Xcel Energy®

Monticello Nuclear Generating Plant
2807 W County Road 75
Monticello, MN 55362

May 10, 2013

L-MT-13-042
Technical Specification 5.6.1

U.S. Nuclear Regulatory Commission
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Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

2012 Annual Radiological Environmental Operating Report

In accordance with the Monticello Nuclear Generating Plant Technical Specification 5.6.1, the Northern States Power Company, a Minnesota corporation (NSPM), d/b/a Xcel Energy, is submitting the Annual Radiological Environmental Operating Report for the year 2012.

Summary of Commitments

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

Mark A. Schimmel
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
Resident Inspector, Monticello, USNRC
Minnesota Department of Commerce

IE48
NRR

ENCLOSURE 1

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
JANUARY 1 – DECEMBER 31, 2012

71 pages follow

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XCEL ENERGY CORPORATION

MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263 LICENSE NO. DPR-22

ANNUAL REPORT
TO THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

Radiological Environmental Monitoring Program

January 1 to December 31, 2012

Prepared under Contract by

ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8010

Approved: 04/17/13

Bronia Grob, M.S.
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PREFACE

The staff of Environmental, Inc., Midwest Laboratory was responsible for the acquisition of data presented in this report. Samples were collected by personnel of the Monticello Nuclear Generating Plant, operated by Northern States Power Co. -Minnesota for XCEL Energy Corporation. This report was prepared by Environmental, Inc., Midwest Laboratory.

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory for the Monticello Nuclear Generating Plant, Monticello, Minnesota, during the period January - December, 2012. This Program monitors the levels of radioactivity in the air, terrestrial, and aquatic environments in order to assess the impact of the Plant on its surroundings.

Tabulations of the individual analyses made during the year are not included in this report. These data are included in a reference document (Environmental, Inc., Midwest Laboratory, 2012a) available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

The Monticello Nuclear Generating Plant is a boiling water reactor with a nominal generating capacity of 600 MWe. It is located on the Mississippi River in Wright County, Minnesota, owned by Xcel Energy Corporation and operated by Northern States Power Co.-Minnesota. Initial criticality was achieved on December 10, 1970. Full power was achieved March 5, 1971 and commercial operation began on June 30, 1971.

2.0 SUMMARY

The Radiological Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications and the Offsite Dose Calculation Manual (ODCM) for the Monticello Nuclear Generating Plant is described. Results for the year 2012 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.

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

3.1 Program Design and Data Interpretation

The purpose of the Radiological 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
(5) Fallout from nuclear accidents.

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

A major interpretive aid in assessment of these effects is the design of the monitoring program at the 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 Radiological 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 plant site. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Monticello Generating Plant REMP Surveillances, Current Revision). 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 determined by gamma spectroscopy. 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).

Ambient gamma radiation is monitored at forty locations, using $CaSO_4$:Dy dosimeters with four sensitive areas at each location: fourteen in an inner ring in the general area of the site boundary, sixteen in the outer ring within 4-5 mile radius, six at special interest locations and four control locations, outside a 10 mile radius from the plant. They are replaced and measured quarterly.

Milk sampling from two goat farms (one indicator, M-16 and one control, M-17) was added to the program in 2010. Samples are collected monthly from November through April and biweekly during the growing season (May - October), when animals may be on pasture. The samples are analyzed for iodine-131 and gamma-emitting isotopes. In addition, pasture grass and vegetation are collected from locations M-41, M-42 and M-43 (C). The samples are analyzed for iodine-131 and other gamma emitting isotopes, as substitute for dairy sampling.

Vegetables, corn and potatoes are collected annually if fields are irrigated by water in which liquid radioactive effluent has been discharged. Analysis is done for gamma-emitting isotopes.

Ground water is monitored by quarterly collections from three off-site locations (one control and two indicators) and one on-site Plant well. To prevent possible groundwater contamination due to plant operations, samples from nineteen on-site monitoring wells are collected and analyzed for tritium and gamma emitting isotopes. The Ground Water Monitoring Program is further described in Appendix E.

Quarterly collections of storm water runoff were added to monitor another possible pathway to the groundwater aquifer. The samples are also 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, invertebrates, and shoreline sediments. Shoreline sediment is also collected from one downstream recreational 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) Air Particulates / Air Iodine:

M-02. Volume for the week ending January 4, 2012 was lower than expected. A short power outage is suspected.
No air particulate sample was collected for the week ending June 27, 2012, the filter was misaligned in the holder.

M-03. No air particulate / air iodine sample was available for the week ending May 9, 2012, the timer reading was low due to power interruption.
No air particulate sample was collected for the week ending June 27, 2012, the filter was misaligned in the holder.
No air particulate / air iodine sample was available for the week ending July 18, 2012, low volume due to power interruption.

M-04. No air particulate / air iodine sample was available for the week ending May 30, 2012, the timer reading was low due to power interruption.

M-05. No air particulate / air iodine sample was available for the week ending May 30, 2012, the volume was low due to power interruption.

(2) Thermoluminescent Dosimeters:

The TLD for location M-01B was missing in the field for the first quarter, 2012.
The TLD for location M-08A was missing in the field for the first quarter, 2012.
The TLD for location M-11A was missing in the field for the fourth quarter, 2012.

(3) Surface Water:

Surface water was not collected at location M-08 for the weeks ending January 25 through February 15, 2012. The water was not collected due to unsafe ice conditions. Both the January and February monthly composite samples were made up from available collections.

