.

Eisenbud, M. 1963. Environmental Radioactivity, McGraw-Hill, New York, New York, pp. 213, 275 and 276.

Environmental, Inc., Midwest Laboratory

_____ 2001a through 2004a. Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January-December, 2000 through 2003.

_____ 2001b through 2004b. Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 2000-2003.

_____ 2000. Quality Assurance Program Manual, Rev. 0, 01 October 2003.

_____ 2000. Quality Control Procedures Manual, Rev. 0, 21 September 2000.

_____ 2000. Quality Control Program, Rev. 0, 21 August 2003.

Gold, S., H. W. Barkhau, B. Shlein, and B. Kahn, 1964. Measurement of Naturally Occurring Radionuclides in Air, in the Natural Environment, University of Chicago Press, Chicago, Illinois, 369-382.

Hazleton Environmental Sciences Corporation.

_____ 1979a to 1983a. Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January - December 1978 through 1982.

_____ 1979b to 1983b. Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December 1978 through 1982.

Hohenemser, C. M. Deicher, A. Ernst, H. Hofsass, G. Lindner, E. Racknagel. 1986. "Chernobyl," Chemtech, October 1986, pp. 596-605.

National Center for Radiological Health, 1968. Radiological Health and Data Reports, Vol. 9, No. 12, 730-746.

Northern States Power Company.

_____ 1972. Prairie Island Nuclear Generating Plant, Environmental Monitoring and Ecological Studies Program, January 1, 1971 to December 31, 1971. Minneapolis, Minnesota.

_____ 1973. Prairie Island Nuclear Generating Plant, Environmental Monitoring and Ecological Studies Program, January 1, 1972 to December 31, 1972. Minneapolis, Minnesota.

_____ 1974. Prairie Island Nuclear Generating Plant, Environmental Monitoring and Ecological Studies Program, Volume 1, January 1, 1973 to December 31, 1973. Minneapolis, Minnesota.

_____ 1979 to 2003. Prairie Island Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 1978 through 2002. Minneapolis, Minnesota.

## 6.0 REFERENCES CITED (continued)


Prairie Island Nuclear Generating Plant, 2003. Radiological Environmental Monitoring for Prairie Island Nuclear Generating Plant, Radiation Protection Implementing Procedures, 4700 series.

Teledyne Brown Engineering Environmental Services, Midwest Laboratory. 1984a to 2000a. Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1983 through 1999.

_____ 1984b to 2000b. Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1983 through 1999.

U.S. Dep't of Energy 1997 HASL-300, Edition 28, Procedures Manual, Environmental Measurements Laboratory, New York, NY.

U.S. Environmental Protection Agency . 1980. Prescribed Procedures for Measurement of Radioactivity in Drinking Water, Cincinnati, Ohio (EPA-600/4-80-032).

_____1984. Eastern Environmental Radiation Facility, Radiochemistry Procedures Manual, Montgomery, Alabama (EPA-520/5-84-006).

Wilson, D. W., G. M. Ward and J. E. Johnson. 1969. In Environmental Contamination by Radioactive Materials, International Atomic Energy Agency. p.125.

Xcel Energy Corporation. 2004. Monticello Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 2003 (prepared by Environmental, Inc., Midwest Laboratory). Northbrook, Illinois

PRAIRIE ISLAND

Table D-1. Sample collection and analysis program, Prairie Island Nuclear Generating Plant.

| Medium | Location No. | Location Codes (and Type)[a] | Collection Type and Frequency[b] | Analysis Type and Frequency[c] |
|---|---|---|---|---|
| Ambient radiation (TLD's) | 54 | P-01A - P-10A<br>P-01B - P-15B<br>P-01S - P-08S<br>P-01IA - P-08IA<br>P-01IB - P-08IB<br>P-01IX- P-04IX, P-01C | C/Q | Ambient gamma |
| Airborne Particulates | 5 | P-1(C), P-2,<br>P-3, P-4, P-6 | C/W | GB, GS (QC of each location) |
| Airborne Iodine | 5 | P-1(C), P-2, P-3, P-4, P-6 | C/W | I-131 |
| Milk | 5 | P-14, P-18, P-37, P-42<br>P-41 [C] | G/M[d] | I-131, GS |
| River water | 2 | P-5(C), P-6 | G/W | GS(MC), H-3(QC) |
| Drinking water | 1 | P-11 | G/W | GB(MC), I-131(MC)<br>GS (MC), H-3 (QC) |
| Well water | 5 | P-6, P-8, P-9, P-24, P-41 (C) | G/Q | H-3, GS |
| Edible cultivated crops - leafy green vegetables | 2 | P-38(C), P-24 | G/A | GS (I-131) |
| Fish<br>(one species, edible portion) | 2 | P-19(C), P-13 | G/SA | GS |
| Periphyton or invertebrates | 2 | P-40(C), P-6 | G/SA | GS |
| Bottom sediment | 2 | P-20(C), P-6 | G/SA | GS |
| Shoreline sediment | 1 | P-12 | G/SA | GS |

[a] Location codes are defined in Table D-2. Control stations are indicated by (C). All other stations are indicators.

[b] Collection type is coded as follows: C/ = continuous, G/ = grab. Collection frequency is coded as follows: W= weekly, M = monthly, Q = quarterly, SA = semiannually, A = annually.

[c] Analysis type is coded as follows: GB = gross beta, GS = gamma spectroscopy, H-3 = tritium, I-131 = iodine 131. Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.

[d] Milk is collected biweekly during the grazing season (May - October).

## PRAIRIE ISLAND

Table D-2. Sampling locations, Prairie Island Nuclear Generating Plant.

| Code | Type[a] | Collection Site | Sample Type[b] | Distance and Direction from Reactor |
|---|---|---|---|---|
| P-1 | C | Air Station P-1 | AP, AI | 11.8 mi @ 316°/NNW |
| P-2 | | Air Station P-2 | AP, AI | 0.5 mi @ 294°/WNW |
| P-3 | | Air Station P-3 | AP, AI | 0.8 mi @ 313°/NW |
| P-4 | | Air Station P-4 | AP, AI | 0.4 mi @ 359°/N |
| P-5 | C | Upstream of Plant | RW | 1.8 mi @ 11°/N |
| P-6 | | Lock and Dam #3 & Air Station P-6 | AP, AI, RW WW, BS, BO[c] | 1.6 mi @ 129°/SE |
| P-8 | | Community Center | WW | 1.0 mi @ 321°/WNW |
| P-9 | | Plant Well #2 | WW | 0.3 mi @ 306°/NW |
| P-11 | | Red Wing Service Center | DW | 3.3 mi @ 158°/SSE |
| P-12 | | Downstream of Plant | SS | 3.0 mi @ 116°/ESE |
| P-13 | | Downstream of Plant | F[c] | 3.5 mi @ 113°/ESE |
| P-14 | | Gustafson Farm | M | 2.3 mi @ 173°/S |
| P-18 | | Christiansen Farm | M | 3.8 mi @ 88°/E |
| P-19 | C | Upstream of Plant | F[c] | 1.3 mi @ 0°/N |
| P-20 | C | Upstream of Plant | BS | 0.9 mi @ 45°/NE |
| P-24 | | Suter Residence | VE, WW | 0.6 mi @ 158°/SSE |
| P-37 | | Welsch Farm | M | 4.1 mi @ 87°/E |
| P-38 | C | Cain Residence | VE | 14.2 mi @ 359°/N |
| P-40 | C | Upstream of Plant | BO[c] | 0.4 mi @ 0°/N |
| P-41 | C | Huppert Farm | M, WW | 13.8 mi @ 354°/N |
| P-42 | | Rother Farm | M | 4.3 mi. @ 264°/W |
| General Area of the Site Boundary | | | | |
| P-01A | | Property Line | TLD | 0.4 mi @ 359°/N |
| P-02A | | Property Line | TLD | 0.3 mi @ 10°/N |
| P-03A | | Property Line | TLD | 0.5 mi @ 183°/S |
| P-04A | | Property Line | TLD | 0.4 mi @ 204°/SWW |
| P-05A | | Property Line | TLD | 0.4 mi @ 225°/SW |
| P-06A | | Property Line | TLD | 0.4 mi @ 249°/WSW |
| P-07A | | Property Line | TLD | 0.4 mi @ 268°/W |
| P-08A | | Property Line | TLD | 0.4 mi @ 291°/WNW |
| P-09A | | Property Line | TLD | 0.7 mi @ 317°/NW |
| P-10A | | Property Line | TLD | 0.5 mi @ 333°/NNW |

Table D-2. Sampling locations, Prairie Island Nuclear Generating Plant, (continued).

| Code | Type[a] | Collection Site | Sample Type[b] | Distance and Direction from Reactor |
|---|---|---|---|---|
| Approximately 4 to 5 miles Distant from the Plant | | | | |
| P-01B | | Thomas Killian Residence | TLD | 4.7 mi @ 355°/N |
| P-02B | | Roy Kinneman Residence | TLD | 4.8 mi @ 17°/NNE |
| P-03B | | Wayne Anderson Farm | TLD | 4.9 mi @ 46°/NE |
| P-04B | | Nelson Drive (Road) | TLD | 4.2 mi @ 61°/ENE |
| P-05B | | County Road E and Coulee | TLD | 4.2 mi @ 102°/ESE |
| P-06B | | William Hauschbilt Residence | TLD | 4.4 mi @ 112°/ESE |
| P-07B | | Red Wing Public Works | TLD | 4.7 mi @ 140°/SE |
| P-08B | | David Wnuk Residence | TLD | 4.1 mi @ 165°/SSE |
| P-09B | | Highway 19 South | TLD | 4.2 mi @ 187°/S |
| P-10B | | Cannondale Farm | TLD | 4.9 mi @ 200°/SSW |
| P-11B | | Wallace Weberg Farm | TLD | 4.5 mi @ 221°/SW |
| P-12B | | Ray Gergen Farm | TLD | 4.6 mi @ 251°/WSW |
| P-13B | | Thomas O'Rourke Farm | TLD | 4.4 mi @ 270°/W |
| P-14B | | David J. Anderson Farm | TLD | 4.9 mi @ 306°/NW |
| P-15B | | Holst Farms | TLD | 3.8 mi @ 345°/NNW |
| Special Interest Locations | | | | |
| P-01S | | Federal Lock & Dam #3 | TLD | 1.6 mi @ 129°/SE |
| P-02S | | Charles Suter Residence | TLD | 0.5 mi @ 155°/SSE |
| P-03S | | Carl Gustafson Farm | TLD | 2.2 mi @ 173°/S |
| P-04S | | Richard Burt Residence | TLD | 2.0 mi @ 202°/SSW |
| P-05S | | Kinney Store | TLD | 2.0 mi @ 270°/W |
| P-06S | | Earl Flynn Farm | TLD | 2.5 mi @ 299°/WNW |
| P-07S | | Indian Community | TLD | 0.7 mi @ 271°/W |
| P-08S | | Indian Community | TLD | 0.7 mi @ 287°/NWW |
| P-01C | C | Robert Kinneman Farm | TLD | 11.1 mi @ 331°/NNW |

Table D-2. Sampling locations, Prairie Island Nuclear Generating Plant, (continued).

| Code | Type[a] | Collection Site | Type of Sample[b] | Approximate Distance and Direction from ISFSI Center. |
|---|---|---|---|---|
| ISFSI Area Inside Earth Berm | | | | |
| P-01IA | | ISFSI Nuisance Fence | TLD | 190' @ 45°/NE |
| P-02IA | | ISFSI Nuisance Fence | TLD | 360' @ 82°/E |
| P-03IA | | ISFSI Nuisance Fence | TLD | 370' @ 100°/E |
| P-04IA | | ISFSI Nuisance Fence | TLD | 200' @ 134°/SE |
| P-05IA | | ISFSI Nuisance Fence | TLD | 180' @ 219°/SW |
| P-06IA | | ISFSI Nuisance Fence | TLD | 320' @ 258°/WSW |
| P-07IA | | ISFSI Nuisance Fence | TLD | 320' @ 281°/WNW |
| P-08IA | | ISFSI Nuisance Fence | TLD | 190' @ 318°/NW |
| P-01IX | | ISFSI Nuisance Fence | TLD | 140' @ 180°/S |
| P-02IX | | ISFSI Nuisance Fence | TLD | 310' @ 270°/W |
| P-03IX | | ISFSI Nuisance Fence | TLD | 140' @ 0°/N |
| P-04IX | | ISFSI Nuisance Fence | TLD | 360' @ 90°/E |
| ISFSI Area Outside Earth Berm | | | | |
| P-01IB | | ISFSI Berm Area | TLD | 340' @ 3°/N |
| P-02IB | | ISFSI Berm Area | TLD | 380' @ 28°/NNE |
| P-03IB | | ISFSI Berm Area | TLD | 560' @ 85°/E |
| P-04IB | | ISFSI Berm Area | TLD | 590' @ 165°/SSE |
| P-05IB | | ISFSI Berm Area | TLD | 690' @ 186°/S |
| P-06IB | | ISFSI Berm Area | TLD | 720' @ 201°/SSW |
| P-07IB | | ISFSI Berm Area | TLD | 610' @ 271°/W |
| P-08IB | | ISFSI Berm Area | TLD | 360' @ 332°/NNW |

[a] "C" denotes control location. All other locations are indicators.

[b] Sample Codes:

| | | | |
|---|---|---|---|
| AP | Airborne particulates | F | Fish |
| AI | Airborne Iodine | M | Milk |
| BS | Bottom (river) sediments | SS | Shoreline Sediments |
| BO | Bottom organisms | SW | Surface Water |
| | (periphyton or macroinvertebrates | VE | Vegetation/vegetables |
| DW | Drinking water | WW | Well water |

[c] Distance and direction data for fish and bottom organisms are approximate since availability of sample specimen may vary at any one location.

Environmental, Inc.
Midwest Laboratory
an Allegheny Technologies Co.

700 Landwehr Road • Northbrook, IL 60062-2 •
(847) 564-0700 fax (847) 564-4517

# APPENDIX A

## INTERLABORATORY COMPARISON PROGRAM RESULTS

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

January, 2003 through December, 2003

## Appendix A

## Interlaboratory Comparison Program Results

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

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

Results in Table A-1 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2. Results of internal laboratory testing is also listed.

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

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

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

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

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

Attachment A lists acceptance criteria for "spiked" samples.

