



Northern States Power Company

Monticello Nuclear Generating Plant
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US Nuclear Regulatory Commission
Attention: Document Control Desk
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Monticello Nuclear Generating Plant
Docket No. 50-263 License No. DPR-22

1993 Annual Radiological Environmental Monitoring Report

In accordance with the Monticello Technical Specifications, Appendix A to Operating License DPR-22, we are submitting the Annual Radiological Monitoring Report, covering the period January 1 through December 31 of 1993.

Respectfully submitted,

John Windschill, General Superintendent Radiological Services

JEW:mwl
Attachment

cc: Monticello REMP File
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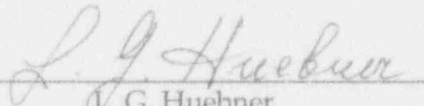
MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263 LICENSE NO. DPR-22

ANNUAL REPORT
TO THE
UNITED STATES REGULATORY COMMISSION

Radiation Environmental Monitoring Program
January 1, 1993 to December 31, 1993
Project No. 8010

Prepared under Contract
by
TELEDYNE ISOTOPES MIDWEST LABORATORY
Project No. 8010

Approved by: _____


L. G. Huebner
General Manager

23 March 1994

PREFACE

The staff of Teledyne Isotopes Midwest Laboratory was responsible for the acquisition of the data presented in this report. Samples were collected by members of the staff of the Monticello Nuclear Generating Plant, Northern States Power Company. The report was prepared by L.G. Huebner, General Manager, Teledyne Isotopes Midwest Laboratory. He was assisted in the report preparation by other staff members of this laboratory.

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiation Environmental Monitoring Program (REMP) conducted by Teledyne Isotopes Midwest Laboratory at the Monticello Nuclear Generating Plant, Monticello, Minnesota, during the period January - December, 1993. 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.

Tabulation of the individual analyses made during the year are not included in this report. These data are included in a reference document (Teledyne Isotopes Midwest Laboratory, 1994a) available at Northern States Power Company, Nuclear Generation Department.

Monticello Nuclear Generating Plant is a 545 MWe boiling water reactor located on the Mississippi River in Wright County, Minnesota, and operated by Northern States Power Company. Initial criticality was achieved on 10 December 1970. Full power was achieved on 5 March 1971 and commercial operation began on 30 June 1971.

2.0 SUMMARY

The Radiation Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Monticello Nuclear Generating Plant is described. Results for 1993 are summarized and discussed.

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

No effect on the environment due to the operation of the Monticello Generating Plant is indicated.

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 Monticello 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 (TLD's).

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
- () 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 Monticello 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 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 as 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.

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 (REMP) at the Monticello Plant 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. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Monticello Nuclear Generating Plant, 1987). Maps of 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. Also, airborne iodine is collected by continuous pumping through charcoal filters at all of these 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 gamma-scanned on a HP Ge or Ge(Li) detector. One of the five locations is a control (M-1), and four are indicators (M-2, M-3, M-4, M-5). One of the indicators is located in the geographical sector expected to be most susceptible to any atmospheric emissions from the Plant (highest D/Q sector).

As a "Lessons Learned" commitment, ambient gamma radiation is monitored at thirty-seven (37) locations, using $\text{CaSO}_4:\text{Dy}$ dosimeter with four sensitive areas at each location: fourteen (14) in an inner ring in the general area of the site boundary, sixteen (16) in the outer ring within 4-5 mile radius, six (6) 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 TLD's for all locations is placed in the field at the same time as regular sets. The emergency set is returned to TIML quarterly for annealing and repackaging.

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

Leafy green vegetables (cabbage) are collected annually from the highest D/Q garden and a control location and analyzed for iodine-131. Corn and potatoes are collected annually only if the field is irrigated by water in which radioactive effluent has been discharged. Analysis is for gamma-emitting isotopes.

The terrestrial environment is also monitored by collection of well water from four locations on a quarterly basis. All samples are analyzed for tritium and gamma-emitting isotopes.

River water is collected weekly at two locations, one upstream of the plant and one downstream. Monthly composites are analyzed for gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

Drinking water is collected weekly from the City of Minneapolis water supply, which is taken from the Mississippi River downstream of the Plant. 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, algae or aquatic insects, 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) There was no TLD data for location M-04B for the second quarter of 1993. The TLD's were lost in the field.

Deviations from the program are summarized in Table 5.3.

3.4 Laboratory Procedures

The iodine-131 analyses in milk and drinking water were made using a sensitive radiochemical procedure which involves separation of the iodine using an ion-exchange method and solvent extraction and subsequent beta counting.

All gamma-spectroscopic analyses were performed with an HP Ge or Ge(Li) detector. Levels of iodine-131 in cabbage and natural vegetation were determined by HP Ge or Ge(Li) spectrometry. The concentrations of airborne iodine-131 in charcoal samples were measured by HP Ge or Ge(Li) spectrometry.

Tritium was determined by a liquid scintillation technique.

Analytical procedures used by the Teledyne Isotopes Midwest Laboratory are specified in detail elsewhere (Teledyne Isotopes Midwest Laboratory, 1993). Procedures are based on those prescribed by the National Center for Radiological Health of the U.S. Public Health Service (U.S. Public Health Service, 1967) and by the Health and Safety Laboratory of the U.S. Atomic Energy Commission (U.S. Atomic Energy Commission, 1972).

Teledyne Isotopes Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of TIML's QA Program are presented elsewhere (Teledyne Isotopes Midwest Laboratory, 1994). The TIML QA Program includes participation in Interlaboratory Comparison

3.4 Laboratory Procedures (continued)
(crosscheck) Programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

There were no program modifications in 1993.

3.6 Land Use Census

In accordance with the Technical Specifications 4.16 Paragraph B1, a land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 ft² producing fresh leafy vegetables, in each of the 16 meteorological sectors within a distance of 5 miles. The census shall also identify the locations of all milk animals and all 500 ft² or greater gardens producing broad leaf vegetation in each of the meteorological sectors within a distance of three miles. This census shall be conducted at least once per year between the dates of May 1 and October 31. New locations shall be 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. The 1993 land use census was conducted between August 17 and August 26, 1993. One change for the highest D/Q garden location was identified. This location was moved from the SSE sector to the SSW sector. The dairy farm (M-28) is still ranked as the highest D/Q location for milk. The highest D/Q residence remained the same.

4.0 RESULTS AND DISCUSSION

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

All 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 1993. The last reported test was conducted by the People's Republic of China on October 16, 1980. The reported yield was in the 200 kiloton to 1 megaton range.

There were no reported accidents with significant releases in 1993.

4.2 Summary of Preoperational Data

The following constitutes a summary of preoperational studies conducted at the Monticello Nuclear Generating Plant during the years 1968 to 1970, 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 to make, since background levels of radiation were much higher in these years due to radioactive fallout from the atmosphere. Gross beta measurements in fallout averaged 20,600 pCi/m² in 1969 and 12,000 pCi/m² in 1970. These levels are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.1 mR/4 weeks during preoperational studies (1970). Gross beta in air particulates in 1969 and 1970 averaged 0.20 pCi/m³. Average levels today have stabilized at around 0.025 pCi/m³. Airborne radioiodine remained below detection levels.

In the terrestrial environment of 1968 to 1970, milk, agricultural crops, and soil were monitored. In milk samples, low levels of Cs-137 and Sr-90 were detected. Cs-137 levels averaged 16.7 pCi/L. Soybean crop measurements in 1969 averaged 35.5 pCi/g for gross beta and 0.3 pCi/g for Cs-137. Gross beta measured in soil averaged 51.7 pCi/g gross beta. Measurements today for cesium-137 are below detection levels in milk and agricultural crops.

The aquatic environment was monitored by testing of river water, bottom and shoreline sediments, fish, aquatic vegetation, and periphyton. Specific location comparison of drinking water, river, and well water concentrations for tritium and gross beta are not possible. However, tritium background levels, measured at seven separate locations from 1968 to 1970, averaged 970 pCi/L. Levels of tritium today measure below 330 pCi/L. Values for gross beta, measured from 1968 to 1970, averaged 9.8 pCi/L in upstream and downstream Mississippi River water, 4.4 pCi/L for well waters, and 18.6 pCi/L for lake waters. Gamma emitters were below the lower limit of detection (LLD). In bottom sediments, the gross beta background levels in 1970 averaged 49.8 pCi/g for both upstream and downstream samples. Cs-137 activity averaged 0.10 pCi/g for both upstream and downstream samples. The lower levels of Cs-137 that are occasionally observed today can

be attributed to residual activity from atmospheric fallout. Gross beta levels in fish flesh averaged 5.3 pCi/g in 1968 and 1969. Cs-137, measured in 1969 and 1970, averaged 0.044 pCi/g. Gross beta background levels, in 1970 for aquatic vegetation, algae, and periphyton samples measured 36.7 pCi/g, 76.5 pCi/g, and 28.1 pCi/g respectively.

4.3 Program Findings

Results obtained show background levels of radioactivity in the environmental samples collected in the vicinity of the Monticello Nuclear Generating Plant in 1993.

Ambient Radiation (TLDs)

Ambient radiation was measured in the general area of site boundary, at outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at one control location. The means were similar for both inner and outer rings (15.6 and 15.9 mR/91 days, respectfully). The mean for special locations was 15.4 mR/91 days. The mean for the control location was 15.3 mR/91 days. The differences are not statistically significant. The dose rates measured were similar to those observed in 1978, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, and 1992 (12.3, 12.5, 13.6, 14.2, 15.3, 15.4, 15.2, 15.2, 16.2, 15.5, and 15.2 mR/91 days, respectfully). No Plant effect on ambient gamma radiation was indicated.

Airborne Particulates

The average annual gross beta concentration in airborne particulates was identical at indicator and control locations (0.023 pCi/m³) and was nearly identical or similar to the levels observed in 1982 (0.026 pCi/m³), 1983 (0.023 pCi/m³), 1984 (0.024 pCi/m³), 1985 (0.025 pCi/m³), 1986 (0.026 pCi/m³), 1987 (0.026 pCi/m³), 1988 (0.030 pCi/m³), 1989 (0.026 pCi/m³), 1990 (0.023 pCi/m³), 1991 (0.024 pCi/m³), and 1992 (0.023 pCi/m³). The average of 0.026 pCi/m³ for 1986 does not include the results from May 19 to June 9, 1986, which were influenced by the accident at Chernobyl.

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 did not occur in 1983 through 1993. In 1986, the spring peak could not be identified because it was overshadowed by the releases of radioactivity from Chernobyl. From 1983 to 1993, the highest averages for gross beta occurred in the months of January and December (the first and fourth quarters, exclusive of the period between May 19, 1986 and June 9, 1986).

Two pieces of evidence indicate conclusively that the elevated activity observed during the first and fourth quarters 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 Prairie Island Nuclear Generating Plant, about 100 miles distant from the Monticello Nuclear Generating Plant (Northern States Power Company, 1993b).

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced

Airborne Particulates (continued)

continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955) was detected in all samples, with an average of 0.061 pCi/m^3 at both indicators and control locations. 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.

Milk

Iodine-131 results were below the detection limit of 1.0 pCi/L in all samples.

Cesium-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 of the milk samples. This is consistent with the finding 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 1993 show no radiological effects of the plant operation.

River Water and Drinking Water

Tritium was below the LLD of 330 pCi/L in all samples. Gross beta in Minneapolis drinking water averaged 2.6 pCi/L and was lower or similar to average levels observed in 1977 (3.4 pCi/L), in 1978 (3.8 pCi/L), in 1979 (3.4 pCi/L), in 1980 (3.2 pCi/L), in 1981 (3.5 pCi/L), in 1982 (2.9 pCi/L), in 1983 (3.3 pCi/L), in 1984 (2.8 pCi/L), in 1985 (2.8 pCi/L), in 1986 (2.5 pCi/L), in 1987 (2.4 pCi/L), in 1988 (2.7 pCi/L), in 1989 (2.6 pCi/L), in 1990 (2.2 pCi/L), in 1991 (2.9 pCi/L), and in 1992 (2.1 pCi/L). Comparisons with gross beta data reported by EPA for Minneapolis drinking water sample collected in 1975, 1976, 1977, and 1978 indicates that concentrations of these nuclides are remaining fairly constant and are in the range of drinking water levels in other parts of the country (U.S. Environmental Protection Agency, 1975, 1976, 1977, 1978). Gamma-emitting isotopes were below detection limits in all surface water samples. There was no indication of a plant effect.

Well Water

The tritium level was below the LLD level of 330 pCi/L in all samples. All gamma scan results were below detection limits. There was no indication of a plant effect.

Crops

Two (2) samples of cabbage were collected in September and analyzed for iodine-131. The I-131 level was below 0.012 pCi/g wet weight in both samples. There was no indication of a plant effect. The field sampling personnel conducted a survey to a distance of five miles downstream on the Mississippi River ; no signs of irrigation were evident. One liquid release of tritium occurred in 1993, with a total activity of 1.88 E-05 Ci and an average diluted concentration of 7.69 E-10 μ Ci/ml. Therefore, no corn or potato samples were collected for analysis.

Fish

Fish samples were collected in April and October. Flesh was separated from the bones and gamma-scanned. Potassium-40, the naturally-occurring isotope, was found to be similar in upstream and downstream samples (3.14 and 2.86 pCi/g wet weight, respectively). All gamma-emitting isotopes were below their respective LLD levels. There was no indication of a plant effect.

Invertebrates

Two samples were collected in June and two in October. The samples were analyzed for gamma-emitting isotopes. All of the isotopes, except naturally-occurring K-40, were below detection limits. Potassium-40 averaged 2.16 pCi/g wet weight at the control location and 3.86 pCi/g wet weight at the indicator location. There was no indication of a plant effect.

Bottom and Shoreline Sediments

Bottom and shoreline sediment collections were made in June and October and analyzed for gamma-emitting isotopes. Cesium-137 was detected in two downstream bottom sediment samples, averaging 0.083 pCi/g dry weight, and in two shoreline sediment samples, averaging 0.096 pCi/g dry weight, indicating the influence of fallout deposition. Similar levels of activities and distribution were observed in 1978-1992. The only other gamma-emitting isotope detected was naturally-occurring potassium-40. There was no indication of a plant effect.

5.0 TABLES

Table 5.1. Sample collection and analysis program, Monticello Nuclear Generating Plant, 1993.

| Medium | Locations | | Collection Type and Frequency ^b | Analysis Type and Frequency ^c |
|--|-----------|--|--|--|
| | No. | Codes (and Type) ^a | | |
| Ambient Radiation (TLD's) | 37 | M-01A - M-14A M-01B - M-16B M-01S - M-06S M-01C | C/Q | Ambient gamma |
| Airborne particulates | 5 | M-1(C), M-2, M-3, M-4, M-5 | C/W | GB, GS (QC of each location) |
| Airborne Iodine | 5 | M-1(C), M-2, M-3, M-4, M-5 | C/W | I-131 |
| Milk | 4 | M-10 (C), M-24, M-28, M-29 | G/M ^d | I-131, GS |
| River water | 2 | M-8(C), M-9 | G/W | GS(MC), H-3(QC) |
| Drinking water | 1 | M-14 | G/W | GB(MC), I-131(MC) GS(MC), H-3(QC) |
| Well Water | 4 | M-10(C), M-11, M-12, M-13 | G/Q | H-3, GS |
| Edible cultivated crops - Cabbage | 2 | M-10 ^f (C), M-27 | G/A | I-131 |
| Edible cultivated crops - Corn ^e | 1 | M-19 | G/A | GS |
| Edible cultivated crops - Potatoes ^e | 1 | M-21 | G/A | GS |
| Fish (one species, edible portion) | 2 | M-8(C), M-9 | G/SA | GS |
| Algae or Aquatic Insects | 2 | M-8(C), M-9 | G/SA | GS |
| Bottom Sediment | 2 | M-8(C), M-9 | G/SA | GS |
| Shoreline Sediment | 1 | M-15 | G/SA | GS |

^a Location codes are defined in Table 5.2. 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) if milk animals are on pasture.

^e Collected only if the field is irrigated by water in which liquid radioactive effluent has been discharged.

^f No vegetables produced in 1993 at location M-10, Control cabbage sample obtained in Elk River, MN, 13.5 mi. @ 95° /E.

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant, 1993.

| Code | Type ^a | Collection Site | Type of Sample ^b | Distance and Direction from Site Stack |
|--|-------------------|---|-----------------------------|--|
| M-1 | C | Air Station M-1 | AP, AI | 11.1 mi @ 306°/NW |
| M-2 | | Air Station M-2 | AP, AI | 0.8 mi @ 140°/SE |
| M-3 | | Air Station M-3 | AP, AI | 0.6 mi @ 104°/ESE |
| M-4 | | Air Station M-4 | AP, AI | 0.9 mi @ 150°/SSE |
| M-5 | | Air Station M-5 | AP, AI | 2.7 mi @ 136°/SE |
| M-8 | C | Upstream of Plant | RW, BS, BO, F | 0.2 mi @ 285°/WNW |
| M-9 | | Downstream of Plant | RW, BS, BO, F | 0.2 mi @ 62°/ENE |
| M-10 | C | Kirchenbauer Farm | M, WW | 11.5 mi @ 323°/NW |
| M-11 | | City of Monticello | WW | 3.2 mi @ 128°/SE |
| M-12 | | Plant Well #1 | WW | 0.2 mi @ 267°/W |
| M-13 | | Ernst Residence | WW | 0.6 mi @ 202°/SSW |
| M-14 | | City of Minneapolis | DW | 36.0 mi @ 128°/SE |
| M-15 | | Montissippi Park | SS | 1.6 mi @ 117°/ESE |
| M-19 | | River Irrigated Corn Field ^c | | |
| M-21 | | River Irrigated Potato Field ^c | | |
| M-24 | | Weinand Farm | M | 4.8 mi @ 180°/S |
| M-27 | | Wise Residence - Highest D/Q garden | VE | 0.7 mi @ 208°/SSW |
| M-28 | | Hoglund Farm | M | 3.7 mi @ 300°/WNW |
| | | Highest D/Q dairy | | |
| M-29 | | Holthaus Farm | M | 4.1 mi @ 173°/S |
| | C | Elk River, MN Vegetable Garden | VE | 13.5 mi @ 95° / E |
| <u>General Area of the Site Boundary</u> | | | | |
| M-01A | | North Boundary Road | TLD | 0.7 mi @ 353°/N |
| M-02A | | North Boundary Road | TLD | 0.8 mi @ 23°/NNE |
| M-03A | | North Boundary Road | TLD | 1.0 mi @ 43°/NE |
| M-04A | | Biology Station Road | TLD | 0.7 mi @ 92°/E |
| M-05A | | Biology Station Road | TLD | 0.6 mi @ 112°/ESE |
| M-06A | | Biology Station Road | TLD | 0.6 mi @ 133°/SE |
| M-07A | | County Road 75 | TLD | 0.5 mi @ 158°/SSE |
| M-08A | | County Road 75 | TLD | 0.5 mi @ 183°/S |
| M-09A | | County Road 75 | TLD | 0.4 mi @ 203°/SSW |
| M-10A | | County Road 75 | TLD | 0.3 mi @ 225°/SW |
| M-11A | | County Road 75 | TLD | 0.4 mi @ 250°/WSW |
| M-12A | | County Road 75 | TLD | 0.7 mi @ 273°/W |
| M-13A | | North Boundary Road | TLD | 1.1 mi @ 317°/NW |
| M-14A | | North Boundary Road | TLD | 0.8 mi @ 338°/NNW |

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant, 1993 (continued).

| Code | Type ^a | Collection Site | Type of Sample | Distance and Direction From Site Stack |
|--|-------------------|--|----------------|--|
| <u>Approximately 4 to 5 miles Distant from the Plant</u> | | | | |
| M-01B | | Sherco #1 Air Station | TLD | 4.6 mi @ 02°/N |
| M-02B | | County Road 11 | TLD | 4.4 mi @ 17°/NNE |
| M-03B | | Intersection of County Road & Route 81 | TLD | 4.5 mi @ 49°/NE |
| M-04B | | Sherco #6 Air Station | TLD | 4.2 mi @ 67°/ENE |
| M-05B | | City of Big Lake | TLD | 4.4 mi @ 87°/E |
| M-06B | | County Road #14 and 196th St. | TLD | 4.3 mi @ 116°/ESE |
| M-07B | | Monte Industrial Drive | TLD | 4.4 mi @ 135°/SE |
| M-08B | | Dale K. Larson Residence | TLD | 4.6 mi @ 162°/SSE |
| M-09B | | Norbert Weinand Farm | TLD | 4.7 mi @ 180°/S |
| M-10B | | John Reisewitz Farm | TLD | 4.4 mi @ 206°/SSW |
| M-11B | | Clifford Vanlith Farm | TLD | 4.2 mi @ 225°/SW |
| M-12B | | Lake Maria State Park | TLD | 4.4 mi @ 253°/WSW |
| M-13B | | Bridgewater Station | TLD | 4.1 mi @ 271°/W |
| M-14B | | Richard K. Anderson Residence | TLD | 4.5 mi @ 228°/WNW |
| M-15B | | Gary Williamson Residence | TLD | 4.5 mi @ 308°/NW |
| M-16B | | Sand Plain Research Farm | TLD | 4.3 mi @ 338°/NNW |
| <u>Special Interest Locations</u> | | | | |
| M-01S | | Osowski's Orchard | TLD | 0.7 mi @ 230°/SW |
| M-02S | | Edgar Klucas Residence | TLD | 0.7 mi @ 142°/SE |
| M-03S | | Big Oaks Park | TLD | 1.3 mi @ 89°/E |
| M-04S | | Pinewood School | TLD | 2.3 mi @ 132°/SE |
| M-05S | | Roman Greener Residence | TLD | 2.5 mi @ 112°/ESE |
| M-06S | | Monticello Public Works Building | TLD | 2.7 mi @ 136°/SE |
| M-01C | C | Kirchenbaur Farm | TLD | 11.5 mi @ 323°/NW |

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

^b Sample Codes:

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

^c Collected only if the field is irrigated by water in which liquid radioactive effluent has been discharged.

Table 5.3. Missed collections and analyses for 1993 at the Monticello Nuclear Generating Plant.
All required samples were collected and analyzed as scheduled except the following:

| Sample | Analysis | Location | Collection Date or Period | Reason for not conducting REMP as required | Plans for Preventing Recurrence |
|--------|----------|----------|---------------------------|--|---|
| TLD | Gamma | M-04B | 2nd Qtr., 1993 | TLD lost in the field. | Relocated away from highway to reduce potential for vandalism |

Table 5.4. Radiation Environmental Monitoring Program Summary.

| | | | |
|----------------------|--------------------------------------|------------------|-------------------------|
| Name of Facility | Monticello Nuclear Generating Plant | Docket No. | 50-263 |
| Location of Facility | Wright, Minnesota (County, State) | Reporting Period | January - December 1993 |

| Sample Type (Units) | Type and Number of Analyses ^a | LLD ^b | Indicator Locations Mean (F) ^c Range ^c | Location with Highest Quarterly Mean | | Control Locations Mean (F) ^c Range | Number Non-Routine Results ^e |
|--|--|------------------|--|--|---|---|---|
| | | | | Location ^d | Mean (F) ^c Range ^c | | |
| TLD (mR/91 days) (Inner Ring, General Area at Site Boundary) | Gamma 56 | 3.0 | 15.6 (56/56) (12.5-20.5) | M-12A, Cty Rd 75 0.7 mi @ 273°/W | 17.6 (4/4) (14.7-20.5) | (See Control below.) | 0 |
| TLD (mR/91 days) (Outer Ring, 4 - 5 miles distant) | Gamma 63 | 3.0 | 15.9 (63/63) (12.3-22.7) | M-05B, City of Big Lake 4.4 mi @ 87°/E | 20.9 (4/4) (19.2-22.7) | (See Control below.) | 0 |
| TLD (mR/91 days) (Special Interest Areas) | Gamma 24 | 3.0 | 15.4 (24/24) (12.1-18.0) | M-06S, Monte Service Center 2.7 mi @ 136°/SE | 16.8 (4/4) (15.6-18.0) | (See Control below.) | 0 |
| TLD (mR/91 days) (Control) | Gamma 4 | 3.0 | None | M-01C, Kirchenbauer Farm, 11.5 mi @ 323°/NW | 15.3 (4/4) (14.4-16.1) | 15.3 (4/4) (14.4-16.1) | 0 |
| Airborne Particulates (pCi/m ³) | GB 260 | 0.003 | 0.024 (208/208) (0.008-0.064) | Three locations had identical means | 0.024 (156/156) (0.008-0.064) | 0.023 (52/52) (0.008-0.057) | 0 |
| | GS 20 | | | | | | |
| | Be-7 | 0.020 | 0.061 (16/16) (0.045-0.080) | M-3, Station M-3 0.6 mi. @104°/ESE | 0.065 (4/4) (0.050-0.078) | 0.061 (4/4) (0.041-0.070) | 0 |
| | Mn-54 | 0.0013 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 0.0016 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 0.0016 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 0.0031 | <LLD | - | - | <LLD | 0 |
| | Zr-Nb-95 | 0.0029 | <LLD | - | - | <LLD | 0 |
| | Ru-103 | 0.0013 | <LLD | - | - | <LLD | 0 |
| | Ru-106 | 0.0097 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 0.0014 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 0.0012 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 0.0055 | <LLD | - | - | <LLD | 0 |
| | Ce-141 | 0.0027 | <LLD | - | - | <LLD | 0 |
| | Ce-144 | 0.0066 | <LLD | - | - | <LLD | 0 |
| Airborne Iodine (pCi/m ³) | I-131 260 | 0.07 | <LLD | - | - | <LLD | 0 |

Table 5.4. Radiation Environmental Monitoring Program Summary.

Name of Facility Monticello Nuclear Generating Plant
 Location of Facility Wright, Minnesota
 (County, State)

Docket No. 50-263
 Reporting Period January - December 1993

| Sample Type (Units) | Type and Number of Analyses ^a | LLD ^b | Indicator Locations Mean (F) ^c Range ^c | Location with Highest Quarterly Mean | | Control Locations Mean (F) ^c Range | Number Non-Routine Results ^e |
|---------------------|--|------------------|--|---|---|---|---|
| | | | | Location ^d | Mean (F) ^c Range ^c | | |
| Milk, (pCi/L) | I-131 76 | 1.0 | <LLD | - | - | <LLD | 0 |
| | GS 76 | | | | | | |
| | K-40 | 200 | 1320 (57/57) (1160-1500) | M-10, Kirchenbauer Farm 11.5 mi @ 323°/NW | 1360 (19/19) (1120-1520) | 1360 (19/19) (1120-1520) | 0 |
| | Cs-134 | 15 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 15 | <LLD | - | - | <LLD | 0 |
| | Other gammas | 15 | <LLD | - | - | <LLD | 0 |
| River Water (pCi/L) | H-3 8 | 330 | <LLD | - | - | <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 | 10 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 10 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 15 | <LLD | - | - | <LLD | 0 |
| | Ce-144 | 60 | <LLD | - | - | <LLD | 0 |

Table 5.4. Radiation Environmental Monitoring Program Summary.

Name of Facility Monticello Nuclear Generating Plant
 Location of Facility Wright, Minnesota
 (County, State)

Docket No. 50-263
 Reporting Period January - December 1993

| Sample Type (Units) | Type and Number of Analyses ^a | LLD ^b | Indicator Locations Mean (F) ^c Range ^c | Location with Highest Quarterly Mean | | Control Locations Mean (F) ^c Range | Number Non-Routine Results ^e |
|-----------------------------|--|------------------|--|--------------------------------------|--|---|---|
| | | | | Location ^d | Mean (F) ^c Range ^c | | |
| Drinking Water (pCi/L) | GB 12 | 1.0 | 2.6 (12/12) (1.5-5.8) | M-14, Minneapolis 36 mi @ 128°/SE | 2.6 (12/12) (1.5-5.8) | None | 0 |
| | I-131 12 | 1.0 | <LLD | - | - | None | 0 |
| | H-3 4 | 330 | <LLD | - | - | None | 0 |
| | CS 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 10 | | <LLD | - | - | None | 0 |
| | Ba-La-140 15 | | <LLD | - | - | None | 0 |
| | Ce-144 43 | | <LLD | - | - | None | 0 |
| Well Water (pCi/L) | H-3 16 | 330 | <LLD | - | - | <LLD | 0 |
| | CS 16 | | | | | | |
| | 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 54 | | <LLD | - | - | <LLD | 0 |
| Crops - Cabbage (pCi/g wet) | I-131 2 | 0.012 | <LLD | - | - | <LLD | 0 |

Table 5.4. Radiation Environmental Monitoring Program Summary.

Name of Facility Monticello Nuclear Generating Plant
 Location of Facility Wright, Minnesota
 (County, State)

Docket No. 50-263
 Reporting Period January - December 1993

| Sample Type (Units) | Type and Number of Analyses ^a | LLD ^b | Indicator Locations Mean (F) ^c Range ^c | Location with Highest Quarterly Mean | | Control Locations Mean (F) ^c Range | Number Non-Routine Results ^e |
|---------------------------|--|------------------|--|--|--|---|---|
| | | | | Location ^d | Mean (F) ^c Range ^c | | |
| Fish (pCi/g wet) | GS 4 | | | | | | |
| | K-40 | 0.1 | 2.86 (2/2) (2.85-2.86) | M-8, Upstream of Plant, 0.2 mi @ 285°/WNW | 3.14 (2/2) (2.99-3.28) | 3.14 (2/2) (2.99-3.28) | 0 |
| | Mn-54 | 0.016 | <LLD | - | - | <LLD | 0 |
| | Fe-59 | 0.053 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 0.018 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 0.017 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 0.049 | <LLD | - | - | <LLD | 0 |
| | Nb-95 | 0.024 | <LLD | - | - | <LLD | 0 |
| | Zr-95 | 0.027 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 0.020 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 0.018 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 0.90 | <LLD | - | - | <LLD | 0 |
| Invertebrates (pCi/g wet) | GS 4 | | | | | | |
| | Be-7 | 1.95 | <LLD | - | - | <LLD | 0 |
| | K-40 | 0.1 | 3.86 (2/2) (0.95-6.76) <LLD | M-9, Downstream of Plant, 0.2 mi @ 62°/ENE | 3.86 (2/2) (0.95-6.76) | 2.16 (2/2) (2.11-2.21) | 0 |
| | Mn-54 | 0.093 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 0.12 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 0.11 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 0.21 | <LLD | - | - | <LLD | 0 |
| | Zr-Nb-95 | 0.17 | <LLD | - | - | <LLD | 0 |
| | Ru-103 | 0.15 | <LLD | - | - | <LLD | 0 |
| | Ru-106 | 0.77 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 0.081 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 0.088 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 0.15 | <LLD | - | - | <LLD | 0 |
| | Ce-141 | 0.14 | <LLD | - | - | <LLD | 0 |
| | Ce-144 | 0.51 | <LLD | - | - | <LLD | 0 |

Table 5.4. Radiation Environmental Monitoring Program Summary.

Name of Facility Monticello Nuclear Generating Plant
 Location of Facility Wright, Minnesota
 (County, State)

Docket No. 50-263
 Reporting Period January - December 1993

| Sample Type (Units) | Type and Number of Analyses ^a | LLD ^b | Indicator Locations Mean (F) ^c Range ^c | Location with Highest Quarterly Mean | | Control Locations Mean (F) ^c Range | Number Non-Routine Results ^e |
|--|--|------------------|--|---|--|---|---|
| | | | | Location ^d | Mean (F) ^c Range ^c | | |
| Bottom and Shoreline Sediments (pCi/g dry) | GS 6 | | | | | | |
| | Be-7 | 0.28 | <LLD | - | - | <LLD | 0 |
| | K-40 | 0.5 | 11.94 (4/4) (11.43-12.57) | M-15, Montissippi Park, 1.6 mi @ 117°/ESE | 12.32 (2/2) (12.07-12.57) | 10.11 (2/2) (9.93-10.29) | 0 |
| | Mn-54 | 0.025 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 0.035 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 0.024 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 0.11 | <LLD | - | - | <LLD | 0 |
| | Zr-95 | 0.064 | <LLD | - | - | <LLD | 0 |
| | Nb-95 | 0.034 | <LLD | - | - | <LLD | 0 |
| | Ru-103 | 0.024 | <LLD | - | - | <LLD | 0 |
| | Ru-106 | 0.22 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 0.048 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 0.014 | 0.090 (4/4) (0.083-0.10) | M-15, Montissippi Park 1.6 mi @ 117°/ESE | 0.096 (2/2) (0.092-0.10) | <LLD | 0 |
| | Ba-La-140 | 0.046 | <LLD | - | - | <LLD | 0 |
| | Ce-141 | 0.048 | <LLD | - | - | <LLD | 0 |
| | Ce-144 | 0.17 | <LLD | - | - | <LLD | 0 |

^a GB = Gross beta; GS = gamma scan.

^b LLD = Nominal lower limit of detection based on 4.66 sigma 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 code (Table 2) and (2) by distance, direction and sector 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 times the typical pre-operational value for the medium or location.

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APPENDIX A
INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Teledyne's Midwest Laboratory participates in intercomparison studies administered by U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. The results are reported in Appendix A. Also reported are results of in-house spikes and blanks. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only. Please refer to March, June, September and December progress reports for information.

January, 1990 through December, 1993

Appendix A

Interlaboratory Comparison Program Results

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

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

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water and air filters during the period 1990-1993.

This program is conducted by the U.S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), since 1976 via various International Intercomparisons of Environmental Dosimeters under the sponsorships listed in Table A-2. Also Teledyne testing results are listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. 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.

Attachment A lists acceptance criteria for "spiked" samples.