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

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

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

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

[b] Laboratory limit.

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

| Lab Code | Date | Analysis | Concentration (pCi/L) Laboratory Result[b] | ERA Result[c] | Control Limits |
|---|---|---|---|---|---|
| STW-973 | 02/17/03 | Sr-89 | 17.0 ± 0.5 | 15.9 ± 5.0 | 7.2 - 24.6 |
| STW-973 | 02/17/03 | Sr-90 | 8.9 ± 0.3 | 9.0 ± 5.0 | 0.4 - 17.7 |
| STW-974 | 02/17/03 | Ba-133 | 14.5 ± 0.9 | 19.5 ± 5.0 | 10.8 - 28.2 |
| STW-974 | 02/17/03 | Co-60 | 37.5 ± 0.9 | 37.4 ± 5.0 | 28.7 - 46.1 |
| STW-974 | 02/17/03 | Cs-134 | 18.2 ± 0.6 | 17.8 ± 5.0 | 9.1 - 26.5 |
| STW-974 | 02/17/03 | Cs-137 | 42.7 ± 1.0 | 44.2 ± 5.0 | 35.5 - 52.9 |
| STW-974 | 02/17/03 | Zn-65 | 56.8 ± 2.2 | 60.3 ± 6.0 | 49.9 - 70.7 |
| STW-975[d] | 02/17/03 | Gr. Alpha | 18.4 ± 0.3 | 37.6 ± 9.4 | 21.3 - 53.9 |
| STW-975 | 02/17/03 | Gr. Beta | 11.7 ± 0.5 | 8.6 ± 5.0 | 0.0 - 17.2 |
| STW-976 | 02/17/03 | Ra-226 | 4.1 ± 0.1 | 4.7 ± 0.7 | 3.5 - 6.0 |
| STW-976 | 02/17/03 | Ra-228 | 7.6 ± 0.5 | 6.5 ± 1.6 | 3.7 - 9.3 |
| STW-976 | 02/17/03 | Uranium | 52.9 ± 1.9 | 53.7 ± 5.4 | 44.4 - 63.0 |
| STW-983 | 05/19/03 | H-3 | 1290.0 ± 25.0 | 1250.0 ± 331.0 | 678.0 - 1820.0 |
| STW-984 | 05/19/03 | I-131 | 19.7 ± 1.3 | 20.8 ± 3.0 | 15.6 - 26.0 |
| STW-985 | 05/19/03 | Gr. Alpha | 54.4 ± 3.0 | 70.3 ± 17.6 | 39.9 - 101.0 |
| STW-985 | 05/19/03 | Ra-226 | 14.9 ± 0.2 | 16.5 ± 2.5 | 12.2 - 20.8 |
| STW-985 | 05/19/03 | Ra-228 | 13.1 ± 0.6 | 10.3 ± 2.6 | 5.8 - 14.8 |
| STW-985 | 05/19/03 | Uranium | 14.5 ± 0.4 | 15.1 ± 3.0 | 9.9 - 20.3 |
| STW-986 | 05/19/03 | Co-60 | 56.9 ± 8.6 | 63.8 ± 5.0 | 55.1 - 72.5 |
| STW-986[e] | 05/19/03 | Cs-134 | 61.6 ± 6.6 | 75.7 ± 5.0 | 67.0 - 84.4 |
| STW-986 | 05/19/03 | Cs-137 | 143.0 ± 1.2 | 150.0 ± 7.5 | 137.0 - 163.0 |
| STW-986 | 05/19/03 | Gr. Beta | 309.0 ± 2.7 | 363.0 ± 54.5 | 269.0 - 457.0 |
| STW-986 | 05/19/03 | Sr-89 | 33.1 ± 0.2 | 31.3 ± 5.0 | 22.6 - 40.0 |
| STW-986 | 05/19/03 | Sr-90 | 28.8 ± 1.3 | 27.4 ± 5.0 | 18.7 - 36.1 |
| STW-988 | 08/18/03 | Ra-226 | 13.3 ± 1.1 | 13.4 ± 2.0 | 9.9 - 16.9 |
| STW-988 | 08/18/03 | Ra-228 | 11.5 ± 1.0 | 12.5 ± 3.1 | 7.1 - 17.9 |
| STW-988 | 08/18/03 | Uranium | 12.3 ± 0.4 | 11.4 ± 3.0 | 6.2 - 16.6 |
| STW-989 | 08/18/03 | Ba-133 | 18.1 ± 1.9 | 20.7 ± 5.0 | 12.0 - 29.4 |
| STW-989 | 08/18/03 | Co-60 | 35.9 ± 1.3 | 37.4 ± 5.0 | 28.7 - 46.1 |
| STW-989 | 08/18/03 | Cs-134 | 32.6 ± 1.8 | 32.6 ± 5.0 | 23.9 - 41.3 |
| STW-989 | 08/18/03 | Cs-137 | 48.3 ± 0.6 | 44.3 ± 5.0 | 35.6 - 53.0 |
| STW-989 | 08/18/03 | Zn-65 | 58.9 ± 2.1 | 60.2 ± 6.0 | 49.8 - 70.6 |
| STW-990 | 08/18/03 | Gr. Alpha | 41.8 ± 3.4 | 56.2 ± 16.3 | 36.9 - 93.3 |
| STW-990[f] | 08/18/03 | Gr. Beta | 51.3 ± 3.0 | 31.6 ± 5.0 | 22.9 - 40.3 |
| STW-991 | 08/18/03 | Sr-89 | 57.2 ± 4.3 | 58.8 ± 5.0 | 50.1 - 67.5 |
| STW-991 | 08/18/03 | Sr-90 | 21.2 ± 0.9 | 20.6 ± 5.0 | 11.9 - 29.3 |

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

| Lab Code | Date | Analysis | Concentration (pCi/L) | | |
|---|---|---|---|---|---|
| | | | Laboratory Result[b] | ERA Result[c] | Control Limits |
| STW-997 | 11/18/03 | Gr. Alpha | 37.0 ± 2.0 | 29.5 ± 7.4 | 16.7 - 42.3 |
| STW-997 | 11/18/03 | Gr. Beta | 26.5 ± 0.8 | 26.3 ± 5.0 | 17.6 - 35.0 |
| STW-998 | 11/18/03 | I-131 | 14.8 ± 0.3 | 16.5 ± 3.0 | 11.3 - 21.7 |
| STW-999 | 11/18/03 | Ra-226 | 17.2 ± 1.1 | 17.8 ± 2.7 | 13.2 - 22.4 |
| STW-999 | 11/18/03 | Ra-228 | 6.6 ± 0.3 | 6.8 ± 1.7 | 3.8 - 9.7 |
| STW-999 | 11/18/03 | Uranium | 11.7 ± 0.3 | 11.7 ± 3.0 | 6.5 - 16.9 |
| STW-1000 | 11/18/03 | H-3 | 15900.0 ± 174.0 | 14300.0 ± 1430.0 | 11800.0 - 16800.0 |
| STW-1001 | 11/18/03 | Gr. Alpha | 32.9 ± 0.3 | 54.2 ± 3.0 | 30.7 - 77.7 |
| STW-1001 | 11/18/03 | Ra-226 | 16.5 ± 0.9 | 16.1 ± 2.4 | 11.9 - 20.3 |
| STW-1001 | 11/18/03 | Ra-228 | 6.2 ± 0.5 | 5.5 ± 1.4 | 3.1 - 7.9 |
| STW-1001 | 11/18/03 | Uranium | 9.7 ± 1.5 | 9.3 ± 13.6 | 4.1 - 14.5 |
| STW-1002 | 11/18/03 | Co-60 | 27.7 ± 1.9 | 27.7 ± 5.0 | 19.0 - 36.4 |
| STW-1002 | 11/18/03 | Cs-134 | 21.5 ± 1.1 | 23.4 ± 5.0 | 17.6 - 29.2 |
| STW-1002 | 11/18/03 | Cs-137 | 66.3 ± 2.8 | 64.2 ± 5.0 | 55.5 - 72.9 |
| STW-1002 | 11/18/03 | Gr. Beta | 159.0 ± 2.5 | 168.0 ± 5.0 | 124.0 - 212.0 |
| STW-1002 | 11/18/03 | Sr-89 | 48.5 ± 0.4 | 50.4 ± 5.0 | 41.7 - 59.1 |
| STW-1002 | 11/18/03 | Sr-90 | 10.1 ± 3.0 | 10.2 ± 25.2 | 1.5 - 18.9 |

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the environmental samples crosscheck program operated by Environmental Resources Associates (ERA).

[b] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[c] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

[d] Recount of the original sample still low. The ERA blank was spiked in the lab; known value of 20.1 pCi/L, measured 21.5 ± 1.1 pCi/L. No explanation for ERA test failure.

[e] Lower bias observed for gamma spectroscopic analysis. The undiluted sample was reanalyzed; Results of reanalysis, Co-60: 62.3 pCi/L., Cs-134: 69.2 pCi/L., Cs-137: 152.3 pCi/L.

[f] Reason for deviation unknown. A recount of the original planchets averaged 43.4 pCi/L. Cs-137activity by gamma spectroscopy; 28.3 pCi/L. Result of reanalysis; 29.3 pCi/L.

TABLE A-2. Crosscheck program results; Thermoluminescent Dosimetry, (TLDs).

| Lab Code | TLD Type | Date | Description | mR Known Value | mR Lab Result ± 2 sigma | mR Control Limits |
|---|---|---|---|---|---|---|
| Environmental, Inc. | | | | | | |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 120 | 4.69 | 4.74 ± 0.54 | 3.28 - 6.10 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 150 | 3.00 | 3.02 ± 0.20 | 2.10 - 3.90 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 180 | 2.08 | 1.89 ± 0.45 | 1.46 - 2.70 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 180 | 2.08 | 2.11 ± 0.22 | 1.46 - 2.70 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 30 | 75.00 | 84.40 ± 4.87 | 52.50 - 97.50 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 60 | 18.75 | 19.11 ± 1.86 | 13.13 - 24.38 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 60 | 18.75 | 22.82 ± 5.41 | 13.13 - 24.38 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 90 | 8.33 | 9.05 ± 1.17 | 5.83 - 10.83 |
| 2003-1 | CaSO4: Dy Cards | 8/8/2003 | Reader 1, 90 | 8.33 | 7.60 ± 1.08 | 5.83 - 10.83 |
| Environmental, Inc. | | | | | | |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 30 | 61.96 | 73.50 ± 2.58 | 43.37 - 80.55 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 60 | 15.49 | 19.70 ± 0.51 | 10.84 - 20.14 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 60 | 15.49 | 16.93 ± 1.37 | 10.84 - 20.14 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 90 | 6.88 | 8.06 ± 0.60 | 4.82 - 8.94 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 90 | 6.88 | 6.64 ± 0.58 | 4.82 - 8.94 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 120 | 3.87 | 4.39 ± 0.17 | 2.71 - 5.03 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 150 | 2.48 | 2.34 ± 0.18 | 1.74 - 3.22 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 150 | 2.48 | 2.51 ± 0.16 | 1.74 - 3.22 |
| 2003-2 | CaSO4: Dy Cards | 1/12/2004 | Reader 1, 180 | 1.72 | 2.01 ± 0.13 | 1.20 - 2.24 |