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

December, 1993

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

| Analysis | Level | One Standard Deviation for single determinations |
|--|--|--|
| Gamma Emitters | 5 to 100 pCi/liter or kg >100 pCi/liter or kg | 5.0 pCi/liter 5% of known value |
| Strontium-89 ^b | 5 to 50 pCi/liter or kg >50 pCi/liter or kg | 5.0 pCi/liter 10% of known value |
| Strontium-90 ^b | 2 to 30 pCi/liter or kg >30 pCi/liter or kg | 5.0 pCi/liter 10% of known value |
| Potassium | >0.1 g/liter or kg | 5% of known value |
| Gross alpha | ≤20 pCi/liter >20 pCi/liter | 5.0 pCi/liter 25% of known value |
| Gross beta | ≤100 pCi/liter >100 pCi/liter | 5.0 pCi/liter 5% of known value |
| Tritium | ≤4,000 pCi/liter >4,000 pCi/liter | 1s = (pCi/liter) = 169.85 x (known) ^{0.0933} 10% of known value |
| Radium-226,-228 | <0.1 pCi/liter | 15% of known value |
| Plutonium | 0.1 pCi/liter, gram, or sample | 10% of known value |
| Iodine-131, Iodine-129 ^b | ≤55 pCi/liter >55 pCi/liter | 6.0 pCi/liter 10% of known value |
| Uranium-238, Nickel-64 ^b Technetium-99 ^b | ≤35 pCi/liter >35 pCi/liter | 6.0 pCi/liter 15% of known value |
| Iron-55 ^b | 50 to 100 pCi/liter >100 pCi/liter | 10 pCi/liter 10% of known value |
| Others ^b | — | 20% of known value |