TABLE A-3. In-House "Spike" Samples

| Lab Code | Sample Type | Date | Concentration (pCi/L)[a] | | | |
|---|---|---|---|---|---|---|
| | | | Analysis | Laboratory results 2s, n=1[b] | Known Activity | Control Limits[c] |
| SPW-356 | water | 1/2/2003 | Sr-90 | 34.04 ± 1.57 | 30.93 | 24.74 - 37.12 |
| W-10303 | water | 1/3/2003 | Gr. Beta | 63.24 ± 1.20 | 63.90 | 53.90 - 73.90 |
| W-11303 | water | 1/13/2003 | Gr. Beta | 59.75 ± 1.10 | 63.90 | 53.90 - 73.90 |
| W-12103 | water | 1/21/2003 | Gr. Beta | 61.56 ± 1.59 | 63.99 | 53.99 - 73.99 |
| SPAP-446 | Air Filter | 1/31/2003 | Gr. Beta | 1.49 ± 0.02 | 1.52 | -8.48 - 11.52 |
| SPW-468 | water | 1/31/2003 | H-3 | 95982.00 ± 865.00 | 89607.00 | 71685.60 - 107528.40 |
| W-20703 | water | 2/7/2003 | Fe-55 | 9095.00 ± 114.00 | 10587.00 | 8469.60 - 12704.40 |
| SPU-1347 | Urine | 3/1/2003 | H-3 | 1724.00 ± 412.00 | 1784.33 | 1101.27 - 2467.39 |
| DW-30303 | water | 3/3/2003 | Gr. Beta | 65.44 ± 0.59 | 63.90 | 53.90 - 73.90 |
| SPCH-964 | Charcoal | 3/8/2003 | I-131(G) | 73.37 ± 0.28 | 69.45 | 59.45 - 79.45 |
| SPMI-1086 | Milk | 3/13/2003 | Cs-137 | 57.18 ± 8.03 | 49.50 | 39.50 - 59.50 |
| SPMI-1086 | Milk | 3/13/2003 | I-131 | 75.13 ± 12.01 | 67.60 | 54.08 - 81.12 |
| SPMI-1086 | Milk | 3/13/2003 | I-131(G) | 65.81 ± 1.06 | 67.56 | 57.56 - 77.56 |
| SPW-1088 | water | 3/13/2003 | Co-60 | 27.16 ± 4.79 | 28.20 | 18.20 - 38.20 |
| SPW-1088 | water | 3/13/2003 | Cs-137 | 51.74 ± 9.15 | 49.50 | 39.50 - 59.50 |
| SPW-1088 | water | 3/13/2003 | I-131(G) | 68.14 ± 12.92 | 67.60 | 57.60 - 77.60 |
| SPW-1088 | water | 3/13/2003 | I-131 | 76.94 ± 1.13 | 67.56 | 54.05 - 81.07 |
| SPVE-1110 | Vegetation | 3/14/2003 | I-131(G) | 122.80 ± 16.80 | 124.00 | 111.60 - 136.40 |
| SPW-1194 | water | 3/21/2003 | Co-60 | 31.09 ± 6.28 | 28.15 | 18.15 - 38.15 |
| SPW-1194 | water | 3/21/2003 | Cs-137 | 55.11 ± 0.13 | 49.50 | 39.50 - 59.50 |
| SPW-1194 | water | 3/21/2003 | I-131(G) | 66.17 ± 9.15 | 67.60 | 57.60 - 77.60 |
| W-32103 | water | 3/21/2003 | C-14 | 5201.00 ± 16.60 | 4966.00 | 2979.60 - 6952.40 |
| SPCH-1429 | Charcoal | 4/1/2003 | I-131(G) | 8.83 ± 0.11 | 9.18 | -0.82 - 19.18 |
| W-40103 | water | 4/1/2003 | Gr. Beta | 67.74 ± 0.52 | 63.39 | 53.39 - 73.39 |
| SPF-1407 | Fish | 4/2/2003 | Cs-134 | 0.58 ± 0.03 | 0.59 | 0.35 - 0.83 |
| SPF-1407 | Fish | 4/2/2003 | Cs-137 | 1.29 ± 0.06 | 1.32 | 0.79 - 1.85 |
| SPAP-1409 | Air Filter | 4/2/2003 | Gr. Beta | 1.44 ± 0.02 | 1.51 | -8.49 - 11.51 |
| SPU-41203 | Urine | 4/12/2003 | H-3 | 1798.50 ± 409.30 | 1784.33 | 1101.27 - 2467.39 |
| SPU-41703 | Urine | 4/17/2003 | H-3 | 1625.10 ± 401.30 | 1784.33 | 1101.27 - 2467.39 |
| SPW-2022 | water | 4/25/2003 | H-3 | 89007.00 ± 798.00 | 88463.00 | 70770.40 - 106155.60 |
| SPW-2053 | water | 4/28/2003 | Cs-137 | 45.70 ± 9.44 | 49.35 | 39.35 - 59.35 |
| SPW-2053 | water | 4/28/2003 | Sr-90 | 47.51 ± 1.87 | 44.47 | 35.58 - 53.36 |
| SPMI-2055 | Milk | 4/28/2003 | Cs-137 | 61.65 ± 7.17 | 65.80 | 55.80 - 75.80 |
| SPMI-2055 | Milk | 4/28/2003 | Sr-90 | 38.45 ± 1.59 | 44.74 | 35.79 - 53.69 |
| W-50603 | water | 5/6/2003 | Gr. Beta | 70.95 ± 0.53 | 63.39 | 53.39 - 73.39 |
| W-60303 | water | 6/3/2003 | Gr. Beta | 63.00 ± 0.51 | 65.73 | 55.73 - 75.73 |
| SPW-3960 | water | 7/15/2003 | H-3 | 88700.00 ± 822.00 | 87369.00 | 69895.20 - 104842.80 |
| SPMI-4019 | Milk | 7/18/2003 | Cs-137 | 47.17 ± 7.22 | 49.11 | 39.11 - 59.11 |
| SPMI-4019 | Milk | 7/18/2003 | Sr-89 | 40.95 ± 4.88 | 49.49 | 39.49 - 59.49 |
| SPMI-4019 | Milk | 7/18/2003 | Sr-90 | 45.30 ± 1.73 | 44.24 | 35.39 - 53.09 |
| SPW-4023 | water | 7/18/2003 | Cs-137 | 51.92 ± 6.24 | 49.11 | 39.11 - 59.11 |
| SPW-4023 | water | 7/18/2003 | Sr-89 | 42.49 ± 10.23 | 49.49 | 39.49 - 59.49 |
| SPW-4023 | water | 7/18/2003 | Sr-90 | 49.69 ± 3.04 | 44.24 | 35.39 - 53.09 |
| SPW-4518 | water | 8/8/2003 | Fe-55 | 8176.00 ± 107.00 | 9330.00 | 7464.00 - 11196.00 |

TABLE A-3. In-House "Spike" Samples

| Lab Code | Sample Type | Date | Analysis | Concentration (pCi/L) Laboratory results 2s, n=1[b] | Known Activity | Control Limits[c] |
|---|---|---|---|---|---|---|
| SPW-6197 | water | 10/16/2003 | Tc-99 | 540.14 ± 54.00 | 539.73 | 377.81 - 701.65 |
| SPAP-3958 | Air Filter | 10/28/2003 | Gr. Beta | 1.45 ± 0.02 | 1.50 | -8.50 - 11.50 |
| SPW-6401 | water | 10/28/2003 | H-3 | 84867.00 ± 826.00 | 85984.00 | 68787.20 - 103180.80 |
| SPAP-6403 | Air Filter | 10/28/2003 | Gr. Beta | 1.71 ± 0.02 | 1.49 | -8.51 - 11.49 |
| SPF-6418 | Fish | 10/28/2003 | Cs-134 | 0.50 ± 0.02 | 0.49 | 0.29 - 0.69 |
| SPF-6418 | Fish | 10/28/2003 | Cs-137 | 1.37 ± 0.05 | 1.30 | 0.78 - 1.82 |
| SPW-6421 | water | 10/28/2003 | Fe-55 | 104.18 ± 1.26 | 88.18 | 68.18 - 108.18 |
| SPMI-7459 | Milk | 12/12/2003 | Cs-134 | 41.06 ± 2.45 | 41.88 | 31.88 - 51.88 |
| SPMI-7459 | Milk | 12/12/2003 | Cs-137 | 48.48 ± 4.99 | 48.64 | 38.64 - 58.64 |
| SPMI-7459 | Milk | 12/12/2003 | Sr-89 | 55.94 ± 4.12 | 65.80 | 52.64 - 78.96 |
| SPMI-7459 | Milk | 12/12/2003 | Sr-90 | 41.86 ± 1.57 | 43.80 | 35.04 - 52.56 |
| SPW-7461 | water | 12/12/2003 | Cs-134 | 44.07 ± 1.49 | 41.88 | 31.88 - 51.88 |
| SPW-7461 | water | 12/12/2003 | Cs-137 | 50.26 ± 2.67 | 48.64 | 38.64 - 58.64 |
| SPW-7461 | water | 12/12/2003 | Sr-89 | 56.41 ± 4.87 | 65.80 | 52.64 - 78.96 |
| SPW-7461 | water | 12/12/2003 | Sr-90 | 48.44 ± 1.84 | 43.80 | 35.04 - 52.56 |

[c] Control limits are based on Attachment A, Page A2 of this report.

NOTE: For fish, Jello is used for the Spike matrix. For Vegetation, cabbage is used for the Spike matrix.

TABLE A-4. In-House "Blank" Samples

| Lab Code | Sample Type | Date | Analysis | Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD | Activity[b] | Acceptance Criteria (4.66 σ) |
|---|---|---|---|---|---|---|
| SPW-357 | water | 1/2/2003 | Sr-90 | 0.50 | 0.12 ± 0.25 | 1 |
| W-10303 | water | 1/3/2003 | Gr. Beta | 0.12 | 0.022 ± 0.10 | 3.2 |
| W-11303 | water | 1/13/2003 | Gr. Beta | 0.14 | 0.035 ± 0.10 | 3.2 |
| W-12103 | water | 1/21/2003 | Gr. Beta | 0.12 | 0.029 ± 0.09 | 3.2 |
| SPAP-447 | Air Filter | 1/31/2003 | Gr. Beta | 0.00 | -0.0034 ± 0.00 | 3.2 |
| SPW-469 | water | 1/31/2003 | H-3 | 160.20 | 19.3 ± 80.30 | 200 |
| W-20103 | water | 2/1/2003 | Gr. Beta | 0.17 | 0.0 ± 0.12 | 3.2 |
| W-20703 | water | 2/7/2003 | Fe-55 | 802.00 | 149 ± 498.00 | 1000 |
| DW-30303 | | 3/3/2003 | Gr. Beta | 0.15 | 0.007 ± 0.11 | 3.2 |
| SPCH-965 | Charcoal Cani | 3/8/2003 | I-131(G) | 0.01 | | 9.6 |
| SPMI-1087 | Milk | 3/13/2003 | Cs-134 | 7.49 | | 10 |
| SPMI-1087 | Milk | 3/13/2003 | Cs-137 | 7.90 | | 10 |
| SPMI-1087 | Milk | 3/13/2003 | I-131 | 0.33 | -0.013 ± 0.18 | 0.5 |
| SPMI-1087 | Milk | 3/13/2003 | I-131(G) | 7.76 | | 20 |
| SPW-1089 | water | 3/13/2003 | Co-60 | 4.48 | | 10 |
| SPW-1089 | water | 3/13/2003 | Cs-134 | 5.60 | | 10 |
| SPW-1089 | water | 3/13/2003 | Cs-137 | 4.32 | | 10 |
| SPW-1089 | water | 3/13/2003 | I-131 | 0.29 | -0.050 ± 0.16 | 0.5 |
| SPVE-1111 | Vegetation | 3/14/2003 | I-131(G) | 7.53 | | 20 |
| W-32103 | water | 3/21/2003 | C-14 | 17.50 | -0.4 ± 9.200 | 200 |
| SPCH-1430 | Charcoal Cani | 4/1/2003 | I-131(G) | 0.01 | | 9.6 |
| W-40103 | water | 4/1/2003 | Gr. Beta | 0.14 | -0.11 ± 0.100 | 3.2 |
| SPF-1408 | Fish | 4/2/2003 | Cs-134 | 0.01 | | 100 |
| SPF-1408 | Fish | 4/2/2003 | Cs-137 | 0.01 | | 100 |
| SPAP-1410 | Air Filter | 4/2/2003 | Gr. Beta | 0.00 | -0.0029 ± 0.002 | 3.2 |
| SPU-41203 | Urine | 4/12/2003 | H-3 | 653.99 | 542.28 ± 364.780 | 200 |
| SPU-41703 | Urine | 4/17/2003 | H-3 | 648.35 | 100.1 ± 344.800 | 200 |
| SPW-2054 | water | 4/28/2003 | Cs-137 | 3.16 | | 10 |
| SPW-2054 | water | 4/28/2003 | Sr-89 | 0.55 | 0.45 ± 0.50 | 5 |
| SPW-2054 | water | 4/28/2003 | Sr-90 | 0.55 | 0.072 ± 0.260 | 1 |
| SPMI-2056 [c] | Milk | 4/28/2003 | Sr-90 | 0.77 | 0.66 ± 0.430 | 1 |
| SPMI-2056 | Milk | 4/28/2003 | Cs-137 | 2.74 | | 10 |
| SPMI-2056 | Milk | 4/28/2003 | I-131(G) | 3.54 | | 20 |
| W-50603 | water | 5/6/2003 | Gr. Beta | 0.12 | 0 ± 0.090 | 3.2 |
| W-60303 | water | 6/3/2003 | Gr. Beta | 0.14 | -0.035 ± 0.095 | 3.2 |
| SPW-3960 | water | 7/15/2003 | H-3 | 156.60 | 53.4 ± 80.200 | 200 |
| SPMI-4018 | Milk | 7/18/2003 | Cs-137 | 4.10 | | 10 |
| SPMI-4018 | Milk | 7/18/2003 | Sr-89 | 0.73 | 0.39 ± 0.880 | 5 |
| SPMI-4018 [c] | Milk | 7/18/2003 | Sr-90 | 0.51 | 0.93 ± 0.340 | 1 |
| SPW-4024 | water | 7/18/2003 | Sr-89 | 0.83 | 0.21 ± 0.730 | 5 |
| SPW-4024 | water | 7/18/2003 | Sr-90 | 0.62 | 0.09 ± 0.300 | 1 |
| SPW-4519 | water | 8/8/2003 | Fe-55 | 527.00 | 87 ± 369.000 | 1000 |
| SPW-6401 | water | 10/28/2003 | H-3 | 163.80 | -23.8 ± 85.000 | 200 |

TABLE A-4. In-House "Blank" Samples

| Lab Code | Sample Type | Date | Analysis | Concentration (pCi/L)[a] | | |
|---|---|---|---|---|---|---|
| | | | | Laboratory results (4.66σ) | | Acceptance |
| | | | | LLD | Activity[b] | Criteria (4.66 σ) |
| SPAP-6404 | Air Filter | 10/28/2003 | Gr. Beta | 0.87 | -0.99 ± 0.440 | 3.2 |
| SPF-6419 | Fish | 10/28/2003 | Cs-134 | 0.01 | | 100 |
| SPF-6419 | Fish | 10/28/2003 | Cs-137 | 0.01 | | 100 |
| SPMI-7460 | Milk | 12/12/2003 | Cs-134 | 4.52 | | 10 |
| SPMI-7460 | Milk | 12/12/2003 | Cs-137 | 5.77 | | 10 |
| SPMI-7460[c] | Milk | 12/12/2003 | Sr-90 | 0.50 | 1.26 ± 0.370 | 1 |

[a] Liquid sample results are reported in pCi/Liter, air filters( pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

[b] The activity reported is the net activity result.

[c] Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| MI-24, 25 | 1/2/2003 | K-40 | 1362.00 ± 117.00 | 1377.00 ± 188.00 | 1369.50 ± 110.72 |
| MI-24, 25 | 1/2/2003 | Sr-90 | 1.45 ± 0.40 | 2.21 ± 0.50 | 1.83 ± 0.32 |
| CF-47, 48 | 1/2/2003 | Gr. Beta | 2.72 ± 0.10 | 2.84 ± 0.10 | 2.78 ± 0.07 |
| CF-47, 48 | 1/2/2003 | K-40 | 2.61 ± 0.31 | 2.32 ± 0.12 | 2.47 ± 0.17 |
| AP-8827, 8828 | 1/2/2003 | Be-7 | 0.06 ± 0.01 | 0.05 ± 0.02 | 0.05 ± 0.01 |
| AP-8869, 8870 | 1/2/2003 | Be-7 | 0.04 ± 0.02 | 0.05 ± 0.02 | 0.05 ± 0.01 |
| MI-119, 120 | 1/8/2003 | K-40 | 1351.90 ± 116.10 | 1234.70 ± 108.70 | 1293.30 ± 79.52 |
| MI-119, 120 | 1/8/2003 | Sr-90 | 2.22 ± 0.43 | 1.88 ± 0.40 | 2.05 ± 0.30 |
| MI-213, 214 | 1/14/2003 | K-40 | 1372.30 ± 104.80 | 1303.80 ± 109.10 | 1338.05 ± 75.64 |
| MI-213, 214 | 1/14/2003 | Sr-90 | 1.81 ± 0.41 | 2.29 ± 0.45 | 2.05 ± 0.31 |
| MI-262, 263 | 1/15/2003 | K-40 | 1399.20 ± 200.70 | 1347.70 ± 126.40 | 1373.45 ± 118.59 |
| S-696, 697 | 1/29/2003 | Gr. Alpha | 24.70 ± 4.89 | 23.23 ± 4.64 | 23.97 ± 3.37 |
| S-696, 697 | 1/29/2003 | Gr. Beta | 22.89 ± 2.67 | 22.71 ± 2.73 | 22.80 ± 1.91 |
| MI-448, 449 | 2/3/2003 | K-40 | 1159.70 ± 157.90 | 1396.40 ± 106.20 | 1278.05 ± 95.15 |
| SW-470, 471 | 2/3/2003 | Gr. Beta | 13.62 ± 1.23 | 15.21 ± 1.21 | 14.42 ± 0.86 |
| SW-470, 471 | 2/3/2003 | K-40 (ICP) | 5.10 ± 0.51 | 5.20 ± 0.52 | 5.15 ± 0.36 |
| SW-470, 471 | 2/3/2003 | K-40 | 5.80 ± 0.51 | 5.90 ± 0.52 | 5.85 ± 0.36 |
| MI-517, 518 | 2/4/2003 | K-40 | 1437.70 ± 125.50 | 1357.70 ± 188.00 | 1397.70 ± 113.02 |
| MI-541, 542 | 2/5/2003 | K-40 | 1443.00 ± 194.80 | 1385.20 ± 190.10 | 1414.10 ± 136.09 |
| MI-620, 621 | 2/11/2003 | K-40 | 1294.70 ± 115.10 | 1234.10 ± 165.10 | 1264.40 ± 100.63 |
| DW-922, 923 | 3/4/2003 | I-131 | 0.67 ± 0.16 | 0.79 ± 0.16 | 0.73 ± 0.11 |
| CF-1048, 1049 b | 3/10/2003 | K-40 | 3.09 ± 0.12 | 2.67 ± 0.07 | 2.88 ± 0.07 |
| LW-1152, 1153 | 3/13/2003 | H-3 | 1147.26 ± 122.56 | 1094.42 ± 120.92 | 1120.84 ± 86.09 |
| F-1120, 1121 | 3/14/2003 | Cs-137 | 0.04 ± 0.02 | 0.05 ± 0.01 | 0.05 ± 0.01 |
| F-1120, 1121 | 3/14/2003 | Gr. Beta | 2.04 ± 0.06 | 2.11 ± 0.06 | 2.08 ± 0.04 |
| F-1120, 1121 | 3/14/2003 | K-40 | 1.93 ± 0.38 | 1.89 ± 0.25 | 1.91 ± 0.23 |
| DW-1278, 1279 | 3/25/2003 | I-131 | 0.37 ± 0.22 | 0.34 ± 0.29 | 0.36 ± 0.18 |
| SO-1380, 1381 | 3/25/2003 | Gr. Beta | 18.60 ± 2.68 | 20.53 ± 2.83 | 19.57 ± 1.95 |
| LW-1299, 1300 | 3/27/2003 | Gr. Beta | 2.35 ± 0.55 | 2.48 ± 0.56 | 2.42 ± 0.39 |
| LW-1320, 1321 | 3/27/2003 | H-3 | 487.12 ± 104.43 | 422.00 ± 102.00 | 454.56 ± 72.99 |
| W-1403, 1404 | 3/31/2003 | Sr-90 | 0.96 ± 0.32 | 1.10 ± 0.42 | 1.03 ± 0.26 |
| AP-2019, 2020 | 3/31/2003 | Be-7 | 0.07 ± 0.01 | 0.08 ± 0.01 | 0.07 ± 0.01 |
| MI-1422, 1423 | 4/1/2003 | K-40 | 1410.00 ± 176.00 | 1340.00 ± 114.00 | 1375.00 ± 104.85 |
| MI-2170, 2171 | 4/1/2003 | K-40 | 1452.30 ± 129.10 | 1472.50 ± 191.00 | 1462.40 ± 115.27 |
| MI-1422, 1423 | 4/2/2003 | Sr-90 | 1.84 ± 0.42 | 1.15 ± 0.39 | 1.50 ± 0.29 |
| AP-1633, 1634 | 4/2/2003 | Be-7 | 0.05 ± 0.01 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| AP-1871, 1872 | 4/2/2003 | Be-7 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 |
| AP-1974, 1975 | 4/2/2003 | Be-7 | 0.08 ± 0.02 | 0.07 ± 0.02 | 0.08 ± 0.01 |
| LW-1828, 1829 | 4/11/2003 | Gr. Beta | 2.49 ± 0.58 | 3.42 ± 0.63 | 2.96 ± 0.43 |
| S-1544, 1545 | 4/15/2003 | K-40 | 15.84 ± 2.36 | 15.41 ± 2.02 | 15.63 ± 1.55 |
| DW-1913, 1914 | 4/15/2003 | I-131 | 0.29 ± 0.21 | 0.42 ± 0.19 | 0.36 ± 0.14 |
| MI-1996, 1997 | 4/21/2003 | Sr-90 | 2.05 ± 0.74 | 3.25 ± 0.91 | 2.65 ± 0.58 |
| MI-1996, 1997 | 4/22/2003 | K-40 | 1580.20 ± 118.90 | 1602.10 ± 120.40 | 1591.15 ± 84.61 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| LW-2063, 2064 | 4/28/2003 | Gr. Beta | 2.33 ± 0.66 | 2.68 ± 0.60 | 2.51 ± 0.45 |
| SWU-2275, 2276 | 4/28/2003 | Gr. Beta | 3.62 ± 0.67 | 4.60 ± 0.71 | 4.11 ± 0.49 |
| G-2149, 2150 | 4/30/2003 | Be-7 | 0.71 ± 0.19 | 0.69 ± 0.20 | 0.70 ± 0.14 |
| TD-2339, 2340 | 5/1/2003 | H-3 | 221.00 ± 91.00 | 161.00 ± 88.00 | 191.00 ± 63.29 |
| SO-2381, 2382 | 5/1/2003 | Cs-137 | 0.11 ± 0.03 | 0.10 ± 0.02 | 0.10 ± 0.02 |
| SO-2381, 2382 | 5/1/2003 | Gr. Alpha | 11.14 ± 5.15 | 10.39 ± 5.60 | 10.77 ± 3.80 |
| SO-2381, 2382 | 5/1/2003 | Gr. Beta | 35.18 ± 4.69 | 39.66 ± 5.24 | 37.42 ± 3.52 |
| SO-2381, 2382 | 5/1/2003 | K-40 | 18.29 ± 0.84 | 17.83 ± 0.84 | 18.06 ± 0.59 |
| SO-2381, 2382 | 5/1/2003 | Sr-90 | 0.06 ± 0.02 | 0.10 ± 0.02 | 0.08 ± 0.01 |
| DW-2317, 2318 | 5/6/2003 | I-131 | 1.77 ± 0.27 | 1.47 ± 0.26 | 1.62 ± 0.19 |
| BS-2595, 2596 | 5/6/2003 | Cs-137 | 0.06 ± 0.02 | 0.06 ± 0.02 | 0.06 ± 0.02 |
| BS-2595, 2596 | 5/6/2003 | K-40 | 13.74 ± 0.62 | 14.10 ± 0.73 | 13.92 ± 0.48 |
| U-2484, 2485 | 5/9/2003 | H-3 | 512.00 ± 100.00 | 370.00 ± 95.00 | 441.00 ± 68.97 |
| SO-2645, 2646 | 5/14/2003 | Be-7 | 1.18 ± 0.42 | 1.21 ± 0.35 | 1.19 ± 0.27 |
| SO-2645, 2646 | 5/14/2003 | Cs-137 | 0.11 ± 0.04 | 0.09 ± 0.05 | 0.10 ± 0.03 |
| SO-2645, 2646 | 5/14/2003 | K-40 | 16.50 ± 1.13 | 15.33 ± 1.09 | 15.91 ± 0.79 |
| MI-2696, 2697 | 5/19/2003 | K-40 | 1320.40 ± 124.50 | 1394.10 ± 113.00 | 1357.25 ± 84.07 |
| MI-2696, 2697 | 5/19/2003 | Sr-90 | 1.49 ± 0.47 | 2.01 ± 0.45 | 1.75 ± 0.32 |
| SO-2787, 2788 | 5/28/2003 | Cs-137 | 0.27 ± 0.04 | 0.23 ± 0.04 | 0.25 ± 0.03 |
| SO-2787, 2788 | 5/28/2003 | Gr. Beta | 19.62 ± 1.73 | 20.81 ± 1.72 | 20.21 ± 1.22 |
| SO-2787, 2788 | 5/28/2003 | K-40 | 14.77 ± 1.02 | 14.41 ± 1.00 | 14.59 ± 0.71 |
| MI-2840, 2841 | 5/28/2003 | K-40 | 1179.50 ± 167.80 | 1401.70 ± 120.20 | 1290.60 ± 103.20 |
| SWU-2864, 2865 | 5/28/2003 | Gr. Beta | 3.39 ± 0.59 | 3.41 ± 0.64 | 3.40 ± 0.43 |
| BS-2888, 2889 | 5/29/2003 | Cs-137 | 0.05 ± 0.02 | 0.07 ± 0.04 | 0.06 ± 0.02 |
| BS-2888, 2889 | 5/29/2003 | K-40 | 9.70 ± 0.83 | 10.17 ± 0.87 | 9.93 ± 0.60 |
| W-3230, 3231 | 5/30/2003 | Gr. Beta | 4.33 ± 1.00 | 3.28 ± 1.22 | 3.81 ± 0.79 |
| TD-3036, 3037 | 6/2/2003 | H-3 | 529.50 ± 100.00 | 585.50 ± 102.00 | 557.50 ± 71.42 |
| SL-2909, 2910 b | 6/3/2003 | Gr. Beta | 7.10 ± 0.15 | 7.60 ± 0.16 | 7.35 ± 0.11 |
| SL-2909, 2910 | 6/3/2003 | K-40 | 3.90 ± 0.67 | 3.49 ± 0.52 | 3.70 ± 0.42 |
| SW-3080, 3081 | 6/10/2003 | Gr. Alpha | 4.63 ± 1.90 | 4.47 ± 1.71 | 4.55 ± 1.28 |
| SW-3080, 3081 | 6/10/2003 | Gr. Beta | 9.07 ± 1.29 | 8.98 ± 1.28 | 9.02 ± 0.91 |
| VE-3172, 3173 | 6/11/2003 | K-40 | 2.62 ± 0.35 | 3.17 ± 0.58 | 2.90 ± 0.34 |
| F-3742, 3743 | 6/11/2003 | Gr. Beta | 3.47 ± 0.13 | 3.71 ± 0.14 | 3.59 ± 0.10 |
| F-3742, 3743 | 6/11/2003 | K-40 | 2.94 ± 0.39 | 2.70 ± 0.40 | 2.82 ± 0.28 |
| SO-3325, 3326 | 6/13/2003 | Gr. Beta | 20.95 ± 1.88 | 19.97 ± 2.01 | 20.46 ± 1.38 |
| MI-3253, 3254 | 6/17/2003 | K-40 | 1329.40 ± 121.80 | 1417.60 ± 130.90 | 1373.50 ± 89.40 |
| MI-3297, 3298 | 6/17/2003 | Sr-90 | 2.14 ± 0.57 | 2.27 ± 0.50 | 2.21 ± 0.38 |
| WW-3380, 3381 | 6/23/2003 | Gr. Beta | 5.58 ± 0.69 | 5.03 ± 0.69 | 5.31 ± 0.49 |
| SWT-3403, 3404 | 6/24/2003 | Gr. Beta | 2.80 ± 0.56 | 2.63 ± 0.55 | 2.72 ± 0.39 |
| MI-3424, 3425 | 6/24/2003 | K-40 | 1422.80 ± 185.40 | 1216.20 ± 170.10 | 1319.50 ± 125.80 |
| SW-3862, 3863 | 6/24/2003 | Gr. Beta | 3.66 ± 1.18 | 3.70 ± 1.22 | 3.68 ± 0.85 |
| G-3479, 3480 | 6/25/2003 | Be-7 | 1.52 ± 0.25 | 1.43 ± 0.28 | 1.47 ± 0.19 |
| G-3479, 3480 | 6/25/2003 | K-40 | 5.02 ± 0.45 | 5.10 ± 0.48 | 5.06 ± 0.33 |
| LW-3809, 3810 | 6/30/2003 | Gr. Beta | 2.12 ± 0.76 | 2.39 ± 0.72 | 2.25 ± 0.52 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| LW-3809, 3810 | 6/30/2003 | H-3 | 2814.09 ± 167.99 | 2812.17 ± 167.94 | 2813.13 ± 118.77 |
| AP-4105, 4106 | 6/30/2003 | Be-7 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 |
| G-3572, 3573 | 7/1/2003 | Be-7 | 0.91 ± 0.24 | 0.81 ± 0.28 | 0.86 ± 0.18 |
| G-3572, 3573 | 7/1/2003 | Gr. Beta | 6.35 ± 0.15 | 6.35 ± 0.15 | 6.35 ± 0.11 |
| G-3572, 3573 | 7/1/2003 | K-40 | 5.44 ± 0.55 | 5.68 ± 0.28 | 5.56 ± 0.31 |
| G-3572, 3573 | 7/1/2003 | Sr-90 | 0.01 ± 0.00 | 0.02 ± 0.00 | 0.01 ± 0.00 |
| MI-3601, 3602 | 7/1/2003 | K-40 | 1318.60 ± 117.40 | 1435.10 ± 117.80 | 1376.85 ± 83.16 |
| MI-3601, 3602 | 7/1/2003 | Sr-90 | 0.86 ± 0.51 | 1.74 ± 0.60 | 1.30 ± 0.39 |
| AP-3933, 3934 | 7/1/2003 | Be-7 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 |
| AP-4061, 4062 | 7/2/2003 | Be-7 | 0.07 ± 0.01 | 0.08 ± 0.01 | 0.08 ± 0.01 |
| AP-4147, 4148 | 7/2/2003 | Be-7 | 0.08 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 |