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

^b Teledyne limit.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|---|---|------------------------------------|-----------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-589 | WATER | Jan, 1990 | Sr-89 | 22.7 ± 5.0 | 25.0 ± 5.0 | 16.3 - 33.7 |
| | | | Sr-90 | 17.3 ± 1.2 | 20.0 ± 1.5 | 17.4 - 22.6 |
| | | | The sample was reanalyzed in triplicate for Sr-90; results of reanalyses were 18.8 ± 1.5 pCi/L. No further action is planned. | | | |
| STW-591 | WATER | Jan, 1990 | Gr. Alpha | 10.3 ± 3.0 | 12.0 ± 5.0 | 3.3 - 20.7 |
| | | | Gr. Beta | 12.3 ± 1.2 | 12.0 ± 5.0 | 3.3 - 20.7 |
| STW-592 | WATER | Jan, 1990 | Ba-133 | 78.0 ± 0.0 | 74.0 ± 7.0 | 61.9 - 86.1 |
| | | | Co-60 | 14.7 ± 2.3 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Cs-134 | 17.3 ± 1.2 | 18.0 ± 5.0 | 9.3 - 26.7 |
| | | | Cs-137 | 19.3 ± 1.2 | 18.0 ± 5.0 | 9.3 - 26.7 |
| | | | Ru-106 | 133.3 ± 13.4 | 139.0 ± 14.0 | 114.8 - 163.2 |
| | | | Zn-65 | 135.0 ± 6.9 | 139.0 ± 14.0 | 114.8 - 163.2 |
| | | | | | | |
| STW-593 | WATER | Feb, 1990 | H-3 | 4827.0 ± 83.0 | 4976.0 ± 498.0 | 4113.0 - 5839.0 |
| STW-594 | WATER | Mar, 1990 | Ra-226 | 5.0 ± 0.2 | 4.9 ± 0.7 | 4.1 - 5.7 |
| | | | Ra-228 | 13.5 ± 0.7 | 12.7 ± 1.9 | 9.4 - 16.0 |
| STW-595 | WATER | Mar, 1990 | Uranium | 4.0 ± 0.0 | 4.0 ± 6.0 | 0.0 - 14.4 |
| | | | | | | |
| STAF-596 | AIR FILTER | Mar, 1990 | Cs-137 | 9.3 ± 1.2 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | Gr. Alpha | 7.3 ± 1.2 | 5.0 ± 5.0 | 0.0 - 13.7 |
| | | | Gr. Beta | 34.0 ± 0.0 | 31.0 ± 5.0 | 22.3 - 39.7 |
| | | | Sr-90 | 10.0 ± 0.0 | 10.0 ± 1.5 | 7.4 - 12.6 |
| STW-597 | WATER | Apr, 1990 | Gr. Alpha | 81.0 ± 3.5 | 90.0 ± 23.0 | 50.1 - 129.9 |
| | | | Ra-226 | 4.9 ± 0.4 | 5.0 ± 0.8 | 3.6 - 6.4 |
| | | | Ra-228 | 10.6 ± 0.3 | 10.2 ± 1.5 | 7.6 - 12.8 |
| | | | U | 18.7 ± 3.0 | 20.0 ± 6.0 | 9.6 - 30.4 |
| | | | | | | |
| STW-598 | WATER | Apr, 1990 | Cs-134 | 16.0 ± 0.0 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Cs-137 | 19.0 ± 2.0 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Gross Beta | 51.0 ± 10.1 | 52.0 ± 5.0 | 43.3 - 60.7 |
| | | | Sr-89 | 9.3 ± 1.2 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | | | | |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media*.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|---|--|------------------------------------|-----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STM-599 | MILK | Apr, 1990 | Sr-90 | 10.3 \pm 3.1 | 10.0 \pm 1.5 | 8.3 - 11.7 |
| | | | Cs-137 | 26.0 \pm 6.0 | 24.0 \pm 5.0 | 15.3 - 32.7 |
| | | | I-131 | 98.7 \pm 1.2 | 99.0 \pm 10.0 | 81.7 - 116.3 |
| | | | K | 1300.0 \pm 69.2 | 1550.0 \pm 78.0 | 1414.7 - 1685.3 |
| | | | The K analysis was repeated in triplicate; result of reanalysis was 1421.7 \pm 95.3 mg/L. No further action is planned. | | | |
| STW-600 | WATER | May, 1990 | Sr-89 | 21.7 \pm 3.1 | 23.0 \pm 5.0 | 14.3 - 31.7 |
| | | | Sr-90 | 21.0 \pm 7.0 | 23.0 \pm 5.0 | 14.3 - 31.7 |
| | | | Sr-89 | 6.0 \pm 2.0 | 7.0 \pm 5.0 | 0.0 - 15.7 |
| | | | Sr-90 | 6.7 \pm 1.2 | 7.0 \pm 5.0 | 0.0 - 15.7 |
| | | | Gr. Alpha | 11.0 \pm 2.0 | 22.0 \pm 6.0 | 11.6 - 32.4 |
| STW-602 | WATER | Jun, 1990 | Gross Alpha analysis was repeated in triplicate; results of reanalyses were 13.4 \pm 1.0 pCi/L. No further action is planned. | | | |
| | | | Gr. Beta | 12.3 \pm 1.2 | 15.0 \pm 5.0 | 6.3 - 23.7 |
| | | | Ba-133 | 100.7 \pm 8.1 | 99.0 \pm 10.0 | 81.7 - 116.3 |
| | | | Co-60 | 25.3 \pm 2.3 | 24.0 \pm 5.0 | 15.3 - 32.7 |
| | | | Cs-134 | 23.7 \pm 1.2 | 24.0 \pm 5.0 | 18.2 - 29.8 |
| | | | Cs-137 | 27.7 \pm 3.1 | 25.0 \pm 5.0 | 16.3 - 33.7 |
| | | | Ru-106 | 202.7 \pm 17.2 | 210.0 \pm 21.0 | 173.6 - 246.4 |
| | | | Zn-65 | 155.0 \pm 10.6 | 148.0 \pm 15.0 | 130.6 - 165.4 |
| STW-603 | WATER | Jun, 1990 | H-3 | 2927.0 \pm 306.0 | 2933.0 \pm 358.0 | 2312.0 - 3554.0 |
| STW-604 | WATER | Jul, 1990 | Ra-226 | 11.8 \pm 0.9 | 12.1 \pm 1.8 | 9.0 - 15.2 |
| | | | Ra-228 | 4.1 \pm 1.4 | 5.1 \pm 1.3 | 2.8 - 7.4 |
| STW-605 | WATER | Jul, 1990 | U | 20.3 \pm 1.7 | 20.8 \pm 3.0 | 15.6 - 26.0 |
| STW-606 | WATER | Aug, 1990 | I-131 | 43.0 \pm 1.2 | 39.0 \pm 6.0 | 28.6 - 49.4 |
| STW-607 | WATER | Aug, 1990 | Pu-239 | 10.0 \pm 1.7 | 9.1 \pm 0.9 | 7.5 - 10.7 |
| STAF-608 | AIR FILTER | Aug, 1990 | Cs-137 | 19.0 \pm 2.0 | 20.0 \pm 5.0 | 11.3 - 28.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|------------|--|------------------------------------|-----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-609 | WATER | Sep, 1990 | Gr. Alpha | 14.0 \pm 0.0 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Gr. Beta | 65.3 \pm 1.2 | 62.0 \pm 5.0 | 53.3 - 70.7 |
| | | | Sr-90 | 19.0 \pm 6.9 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | Sr-89 | 9.0 \pm 2.0 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Sr-90 | 9.0 \pm 2.0 | 9.0 \pm 5.0 | 0.3 - 17.7 |
| STW-610 | WATER | Sep, 1990 | | | | |
| STM-611 | MILK | Sep, 1990 | Gr. Alpha | 8.3 \pm 1.2 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Gr. Beta | 10.3 \pm 1.2 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Cs-137 | 20.0 \pm 2.0 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | I-131 | 63.0 \pm 6.0 | 58.0 \pm 6.0 | 47.6 - 68.4 |
| | | | K-40 | 1673.3 \pm 70.2 | 1700.0 \pm 85.0 | 1552.5 - 1847.5 |
| STW-612 | WATER | Oct, 1990 | Sr-89 | 11.7 \pm 3.1 | 16.0 \pm 5.0 | 7.3 - 24.7 |
| | | | Sr-90 | 15.0 \pm 0.0 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | Ba-133 | 116.7 \pm 9.9 | 110.0 \pm 11.0 | 90.9 - 129.0 |
| | | | Co-60 | 20.3 \pm 3.1 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | Cs-134 | 11.0 \pm 0.0 | 12.0 \pm 5.0 | 3.3 - 20.7 |
| STW-613 | WATER | Oct, 1990 | Cs-137 | 14.0 \pm 2.0 | 12.0 \pm 5.0 | 3.3 - 20.7 |
| | | | Ru-106 | 152.0 \pm 8.0 | 151.0 \pm 15.0 | 125.0 - 177.0 |
| | | | Zn-65 | 115.3 \pm 12.2 | 115.0 \pm 12.0 | 94.2 - 135.8 |
| | | | H-3 | 7167.0 \pm 330.0 | 7203.0 \pm 720.0 | 5954.0 - 8452.0 |
| | | | | | | |
| STW-614 | WATER | Oct, 1990 | | | | |
| STW-615 | WATER | Oct, 1990 | Gr. Alpha | 68.7 \pm 7.2 | 62.0 \pm 16.0 | 34.2 - 89.8 |
| | | | Ra-226 | 12.9 \pm 0.3 | 13.6 \pm 2.0 | 10.1 - 17.1 |
| | | | Ra-228 | 4.2 \pm 0.6 | 5.0 \pm 1.3 | 2.7 - 7.3 |
| | | | U | 10.4 \pm 0.6 | 10.2 \pm 3.0 | 5.0 - 15.4 |
| | | | Cs-134 | 9.0 \pm 1.7 | 7.0 \pm 5.0 | 0.0 - 15.7 |
| | | | Cs-137 | 7.7 \pm 1.2 | 5.0 \pm 5.0 | 0.0 - 13.7 |
| | | | Gross Beta | 55.0 \pm 8.7 | 53.0 \pm 5.0 | 44.3 - 61.7 |
| | | | Sr-89 | 15.7 \pm 2.9 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | Sr-90 | 12.0 \pm 2.0 | 15.0 \pm 5.0 | 6.0 - 23.7 |
| | | | | | | |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|---|--|------------------------------------|-----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-616 | WATER | Nov, 1990 | | | | |
| | | | Ra-226 | 6.8±1.0 | 7.4±1.1 | 5.5 - 9.3 |
| | | | Ra-228 | 5.3±1.7 | 7.7±1.9 | 4.4 - 11.0 |
| STW-617 | WATER | Nov, 1990 | | | | |
| | | | U | 35.0±0.4 | 35.5±3.6 | 29.3 - 41.7 |
| | | | Sample was analyzed but the results were not submitted to the EPA because the deadline was missed (all data on file). | | | |
| STW-618 | WATER | Jan, 1991 | | | | |
| | | | Sr-89 | 4.3±1.2 | 5.0±5.0 | 0.0 - 13.7 |
| | | | Sr-90 | 4.7±1.2 | 5.0±5.0 | 0.0 - 13.7 |
| STW-619 | WATER | Jan, 1991 | | | | |
| | | | Pu-239 | 3.6±0.2 | 3.3±0.3 | 2.8 - 3.8 |
| STW-620 | WATER | Jan, 1991 | | | | |
| | | | Gr. Alpha | 6.7±3.0 | 5.0±5.0 | 0.0 - 13.7 |
| | | | Gr. Beta | 6.3±1.2 | 5.0±5.0 | 0.0 - 13.7 |
| STW-621 | WATER | Feb, 1991 | | | | |
| | | | Ba-133 | 85.7±9.2 | 75.0±8.0 | 61.1 - 88.9 |
| | | | Co-60 | 41.3±8.4 | 40.0±5.0 | 31.3 - 48.7 |
| | | | Cs-134 | 9.0±2.0 | 8.0±5.0 | 0.0 - 16.7 |
| | | | Cs-137 | 9.7±1.2 | 8.0±5.0 | 0.0 - 16.7 |
| | | | Ru-106 | 209.7±18.6 | 186.0±19.0 | 153.0 - 219.0 |
| | | | Zn-65 | 166.7±19.7 | 149.0±15.0 | 123.0 - 175.0 |
| STW-622 | WATER | Feb, 1991 | | | | |
| | | | I-131 | 81.3±6.1 | 75.0±8.0 | 61.1 - 88.9 |
| STW-623 | WATER | Feb, 1991 | | | | |
| | | | H-3 | 4310.0±144.2 | 4418.0±442.0 | 3651.2 - 5184.8 |
| STW-624 | WATER | Mar, 1991 | | | | |
| | | | Ra-226 | 31.4±3.2 | 31.8±4.8 | 23.5 - 40.1 |
| | | | Ra-228 | | 21.1±5.3 | 11.9 - 30.3 |
| | | | No data for Ra-228 was reported; sample was lost during analysis. | | | |
| STW-625 | WATER | Mar, 1991 | | | | |
| | | | U | 6.7±0.4 | 7.6±3.0 | 2.4 - 12.8 |
| STAF-626 | AIR FILTER | Mar, 1991 | | | | |
| | | | Cs-137 | 33.7±4.2 | 40.0±5.0 | 31.3 - 48.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|--|---|------------------------------------|-----------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-627 | WATER | Apr, 1991 | Gr. Alpha | 38.7±1.2 | 25.0±6.0 | 14.6 - 35.4 |
| | | | The cause of the high Gross Alpha result is the difference in geometry between the standard used in the TIML lab and the EPA filter. | | | |
| | | | Gr. Beta | 130.0±4.0 | 124.0±6.0 | 113.6 - 134.4 |
| | | | Sr-90 | 35.7±1.2 | 40.0±5.0 | 31.3 - 48.7 |
| | | | Gr. Alpha | 51.0±6.0 | 54.0±14.0 | 29.7 - 78.3 |
| | | | Ra-226 | 7.0±0.8 | 8.0±1.2 | 5.9 - 10.1 |
| STW-628 | WATER | Apr, 1991 | Ra-228 | 9.7±1.9 | 15.2±3.8 | 8.6 - 21.8 |
| | | | U | 27.7±2.4 | 29.8±3.0 | 24.6 - 35.0 |
| | | | Cs-134 | 27.3±1.2 | 24.0±5.0 | 15.3 - 32.7 |
| | | | Cs-137 | 29.0±2.0 | 25.0±5.0 | 16.3 - 33.7 |
| | | | Gross Beta | 93.3±6.4 | 115.0±17.0 | 85.5 - 144.5 |
| | | | Sr-89 | 21.0±3.5 | 28.0±5.0 | 19.3 - 36.7 |
| STM-629 | MILK | Apr, 1991 | Sr-90 | 23.0±0.0 | 26.0±5.0 | 17.3 - 34.7 |
| | | | Cs-137 | 54.7±11.0 | 49.0±5.0 | 40.3 - 57.7 |
| | | | I-131 | 65.3±14.7 | 60.0±6.0 | 49.6 - 70.4 |
| | | | K-40 | 1591.7±180.1 | 1650.0±83.0 | 1506.0 - 1794.0 |
| | | | Sr-89 | 24.0±8.7 | 32.0±5.0 | 23.3 - 40.7 |
| | | | Sr-90 | 28.0±2.0 | 32.0±5.0 | 23.3 - 40.7 |
| STW-630 | WATER | May, 1991 | Sr-89 | 40.7±2.3 | 39.0±5.0 | 30.3 - 47.7 |
| | | | Sr-90 | 23.7±1.2 | 24.0±5.0 | 15.3 - 32.7 |
| | | | Gr. Alpha | 27.7±5.8 | 24.0±6.0 | 13.6 - 34.4 |
| STW-631 | WATER | May, 1991 | Gr. Beta | 46.0±0.0 | 46.0±5.0 | 37.3 - 54.7 |
| | | | Ba-133 | 74.0±6.9 | 62.0±6.0 | 51.6 - 72.4 |
| STW-632 | WATER | Jun, 1991 | Sample was reanalyzed for Ba-133. Result of the reanalysis was 63.8±6.9 pCi/L; within the EPA control limits. | | | |
| | | | Co-60 | 11.3±1.2 | 10.0±5.0 | 1.3 - 18.7 |
| | | | Cs-134 | 15.3±1.2 | 15.0±5.0 | 6.3 - 23.7 |
| | | | Cs-137 | 16.3±1.2 | 14.0±5.0 | 5.3 - 22.7 |
| | | | Ru-106 | 162.3±19.0 | 149.0±15.0 | 123.0 - 175.0 |
| | | | | | | |
| | | | | | | |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|--|--|------------------------------------|-------------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-633 | WATER | Jun, 1991 | Zn-65 | 119.3 \pm 16.3 | 108.0 \pm 11.0 | 88.9 - 127.1 |
| | | | H-3 | 13470.0 \pm 385.8 | 12480.0 \pm 1248.0 | 10314.8 - 14645.2 |
| STW-634 | WATER | Jul, 1991 | Ra-226 | 14.9 \pm 0.4 | 15.9 \pm 2.4 | 11.7 - 20.1 |
| | | | Ra-228 | 17.6 \pm 1.8 | 16.7 \pm 4.2 | 9.4 - 24.0 |
| STW-635 | WATER | Jul, 1991 | U | 12.8 \pm 0.1 | 14.2 \pm 3.0 | 9.0 - 19.4 |
| STW-636 | WATER | Aug, 1991 | I-131 | 19.3 \pm 1.2 | 20.0 \pm 6.0 | 9.6 - 30.4 |
| STW-637 | WATER | Aug, 1991 | Pu-239 | 21.4 \pm 0.5 | 19.4 \pm 1.9 | 16.1 - 22.7 |
| SLAF-638 | AIR FILTER | Aug, 1991 | Cs-137 | 26.3 \pm 1.2 | 30.0 \pm 5.0 | 21.3 - 38.7 |
| | | | Gr. Alpha | 33.0 \pm 2.0 | 25.0 \pm 6.0 | 14.6 - 35.4 |
| | | | Gr. Beta | 88.7 \pm 1.2 | 92.0 \pm 10.0 | 80.4 - 103.6 |
| | | | Sr-90 | 27.0 \pm 4.0 | 30.0 \pm 5.0 | 21.3 - 38.7 |
| | | | Sr-89 | 47.0 \pm 10.4 | 49.0 \pm 5.0 | 40.3 - 57.7 |
| STW-639 | WATER | Sep, 1991 | Sr-90 | 24.0 \pm 2.0 | 25.0 \pm 5.0 | 16.3 - 33.7 |
| | | | Gr. Alpha | 12.0 \pm 4.0 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Gr. Beta | 20.3 \pm 1.2 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| STM-641 | MILK | Sep, 1991 | Cs-137 | 33.7 \pm 3.2 | 30.0 \pm 5.0 | 21.3 - 38.7 |
| | | | I-131 | 130.7 \pm 16.8 | 108.0 \pm 11.0 | 88.9 - 127.1 |
| | | | The cause of the high result for the I-131 analysis is unknown. An in-house spike sample was prepared with activity for I-131 of 68.3 \pm 6.8 pCi/L. Result of TIML's analysis of the in-house spike was 69.1 \pm 9.7 pCi/L. | | | |
| STW-642 | WATER | Oct, 1991 | K | 1743.3 \pm 340.8 | 1740.0 \pm 87.0 | 1589.1 - 1890.9 |
| | | | Sr-89 | 20.3 \pm 5.0 | 25.0 \pm 5.0 | 16.3 - 33.7 |
| | | | Sr-90 | 19.7 \pm 3.1 | 25.0 \pm 5.0 | 16.3 - 33.7 |
| | | | Ba-133 | 94.7 \pm 3.1 | 98.0 \pm 10.0 | 80.7 - 115.3 |
| | | | Co-60 | 29.7 \pm 1.2 | 29.0 \pm 5.0 | 20.3 - 37.7 |
| | | | Cs-134 | 9.7 \pm 1.2 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | | | | |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|------------|--|------------------------------------|-----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-643 | WATER | Oct, 1991 | Cs-137 | 11.0 \pm 2.0 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Ru-106 | 196.3 \pm 15.1 | 199.0 \pm 20.0 | 164.3 - 233.7 |
| | | | Zn-65 | 75.7 \pm 8.3 | 73.0 \pm 7.0 | 60.9 - 85.1 |
| | | | H-3 | 2640.0 \pm 156.2 | 2454.0 \pm 352.0 | 1843.3 - 3064.7 |
| STW-644 | WATER | Oct, 1991 | Gr. Alpha | 73.0 \pm 13.1 | 82.0 \pm 21.0 | 45.6 - 118.4 |
| | | | Ra-226 | 20.9 \pm 2.0 | 22.0 \pm 3.3 | 16.3 - 27.7 |
| | | | Ra-228 | 19.6 \pm 2.3 | 22.2 \pm 5.6 | 12.5 - 31.9 |
| | | | U | 13.5 \pm 0.6 | 13.5 \pm 3.0 | 8.3 - 18.7 |
| STW-645 | WATER | Oct, 1991 | Co-60 | 20.3 \pm 1.2 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| | | | Cs-134 | 9.0 \pm 5.3 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Cs-137 | 14.7 \pm 5.0 | 11.0 \pm 5.0 | 2.3 - 19.7 |