| AP-4084, 4085 | 7/3/2003 | Be-7 | 0.09 ± 0.02 | 0.08 ± 0.02 | 0.08 ± 0.01 |
| LW-3786, 3787 | 7/9/2003 | Gr. Beta | 2.13 ± 0.56 | 2.93 ± 0.62 | 2.53 ± 0.42 |
| WW-4168, 4169 | 7/11/2003 | Gr. Beta | 3.79 ± 1.87 | 4.48 ± 1.98 | 4.14 ± 1.36 |
| CF-3975, 3976 | 7/14/2003 | Be-7 | 1.64 ± 0.81 | 1.66 ± 0.57 | 1.65 ± 0.50 |
| CF-3975, 3976 | 7/14/2003 | K-40 | 6.54 ± 0.75 | 6.19 ± 0.50 | 6.36 ± 0.45 |
| MI-4020, 4021 | 7/16/2003 | K-40 | 1350.90 ± 174.90 | 1199.80 ± 153.20 | 1275.35 ± 116.25 |
| DW-4272, 4273 | 7/29/2003 | Gr. Beta | 2.35 ± 0.92 | 2.29 ± 0.89 | 2.32 ± 0.64 |
| SWU-4461, 4462 | 7/30/2003 | Gr. Beta | 2.28 ± 0.44 | 1.93 ± 0.43 | 2.10 ± 0.31 |
| SL-4398, 4399 | 8/4/2003 | Be-7 | 4.55 ± 1.05 | 4.50 ± 1.10 | 4.53 ± 0.76 |
| SL-4398, 4399 b | 8/4/2003 | Gr. Beta | 3.41 ± 0.12 | 3.12 ± 0.11 | 3.27 ± 0.08 |
| SL-4398, 4399 | 8/4/2003 | K-40 | 2.47 ± 0.67 | 2.44 ± 0.87 | 2.46 ± 0.55 |
| G-4419, 4420 | 8/4/2003 | Be-7 | 3.98 ± 0.63 | 3.93 ± 0.57 | 3.96 ± 0.42 |
| G-4419, 4420 | 8/4/2003 | Gr. Beta | 5.38 ± 0.14 | 5.35 ± 0.16 | 5.37 ± 0.11 |
| G-4419, 4420 | 8/4/2003 | K-40 | 4.42 ± 0.66 | 4.32 ± 0.74 | 4.37 ± 0.50 |
| TD-4550, 4551 | 8/4/2003 | H-3 | 327.30 ± 95.10 | 390.20 ± 92.10 | 358.75 ± 66.19 |
| MI-4482, 4483 | 8/6/2003 | K-40 | 1301.40 ± 115.20 | 1370.30 ± 116.80 | 1335.85 ± 82.03 |
| MI-4482, 4483 | 8/6/2003 | Sr-90 | 0.81 ± 0.30 | 0.85 ± 0.31 | 0.83 ± 0.21 |
| G-4526, 4527 | 8/6/2003 | Be-7 | 1.47 ± 0.29 | 1.42 ± 0.28 | 1.45 ± 0.20 |
| G-4526, 4527 | 8/6/2003 | K-40 | 5.42 ± 0.56 | 5.21 ± 0.63 | 5.31 ± 0.42 |
| SWU-4609, 4610 | 8/6/2003 | Gr. Beta | 3.22 ± 0.63 | 2.67 ± 0.64 | 2.95 ± 0.45 |
| CW-4694, 4695 | 8/6/2003 | Gr. Beta | 1.48 ± 0.34 | 1.09 ± 0.34 | 1.29 ± 0.24 |
| CW-4694, 4695 | 8/6/2003 | H-3 | 22776.41 ± 428.73 | 21831.75 ± 420.10 | 22304.08 ± 300.12 |
| LW-4673, 4674 | 8/13/2003 | Gr. Beta | 2.86 ± 0.65 | 3.75 ± 0.71 | 3.30 ± 0.48 |
| MI-4735, 4736 | 8/19/2003 | K-40 | 1396.30 ± 127.90 | 1410.10 ± 120.20 | 1403.20 ± 87.76 |
| MI-4756, 4757 | 8/19/2003 | Sr-90 | 1.66 ± 0.47 | 1.53 ± 0.44 | 1.60 ± 0.32 |
| VE-4832, 4833 | 8/20/2003 | K-40 | 1.96 ± 0.50 | 1.43 ± 0.47 | 1.70 ± 0.34 |
| MI-4860, 4861 | 8/26/2003 | K-40 | 1312.10 ± 191.80 | 1307.80 ± 109.30 | 1309.95 ± 110.38 |
| SO-5082, 5083 | 8/28/2003 | Cs-137 | 0.01 ± 0.00 | 0.01 ± 0.00 | 0.01 ± 0.00 |
| SO-5082, 5083 | 8/28/2003 | Gr. Beta | 20.02 ± 1.84 | 20.92 ± 2.03 | 20.47 ± 1.37 |
| CW-5349, 5350 | 8/31/2003 | Gr. Beta | 1.45 ± 0.39 | 1.55 ± 0.45 | 1.50 ± 0.30 |
| CW-5349, 5350 | 8/31/2003 | H-3 | 24429.50 ± 444.42 | 24744.25 ± 447.18 | 24586.88 ± 315.23 |
| ME-4968, 4969 | 9/2/2003 | Gr. Beta | 4.90 ± 0.23 | 5.18 ± 0.24 | 5.04 ± 0.17 |
| ME-4968, 4969 | 9/2/2003 | K-40 | 2.46 ± 0.41 | 2.68 ± 0.37 | 2.57 ± 0.28 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| DW-4989, 4990 | 9/2/2003 | Gr. Beta | 2.20 ± 1.04 | 3.19 ± 1.14 | 2.70 ± 0.77 |
| MI-5154, 5155 | 9/8/2003 | K-40 | 1365.50 ± 116.70 | 1456.70 ± 119.10 | 1411.10 ± 83.37 |
| MI-5154, 5155 | 9/8/2003 | Sr-90 | 1.19 ± 0.39 | 1.39 ± 0.39 | 1.29 ± 0.28 |
| AP-6177, 6178 | 9/29/2003 | Be-7 | 0.07 ± 0.01 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| SWU-5773, 5774 | 9/30/2003 | Gr. Beta | 2.55 ± 0.63 | 2.83 ± 0.60 | 2.69 ± 0.44 |
| AP-6102, 6103 | 9/30/2003 | Be-7 | 0.07 ± 0.01 | 0.05 ± 0.01 | 0.06 ± 0.01 |
| G-5631, 5632 | 10/1/2003 | Be-7 | 1.88 ± 0.48 | 2.21 ± 0.40 | 2.05 ± 0.31 |
| G-5631, 5632 | 10/1/2003 | Gr. Beta | 5.87 ± 0.09 | 5.85 ± 0.08 | 5.86 ± 0.06 |
| G-5631, 5632 | 10/1/2003 | K-40 | 5.24 ± 0.77 | 5.26 ± 0.58 | 5.25 ± 0.48 |
| SO-5660, 5661 | 10/1/2003 | Cs-137 | 0.15 ± 0.04 | 0.16 ± 0.05 | 0.16 ± 0.03 |
| SO-5660, 5661 | 10/1/2003 | Gr. Alpha | 12.72 ± 3.72 | 14.86 ± 3.88 | 13.79 ± 2.69 |
| SO-5660, 5661 | 10/1/2003 | Gr. Beta | 32.42 ± 3.09 | 33.60 ± 3.04 | 33.01 ± 2.17 |
| SO-5660, 5661 | 10/1/2003 | K-40 | 18.93 ± 0.87 | 18.25 ± 1.19 | 18.59 ± 0.74 |
| SO-5660, 5661 | 10/1/2003 | Sr-90 | 0.03 ± 0.01 | 0.03 ± 0.01 | 0.03 ± 0.01 |
| AP-6334, 6335 | 10/1/2003 | Be-7 | 0.06 ± 0.01 | 0.06 ± 0.01 | 0.06 ± 0.01 |
| AP-6363, 6364 | 10/2/2003 | Be-7 | 0.07 ± 0.02 | 0.07 ± 0.02 | 0.07 ± 0.01 |
| MI-5794, 5795 | 10/6/2003 | Sr-90 | 1.37 ± 0.37 | 1.02 ± 0.37 | 1.19 ± 0.26 |
| MI-5838, 5839 | 10/8/2003 | K-40 | 1364.30 ± 124.10 | 1414.40 ± 110.40 | 1389.35 ± 83.05 |
| MI-5838, 5839 | 10/8/2003 | Sr-90 | 0.76 ± 0.30 | 1.00 ± 0.34 | 0.88 ± 0.23 |
| BS-5938, 5939 | 10/8/2003 | Cs-137 | 0.18 ± 0.03 | 0.20 ± 0.05 | 0.19 ± 0.03 |
| BS-5938, 5939 | 10/8/2003 | K-40 | 15.59 ± 0.70 | 16.69 ± 0.80 | 16.14 ± 0.53 |
| SS-5959, 5960 | 10/13/2003 | K-40 | 7.49 ± 0.42 | 7.29 ± 0.63 | 7.39 ± 0.38 |
| MI-6011, 6012 | 10/13/2003 | K-40 | 1165.20 ± 118.70 | 1191.20 ± 99.50 | 1178.20 ± 77.44 |
| MI-6034, 6035 | 10/14/2003 | Sr-90 | 0.86 ± 0.33 | 0.90 ± 0.34 | 0.88 ± 0.24 |
| VE-6055, 6056 | 10/15/2003 | Gr. Beta | 5.18 ± 0.18 | 5.33 ± 0.18 | 5.25 ± 0.13 |
| VE-6055, 6056 | 10/15/2003 | K-40 | 5.31 ± 0.57 | 4.52 ± 0.51 | 4.92 ± 0.38 |
| MI-6291, 6292 | 10/21/2003 | K-40 | 1935.60 ± 147.70 | 1936.10 ± 116.50 | 1935.85 ± 94.06 |
| MI-6291, 6292 | 10/21/2003 | Sr-90 | 1.22 ± 0.39 | 1.41 ± 0.37 | 1.31 ± 0.27 |
| SS-6435, 6436 | 10/21/2003 | Cs-137 | 0.05 ± 0.02 | 0.05 ± 0.03 | 0.05 ± 0.02 |
| SS-6435, 6436 | 10/21/2003 | K-40 | 14.08 ± 0.54 | 14.28 ± 0.80 | 14.18 ± 0.48 |
| CF-6313, 6314 | 10/22/2003 | K-40 | 14.56 ± 0.45 | 14.70 ± 0.95 | 14.63 ± 0.53 |
| SO-6528, 6529 | 10/22/2003 | Cs-137 | 0.15 ± 0.03 | 0.16 ± 0.05 | 0.16 ± 0.03 |
| SO-6528, 6529 | 10/22/2003 | K-40 | 17.46 ± 0.69 | 17.90 ± 1.05 | 17.68 ± 0.63 |
| SO-6393, 6394 | 10/25/2003 | Cs-137 | 0.09 ± 0.03 | 0.10 ± 0.04 | 0.10 ± 0.03 |
| SO-6393, 6394 | 10/25/2003 | Gr. Beta | 23.21 ± 1.98 | 21.76 ± 1.91 | 22.48 ± 1.38 |
| SO-6393, 6394 | 10/25/2003 | K-40 | 13.98 ± 0.80 | 14.57 ± 0.86 | 14.27 ± 0.59 |
| SWT-6507, 6508 | 10/28/2003 | Gr. Beta | 2.64 ± 0.52 | 2.63 ± 0.53 | 2.63 ± 0.37 |
| DW-6647, 6648 | 10/31/2003 | I-131 | 0.46 ± 0.27 | 0.61 ± 0.31 | 0.53 ± 0.21 |
| BS-6603, 6604 | 11/3/2003 | Cs-137 | 9.03 ± 0.82 | 8.60 ± 1.13 | 8.82 ± 0.70 |
| BS-6603, 6604 | 11/3/2003 | Gr. Beta | 26.83 ± 1.94 | 27.18 ± 1.95 | 27.01 ± 1.38 |
| SO-6670, 6671 | 11/5/2003 | Cs-137 | 0.15 ± 0.04 | 0.13 ± 0.04 | 0.14 ± 0.03 |
| SO-6670, 6671 | 11/5/2003 | K-40 | 12.96 ± 0.66 | 12.95 ± 0.72 | 12.96 ± 0.49 |
| S-7067, 7068 | 11/10/2003 | Cs-137 | 0.21 ± 0.05 | 0.19 ± 0.08 | 0.20 ± 0.05 |
| MI-6818, 6819 | 11/11/2003 | K-40 | 1695.50 ± 129.80 | 1709.40 ± 143.00 | 1702.45 ± 96.56 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| MI-6818, 6819 | 11/11/2003 | Sr-90 | 2.01 ± 0.41 | 1.59 ± 0.39 | 1.80 ± 0.28 |
| WL-6987, 6988 | 11/17/2003 | Fe-55 | 603.49 ± 53.32 | 619.65 ± 53.97 | 611.57 ± 37.93 |
| SO-7156, 7157 | 11/21/2003 | Cs-137 | 0.74 ± 0.08 | 0.77 ± 0.07 | 0.76 ± 0.06 |
| SO-7156, 7157 | 11/21/2003 | Gr. Alpha | 14.90 ± 4.24 | 19.25 ± 4.45 | 17.07 ± 3.07 |
| SO-7156, 7157 | 11/21/2003 | Gr. Beta | 22.97 ± 3.12 | 25.51 ± 2.98 | 24.24 ± 2.16 |
| SO-7156, 7157 | 11/21/2003 | K-40 | 12.51 ± 1.06 | 12.94 ± 1.07 | 12.73 ± 0.75 |
| S-7281, 7282 | 11/24/2003 | Cs-137 | 0.82 ± 0.15 | 1.16 ± 0.20 | 0.99 ± 0.12 |
| SWU-7198, 7199 | 11/25/2003 | Gr. Beta | 2.60 ± 0.53 | 2.54 ± 0.55 | 2.57 ± 0.38 |
| DW-7221, 7222 | 11/25/2003 | Gr. Beta | 12.32 ± 1.40 | 12.38 ± 1.43 | 12.35 ± 1.00 |
| SW-7133, 7134 | 12/1/2003 | Gr. Beta | 2.10 ± 0.23 | 2.46 ± 0.23 | 2.28 ± 0.16 |
| SW-7133, 7134 | 12/1/2003 | K-40 | 1.50 ± 0.15 | 1.40 ± 0.14 | 1.45 ± 0.10 |
| W-7519, 7520 | 12/1/2003 | Fe-55 | 3.03 ± 0.65 | 3.12 ± 0.64 | 3.08 ± 0.46 |
| SW-7805, 7806 | 12/1/2003 | Sr-90 | 0.59 ± 0.32 | 0.56 ± 0.33 | 0.58 ± 0.23 |
| VE-7399, 7400 | 12/9/2003 | Gr. Beta | 4.99 ± 0.15 | 5.24 ± 0.15 | 5.11 ± 0.11 |
| VE-7399, 7400 | 12/9/2003 | K-40 | 5.04 ± 0.46 | 5.34 ± 0.74 | 5.19 ± 0.43 |
| SW-7540, 7541 | 12/9/2003 | Gr. Alpha | 2.64 ± 1.36 | 2.10 ± 1.19 | 2.37 ± 0.91 |
| SW-7540, 7541 | 12/9/2003 | Gr. Beta | 6.62 ± 1.22 | 5.89 ± 1.35 | 6.25 ± 0.91 |
| LW-7736, 7737 | 12/26/2003 | Gr. Beta | 2.62 ± 0.54 | 2.83 ± 0.56 | 2.73 ± 0.39 |
| AP-7868, 7869 | 12/30/2003 | Be-7 | 0.05 ± 0.01 | 0.04 ± 0.01 | 0.04 ± 0.01 |
| AP-7952, 7953 | 12/30/2003 | Be-7 | 0.04 ± 0.01 | 0.04 ± 0.01 | 0.04 ± 0.01 |
| AP-7994, 7995 | 12/31/2003 | Be-7 | 0.05 ± 0.02 | 0.05 ± 0.01 | 0.05 ± 0.01 |