| | | | Gross Beta | 55.3 \pm 3.1 | 65.0 \pm 10.0 | 47.7 - 82.3 |
| | | | Sr-89 | 9.7 \pm 3.1 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Sr-90 | 8.7 \pm 1.2 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | Ra-226 | 5.6 \pm 1.2 | 6.5 \pm 1.0 | 4.8 - 8.2 |
| | | | Ra-228 | 9.6 \pm 0.5 | 8.1 \pm 2.0 | 4.6 - 11.6 |
| STW-647 | WATER | Nov, 1991 | U | 24.7 \pm 2.3 | 24.9 \pm 3.0 | 19.7 - 30.1 |
| | | | Sr-89 | 42.7 \pm 6.4 | 51.0 \pm 5.0 | 42.3 - 59.7 |
| | | | Sr-90 | 18.3 \pm 3.1 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| STW-649 | WATER | Jan, 1992 | Pu-239 | 16.1 \pm 0.8 | 16.8 \pm 1.7 | 13.9 - 19.7 |
| | | | Gr. Alpha | 23.7 \pm 9.2 | 30.0 \pm 8.0 | 16.1 - 43.9 |
| STW-650 | WATER | Jan, 1992 | Gr. Beta | 27.7 \pm 4.2 | 30.0 \pm 5.0 | 21.3 - 38.7 |
| | | | I-131 | 60.3 \pm 4.2 | 59.0 \pm 6.0 | 48.6 - 69.4 |
| STW-651 | WATER | Feb, 1992 | Ba-133 | 79.0 \pm 3.4 | 76.0 \pm 8.0 | 62.1 - 89.9 |
| | | | Co-60 | 40.3 \pm 5.0 | 40.0 \pm 5.0 | 31.3 - 48.7 |
| | | | Cs-134 | 31.7 \pm 4.2 | 31.0 \pm 5.0 | 22.3 - 39.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media*.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|-------------------------------|--|------------------------------------|-----------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-653 | WATER | Feb, 1992 | Cs-137 | 51.0±3.4 | 49.0±5.0 | 40.3 - 57.7 |
| | | | Ru-106 | 188.7±28.8 | 203.0±20.0 | 168.3 - 237.7 |
| | | | Zn-65 | 148.0±15.0 | 150.7±6.1 | 122.0 - 174.0 |
| | | | H-3 | 7714.0±119.6 | 7904.0±790.0 | 6533.4 - 9274.6 |
| STW-654 | WATER | Mar, 1992 | Ra-226 | 9.0±0.4 | 10.1±1.5 | 7.5 - 12.7 |
| STW-655 | WATER | Mar, 1992 | Ra-228 | 18.8±0.6 | 15.5±3.9 | 8.7 - 22.3 |
| | | | Rn-222 | 0.0 | | |
| | | | No Data; Special EPA testing. | | | |
| STW-656 | WATER | Mar, 1992 | U | 25.1±1.9 | 25.3±3.0 | 20.1 - 30.5 |
| STW-657 | WATER | Mar, 1992 | Rn-222 | No Data is available; Special EPA testing. | | |
| STAF-658 | AIR FILTER | Mar, 1992 | Cs-137 | 10.0±0.0 | 10.0±5.0 | 1.3 - 18.7 |
| STW-659 | WATER | Apr, 1992 | Gr. Alpha | 7.0±0.0 | 7.0±5.0 | 0.0 - 15.7 |
| | | | Gr. Beta | 39.3±1.6 | 41.0±5.0 | 32.3 - 49.7 |
| | | | Sr-90 | 13.7±1.6 | 15.0±5.0 | 6.3 - 23.7 |
| | | | Gr. Alpha | 35.7±6.1 | 40.0±10.0 | 22.7 - 57.3 |
| | | | Ra-226 | 12.7±1.2 | 14.9±2.2 | 11.1 - 18.7 |
| STW-660 | WATER | Apr, 1992 | Ra-228 | 14.5±2.1 | 14.0±3.5 | 7.9 - 20.1 |
| | | | U | 3.9±0.2 | 4.0±3.0 | 0.0 - 9.2 |
| | | | Co-60 | 61.0±4.0 | 56.0±5.0 | 47.3 - 64.7 |
| | | | Cs-134 | 24.3±1.2 | 24.0±5.0 | 15.3 - 32.7 |
| | | | Cs-137 | 24.0±2.0 | 22.0±5.0 | 13.3 - 30.7 |
| STM-661 | MILK | Apr, 1992 | Gross Beta | 113.0±7.2 | 140.0±21.0 | 103.6 - 176.4 |
| | | | Sr-89 | 12.3±4.2 | 15.0±5.0 | 6.3 - 23.7 |
| | | | Sr-90 | 15.0±1.2 | 17.0±5.0 | 8.3 - 25.7 |
| | | | Cs-137 | 39.3±2.3 | 39.0±5.0 | 30.3 - 47.7 |
| | | | I-131 | 78.7±9.5 | 78.0±8.0 | 64.1 - 91.9 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|--|--|------------------------------------|-----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-662 | WATER | May, 1992 | K-40 | 1610.0 \pm 72.1 | 1710.0 \pm 86.0 | 1560.8 - 1859.2 |
| | | | Sr-89 | 25.3 \pm 7.6 | 38.0 \pm 5.0 | 29.3 - 46.7 |
| | | | The cause of the low Sr-89 results is unknown. Data were checked for errors. An in-house spike sample was prepared with activity for Sr-89 of 41.0 \pm 10.0 pCi/L. Result of the analysis of the in-house spike sample for Sr-89 was 37.2 \pm 3.6 pCi/L. | | | |
| | | | Sr-90 | 24.3 \pm 3.1 | 29.0 \pm 5.0 | 20.3 - 37.7 |
| | | | Sr-89 | 24.0 \pm 4.0 | 29.0 \pm 5.0 | 20.3 - 37.7 |
| | | | Sr-90 | 6.7 \pm 1.2 | 8.0 \pm 5.0 | 0.0 - 16.7 |
| | | | Gr. Alpha | 12.3 \pm 2.1 | 15.0 \pm 5.0 | 6.3 - 23.7 |
| | | | Gr. Beta | 46.0 \pm 5.0 | 44.0 \pm 5.0 | 35.3 - 52.7 |
| | | | Ba-133 | 92.7 \pm 11.0 | 98.0 \pm 10.0 | 80.7 - 115.3 |
| | | | Co-60 | 20.3 \pm 1.2 | 20.0 \pm 5.0 | 11.3 - 28.7 |
| STW-665 | WATER | Jun, 1992 | Cs-134 | 14.3 \pm 2.3 | 15.0 \pm 5.0 | 6.3 - 23.7 |
| | | | Cs-137 | 15.0 \pm 2.0 | 15.0 \pm 5.0 | 6.3 - 23.7 |
| | | | Ru-106 | 142.7 \pm 23.7 | 141.0 \pm 14.0 | 116.7 - 165.3 |
| | | | Zn-65 | 103.3 \pm 10.6 | 99.0 \pm 10.0 | 81.7 - 116.5 |
| | | | H-3 | 2153.3 \pm 144.6 | 2125.0 \pm 347.0 | 1523.0 - 2727.0 |
| | | | Ra-226 | 22.3 \pm 2.2 | 24.9 \pm 3.7 | 18.5 - 31.3 |
| | | | Ra-228 | 16.7 \pm 3.1 | 16.7 \pm 4.2 | 9.4 - 24.0 |
| | | | Uranium | 3.6 \pm 0.3 | 4.0 \pm 3.0 | 0.0 - 9.2 |
| | | | I-131 | 47.0 \pm 3.5 | 45.0 \pm 6.0 | 34.6 - 55.4 |
| | | | Pu-239 | 8.5 \pm 0.9 | 9.0 \pm 0.9 | 7.4 - 10.6 |
| STAF-670 | AIR FILTER | Aug, 1992 | Alpha | 25.7 \pm 1.2 | 30.0 \pm 8.0 | 16.1 - 43.9 |
| | | | Beta | 69.0 \pm 2.0 | 69.0 \pm 10.0 | 51.7 - 86.3 |
| | | | Cs-137 | 16.0 \pm 0.0 | 18.0 \pm 5.0 | 9.3 - 26.7 |
| | | | Sr-90 | 26.0 \pm 4.0 | 25.0 \pm 5.0 | 16.3 - 33.7 |
| | | | | | | |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media*.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|--|-------------|----------------|-------------|---|------------------------------------|-----------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-671 | WATER | Sep, 1992 | Sr-89 | 16.0 ± 4.0 | 20.0 ± 5.0 | 11.3 - 28.7 |
| | | | Sr-90 | 14.3 ± 3.1 | 15.0 ± 5.0 | 6.3 - 23.7 |
| STW-672 | WATER | Sep, 1992 | Alpha | 43.0 ± 13.1 | 45.0 ± 11.0 | 25.9 - 64.1 |
| | | | Beta | 41.3 ± 18.6 | 50.0 ± 5.0 | 14.3 - 58.7 |
| STM-673 | MILK | Sep, 1992 | Cs-137 | 14.0 ± 3.5 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | I-131(gamma | 109.7 ± 19.4 | 100.0 ± 10.0 | 82.7 - 117.3 |
| | | | K | 1540.0 ± 103.9 | 1750.0 ± 88.0 | 1597.3 - 1902.7 |
| The K activity was calculated using the wrong volume (3.5 L), instead of 3.25 L. Correction for volume resulted in a value of 1660.0 ± 110.1; within EPA control limits. | | | | | | |
| | | | Sr-89 | 11.0 ± 3.5 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Sr-90 | 12.7 ± 1.6 | 15.0 ± 5.0 | 6.3 - 23.7 |
| STW-674 | WATER | Oct, 1992 | Ba-133 | 80.3 ± 9.0 | 74.0 ± 7.0 | 61.9 - 86.1 |
| | | | Co-60 | 11.3 ± 2.3 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | Cs-134 | 9.7 ± 2.3 | 8.0 ± 5.0 | 0.0 - 16.7 |
| | | | Cs-137 | 9.7 ± 1.2 | 8.0 ± 5.0 | 0.0 - 16.7 |
| | | | Ru-106 | 170.7 ± 2.3 | 175.0 ± 18.0 | 143.8 - 206.2 |
| | | | Zn-65 | 169.7 ± 25.0 | 148.0 ± 15.0 | 122.0 - 174.0 |
| STW-675 | WATER | Oct, 1992 | H-3 | 5896.7 ± 136.2 | 5962.0 ± 596.0 | 4928.0 - 6996.0 |
| STW-676 | WATER | Oct, 1992 | Gr. Alpha | 24.7 ± 5.0 | 29.0 ± 7.0 | 16.9 - 41.1 |
| | | | Ra-226 | 7.1 ± 0.4 | 7.4 ± 1.1 | 5.5 - 9.3 |
| | | | Ra-228 | 11.5 ± 1.0 | 10.0 ± 2.5 | 5.7 - 14.3 |
| | | | Uranium | 9.7 ± 0.5 | 10.2 ± 3.0 | 5.0 - 15.4 |
| STW-677 | WATER | Oct, 1992 | Co-60 | 15.0 ± 2.0 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Cs-134 | 5.7 ± 1.2 | 5.0 ± 5.0 | 0.0 - 13.7 |
| | | | Cs-137 | 8.0 ± 2.0 | 8.0 ± 5.0 | 0.0 - 16.7 |
| | | | Gr. Beta | 42.7 ± 8.1 | 53.0 ± 10.0 | 35.7 - 70.3 |
| | | | Sr-89 | 6.7 ± 1.2 | 8.0 ± 5.0 | 0.0 - 16.7 |
| | | | Sr-90 | 10.0 ± 2.0 | 110.0 ± 5.0 | 1.3 - 18.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|---|--|------------------------------------|----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-678 | WATER | Oct, 1992 | Ra-226 | 7.5 \pm 0.8 | 7.5 \pm 1.1 | 5.6 - 9.4 |
| | | | Ra-228 | 5.8 \pm 0.7 | 5.0 \pm 1.3 | 2.7 - 7.3 |
| | | | Uranium | 15.5 \pm 1.1 | 15.2 \pm 3.3 | 10.0 - 20.4 |
| STW-679 | WATER | Nov, 1992 | | | | |
| STW-680 | WATER | Jan, 1993 | Sr-89 | 15.0 \pm 2.0 | 15.0 \pm 5.0 | 6.3 - 23.7 |
| | | | Sr-90 | 10.3 \pm 1.2 | 10.0 \pm 5.0 | 1.3 - 18.7 |
| | | | | | | |
| STW-681 | WATER | Jan, 1993 | | | | |
| STW-682 | WATER | Jan, 1993 | Pu-239 | 17.5 \pm 1.6 | 20.0 \pm 2.0 | 16.5 - 23.5 |
| | | | Alpha | 17.1 \pm 1.2 | 34.0 \pm 9.0 | 18.4 - 49.6 |
| | | | Gross Alpha analysis was repeated with similar results. An investigation of possible causes for the deviation from the EPA was conducted with no cause discovered. The sample was spiked with Th-230; so Alpha Spec Analysis for Th-230 was performed in triplicate with results of 15.5 \pm 2.1, 13.4 \pm 1.4, and 14.8 \pm 2.0. It should be noted that 66% of all participants failed this analysis with a grand average of 17.1. This coupled with the support of the Alpha Spec results leaves TIML cause to believe that there may have been a dilution error at the EPA. It should be noted that on the next Gross Alpha EPA check, TIML reported results that were exactly the known value. Since no apparent cause can be found, and TIML had outstanding results on the following sample, it is felt that no further investigation is needed. | | | |
| STW-683 | WATER | Feb, 1993 | Beta | 46.7 \pm 3.2 | 44.0 \pm 5.0 | 35.3 - 52.7 |
| | | | I-131 | 106.0 \pm 10.0 | 100.0 \pm 10.0 | 82.7 - 117.3 |
| | | | | | | |
| STW-684 | WATER | Feb, 1993 | | | | |
| STW-685 | WATER | Mar, 1993 | Uranium | 7.2 \pm 0.5 | 7.6 \pm 3.0 | 2.4 - 12.8 |
| | | | Ra-226 | 9.3 \pm 1.3 | 9.8 \pm 1.5 | 7.2 - 12.4 |
| | | | Ra-228 | 20.8 \pm 2.2 | 18.5 \pm 4.6 | 10.5 - 26.5 |
| STW-686 | WATER | Apr, 1993 | Alpha | 88.3 \pm 8.1 | 95.0 \pm 24.0 | 53.4 - 136.6 |
| | | | Ra-226 | 25.4 \pm 1.4 | 24.9 \pm 3.7 | 18.5 - 31.3 |
| | | | Ra-228 | 17.4 \pm 1.2 | 19.0 \pm 4.8 | 10.7 - 27.3 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|---|-------------|----------------|----------|---|------------------------------------|------------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STW-687 | WATER | Apr, 1993 | Uranium | 27.8 ± 2.2 | 28.9 ± 3.0 | 23.7 - 34.1 |
| | | | Beta | 141.7 ± 9.0 | 177.0 ± 27.0 | 130.2 - 223.8 |
| | | | Co-60 | 41.3 ± 1.2 | 39.0 ± 5.0 | 30.3 - 47.7 |
| | | | Cs-134 | 24.7 ± 1.2 | 27.0 ± 5.0 | 18.3 - 35.7 |
| | | | Cs-137 | 30.0 ± 0.0 | 32.0 ± 5.0 | 23.3 - 40.7 |
| | | | Sr-89 | 28.7 ± 9.4 | 41.0 ± 5.0 | 32.3 - 49.7 |
| The EPA report was received 08-16-93. No cause for the low result for Sr-89 was found. The analyst has been observed performing this procedure with no noted discrepancies. Teledyne will continue to monitor this procedure in the future. No further action is anticipated unless conditions warrant. | | | | | | |
| STW-688 | WATER | Jun, 1993 | Sr-90 | 28.0 ± 3.5 | 29.0 ± 5.0 | 20.3 - 37.7 |
| | | | H-3 | 9613.3 ± 46.2 | 9844.0 ± 984.0 | 8136.8 - 11551.2 |
| STW-689 | WATER | Jun, 1993 | Ba-133 | 101.7 ± 10.3 | 99.0 ± 10.0 | 81.7 - 116.3 |
| | | | Co-60 | 17.3 ± 4.6 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Cs-134 | 5.7 ± 1.2 | 5.0 ± 5.0 | 0.0 - 13.7 |
| | | | Cs-137 | 6.0 ± 2.0 | 5.0 ± 5.0 | 0.0 - 13.7 |
| | | | Ru-106 | 108.0 ± 8.0 | 119.0 ± 12.0 | 98.2 - 139.8 |
| | | | Zn-65 | 114.0 ± 13.2 | 103.0 ± 10.0 | 85.7 - 120.3 |
| STW-690 | WATER | Jul, 1993 | Sr-89 | 28.3 ± 2.3 | 34.0 ± 5.0 | 25.3 - 42.7 |
| | | | Sr-90 | 25.0 ± 1.0 | 25.0 ± 5.0 | 16.3 - 33.7 |
| STW-691 | WATER | Jul, 1993 | Alpha | 15.0 ± 2.7 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Beta | 41.3 ± 4.9 | 43.0 ± 6.9 | 31.0 - 55.0 |
| STW-692 | WATER | Aug, 1993 | Uranium | 24.9 ± 1.4 | 25.3 ± 3.0 | 20.1 - 30.5 |
| STAF-693 | AIR FILTER | Aug, 1993 | Alpha | 17.0 ± 1.0 | 19.0 ± 5.0 | 10.3 - 27.7 |
| | | | Beta | 47.3 ± 0.6 | 47.0 ± 5.0 | 38.3 - 55.7 |
| | | | Cs-137 | 10.0 ± 1.0 | 9.0 ± 5.0 | 0.3 - 17.7 |
| | | | Sr-90 | 19.3 ± 0.6 | 19.0 ± 5.0 | 10.3 - 27.7 |
| STW-694 | WATER | Sep, 1993 | Ra-226 | 15.9 ± 0.7 | 14.9 ± 2.2 | 11.1 - 18.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|---|-------------|----------------|-----------|---|------------------------------------|-----------------|
| | | | | Teledyne Results ±2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| STM-695 | MILK | Sep, 1993 | Ra-228 | 21.0 ± 1.6 * | 20.4 ± 5.1 | 11.6 - 29.2 |
| | | | Cs-137 | 49.0 ± 3.0 | 49.0 ± 5.0 | 40.3 - 57.7 |
| | | | I-131 | 125.3 ± 4.5 | 120.0 ± 12.0 | 99.2 - 140.8 |
| | | | K | 1616.7 ± 37.9 | 1679.0 ± 84.0 | 1533.3 - 1824.7 |
| | | | Sr-89 | 19.3 ± 1.5 | 30.0 ± 5.0 | 21.3 - 38.7 |
| Report was received 01-18-94; an investigation is underway as to the cause of the low Sr-89 results. In-house spikes have been prepared and the analysis is in progress (see SPM-4848 and SPM-4849 in future reports). There is no apparent cause of the low Sr-89 results. In-house spikes have been prepared and the analysis is in progress. The analyst has been observed performing this procedure with no discrepancies noted. No further action is planned unless the results of the in-house spikes show a problem. | | | | | | |
| STW-696 | WATER | Oct, 1993 | Sr-90 | 22.0 ± 0.0 | 25.0 ± 5.0 | 16.3 - 33.7 |
| | | | I-131 | 116.7 ± 2.3 | 117.0 ± 12.0 | 96.2 - 137.8 |
| STW-697 | WATER | Oct, 1993 | Gr. Alpha | 39.7 ± 1.5 | 40.0 ± 10.0 | 22.7 - 57.3 |
| | | | Ra-226 | 10.6 ± 0.5 * | 9.9 ± 1.5 | 7.3 - 12.5 |
| | | | Ra-228 | 13.2 ± 1.5 | 12.5 ± 3.1 | 7.1 - 17.9 |
| | | | Uranium | 15.3 ± 0.6 | 15.1 ± 3.0 | 9.9 - 20.3 |
| | | | Beta | 52.0 ± 1.0 | 58.0 ± 10.0 | 40.7 - 75.3 |
| STW-698 | WATER | Oct, 1993 | Co-60 | 10.7 ± 0.6 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | Cs-134 | 10.0 ± 1.0 | 12.0 ± 5.0 | 3.3 - 20.7 |
| | | | Cs-137 | 12.3 ± 1.2 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | Sr-89 | 11.3 ± 0.6 | 15.0 ± 5.0 | 6.3 - 23.7 |
| | | | Sr-90 | 11.0 ± 0.0 | 10.0 ± 5.0 | 1.3 - 18.7 |
| | | | Alpha | 18.3 ± 2.5 | 20.0 ± 5.0 | 11.3 - 28.7 |
| | | | Beta | 13.7 ± 0.6 | 15.0 ± 5.0 | 6.3 - 23.7 |
| STW-700 | WATER | Nov, 1993 | H-3 | 7310.0 ± 175.2 | 7398.0 ± 740.0 | 6114.1 - 8681.9 |
| | | | Ba-133 | 75.7 ± 7.6 | 79.0 ± 8.0 | 65.1 - 92.9 |
| STW-701 | WATER | Nov, 1993 | Co-60 | 30.7 ± 2.1 | 30.0 ± 5.0 | 21.3 - 38.7 |

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media^a.

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^b | | |
|----------|-------------|----------------|--|--|------------------------------------|----------------|
| | | | | Teledyne Results ± 2 Sigma ^c | EPA Result ^d 1s, N=1 | Control Limits |
| | | | Cs-134 | 51.3 \pm 5.9 | 59.0 \pm 5.0 | 50.3 - 67.7 |
| | | | Cs-137 | 41.7 \pm 1.2 | 40.0 \pm 5.0 | 31.3 - 48.7 |
| | | | Ru-106 | 163.3 \pm 3.2 | 201.0 \pm 20.0 | 166.3 - 235.7 |
| | | | The report was received on 02-14-94; the cause of the low Ru-106 is under investigation. It should be noted that the grand average of all participants in this analysis was 175.2 pCi/L, with 54% of the participants outside of limits. | | | |
| | | | Zn-65 | 157.0 \pm 8.7 | 150.0 \pm 15.0 | 124.0 - 176.0 |

^a Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency (EPA), Las Vegas, Nevada.

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

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

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

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

| Lab Code | TLD Type | Date | Measurement | mR | | |
|---|----------------------------|-----------|-------------|-------------------------------|--------------------------|---|
| | | | | Teledyne Results ± 2 Sigma | Known Value ± 2 Sigma | Average ± 2 Sigma (All Participants) |
| <u>2nd International Intercomparison</u> | | | | | | |
| 115-2 | CaF ₂ : Mn Bulb | Apr, 1976 | | | | |
| | | | Field | 17.0 ± 1.9 | 17.1 | 16.4 ± 7.7 |
| | | | Lab | 20.8 ± 4.1 | 21.3 | 18.8 ± 7.6 |
| Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (HASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas. | | | | | | |
| <u>3rd International Intercomparison</u> | | | | | | |
| 115-3 | CaF ₂ : Mn Bulb | Jun, 1977 | | | | |
| | | | Field | 30.7 ± 3.2 | 34.9 ± 4.8 | 31.5 ± 3.0 |
| | | | Lab | 89.6 ± 6.4 | 91.7 ± 14.6 | 86.2 ± 24.0 |
| Third International Intercomparison of Environmental Dosimeters conducted in the summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas. | | | | | | |
| <u>4th International Intercomparison</u> | | | | | | |
| 115-4 | CaF ₂ : Mn Bulb | Jun, 1979 | | | | |
| | | | Field | 14.1 ± 1.1 | 14.1 ± 1.4 | 16.0 ± 9.0 |
| | | | Lab, High | 40.4 ± 1.4 | 45.8 ± 9.2 | 43.9 ± 13.2 |
| | | | Lab, Low | 9.8 ± 1.3 | 12.2 ± 2.4 | 12.0 ± 7.4 |
| Fourth International Intercomparison of Environmental Dosimeters conducted in the summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas. | | | | | | |
| <u>5th International Intercomparison</u> | | | | | | |
| 115-5A | CaF ₂ : Mn Bulb | Oct, 1980 | | | | |
| | | | Field | 31.4 ± 1.8 | 30.0 ± 6.0 | 30.2 ± 14.6 |
| | | | Lab, End | 96.6 ± 5.8 | 88.4 ± 8.8 | 90.7 ± 31.2 |
| | | | Lab, Start | 77.4 ± 5.8 | 75.2 ± 7.6 | 75.8 ± 40.4 |
| 115-5B | LiF-100 Chips | Oct, 1980 | | | | |
| | | | Field | 30.3 ± 4.8 | 30.0 ± 6.0 | 30.2 ± 14.6 |
| | | | Lab, End | 85.4 ± 11.7 | 88.4 ± 8.8 | 90.7 ± 31.2 |
| | | | Lab, Start | 81.1 ± 7.4 | 75.2 ± 7.6 | 75.8 ± 40.4 |
| Fifth International Intercomparison of Environmental Dosimeters conducted in the fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy. | | | | | | |
| <u>7th International Intercomparison</u> | | | | | | |
| 115-7A | LiF-100 Chips | Jun, 1984 | | | | |
| | | | Field | 75.4 ± 2.6 | 75.8 ± 6.0 | 75.1 ± 29.8 |

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

| Lab Code | TLD Type | Date | Measurement | mR | | |
|----------|--------------------------------|-----------|-------------|-------------------------------|--------------------------|---|
| | | | | Teledyne Results ± 2 Sigma | Known Value ± 2 Sigma | Average ± 2 Sigma (All Participants) |
| 115-7B | CaF ₂ : Mn Bulb | Jun, 1984 | Lab, Co-60 | 80.0 ± 3.5 | 79.9 ± 4.0 | 77.9 ± 27.6 |
| | | | Lab, Cs-137 | 66.6 ± 2.5 | 75.0 ± 3.8 | 73.0 ± 22.2 |
| | | | Field | 71.5 ± 2.6 | 75.8 ± 6.0 | 75.1 ± 29.8 |
| | | | Lab, Co-60 | 84.8 ± 6.4 | 79.9 ± 4.0 | 77.9 ± 27.6 |
| | | | Lab, Cs-137 | 78.8 ± 1.6 | 75.0 ± 3.8 | 73.0 ± 22.2 |
| 115-7C | CaSO ₄ :Dy Cards | Jun, 1984 | Field | 76.8 ± 2.7 | 75.8 ± 6.0 | 75.1 ± 29.8 |
| | | | Lab, Co-60 | 82.5 ± 3.7 | 79.9 ± 4.0 | 77.9 ± 27.6 |
| | | | Lab, Cs-137 | 79.0 ± 3.2 | 75.0 ± 3.8 | 73.0 ± 22.2 |

Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, The Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency. Teledyne did not participate in the Sixth International Intercomparison of Environmental Dosimeters.

8th International Intercomparison

| | | | | | | |
|--------|--------------------------------|-----------|---------------|------------|------------|-------------|
| 115-8A | LiF-100 Chips | Jan, 1986 | Field, Site 1 | 29.5 ± 1.4 | 29.7 ± 1.5 | 28.9 ± 12.4 |
| | | | Field, Site 2 | 11.3 ± 0.8 | 10.4 ± 0.5 | 10.1 ± 9.1 |
| | | | Lab, Cs-137 | 13.7 ± 0.9 | 17.2 ± 0.9 | 16.2 ± 6.8 |
| 115-8B | CaF ₂ : Mn Bulb | Jan, 1986 | Field, Site 1 | 32.3 ± 1.2 | 29.7 ± 1.5 | 28.9 ± 12.4 |
| | | | Field, Site 2 | 9.0 ± 1.0 | 10.4 ± 0.5 | 10.1 ± 9.0 |
| | | | Lab, Cs-137 | 15.8 ± 0.9 | 17.2 ± 0.9 | 16.2 ± 6.8 |
| 115-8C | CaSO ₄ :Dy Cards | Jan, 1986 | Field, Site 1 | 32.2 ± 0.7 | 29.7 ± 1.5 | 28.9 ± 12.4 |
| | | | Field, Site 2 | 10.6 ± 0.6 | 10.4 ± 0.5 | 10.1 ± 9.0 |
| | | | Lab, Cs-137 | 18.1 ± 0.8 | 17.2 ± 0.9 | 16.2 ± 6.8 |

Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York and sponsored by the U.S. Department of Energy.