Note: Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).

[b] 200 minute count time or longer, resulting in lower error.

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)[a].

| | | | Concentration[b] | | | |
|---|---|---|---|---|---|---|
| Lab Code | Type | Date | Analysis | Laboratory result | Known Activity | Control Limits[c] |
| STW-972 | water | 12/01/02 | Am-241 | 0.56 ± 0.06 | 0.58 ± 0.09 | 0.40 - 0.75 |
| STW-972 | water | 12/01/02 | Co-57 | 57.10 ± 1.90 | 57.00 ± 5.70 | 39.90 - 74.10 |
| STW-972 | water | 12/01/02 | Co-60 | 38.30 ± 0.60 | 38.20 ± 3.82 | 26.74 - 49.66 |
| STW-972 | water | 12/01/02 | Cs-134 | 395.30 ± 10.10 | 421.00 ± 42.10 | 294.70 - 547.30 |
| STW-972 | water | 12/01/02 | Cs-137 | 316.40 ± 5.30 | 329.00 ± 32.90 | 230.30 - 427.70 |
| STW-972 | water | 12/01/02 | Fe-55 | 94.90 ± 24.50 | 96.00 ± 9.60 | 67.20 - 124.80 |
| STW-972 | water | 12/01/02 | Mn-54 | 33.40 ± 0.10 | 32.90 ± 3.29 | 23.03 - 42.77 |
| STW-972 | water | 12/01/02 | Ni-63 | 123.80 ± 5.50 | 136.50 ± 13.70 | 95.55 - 177.45 |
| STW-972 | water | 12/01/02 | Pu-238 | 0.66 ± 0.06 | 0.83 ± 0.08 | 0.58 - 1.08 |
| STW-972 | water | 12/01/02 | Pu-239/40 | 0.001 ± 0.001 | 0.000 ± 0.000 | 0.000 - 0.005 |
| STW-972 | water | 12/01/02 | Sr-90 | 13.80 ± 1.00 | 12.31 ± 1.23 | 8.62 - 16.00 |
| STW-972 | water | 12/01/02 | Tc-99 | 128.10 ± 3.80 | 132.00 ± 13.20 | 92.40 - 171.60 |
| STW-972 | water | 12/01/02 | U-233/4 | 1.60 ± 0.09 | 1.54 ± 0.15 | 1.08 - 2.00 |
| STW-972 | water | 12/01/02 | U-238 | 1.64 ± 0.09 | 1.60 ± 0.16 | 1.12 - 2.08 |
| STW-972 | water | 12/01/02 | Zn-65 | 540.40 ± 9.90 | 516.00 ± 51.60 | 361.20 - 670.80 |
| STSO-987 | soil | 01/01/03 | Co-57 | 534.36 ± 2.61 | 530.00 ± 53.00 | 371.00 - 689.00 |
| STSO-987 | soil | 01/01/03 | Co-60 | 442.16 ± 2.31 | 420.00 ± 42.00 | 294.00 - 546.00 |
| STSO-987 | soil | 01/01/03 | Cs-134 | 211.00 ± 2.30 | 238.00 ± 23.80 | 166.60 - 309.40 |
| STSO-987 | soil | 01/01/03 | Cs-137 | 849.50 ± 3.30 | 832.00 ± 83.20 | 582.40 - 1081.60 |
| STSO-987 | soil | 01/01/03 | K-40 | 716.50 ± 12.80 | 652.00 ± 65.20 | 456.40 - 847.60 |
| STSO-987 | soil | 01/01/03 | Mn-54 | 148.76 ± 2.84 | 137.00 ± 13.70 | 95.90 - 178.10 |
| STSO-987 | soil | 01/01/03 | Ni-63 | 597.10 ± 23.50 | 770.00 ± 77.00 | 539.00 - 1001.00 |
| STSO-987 | soil | 01/01/03 | Pu-238 | 67.05 ± 3.10 | 66.90 ± 6.70 | 46.83 - 86.97 |
| STSO-987 | soil | 01/01/03 | Pu-239/40 | 52.80 ± 3.60 | 52.70 ± 5.30 | 36.90 - 68.50 |
| STSO-987 | soil | 01/01/03 | Sr-90 | 609.50 ± 9.80 | 714.00 ± 71.40 | 499.80 - 928.20 |
| STSO-987 | soil | 01/01/03 | U-233/4 | 99.50 ± 7.60 | 89.00 ± 8.90 | 62.30 - 115.70 |
| STSO-987 | soil | 01/01/03 | U-238 | 508.60 ± 42.20 | 421.00 ± 42.10 | 294.70 - 547.30 |
| STSO-987 | soil | 01/01/03 | Zn-65 | 492.70 ± 28.10 | 490.00 ± 49.00 | 343.00 - 637.00 |

[a] Results obtained by Environmental, Inc. ,Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho

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

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

TABLE A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)

| Lab Code | Type | Date | Concentration[a] Analysis | Laboratory results | EML Result[b] | Control Limits[c] |
|---|---|---|---|---|---|---|
| STW-977 | water | 03/01/03 | Gr. Alpha | 304.30 ± 53.10 | 377.50 | 0.58 - 1.29 |
| STW-977 | water | 03/01/03 | Gr. Beta | 615.80 ± 14.70 | 627.50 | 0.61 - 1.43 |
| STW-978 | water | 03/01/03 | Am-241 | 2.00 ± 0.10 | 2.13 | 0.79 - 1.41 |
| STW-978 | water | 03/01/03 | Co-60 | 221.30 ± 1.20 | 234.00 | 0.80 - 1.20 |
| STW-978 [d] | water | 03/01/03 | Cs-134 | 23.30 ± 1.10 | 30.50 | 0.80 - 1.30 |
| STW-978 | water | 03/01/03 | Cs-137 | 61.40 ± 0.60 | 63.80 | 0.80 - 1.22 |
| STW-978 [e] | water | 03/01/03 | H-3 | 341.90 ± 22.70 | 390.00 | 0.78 - 2.45 |
| STW-978 | water | 03/01/03 | Pu-238 | 3.70 ± 0.20 | 3.33 | 0.74 - 1.20 |
| STW-978 | water | 03/01/03 | Pu-239/40 | 4.40 ± 0.10 | 3.92 | 0.79 - 1.20 |
| STW-978 | water | 03/01/03 | Sr-90 | 4.60 ± 0.30 | 4.34 | 0.69 - 1.34 |
| STW-978 | water | 03/01/03 | Uranium | 5.10 ± 0.60 | 4.29 | 0.75 - 1.33 |
| STSO-979 | soil | 03/01/03 | Ac-228 | 55.60 ± 2.50 | 57.60 | 0.80 - 1.38 |
| STSO-979 | soil | 03/01/03 | Am-241 | 12.42 ± 0.90 | 15.60 | 0.65 - 2.28 |
| STSO-979 | soil | 03/01/03 | Bi-212 | 57.70 ± 3.20 | 60.60 | 0.50 - 1.34 |
| STSO-979 | soil | 03/01/03 | Bi-214 | 60.40 ± 3.20 | 67.00 | 0.78 - 1.42 |
| STSO-979 | soil | 03/01/03 | Cs-137 | 1416.80 ± 70.00 | 1450.00 | 0.80 - 1.25 |
| STSO-979 | soil | 03/01/03 | K-40 | 653.80 ± 11.90 | 636.00 | 0.80 - 1.32 |
| STSO-979 | soil | 03/01/03 | Pb-212 | 51.10 ± 5.20 | 57.90 | 0.78 - 1.32 |
| STSO-979 | soil | 03/01/03 | Pb-214 | 64.70 ± 5.10 | 71.10 | 0.76 - 1.46 |
| STSO-979 | soil | 03/01/03 | Pu-239/40 | 24.40 ± 0.30 | 23.40 | 0.71 - 1.30 |
| STSO-979 | soil | 03/01/03 | Sr-90 | 54.50 ± 2.60 | 64.40 | 0.67 - 2.90 |
| STSO-979 | soil | 03/01/03 | Uranium | 245.00 ± 1.50 | 249.00 | 0.71 - 1.32 |
| STVE-980 | Vegetation | 03/01/03 | Am-241 | 3.10 ± 0.20 | 3.51 | 0.73 - 2.02 |
| STVE-980 | Vegetation | 03/01/03 | Cm-244 | 1.40 ± 0.50 | 2.01 | 0.61 - 1.59 |
| STVE-980 | Vegetation | 03/01/03 | Co-60 | 12.60 ± 0.40 | 12.10 | 0.80 - 1.44 |
| STVE-980 | Vegetation | 03/01/03 | Cs-137 | 449.70 ± 6.20 | 444.00 | 0.80 - 1.31 |
| STVE-980 | Vegetation | 03/01/03 | K-40 | 1159.00 ± 38.60 | 1120.00 | 0.79 - 1.39 |
| STVE-980 | Vegetation | 03/01/03 | Pu-239/40 | 4.80 ± 0.40 | 5.17 | 0.69 - 1.31 |
| STVE-980 | Vegetation | 03/01/03 | Sr-90 | 659.70 ± 50.40 | 650.00 | 0.55 - 1.21 |
| STAP-981 | Air Filter | 03/01/03 | Am-241 | 0.27 ± 0.10 | 0.34 | 0.70 - 2.34 |
| STAP-981 | Air Filter | 03/01/03 | Co-60 | 30.20 ± 0.30 | 33.50 | 0.80 - 1.26 |
| STAP-981 | Air Filter | 03/01/03 | Cs-137 | 90.30 ± 1.30 | 99.70 | 0.80 - 1.32 |
| STAP-981 | Air Filter | 03/01/03 | Mn-54 | 41.80 ± 0.60 | 43.80 | 0.80 - 1.35 |
| STAP-981 | Air Filter | 03/01/03 | Pu-238 | 0.52 ± 0.10 | 0.52 | 0.67 - 1.33 |
| STAP-981 | Air Filter | 03/01/03 | Pu-239/40 | 0.35 ± 0.10 | 0.33 | 0.73 - 1.26 |
| STAP-981 | Air Filter | 03/01/03 | Sr-90 | 2.50 ± 0.10 | 2.80 | 0.53 - 1.84 |
| STAP-981 | Air Filter | 03/01/03 | Uranium | 0.51 ± 0.10 | 0.50 | 0.79 - 2.10 |
| STAP-982 | Air Filter | 03/01/03 | Gr. Alpha | 0.90 ± 0.10 | 1.17 | 0.73 - 1.43 |
| STAP-982 | Air Filter | 03/01/03 | Gr. Beta | 1.50 ± 0.10 | 1.50 | 0.76 - 1.36 |