10th International Intercomparison

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

| Lab Code | TLD Type | Date | Measurement | mR | | |
|----------|--------------------------------|-----------|-------------|-------------------------------|--------------------------|---|
| | | | | Teledyne Results ± 2 Sigma | Known Value ± 2 Sigma | Average ± 2 Sigma (All Participants) |
| 115-10A | LiF-100 Chips | Aug, 1993 | Field | 25.7 ± 1.4 | 27.0 ± 1.6 | 26.4 ± 10.2 |
| | | | Lab | 22.7 ± 1.6 | 25.9 ± 1.3 | 25.0 ± 9.4 |
| | | | Lab | 62.7 ± 2.6 | 72.7 ± 1.9 | 69.8 ± 20.3 |
| 115-10B | CaSO ₄ :Dy Cards | Aug, 1993 | Field | 26.0 ± 2.3 | 27.0 ± 1.6 | 26.4 ± 10.2 |
| | | | Lab | 24.1 ± 1.7 | 25.9 ± 1.3 | 25.0 ± 9.4 |
| | | | Lab | 69.2 ± 3.0 | 72.7 ± 1.9 | 69.8 ± 20.3 |

Tenth International Intercomparison of Environmental Dosimeters conducted in 1993 at Idaho State University and sponsored by the U.S. Department of Energy and the Idaho State University. The Ninth International Intercomparison of Environmental Dosimeters was not available to Teledyne's Midwest Laboratory.

Teledyne Testing

| | | | | | | |
|------|---------------|-----------|-----|------------|------|----|
| 89-1 | LiF-100 Chips | Sep, 1989 | Lab | 21.0 ± 0.4 | 22.4 | ND |
|------|---------------|-----------|-----|------------|------|----|

ND = No Data; Teledyne Testing was only performed by Teledyne.

Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. in September, 1989.

| | | | | | | |
|------|--|-----------|-----|------------|------|----|
| 89-2 | Teledyne CaSO ₄ :Dy Cards | Nov, 1989 | Lab | 20.9 ± 1.0 | 20.3 | ND |
|------|--|-----------|-----|------------|------|----|

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. in November, 1989.

| | | | | | | |
|------|--|-----------|-----|------------|------|----|
| 90-1 | Teledyne CaSO ₄ :Dy Cards | Jun, 1990 | Lab | 20.6 ± 1.4 | 19.6 | ND |
|------|--|-----------|-----|------------|------|----|

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on June 19, 1990.

| | | | | | | |
|------|--|-----------|-----|-------------|-------|----|
| 90-2 | Teledyne CaSO ₄ :Dy Cards | Sep, 1990 | Lab | 100.8 ± 4.3 | 100.0 | ND |
|------|--|-----------|-----|-------------|-------|----|

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.

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

| Lab Code | TLD Type | Date | Measurement | mR | | |
|----------|--|-----------|-------------|-----------------------------------|------------------------------|---|
| | | | | Teledyne Results ± 2 Sigma | Known Value ± 2 Sigma | Average ± 2 Sigma (All Participants) |
| 91-1 | Teledyne CaSO ₄ :Dy Cards | Oct, 1990 | Lab 1 | 33.4 \pm 2.0 | 32.0 | ND |
| | | | Lab 2 | 55.2 \pm 4.7 | 58.8 | ND |
| | | | Lab 3 | 87.8 \pm 6.2 | 85.5 | ND |

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on October 8, 1991.

| | | | | | | |
|------|---------------|-----------|-------|----------------|------|----|
| 92-1 | LiF-100 Chips | Feb, 1992 | Lab 1 | 11.1 \pm 0.2 | 10.7 | ND |
| | | | Lab 2 | 25.6 \pm 0.5 | 25.4 | ND |
| | | | Lab 3 | 46.4 \pm 0.5 | 46.3 | ND |

ND = No Data; Teledyne Testing was only performed by Teledyne.

Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on February 26, 1992.

| | | | | | | |
|------|--|-----------|--------------|----------------|------|----|
| 92-2 | Teledyne CaSO ₄ :Dy Cards | Apr, 1992 | Reader 1, #1 | 20.1 \pm 0.1 | 20.1 | ND |
| | | | Reader 1, #2 | 40.6 \pm 0.1 | 40.0 | ND |
| | | | Reader 1, #3 | 60.0 \pm 1.3 | 60.3 | ND |
| | | | Reader 2, #1 | 20.3 \pm 0.3 | 20.1 | ND |
| | | | Reader 2, #2 | 39.2 \pm 0.3 | 40.0 | ND |
| | | | Reader 2, #3 | 60.7 \pm 0.4 | 60.3 | ND |

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on April 1, 1992.

| | | | | | | |
|------|---------------------------|-----------|-------|----------------|------|----|
| 93-1 | Teledyne LiF-100 Chips | Mar, 1993 | Lab 1 | 10.0 \pm 1.0 | 10.2 | ND |
| | | | Lab 2 | 25.5 \pm 2.2 | 25.5 | ND |
| | | | Lab 3 | 42.7 \pm 5.7 | 45.9 | ND |

ND = No Data; Teledyne Testing was only performed by Teledyne.

Cards and Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on March 10, 1993. Due to a potential error of 10-12% when cards were irradiated, results of the testing on the cards will not be published. Data is available upon request.

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|----------|-------------|----------------|-----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| QCM1-26 | MILK | Jan, 1990 | Cs-134 | 19.3±1.0 | 20.8 | 10.8 - 30.8 |
| | | | Cs-137 | 25.2±1.2 | 22.8 | 12.8 - 32.8 |
| | | | Sr-90 | 18.0±1.6 | 18.8 | 8.8 - 28.8 |
| QCM1-27 | MILK | Feb, 1990 | I-131 | 63.8±2.2 | 62.6 | 50.1 - 75.1 |
| QCM1-28 | MILK | Mar, 1990 | Cs-134 | 18.3±1.0 | 19.7 | 9.7 - 29.7 |
| QCM1-29 | MILK | Apr, 1990 | Cs-137 | 20.3±1.0 | 18.2 | 8.2 - 28.2 |
| | | | I-131 | 90.7±9.2 | 82.5 | 66.0 - 99.0 |
| | | | Sr-89 | 17.9±5.5 | 23.1 | 13.1 - 33.1 |
| QCW-61 | WATER | Apr, 1990 | Sr-90 | 19.4±2.5 | 23.5 | 13.5 - 33.5 |
| QCW-62 | WATER | Apr, 1990 | Co-60 | 8.7±0.4 | 9.4 | 0.0 - 19.4 |
| | | | Cs-134 | 20.0±0.2 | 19.7 | 9.7 - 29.7 |
| | | | Cs-137 | 28.7±1.4 | 22.7 | 12.7 - 32.7 |
| QCW-63 | WATER | Apr, 1990 | I-131 | 63.5±8.0 | 66.0 | 52.8 - 79.2 |
| QCW-64 | WATER | Apr, 1990 | H-3 | 1941.0±130.0 | 1826.0 | 1141.5 - 2510.5 |
| QCW-65 | WATER | Jun, 1990 | Ra-226 | 6.4±0.2 | 6.9 | 4.8 - 9.0 |
| QCW-66 | WATER | Jun, 1990 | Uranium | 6.2±0.2 | 6.0 | 3.6 - 8.4 |
| QCM1-30 | MILK | Jul, 1990 | Cs-134 | 46.0±1.3 | 49.0 | 39.0 - 59.0 |
| | | | Cs-137 | 27.6±1.3 | 25.3 | 15.3 - 35.3 |
| | | | Sr-89 | 12.8±0.4 | 18.4 | 8.4 - 28.4 |
| | | | Sr-90 | 18.2±1.4 | 18.7 | 8.7 - 28.7 |
| QCW-68 | WATER | Jul, 1990 | Gr. Alpha | 9.8±0.3 | 10.6 | 0.6 - 20.6 |
| | | | Gr. Beta | 11.4±0.6 | 11.3 | 1.3 - 21.3 |
| QCM1-31 | MILK | Aug, 1990 | I-131 | 68.8±1.6 | 61.4 | 49.1 - 73.7 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|----------|-------------|----------------|-----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| QCW-69 | WATER | Sep, 1990 | Sr-89 | 17.7 ± 1.6 | 19.2 | 9.2 - 29.2 |
| | | | Sr-90 | 13.9 ± 1.6 | 17.4 | 7.4 - 27.4 |
| QC MI-32 | MILK | Oct, 1990 | Cs-134 | 25.8 ± 1.2 | 27.3 | 17.3 - 37.3 |
| | | | Cs-137 | 25.3 ± 2.0 | 22.4 | 12.4 - 32.4 |
| | | | I-131 | 34.8 ± 0.2 | 32.4 | 20.4 - 44.4 |
| QCW-70 | WATER | Oct, 1990 | H-3 | 2355.0 ± 59.0 | 2276.0 | 1577.3 - 2974.7 |
| QCW-71 | WATER | Oct, 1990 | I-131 | 55.9 ± 0.9 | 51.8 | 39.8 - 63.8 |
| QCW-73 | WATER | Oct, 1990 | Co-60 | 18.3 ± 2.7 | 16.8 | 6.8 - 26.8 |
| | | | Cs-134 | 28.3 ± 2.3 | 27.0 | 17.0 - 37.0 |
| | | | Cs-137 | 22.7 ± 1.3 | 22.4 | 12.4 - 32.4 |
| QCW-74 | WATER | Dec, 1990 | Gr. Alpha | 21.4 ± 1.0 | 26.1 | 13.1 - 39.2 |
| | | | Gr. Beta | 25.9 ± 1.0 | 22.3 | 12.3 - 32.3 |
| QCMI-33 | MILK | Jan, 1991 | Cs-134 | 22.2 ± 1.7 | 19.6 | 9.6 - 29.6 |
| | | | Cs-137 | 26.1 ± 1.6 | 22.3 | 12.3 - 32.3 |
| | | | Sr-89 | 20.7 ± 3.3 | 21.6 | 11.6 - 31.6 |
| | | | Sr-90 | 19.0 ± 1.4 | 23.0 | 13.0 - 33.0 |
| QCMI-34 | MILK | Feb, 1991 | I-131 | 40.7 ± 1.8 | 40.1 | 28.1 - 52.1 |
| QCW-75 | WATER | Mar, 1991 | Sr-89 | 18.8 ± 1.5 | 23.3 | 13.3 - 33.3 |
| | | | Sr-90 | 16.0 ± 0.8 | 17.2 | 7.2 - 27.2 |
| QCMI-35 | MILK | Apr, 1991 | Cs-134 | 19.2 ± 2.0 | 22.6 | 12.6 - 32.6 |
| | | | Cs-137 | 22.8 ± 2.2 | 22.1 | 12.1 - 32.1 |
| | | | I-131 | 48.0 ± 0.8 | 49.2 | 37.2 - 61.2 |
| QCW-76 | WATER | Apr, 1991 | I-131 | 56.5 ± 1.7 | 59.0 | 47.2 - 70.8 |
| QCW-77 | WATER | Apr, 1991 | Co-60 | 16.4 ± 2.2 | 15.7 | 5.7 - 25.7 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|----------|-------------|----------------|-----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| QCW-78 | WATER | Apr, 1991 | Cs-134 | 23.8 ± 2.5 | 22.6 | 12.6 - 32.6 |
| | | | Cs-137 | 25.0 ± 2.4 | 21.1 | 11.1 - 31.1 |
| | | | H-3 | 4027.0 ± 188.0 | 4080.0 | 3264.0 - 4896.0 |
| QCV-79 | WATER | Jun, 1991 | Gr. Alpha | 7.4 ± 0.7 | 7.8 | 0.0 - 17.8 |
| | | | Gr. Beta | 11.0 ± 0.7 | 11.0 | 1.0 - 21.0 |
| | | | | | | |
| SPM-36 | MILK | Jul, 1991 | Cs-137 | 34.3 ± 3.0 | 35.1 | 25.1 - 45.1 |
| | | | I-131 | 14.4 ± 1.9 | 18.3 | 6.3 - 30.3 |
| | | | Sr-89 | 28.1 ± 2.1 | 34.0 | 24.0 - 44.0 |
| | | | Sr-90 | 11.6 ± 0.7 | 11.5 | 1.5 - 21.5 |
| | | | | | | |
| QCM-37 | MILK | Oct, 1991 | Cs-134 | 22.7 ± 2.8 | 22.1 | 12.1 - 32.1 |
| | | | Cs-137 | 38.3 ± 3.0 | 35.1 | 25.1 - 45.1 |
| | | | I-131 | 23.6 ± 3.2 | 25.8 | 13.8 - 37.8 |
| | | | | | | |
| QCW-80 | WATER | Oct, 1991 | Sr-89 | 27.4 ± 6.9 | 24.4 | 14.4 - 34.4 |
| | | | Sr-90 | 11.7 ± 1.4 | 14.1 | 4.1 - 24.1 |
| | | | | | | |
| QCW-81 | WATER | Oct, 1991 | I-131 | 19.1 ± 0.7 | 20.6 | 8.6 - 32.6 |
| QCW-82 | WATER | Oct, 1991 | Co-60 | 22.6 ± 2.7 | 22.1 | 12.1 - 32.1 |
| | | | Cs-134 | 15.5 ± 1.8 | 17.6 | 7.6 - 27.6 |
| | | | Cs-137 | 17.5 ± 2.1 | 17.6 | 7.6 - 27.6 |
| | | | | | | |
| QCW-83 | WATER | Oct, 1991 | H-3 | 4639.0 ± 137.0 | 4382.0 | 3505.6 - 5258.4 |
| QCW-84 | WATER | Dec, 1991 | Gr. Alpha | 6.2 ± 6.0 | 7.8 | 0.0 - 17.8 |
| | | | Gr. Beta | 11.0 ± 0.7 | 11.0 | 1.0 - 21.0 |
| | | | | | | |
| QCM-39 | MILK | Jan, 1992 | Cs-134 | 42.1 ± 5.7 | 49.4 | 39.4 - 59.4 |
| | | | Cs-137 | 55.2 ± 6.4 | 53.0 | 43.0 - 63.0 |
| | | | I-131 | 76.8 ± 0.9 | 83.7 | 67.0 - 100.4 |
| | | | Sr-89 | 21.6 ± 6.5 | 31.2 | 21.2 - 41.2 |
| | | | Sr-90 | 38.7 ± 1.8 | 42.3 | 33.8 - 50.8 |
| | | | | | | |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|----------|-------------|----------------|-----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| QCW-85 | WATER | Mar, 1992 | Sr-89 | 26.2 ± 3.1 | 32.0 | 22.0 - 42.0 |
| | | | Sr-90 | 24.4 ± 1.4 | 28.0 | 18.0 - 38.0 |
| QCM1-40 | MILK | Apr, 1992 | Cs-134 | 58.0 ± 2.6 | 55.9 | 45.9 - 65.9 |
| | | | Cs-137 | 43.7 ± 3.0 | 38.9 | 28.9 - 48.9 |
| QCM1-41 | MILK | Apr, 1992 | I-131 | 50.3 ± 0.8 | 55.9 | 44.7 - 67.1 |
| QCW-86 | WATER | Apr, 1992 | H-3 | 4080.0 ± 190.0 | 4027.0 | 3221.6 - 4832.4 |
| QCW-87 | WATER | Apr, 1992 | I-131 | 33.5 ± 0.6 | 33.2 | 21.2 - 45.2 |
| QCW-88 | WATER | Apr, 1992 | Co-60 | 17.5 ± 2.7 | 19.7 | 9.7 - 29.7 |
| | | | Cs-134 | 28.9 ± 2.5 | 33.5 | 23.5 - 43.5 |
| | | | Cs-137 | 41.0 ± 3.0 | 38.9 | 28.9 - 48.9 |
| | | | Gr. Alpha | 15.3 ± 0.8 | 13.6 | 3.6 - 23.6 |
| QCM1-42 | MILK | Aug, 1992 | Gr. Beta | 17.2 ± 0.9 | 17.6 | 7.6 - 27.6 |
| | | | Cs-134 | 20.1 ± 2.8 | 20.2 | 10.2 - 30.2 |
| | | | Cs-137 | 26.2 ± 2.7 | 26.1 | 16.1 - 36.1 |
| | | | Sr-89 | 41.4 ± 5.9 | 51.2 | 41.0 - 61.4 |
| | | | Sr-90 | 48.9 ± 2.5 | 51.9 | 41.5 - 62.3 |
| QCW-90 | WATER | Sep, 1992 | Sr-89 | 6.7 ± 3.4 | 12.6 | 2.6 - 22.6 |
| | | | Sr-90 | 16.1 ± 1.4 | 15.6 | 5.6 - 25.6 |
| QCM1-43 | MILK | Oct, 1992 | Cs-134 | 14.2 ± 3.4 | 12.7 | 2.7 - 22.7 |
| | | | Cs-137 | 14.1 ± 5.2 | 17.1 | 7.1 - 27.1 |
| | | | I-131 | 19.9 ± 1.0 | 21.5 | 9.5 - 33.5 |
| QCM1-44 | MILK | Oct, 1992 | Cs-134 | 28.2 ± 4.0 | 25.4 | 15.4 - 35.4 |
| | | | Cs-137 | 38.8 ± 5.1 | 34.2 | 24.2 - 44.2 |
| | | | I-131 | 36.1 ± 1.2 | 43.0 | 31.0 - 55.0 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|-----------|--------------------------|----------------|-----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| QCW-91 | WATER | Oct, 1992 | I-131 | 34.9 ± 2.2 | 34.9 | 22.9 - 46.9 |
| QCW-92 | WATER | Oct, 1992 | Co-60 | 11.4 ± 1.9 | 9.2 | 0.0 - 19.2 |
| | | | Cs-134 | 18.7 ± 2.3 | 14.3 | 4.3 - 24.3 |
| | | | Cs-137 | 14.1 ± 1.8 | 15.0 | 5.0 - 25.0 |
| QCW-93 | WATER | Oct, 1992 | H-3 | 3704.0 ± 186.0 | 3904.0 | 3169.2 - 4638.8 |
| QCW-94 | WATER | Oct, 1992 | H-3 | 14925.0 ± 339.0 | 15616.0 | 12492.8 - 18739.2 |
| QCW-95 | WATER | Oct, 1992 | I-131 | 64.2 ± 2.7 | 67.2 | 53.8 - 80.6 |
| QCW-36 | WATER | Dec, 1992 | Alpha | 11.5 ± 2.3 | 15.2 | 9.1 - 21.3 |
| | | | Beta | 26.5 ± 2.0 | 25.7 | 15.4 - 36.0 |
| QCW-96 | WATER | Dec, 1992 | Gr. Alpha | 8.3 ± 0.6 | 10.4 | 0.4 - 20.4 |
| | | | Gr. Beta | 19.8 ± 1.5 | 20.6 | 10.6 - 30.6 |
| SPM-3341 | MILK | Jan, 1993 | Cs-134 | 17.1 ± 2.0 | 21.3 | 11.3 - 31.3 |
| | | | Cs-137 | 21.4 ± 2.0 | 23.8 | 13.8 - 33.8 |
| | | | Sr-89 | 6.7 ± 3.1 | 8.7 | 0.0 - 18.7 |
| | | | Sr-90 | 20.0 ± 1.2 | 19.2 | 9.2 - 29.2 |
| SPM-3387 | MILK | Feb, 1993 | I-131 | 72.5 ± 8.4 | 71.5 | 57.2 - 85.8 |
| SPVE-3401 | VEGETATION (SAW DUST) | Feb, 1993 | I-131 | 994.5 ± 53.2 | 953.7 | 763.0 - 1144.4 |
| SPCH-3402 | CHARCOAL | Feb, 1993 | I-131 | 95.2 ± 12.8 | 95.4 | 76.3 - 114.5 |
| SPW-3434 | WATER | Apr, 1993 | Gr. Alpha | 10.4 ± 1.8 | 10.4 | 0.4 - 20.4 |
| | | | Gr. Beta | 22.0 ± 2.0 | 20.6 | 10.6 - 30.6 |
| SPW-3556 | WATER | Apr, 1993 | Sr-89 | 18.2 ± 5.0 | 22.2 | 12.2 - 32.2 |
| | | | Sr-90 | 20.1 ± 1.8 | 17.0 | 7.0 - 27.0 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|--|-----------------|----------------|----------|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| SPW-3597 | WATER | Apr, 1993 | H-3 | 5464.0 ± 219.0 | 5428.0 | 4342.4 - 6513.6 |
| SPW-3599 | WATER | Apr, 1993 | I-131 | 149.8 ± 1.9 | 145.0 | 116.0 - 174.0 |
| SPW-3606 | WATER | Apr, 1993 | Co-60 | 21.8 ± 2.3 | 21.5 | 11.5 - 31.5 |
| | | | Cs-134 | 26.4 ± 1.9 | 26.4 | 16.4 - 36.4 |
| | | | Cs-137 | 33.9 ± 2.6 | 31.7 | 21.7 - 41.7 |
| SPM-3631 | MILK | Apr, 1993 | Cs-134 | 48.8 ± 2.9 | 52.8 | 42.8 - 62.8 |
| | | | Cs-137 | 65.2 ± 2.9 | 63.4 | 53.4 - 73.4 |
| | | | I-131 | 139.8 ± 1.6 | 145.0 | 116.0 - 174.0 |
| SPF-3681 | FISH (JELLO) | May, 1993 | Cs-137 | 68.2 ± 7.7 | 67.6 | 57.6 - 77.6 |
| Concentrations are in pCi/Total Volume (550g). | | | | | | |
| SPW-3842 | WATER | Jun, 1993 | Th-230 | 4.2 ± 0.5 | 4.5 | 2.7 - 6.3 |
| SPW-4160 | WATER | Jun, 1993 | Alpha | 8.9 ± 1.4 | 12.9 | 7.7 - 18.1 |
| | | | Beta | 22.0 ± 1.9 | 31.9 | 19.1 - 44.7 |
| SPW-4232 | WATER | Aug, 1993 | Fe-55 | 1684.0 ± 415.0 | 1420.0 | 1136.0 - 1704.0 |
| SPW-4246 | WATER | Aug, 1993 | Sr-90 | 32.2 ± 2.6 | 30.4 | 24.3 - 36.5 |
| SPM-4247 | MILK | Aug, 1993 | Sr-89 | 29.1 ± 4.9 | 35.4 | 25.4 - 45.4 |
| | | | Sr-90 | 18.3 ± 1.3 | 19.2 | 9.2 - 29.2 |
| SPW-4248 | WATER | Aug, 1993 | H-3 | 9910.0 ± 300.0 | 10430.0 | 8344.0 - 12516.0 |
| SPW-4250 | WATER | Aug, 1993 | Co-60 | 247.0 ± 23.1 | 247.7 | 222.9 - 272.5 |
| | | | Cs-134 | 141.6 ± 15.9 | 141.1 | 127.0 - 155.2 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|-----------|-----------------------|----------------|--|--|----------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| SPF-4251 | FISH (JELLO) | Aug, 1993 | Cs-137 | 283.5 ± 27.8 | 247.2 | 222.5 - 271.9 |
| | | | The cause of the high Cs-137 data is unknown. All data was reviewed, no errors were found in the calculations. The employee was observed performing this analysis and no deviations from the procedure were observed. The employee's results have been good in the past; no further action is planned. | | | |
| | | | Cs-134 | 63.8 ± 3.3 | 75.3 | 65.3 - 85.3 |
| SPS-4262 | SEDIMENT (BOTTOM) | Aug, 1993 | Cs-137 | 203.6 ± 8.2 | 198.1 | 178.3 - 217.9 |
| | | | Cs-134 | 74.1 ± 9.9 | 71.0 | 61.0 - 81.0 |
| | | | Cs-137 | 212.4 ± 14.8 | 197.8 | 178.0 - 217.6 |
| SPW-4377 | WATER | Sep, 1993 | I-131 | 39.0 ± 10.0 | 42.1 | 30.1 - 54.1 |
| SPM-4378 | MILK | Sep, 1993 | I-131 | 44.5 ± 5.5 | 42.1 | 30.1 - 54.1 |
| | | | I-131 | 90.3 ± 13.5 | 84.3 | 67.4 - 101.2 |
| SPCH-4379 | CHARCOAL | Sep, 1993 | I-131 | 193.2 ± 20.0 | 170.2 | 136.2 - 204.2 |
| SPVE-4380 | VEGETATION (SAW DUST) | Sep, 1993 | Sr-89 | 21.9 ± 4.0 | 28.8 | 18.8 - 38.8 |
| SPW-4381 | WATER | Sep, 1993 | Sr-90 | 19.5 ± 1.8 | 19.0 | 9.0 - 29.0 |
| | | | I-129 | 18.1 ± 1.0 | 18.6 | 6.6 - 30.6 |
| | | | H-3 | 16900.0 ± 368.0 | 17380.0 | 13904.0 - 20856.0 |
| SPW-4428 | WATER | Oct, 1993 | Co-60 | 19.3 ± 3.1 | 18.3 | 8.3 - 28.3 |
| | | | Cs-134 | 31.5 ± 3.3 | 33.5 | 23.5 - 43.5 |
| | | | Cs-137 | 44.4 ± 3.6 | 43.2 | 33.2 - 53.2 |
| | | | Cs-134 | 30.8 ± 4.5 | 33.0 | 23.0 - 43.0 |
| | | | Cs-137 | 43.4 ± 6.0 | 43.2 | 33.2 - 53.2 |
| | | | I-131 | 49.7 ± 8.6 | 44.5 | 32.5 - 56.5 |
| | | | I-131 | 49.7 ± 8.6 | 44.5 | 32.5 - 56.5 |