TABLE A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)

| Lab Code | Type | Date | Concentration[a] Analysis | Laboratory results | EML Result[b] | Control Limits[c] |
|---|---|---|---|---|---|---|
| STW-992 | water | 09/02/03 | Am-241 | 9.78 ± 0.32 | 8.76 | 0.79 - 1.41 |
| The September, 2003 results are preliminary. Control limits used were taken from the March, 2003 data. Control limits may vary slightly when the final study is published. | | | | | | |
| STW-992 | water | 09/02/03 | Co-60 | 468.30 ± 4.10 | 513.00 | 0.80 - 1.20 |
| STW-992 | water | 09/02/03 | Cs-134 | 53.90 ± 0.80 | 63.00 | 0.80 - 1.30 |
| STW-992 | water | 09/02/03 | Cs-137 | 76.10 ± 1.40 | 80.30 | 0.80 - 1.22 |
| STW-992 | water | 09/02/03 | H-3 | 355.20 ± 12.80 | 446.30 | 0.78 - 2.45 |
| STW-992 | water | 09/02/03 | Pu-238 | 1.71 ± 0.07 | 2.07 | 0.74 - 1.20 |
| STW-992 | water | 09/02/03 | Pu-239/40 | 4.24 ± 0.01 | 4.99 | 0.79 - 1.20 |
| STW-992 | water | 09/02/03 | Sr-90 | 6.70 ± 0.50 | 7.04 | 0.69 - 1.34 |
| STW-992 | water | 09/02/03 | Uranium | 6.03 ± 0.14 | 5.69 | 0.75 - 1.33 |
| STW-993 | water | 09/02/03 | Gr. Alpha | 688.00 ± 7.60 | 622.00 | 0.58 - 1.29 |
| STW-993 | water | 09/02/03 | Gr. Beta | 1985.00 ± 111.00 | 1948.00 | 0.61 - 1.43 |
| STSO-994 | soil | 09/02/03 | Am-241 | 19.70 ± 1.50 | 18.40 | 0.65 - 2.28 |
| STSO-994 | soil | 09/02/03 | Cs-137 | 1928.00 ± 19.00 | 1973.00 | 0.80 - 1.25 |
| STSO-994 | soil | 09/02/03 | K-40 | 533.00 ± 79.00 | 488.00 | 0.80 - 1.32 |
| STSO-994 | soil | 09/02/03 | Pu-238 | 15.30 ± 0.80 | 14.60 | 0.59 - 2.88 |
| STSO-994 | soil | 09/02/03 | Pu-239/40 | 32.50 ± 2.30 | 30.40 | 0.71 - 1.30 |
| STSO-994 | soil | 09/02/03 | Sr-90 | 69.80 ± 2.30 | 80.30 | 0.67 - 2.90 |
| STSO-994 | soil | 09/02/03 | Uranium | 228.30 ± 17.10 | 259.30 | 0.71 - 1.32 |
| STAP-995 | Air Filter | 09/02/03 | Am-241 | 0.64 ± 0.05 | 0.44 | 0.70 - 2.34 |
| STAP-995 | Air Filter | 09/02/03 | Co-60 | 48.50 ± 0.40 | 55.10 | 0.80 - 1.26 |
| STAP-995 | Air Filter | 09/02/03 | Cs-137 | 51.20 ± 1.10 | 54.80 | 0.80 - 1.32 |
| STAP-995 | Air Filter | 09/02/03 | Mn-54 | 53.70 ± 1.10 | 58.00 | 0.80 - 1.35 |
| STAP-995 | Air Filter | 09/02/03 | Pu-238 | 0.24 ± 0.05 | 0.23 | 0.67 - 1.33 |
| STAP-995 | Air Filter | 09/02/03 | Pu-239/40 | 0.41 ± 0.10 | 0.40 | 0.73 - 1.26 |
| STAP-995 | Air Filter | 09/02/03 | Sr-90 | 1.90 ± 0.10 | 2.06 | 0.53 - 1.84 |
| STAP-995 | Air Filter | 09/02/03 | Uranium | 0.80 ± 0.06 | 0.82 | 0.79 - 2.10 |
| STAP-996 | Air Filter | 09/02/03 | Gr. Alpha | 3.23 ± 0.07 | 3.11 | 0.73 - 1.43 |
| STAP-996 | Air Filter | 09/02/03 | Gr. Beta | 4.18 ± 0.03 | 3.89 | 0.76 - 1.36 |

[a] Results are reported in Bq/L with the following exceptions: Air Filters (Bq/Filter), Soil and Vegetation (Bq/kg).

[b] The EML result listed is the mean of replicate determinations for each nuclide ± the standard error of the mean.

[c] *Control limits are reported by EML as the ratio of Reported Value / EML value.*

[d] A low bias for Cs-134 activity has been observed in the past. No errors have been found in the library or efficiency. Additional spike analyses will be performed and a correction factored into the calculation.

[e] Reporting error.

# APPENDIX B

## DATA REPORTING CONVENTIONS

## Data Reporting Conventions

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

2.0. Single Measurements

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

where: $x$ = value of the measurement;

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

In cases where the activity is less than the lower limit of detection L, it is reported as: <L,

where L = the lower limit of detection based on 4.66s uncertainty for a background sample.

3.0. Duplicate analyses

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

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

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

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

4.0. Computation of Averages and Standard Deviations

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

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

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

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

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

4.5 In rounding off, the following rules are followed:

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

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

# APPENDIX C

Maximum Permissible Concentrations

of Radioactivity in Air and Water

Above Background in Unrestricted Areas

Table C-1. Maximum permissible concentrations of radioactivity in air and water above natural background in unrestricted areas[a].

| | Air ($pCi/m^3$) | | Water (pCi/L) |
|---|---|---|---|
| Gross alpha | $1 \times 10^{-3}$ | Strontium-89 | 8,000 |
| Gross beta | 1 | Strontium-90 | 500 |
| Iodine-131[b] | $2.8 \times 10^{-1}$ | Cesium-137 | 1,000 |
| | | Barium-140 | 8,000 |
| | | Iodine-131 | 1,000 |
| | | Potassium-40[c] | 4,000 |
| | | Gross alpha | 2 |
| | | Gross beta | 10 |
| | | Tritium | $1 \times 10^6$ |

a Taken from Table 2 of Appendix B to Code of Federal Regulations Title 10, Part 20, and appropriate footnotes. Concentrations may be averaged over a period not greater than one year.

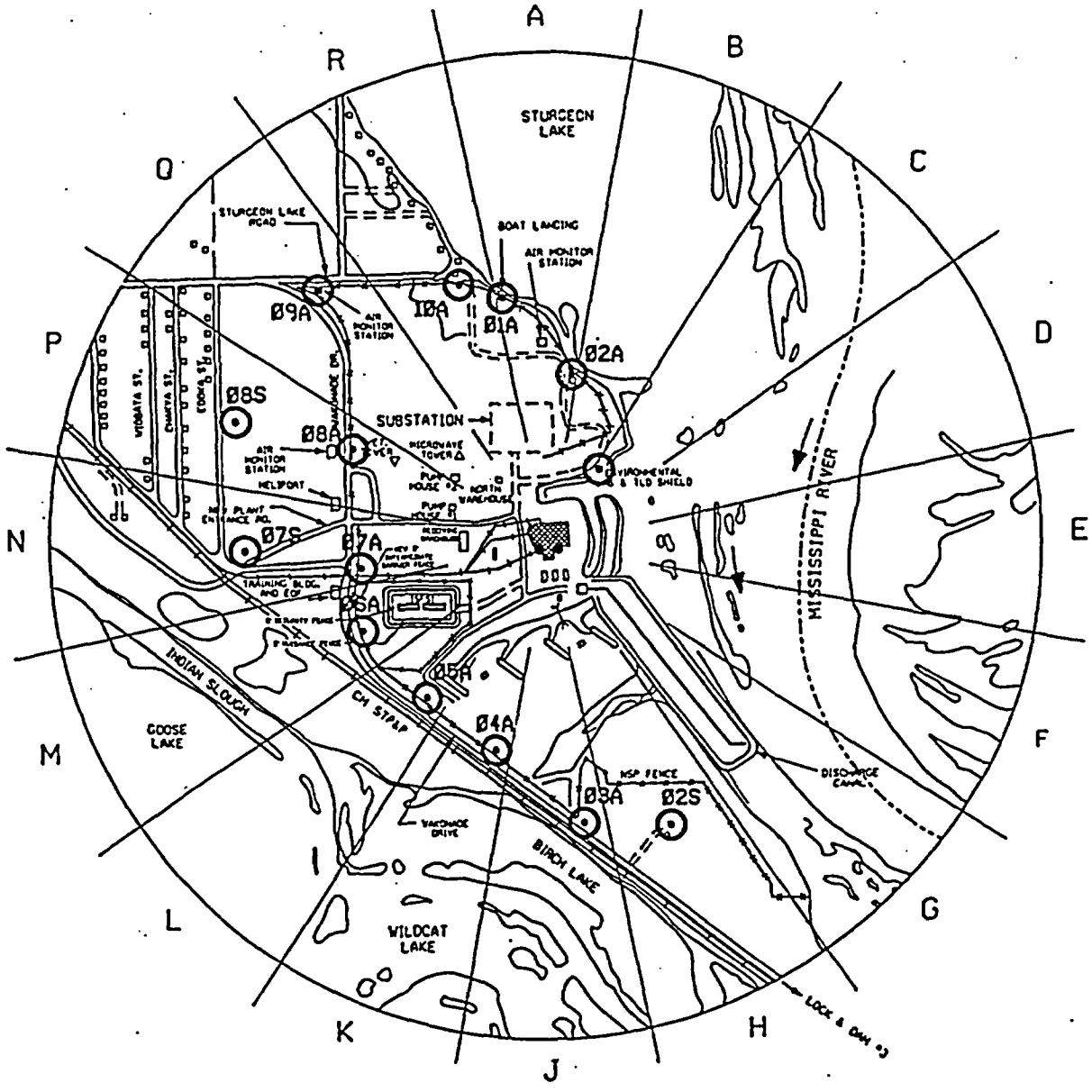
b Value adjusted by a factor of 700 to reduce the dose resulting from the air-grass-cow-milk-child pathway.

c A natural radionuclide.

# APPENDIX D

Sampling Location Maps

# TLD LOCATIONS
# ONE MILE RADIUS




PLANT AREA ENLARGED PLAN [1.00 MILE RADIUS]

[NO SCALE]

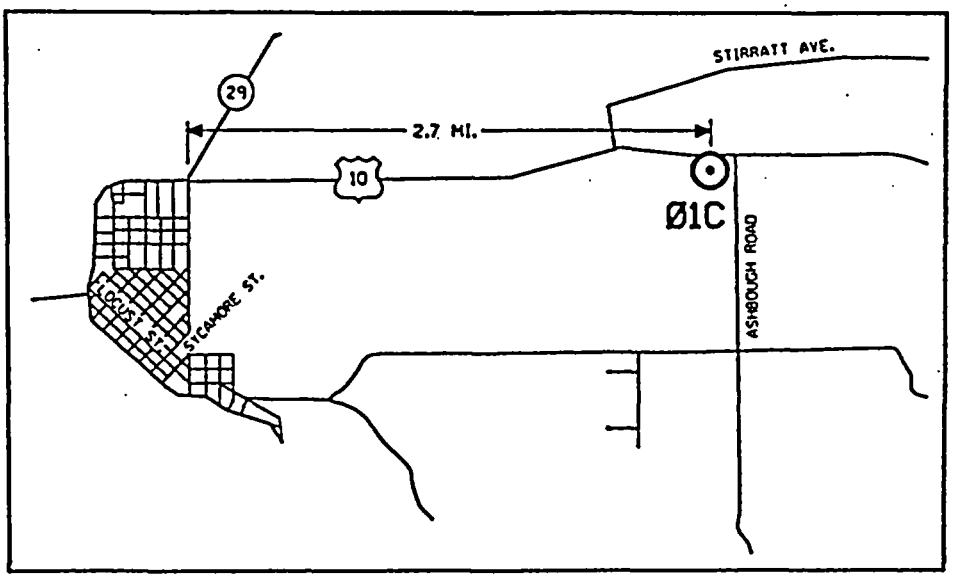
MONITORING LEGEND:

⊙ N.S.P. TLD POINTS

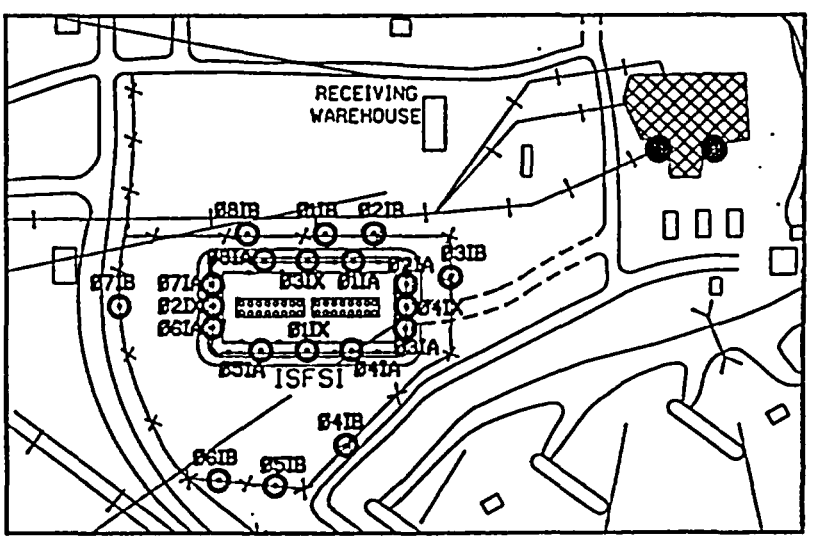


TLD01.DGN

# TLD LOCATIONS




## CONTROL POINTS
PRESCOTT, WISCONSIN




## ISFSI AREA TLD LOCATIONS

MONITORING LEGEND:

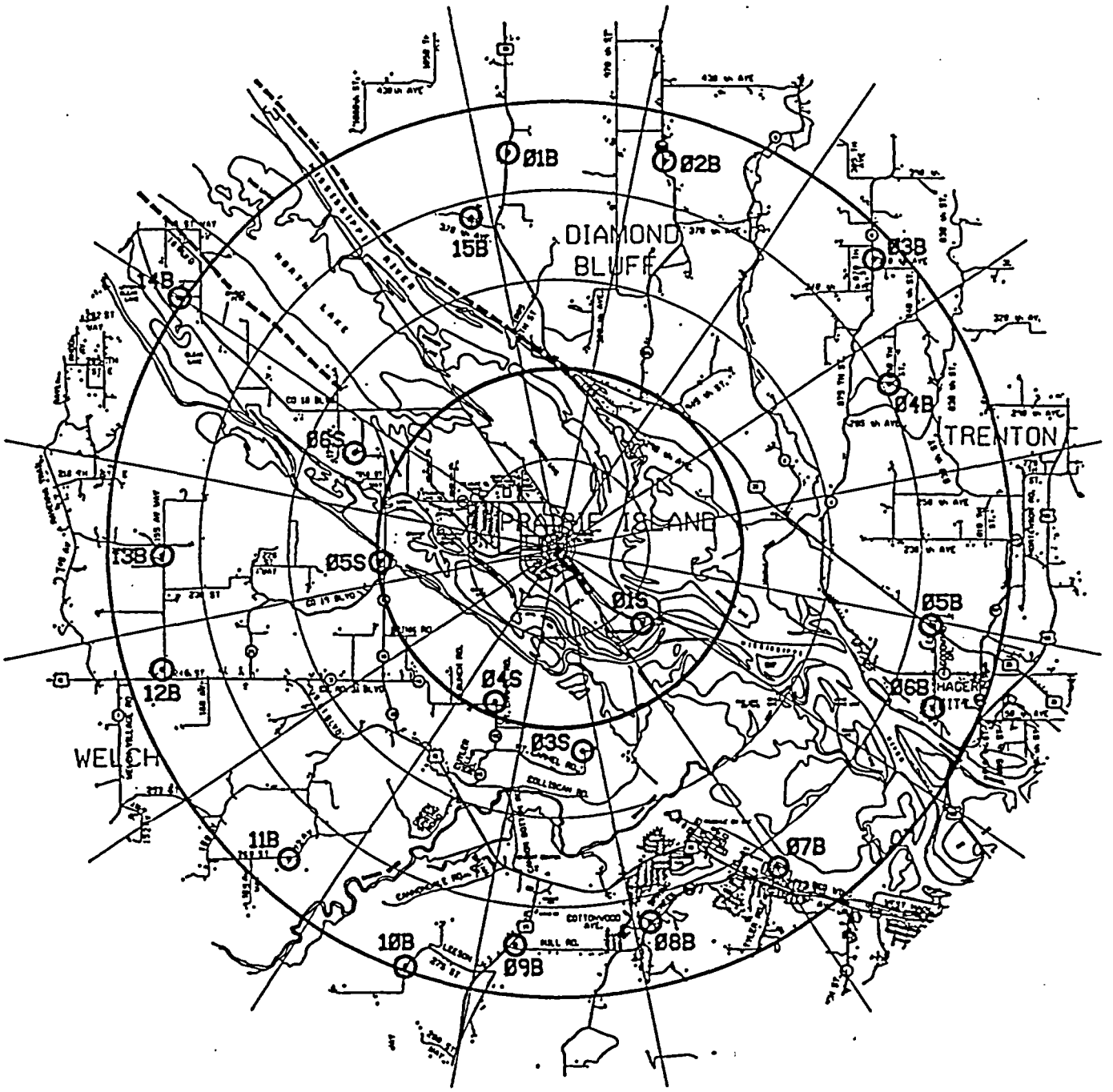
⊙ N.S.P. TLD POINTS



TLDØ2.DGN

TLD LOCATIONS

FIVE MILE RADIUS



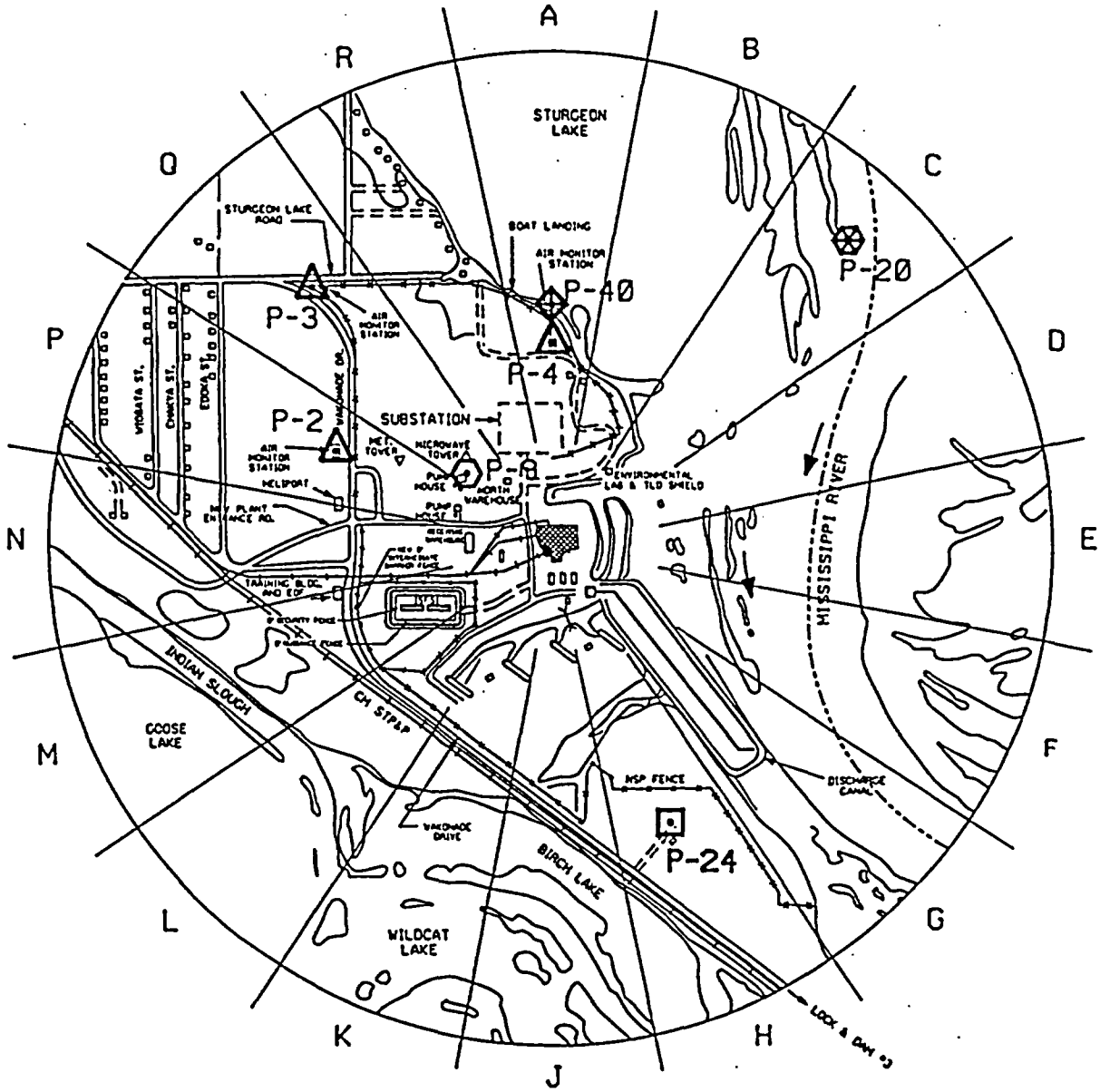

MONITORING LEGEND:

⊙ N.S.P. TLD POINTS



TLDØ3.DGN

# ENVIRONMENTAL SAMPLING POINTS
## ONE MILE RADIUS




PLANT AREA ENLARGED PLAN [1.00 MILE RADIUS]

[NO SCALE]

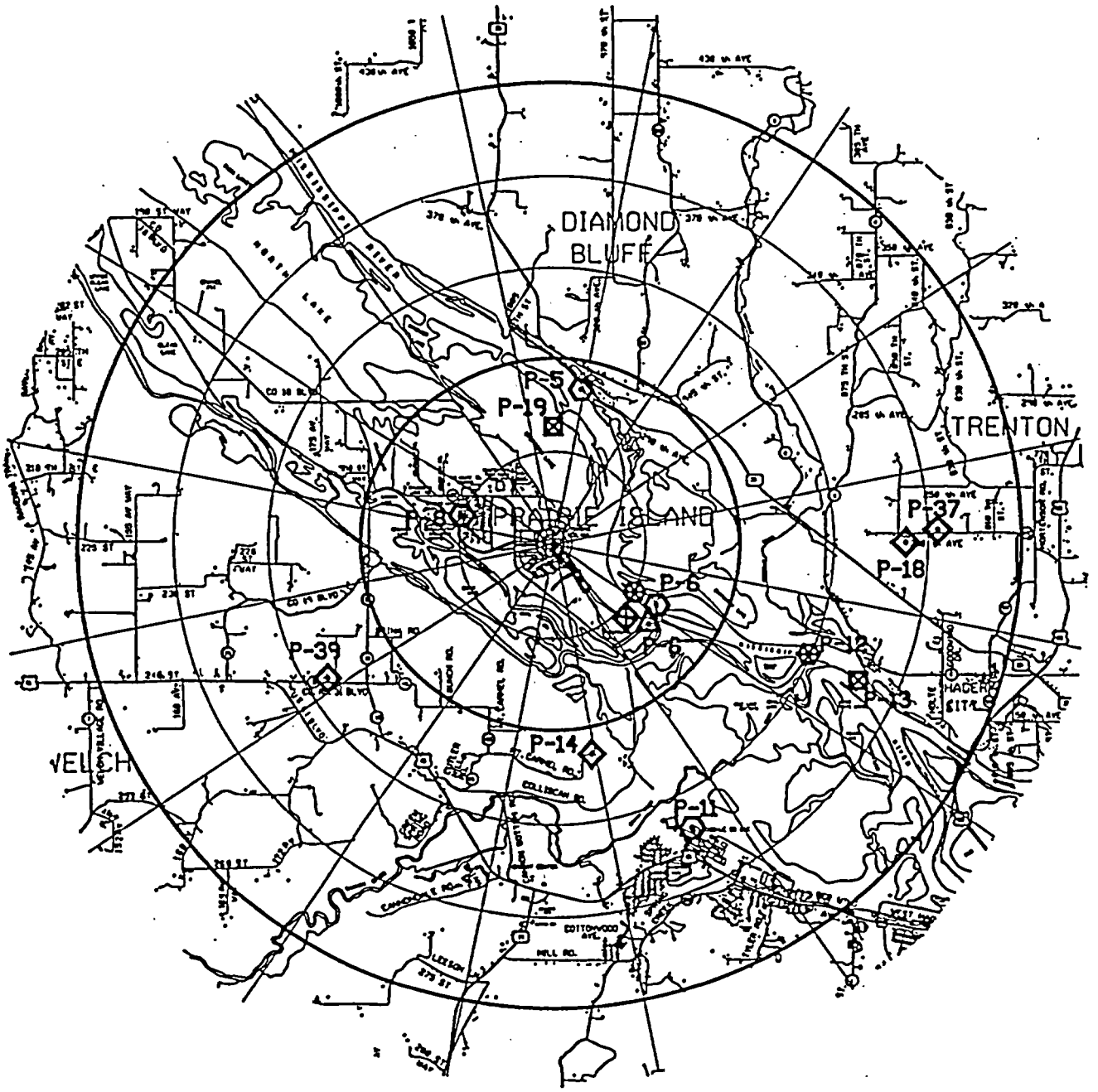
MONITORING LEGEND

- MILK SAMPLING POINT ID NUMBERS P-14, P-18, P-25, P-37, P-39
- AIR SAMPLING POINT ID NUMBERS P-1, P-2, P-3, P-4, P-6
- WATER SAMPLING POINT ID NUMBERS P-5, P-6, P-8, P-9, P-11, P-25
- VEGETATION / VEGETABLES ID NUMBERS P-24, P-38
- FISH SAMPLING POINT ID NUMBERS P-13, P-19
- INVERTEBRATES POINT ID NUMBERS P-6, P-40
- SEDIMENT SAMPLING POINT ID NUMBERS P-6, P-12, P-20



SAMP01.DGN

# ENVIRONMENTAL SAMPLING POINTS
## FIVE MILE RADIUS



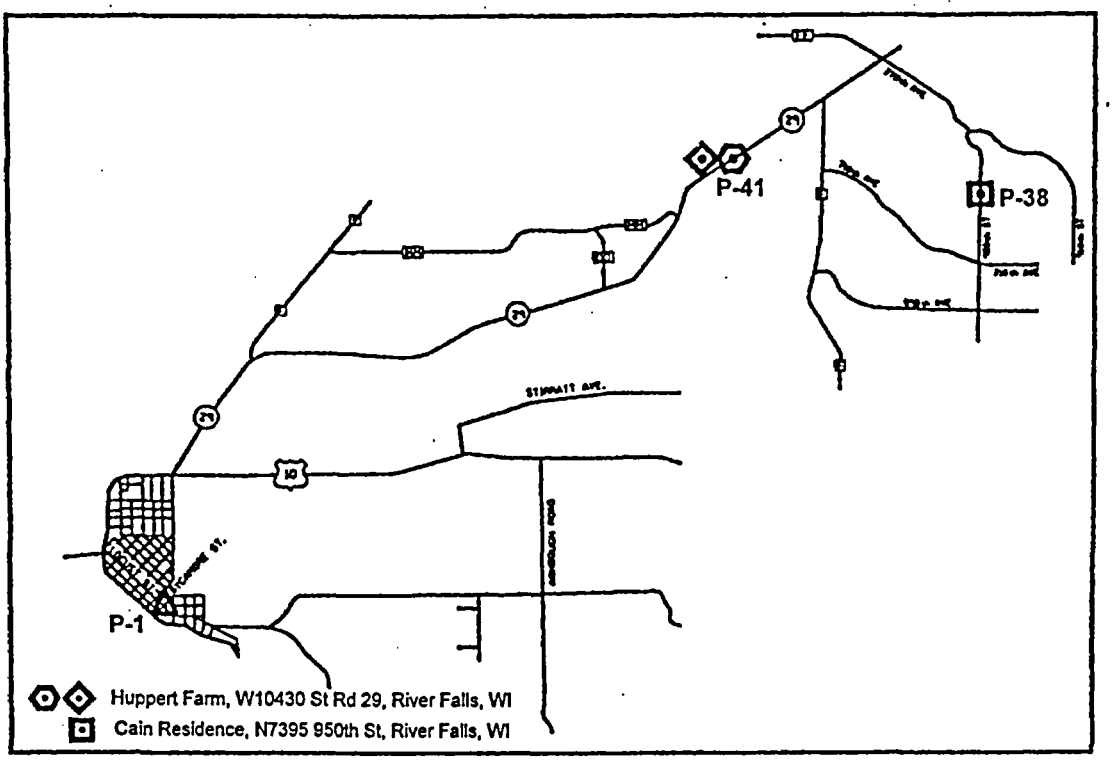

MONITORING LEGEND

- MILK SAMPLING POINT ID NUMBERS P-14, P-18, P-25, P-37, P-39
- AIR SAMPLING POINT ID NUMBERS P-1, P-2, P-3, P-4, P-6
- WATER SAMPLING POINT ID NUMBERS P-5, P-6, P-8, P-9, P-11, P-25
- VEGETATION / VEGETABLES ID NUMBERS P-24, P-38
- FISH SAMPLING POINT ID NUMBERS P-13, P-19
- INVERTEBRATES POINT ID NUMBERS P-6, P-48
- SEDIMENT SAMPLING POINT ID NUMBERS P-6, P-12, P-28



SAMP03.DGN

# ENVIRONMENTAL SAMPLING POINTS




## CONTROL POINTS
## PRESCOTT, WISCONSIN

**Monitoring Legend**

- Milk Sampling Point ID Numbers
  P-14, P-18, P-37, P-39, P-41
- Air Sampling Point ID Numbers
  P-1, P-2, P-3, P-4, P-6
- Water Sampling Point ID Numbers
  P-5, P-6, P-8, P-9, P-11, P-41
- Vegetation / Vegetables Point ID Numbers
  P-24, P-38



SAMP02.DGN