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

| Lab Code | Sample Type | Date Collected | Analyses | Concentration in pCi/L ^a | | |
|-------------|----------------|-------------------|----------|--|-------------------|--------------------------------|
| | | | | Teledyne Results 2s, n=1 ^b | Known Activity | Control ^c Limits |
| SPW-4427 | WATER | Oct, 1993 | I-131 | 95.2 ± 10.6 | 88.9 | 71.1 - 106.7 |

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

^b All samples prior to January 1991 are the results of three determinations; after January 1991, all determinations are single.

^c Control Limits are based on EPA publication; "Environmental Radioactive Laboratory Intercomparison Studies Program", Fiscal Year 1981-1982, EPA-600/4-81-004 (see Attachment A) or limits imposed by Teledyne's Midwest Laboratory.

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | | |
|----------|-------------|-------------|--|----------------------------------|-----------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |
| SPW-8039 | WATER | Jan 1990 | Ra-226 | < 0.2 | | < 1.0 |
| SPM-8040 | MILK | Jan 1990 | Sr-89 | < 0.8 | | < 5.0 |
| | | | Sr-90 | < 1.0 | | < 1.0 |
| SPM-8208 | MILK | Jan 1990 | Cs-134 | < 3.6 | | < 10.0 |
| | | | Cs-137 | < 4.7 | | < 10.0 |
| | | | Sr-89 | < 0.8 | | < 5.0 |
| | | | Sr-90 | N/A | 1.6 ± 0.5 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| SPM-8312 | MILK | Feb 1990 | Sr-89 | < 0.3 | | < 5.0 |
| | | | Sr-90 | N/A | 1.2 ± 0.3 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| SPW-8312 | WATER | Feb 1990 | Sr-89 | < 0.6 | | < 5.0 |
| | | | Sr-90 | < 0.7 | | < 1.0 |
| SPM-8314 | MILK | Mar 1990 | I-131 | < 0.3 | | < 1.0 |
| SPM-8510 | MILK | May 1990 | Cs-134 | < 4.6 | | < 10.0 |
| | | | Cs-137 | < 4.8 | | < 10.0 |
| | | | I-131 | < 0.2 | | < 1.0 |
| SPW-8511 | WATER | May 1990 | H-3 | < 200.0 | | < 300.0 |
| SPM-8600 | MILK | Jul 1990 | Cs-134 | < 5.0 | | < 10.0 |
| | | | Cs-137 | < 7.0 | | < 10.0 |
| | | | I-131 | < 0.3 | | < 1.0 |
| | | | Sr-89 | < 0.8 | | < 5.0 |
| | | | Sr-90 | N/A | 1.7 ± 0.6 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | |
|----------|-------------|-------------|-----------|----------------------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | |
| | | | | LLD | Acceptance Criteria (4.66 Sigma) |
| SPM-8877 | MILK | Aug 1990 | I-131 | < 0.2 | < 1.0 |
| SPW-8925 | WATER | Aug 1990 | H-3 | < 200.0 | < 300.0 |
| SPW-8926 | WATER | Aug 1990 | Gr. Alpha | < 0.3 | < 1.0 |
| | | | Gr. Beta | < 0.7 | < 5.0 |
| SPW-8927 | WATER | Aug 1990 | U-234 | < 0.01 | < 1.0 |
| | | | U-235 | < 0.02 | < 1.0 |
| | | | U-238 | < 0.01 | < 1.0 |
| SPW-8928 | WATER | Aug 1990 | Co-58 | < 4.1 | < 10.0 |
| | | | Co-60 | < 2.4 | < 10.0 |
| | | | Cs-134 | < 3.3 | < 10.0 |
| | | | Cs-137 | < 3.7 | < 10.0 |
| | | | Mn-54 | < 4.0 | < 10.0 |
| SPW-8929 | WATER | Aug 1990 | Sr-89 | < 1.4 | < 5.0 |
| | | | Sr-90 | < 0.6 | < 1.0 |
| SPW-69 | WATER | Sep 1990 | Sr-89 | < 1.8 | < 5.0 |
| | | | Sr-90 | < 0.8 | < 1.0 |
| SPW-106 | WATER | Oct 1990 | H-3 | < 180.0 | < 300.0 |
| | | | I-131 | < 0.3 | < 1.0 |
| SPM-107 | MILK | Oct 1990 | Cs-134 | < 3.3 | < 10.0 |
| | | | Cs-137 | < 4.3 | < 10.0 |
| | | | I-131 | < 0.4 | < 1.0 |
| SPW-370 | WATER | Oct 1990 | Co-58 | < 2.6 | < 10.0 |
| | | | Co-60 | < 1.6 | < 10.0 |
| | | | Cs-134 | < 1.7 | < 10.0 |
| | | | Cs-137 | < 1.8 | < 10.0 |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | |
|-------------|----------------|----------------|--|----------------------------------|--|
| | | | | Teledyne Results (4.66 Sigma) | |
| | | | | LLD | Acceptance Criteria (4.66 Sigma) |
| SPW-372 | WATER | Dec 1990 | Mn-54 | < 1.7 | < 10.0 |
| | | | Gr. Alpha | < 0.3 | < 1.0 |
| | | | Gr. Beta | < 0.8 | < 5.0 |
| SPM-406 | MILK | Jan 1991 | Cs-134 | < 3.7 | < 10.0 |
| | | | Cs-137 | < 5.2 | < 10.0 |
| | | | Sr-89 | < 0.4 | < 5.0 |
| | | | Sr-90 | N/A | 1.8 ± 0.4 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | |
| | | | | | < 1.0 |
| | | | | | |
| SPM-421 | MILK | Feb 1991 | I-131 | < 0.3 | < 1.0 |
| SPM-451 | MILK | Feb 1991 | Ra-226 | < 0.1 | < 1.0 |
| | | | Ra-228 | < 0.9 | < 1.0 |
| | | | | | |
| SPW-514 | WATER | Mar 1991 | Sr-89 | < 1.1 | < 5.0 |
| | | | Sr-90 | < 0.9 | < 1.0 |
| | | | | | |
| SPW-586 | WATER | Apr 1991 | Co-60 | < 2.5 | < 10.0 |
| | | | Cs-134 | < 2.4 | < 10.0 |
| | | | Cs-137 | < 2.2 | < 10.0 |
| | | | I-131 | < 0.2 | < 1.0 |
| | | | | | |
| SPM-587 | MILK | Apr 1991 | Cs-134 | < 1.7 | < 10.0 |
| | | | Cs-137 | < 1.9 | < 10.0 |
| | | | I-131 | < 0.2 | < 1.0 |
| | | | | | |
| SPW-837 | WATER | Jun 1991 | Gr. Alpha | < 0.6 | < 1.0 |
| | | | Gr. Beta | < 1.1 | < 5.0 |
| | | | | | |
| SPM-953 | MILK | Jul 1991 | Cs-137 | < 4.9 | < 10.0 |
| | | | I-131 | < 0.2 | < 1.0 |
| | | | Sr-89 | < 0.7 | < 5.0 |
| | | | | | |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | | |
|----------|-------------|-------------|--|----------------------------------|-----------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |
| SPM-1236 | MILK | Oct 1991 | Sr-90 | N/A | 0.4 ± 0.3 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| | | | Cs-134 | < 3.7 | | < 10.0 |
| | | | Cs-137 | < 4.6 | | < 10.0 |
| SPW-1254 | WATER | Oct 1991 | I-131 | < 0.2 | | < 1.0 |
| | | | Sr-89 | < 2.8 | | < 5.0 |
| | | | Sr-90 | < 0.7 | | < 1.0 |
| | | | | | | |
| SPW-1256 | WATER | Oct 1991 | Co-60 | < 3.6 | | < 10.0 |
| | | | Cs-134 | < 4.0 | | < 10.0 |
| | | | Cs-137 | < 3.0 | | < 10.0 |
| | | | I-131 | < 0.4 | | < 1.0 |
| SPW-1259 | WATER | Oct 1991 | H-3 | < 160.0 | | < 300.0 |
| | | | | | | |
| SPW-1444 | WATER | Dec 1991 | Gr. Alpha | < 0.4 | | < 1.0 |
| | | | Gr. Beta | < 0.8 | | < 5.0 |
| | | | | | | |
| SPM-1578 | MILK | Jan 1992 | Cs-134 | < 7.2 | | < 10.0 |
| | | | Cs-137 | < 8.0 | | < 10.0 |
| | | | I-131 | < 0.2 | | < 1.0 |
| | | | Sr-89 | < 0.5 | | < 5.0 |
| | | | Sr-90 | N/A | 1.3 ± 0.4 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| SPW-1860 | WATER | Mar 1992 | Sr-89 | < 0.6 | | < 5.0 |
| | | | Sr-90 | < 0.4 | | < 1.0 |
| | | | | | | |
| SPW-2067 | WATER | Apr 1992 | H-3 | < 168.0 | | < 300.0 |
| | | | | | | |
| SPW-2114 | WATER | Apr 1992 | C-14 | < 1.0 | | < 200.0 |
| | | | | | | |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | |
|----------|-------------|-------------|---|----------------------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | |
| | | | | LLD | Acceptance Criteria (4.66 Sigma) |
| SPM-2119 | MILK | Apr 1992 | Co-60 | < 6.3 | < 10.0 |
| | | | Cs-134 | < 4.5 | < 10.0 |
| | | | Cs-137 | < 5.4 | < 10.0 |
| SPW-2126 | WATER | Apr 1992 | I-131 | < 0.2 | < 1.0 |
| SPM-2133 | MILK | Apr 1992 | I-131 | < 0.2 | < 1.0 |
| SPW-2220 | WATER | May 1992 | Co-60 | < 2.1 | < 10.0 |
| | | | Cs-134 | < 2.1 | < 10.0 |
| | | | Cs-137 | < 2.3 | < 10.0 |
| SPW-2369 | WATER | Jun 1992 | Gr. Alpha | < 0.4 | < 1.0 |
| | | | Gr. Beta | < 0.8 | < 5.0 |
| SPM-2500 | MILK | Aug 1992 | I-131 | < 0.4 | < 1.0 |
| | | | Sr-89 | < 1.2 | < 5.0 |
| | | | Sr-90 | < 0.9 | < 1.0 |
| SPW-2666 | WATER | Sep 1992 | Sr-89 | < 0.8 | < 5.0 |
| | | | Sr-90 | < 0.5 | < 1.0 |
| SPW-2828 | WATER | Oct 1992 | Co-60 | < 4.8 | < 10.0 |
| | | | Activity result is not available for this sample. | | |
| | | | Cs-134 | < 6.0 | < 10.0 |
| | | | Activity result is not available for this sample. | | |
| | | | Cs-137 | < 6.1 | < 10.0 |
| | | | Activity result is not available for this sample. | | |
| | | | H-3 | < 177.0 | < 300.0 |
| | | | I-131 | < 0.3 | < 1.0 |
| | | | Activity result is not available for this sample. | | |
| | | | | | |
| SPM-2829 | MILK | Oct 1992 | Co-60 | < 9.3 | < 10.0 |
| | | | Cs-134 | < 6.4 | < 10.0 |
| | | | Cs-137 | < 7.2 | < 10.0 |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a . | | |
|----------|-------------|-------------|---|------------------------------------|-----------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |
| SPW-3212 | WATER | Oct 1992 | Ra-228 | < 1.0 | | < 1.0 |
| SPW-3057 | WATER | Nov 1992 | Ra-226 | < 0.03 | | < 1.0 |
| SPW-3294 | WATER | Dec 1992 | Gr. Alpha | < 0.4 | | < 1.0 |
| | | | Gr. Beta | < 0.8 | | < 5.0 |
| SPM-3342 | MILK | Jan 1993 | Cs-134 | < 4.1 | -0.9 ± 2.6 | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | Cs-137 | < 3.9 | 0.8 ± 2.2 | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | Sr-89 | < 0.7 | -0.9 ± 1.1 | < 5.0 |
| | | | Sr-90 | N/A | 1.6 ± 0.5 | < 1.0 |
| | | | Low levels of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| SPM-3386 | MILK | Feb 1993 | I-131 | < 0.2 | 0.1 ± 0.1 | < 1.0 |
| SPW-3557 | WATER | Mar 1993 | Sr-89 | < 0.5 | 0.3 ± 0.5 | < 5.0 |
| | | | Sr-90 | < 0.5 | 0.1 ± 0.2 | < 1.0 |
| SPW-3598 | WATER | Apr 1993 | H-3 | < 180.0 | 84.7 ± 94.2 | < 300.0 |
| SPW-3600 | WATER | Apr 1993 | I-131 | < 0.2 | 0.1 ± 0.2 | < 1.0 |
| SPW-3601 | WATER | Apr 1993 | Co-60 | < 4.2 | | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | Cs-134 | < 4.4 | | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | Cs-137 | < 3.4 | | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | I-131 | < 0.4 | 0.3 ± 0.9 | < 1.0 |
| SPM-3651 | MILK | May 1993 | Cs-134 | < 4.4 | | < 10.0 |
| | | | Activity result is not available for this sample. | | | |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | | |
|-----------|------------------------|-------------|---|----------------------------------|-----------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |
| SPFP-3680 | FOOD | May 1993 | Cs-137 | < 6.3 | | < 10.0 |
| | | | Activity result is not available for this sample. | | | |
| | | | I-131 | < 0.2 | 0.1 ± 0.1 | < 1.0 |
| GPW-3844 | WATER | Jun 1993 | Cs-137 | < 6.5 | 0.0 ± 0.0 | < 10.0 |
| | | | Th-228 | < 0.1 | 0.0 ± 0.1 | < 1.0 |
| | | | Th-230 | < 0.1 | 0.2 ± 0.1 | < 1.0 |
| SPW-4234 | WATER | Jun 1993 | Th-232 | < 0.1 | 0.0 ± 0.0 | < 1.0 |
| | | | Gr. Alpha | < 0.3 | 0.0 ± 0.2 | < 1.0 |
| | | | Gr. Beta | < 0.8 | 0.2 ± 0.3 | < 5.0 |
| SPS-4059 | SEDIMENT (BOTTOM) | Jul 1993 | Cs-134 | < 5.0 | 0.0 ± 0.0 | < 10.0 |
| | | | Cs-137 | < 7.2 | 0.0 ± 0.0 | < 10.0 |
| SPVE-4060 | VEGETATION (SAW DUST) | Jul 1993 | Cs-134 | < 4.8 | 0.0 ± 0.0 | < 10.0 |
| | | | Cs-137 | < 6.4 | 0.0 ± 0.0 | < 10.0 |
| | | | I-131(g) | < 13.5 | 0.0 ± 0.0 | < 20.0 |
| SPM-4061 | MILK | Jul 1993 | Cs-134 | < 8.6 | 0.0 ± 0.0 | < 10.0 |
| | | | Cs-137 | < 5.8 | 0.0 ± 0.0 | < 10.0 |
| SPM-4062 | MILK | Jul 1993 | Cs-134 | < 3.8 | 1.5 ± 1.5 | < 10.0 |
| | | | Cs-137 | < 4.4 | -1.6 ± 3.3 | < 10.0 |
| SPW-4063 | WATER | Jul 1993 | Co-60 | < 4.0 | 1.2 ± 2.3 | < 10.0 |
| | | | Cs-134 | < 3.7 | 0.3 ± 1.2 | < 10.0 |
| | | | Cs-137 | < 3.2 | 0.4 ± 3.2 | < 10.0 |
| SPAP-4064 | AIR FILTER (COMPOSITE) | Jul 1993 | Cs-134 | < 2.1 | 0.0 ± 0.0 | < 10.0 |
| | | | Cs-137 | < 2.8 | 0.0 ± 0.0 | < 10.0 |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a | | |
|----------|-------------|-------------|--|----------------------------------|-----------------------|----------------------------------|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |
| SPCH-406 | CHARCOAL | Jul 1993 | I-131 | < 0.1 | 0.0 ± 0.0 | < 1.0 |
| | | | Based on a volume of 300 m ³ | | | |
| SPW-4233 | WATER | Aug 1993 | Fe-55 | < 506.0 | 0.0 ± 0.3 | < 1000.0 |
| SPM-4235 | MILK | Aug 1993 | Cs-134 | < 8.1 | 1.6 ± 1.8 | < 10.0 |
| | | | Cs-137 | < 4.2 | -1.7 ± 3.4 | < 10.0 |
| | | | I-131 | < 0.1 | 0.0 ± 0.2 | < 1.0 |
| | | | Sr-89 | < 0.8 | -1.0 ± 1.1 | < 5.0 |
| | | | Sr-90 | N/A | 1.8 ± 0.5 | < 1.0 |
| | | | Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual. | | | |
| SPW-4241 | WATER | Aug 1993 | H-3 | < 190.0 | 72.9 ± 99.1 | < 300.0 |
| SPW-4243 | WATER | Aug 1993 | Co-60 | < 7.0 | 0.4 ± 3.1 | < 10.0 |
| | | | Cs-134 | < 7.6 | 0.8 ± 15.6 | < 10.0 |
| | | | Cs-137 | < 5.4 | -0.7 ± 4.2 | < 10.0 |
| | | | I-131 | < 0.5 | 0.0 ± 0.1 | < 1.0 |
| | | | Sr-89 | < 1.1 | -0.6 ± 0.9 | < 5.0 |
| | | | Sr-90 | < 0.7 | 0.4 ± 0.4 | < 1.0 |
| SPW-4244 | WATER | Aug 1993 | Pu-238 | < 1.0 | 0.4 ± 0.7 | < 1.0 |
| | | | Pu-239/240 | < 0.3 | 0.1 ± 0.2 | < 1.0 |
| | | | Th-228 | < 0.4 | -0.1 ± 0.3 | < 1.0 |
| | | | Th-230 | < 0.1 | 0.0 ± 0.1 | < 1.0 |
| | | | Th-232 | < 0.1 | 0.0 ± 0.0 | < 1.0 |
| | | | U-233/234 | < 0.1 | 0.1 ± 0.1 | < 1.0 |
| | | | U-235 | < 0.1 | 0.0 ± 0.1 | < 1.0 |
| | | | U-238 | < 0.1 | 0.1 ± 0.1 | < 1.0 |
| SPW-4245 | WATER | Aug 1993 | Ra-226 | < 0.1 | 0.0 ± 0.0 | < 1.0 |
| | | | Ra-228 | < 0.8 | -0.2 ± 0.5 | < 1.0 |
| SPW-4422 | WATER | Oct 1993 | H-3 | < 180.0 | -27.5 ± 88.9 | < 300.0 |

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

| Lab Code | Sample Type | Sample Date | Analyses | Concentration pCi/L ^a . | | |
|-------------|----------------|----------------|----------|------------------------------------|-----------------------|--|
| | | | | Teledyne Results (4.66 Sigma) | | Acceptance Criteria (4.66 Sigma) |
| | | | | LLD | Activity ^b | |

^a All results are in pCi/L, except for air filter samples, which are in pCi/Filter.

^b Prior to 1993, results were reported as only an LLD, the activity reported is the net activity result.

December, 1993

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES*

| Analysis | Level | One Standard Deviation for single determinations |
|--|--|--|
| Gamma Emitters | 5 to 100 pCi/liter or kg >100 pCi/liter or kg | 5.0 pCi/liter 5% of known value |
| Strontium-89 ^b | 5 to 50 pCi/liter or kg >50 pCi/liter or kg | 5.0 pCi/liter 10% of known value |
| Strontium-90 ^b | 2 to 30 pCi/liter or kg >30 pCi/liter or kg | 5.0 pCi/liter 10% of known value |
| Potassium | >0.1 g/liter or kg | 5% of known value |
| Gross alpha | ≤20 pCi/liter >20 pCi/liter | 5.0 pCi/liter 25% of known value |
| Gross beta | ≤100 pCi/liter >100 pCi/liter | 5.0 pCi/liter 5% of known value |
| Tritium | ≤4,000 pCi/liter >4,000 pCi/liter | 1s = (pCi/liter) = 169.85 x (known) ^{0.0933} 10% of known value |
| Radium-226,-228 | <0.1 pCi/liter | 15% of known value |
| Plutonium | 0.1 pCi/liter, gram, or sample | 10% of known value |
| Iodine-131, Iodine-129 ^b | ≤55 pCi/liter >55 pCi/liter | 6.0 pCi/liter 10% of known value |
| Uranium-238, Nickel-64 ^b Technetium-99 ^b | ≤35 pCi/liter >35 pCi/liter | 6.0 pCi/liter 15% of known value |
| Iron-55 ^b | 50 to 100 pCi/liter >100 pCi/liter | 10 pCi/liter 10% of known value |
| Others ^b | — | 20% of known value |

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

^b Teledyne limit.

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;

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

In cases where the activity is found to be below the lower limit of detection L it is reported as

$$<L$$

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

3.0 Duplicate analyses

- 3.1 Individual results: $x_1 \pm s_1$
 $x_1 \pm s_2$

Reported result: $x \pm s$

where $x = (1/2)(x_1 \pm x_2)$

$$s = (1/2) \sqrt{\frac{2}{s_1^2 + s_2^2}}$$

- 3.2 Individual results: $<L_1$
 $<L_2$

Reported result: $<L$

where L = lower of L_1 and L_2

- 3.3 Individual results: $x \pm s$
 $<L$

Reported result: $x \pm s$ if $x \geq L$;
 $<L$ otherwise

4.0. Computation of Averages and Standard Deviations

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

$$\bar{x} = \frac{1}{n} \sum x$$

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

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all of the values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.
- 4.5 In rounding off, the following rules are followed:
- 4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.
- 4.5.2. If the figure following those to be retained is greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.
- 4.5.3. If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure five is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

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.

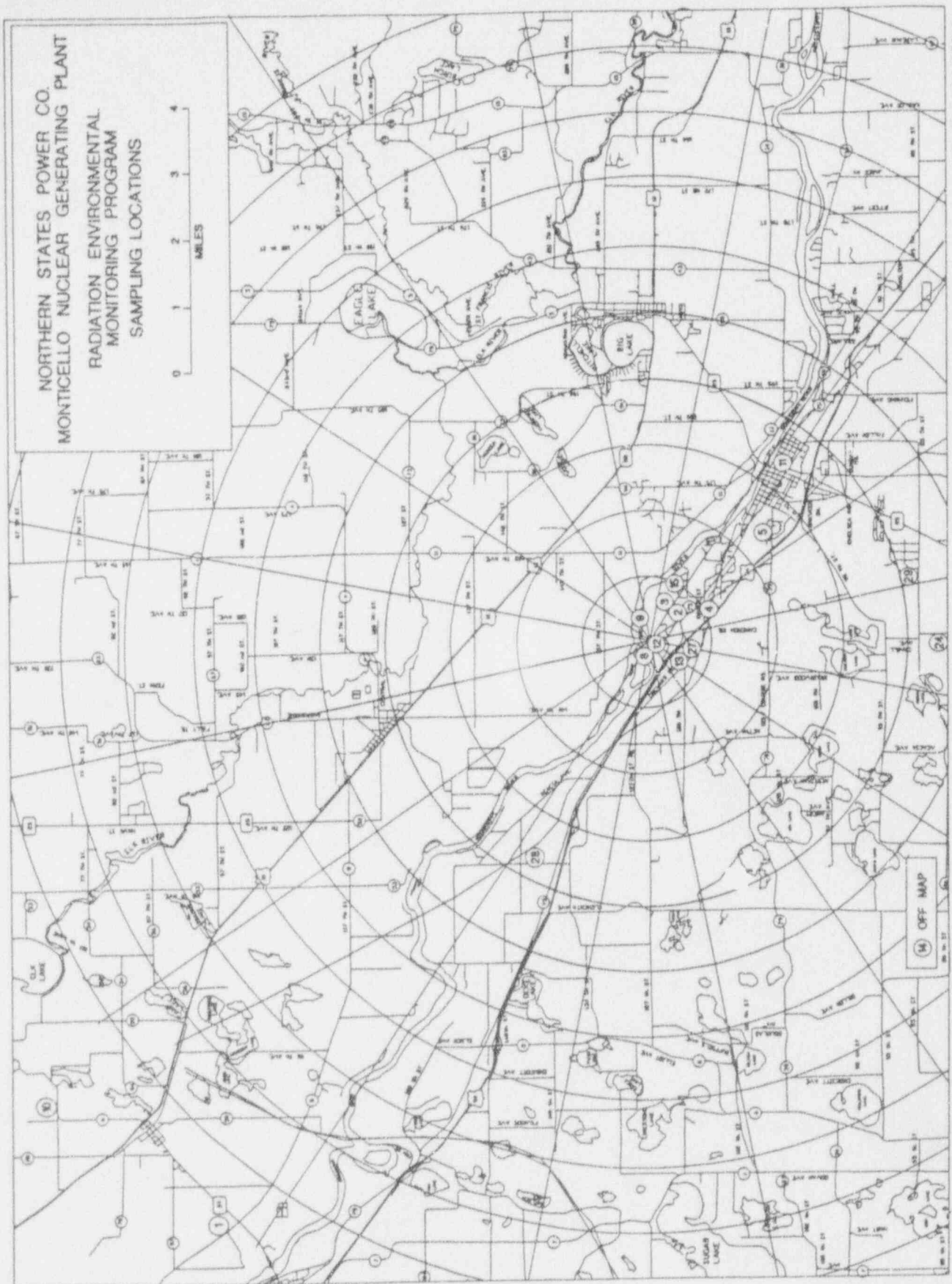
| Air | | | Water | |
|-------------------------|------|--------------------|---------------------------|---------------------------|
| Gross alpha | 3 | pCi/m ³ | Strontium-89 | 3,000 pCi/L |
| Gross beta | 100 | pCi/m ³ | Strontium-90 | 300 pCi/L |
| Iodine-131 ^b | 0.14 | pCi/m ³ | Cesium-137 | 20,000 pCi/L |
| | | | Barium-140 | 20,000 pCi/L |
| | | | Iodine-131 | 300 pCi/L |
| | | | Potassium-40 ^c | 3,000 pCi/L |
| | | | Gross alpha | 30 pCi/L |
| | | | Gross beta | 100 pCi/L |
| | | | Tritium | 3 x 10 ⁶ pCi/L |

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

^b From 10 CFR 20 but 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



MONTI CAD M00524