(4) Well Water:

Well water was not collected at location MW-27 in January, 2012. The outside well was locked and the residence was vacant.

(5) Milk

Milk was not available from locations M-16 and M-17 for the January through March, 2012 collections. No milk was available after November 7, 2012.

(6) Invertebrates

Bottom organisms were not collected in the Spring of 2012, due to high river levels.

(7) Shoreline Sediments

Shoreline sediment was not collected in the Spring of 2012, due to high river levels.

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.

Gamma-spectroscopic analyses are performed using high-purity germanium (HPGe) detectors. Levels of iodine-131 in cabbage and natural vegetation and concentrations of airborne iodine-131 in charcoal samples were determined by gamma spectroscopy.

Tritium concentrations are determined by liquid scintillation.

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

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of the QA Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 2012). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in the crosscheck programs are presented in Appendix A.

3.5 Program Modifications

There were no program modifications made to the Radiological Environmental Monitoring Program (REMP) at the Monticello Nuclear Generating Plant in 2012. Additions to the Groundwater monitoring program are detailed in Appendix E.

3.6 Land Use Census

In accordance with the MNGP Chemistry Manual, Procedure I.05.41, "Annual Land Use Census and Critical Receptor Identification", 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 ft^2 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 ft^2 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 2012 land use census was conducted between September 10 and September 14, 2012.

In the SSE and NW sectors, the highest D/Q value for nearest garden increased by greater than 20%. Closer gardens were identified. The highest D/Q locations for nearest resident and milk animal did not change from the 2011 census. The Offsite Dose Calculation Manual (ODCM) will be revised to reflect the sector changes.

The location for critical receptor did not change from the 2011 census.

Details of the land use census are contained in the Land Use Census and Critical Receptor Report, Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

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 accidents involving significant release to the environment at nuclear reactor facilities in 2012. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2012. The last reported test was conducted on October 16, 1980 by the People's Republic of China.

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/m^2 in 1969 and 12,000 pCi/m^2 in 1970. These levels are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.1 mRem/4 weeks during preoperational studies (1970). Gross beta in air particulates in 1969 and 1970 averaged 0.20 pCi/m^3. Present day levels have stabilized at around 0.025 pCi/m^3. 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 . Present day measurements for cesium-137 are below detection levels in milk and agricultural crops.

The aqueous environment was monitored by testing of river water, bottom sediments, fish, aquatic vegetation, and periphyton. Specific location comparison of drinking, river, and well water concentrations for tritium and gross beta are not possible. However, tritium background levels, measured at seven separate locations from 1968 to 1970, averaged 970 pCi/L. Present day environmental samples measure below detection levels. 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 shoreline sediments, 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. Low levels of Cs-137, occasionally observed today can still 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 86.7 pCi/g, 76.5 pCi/g, and 28.1 pCi/g respectively.

4.3 Program Findings

Results obtained show background levels of radioactivity in environmental samples collected outside of the Site Protected Area in 2012. The trace levels of strontium-90 and cesium-137, still measurable in soil and sediment samples, are generally attributed to deposition of fallout from previous decades.

Tritium was identified in some groundwater samples collected within the site Protected Area.

Ambient Radiation (TLD's)

Ambient radiation was measured in the general area of the site boundary, at an outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (16.2 and 15.5 mRem/91 days, respectively). The mean for special interest locations was 14.1 mRem/91 days and the mean for the control locations was 15.5 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1997 through 2011 and are tabulated below. No plant effect on ambient gamma radiation is indicated (Figure 5-1).

Year	Inner Ring	Outer Ring
	Dose rate (mRem/91 days)	
1997	13.3	12.8
1998	15.0	14.4
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7
2002	15.9	14.8
2003	15.6	15.0
2004	16.0	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1
2008	15.2	14.6
2009	14.9	14.4
2010	14.7	14.3
2011	14.8	14.3
2012	16.2	15.5

Ambient gamma radiation as measured by thermoluminescent dosimetry.
Average quarterly dose rates, Inner vs. Outer Ring locations

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were almost identical at both indicator and control locations (0.032 and 0.031 pCi/m^3,respectively), similar to levels observed from 1997 through 2011. The results are tabulated below.

Year	Indicators	Control
	Concentration (pCi/m^3)	
1997	0.023	0.023
1998	0.023	0.023
1999	0.023	0.025
2000	0.027	0.026
2001	0.027	0.026
2002	0.028	0.028
2003	0.027	0.027
2004	0.024	0.024
2005	0.025	0.025
2006	0.024	0.025
2007	0.027	0.028
2008	0.028	0.029
2009	0.029	0.030
2010	0.026	0.026
2011	0.029	0.027
2012	0.032	0.031

Average annual gross beta concentrations in airborne particulates.

Typically, the highest average readings occur during the months of January and December, and the first and fourth quarters, as observed in 1997 through 2012.

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955) was detected in all samples, with an average activity of 0.066 pCi/m^3 for all 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 0.03 pCi/m^3 in all samples.

River Water and Drinking Water

Tritium activity measured below 500 pCi/L in all samples. Gross beta activity in Minneapolis drinking water averaged 2.4 pCi/L and was similar to average levels observed from 1997 through 2011. Gross beta averages are tabulated below.

Year	Gross Beta (pCi/L)		Year	Gross Beta (pCi/L)
1997	2.3		2005	2.8
1998	2.4		2006	2.1
1999	2.2		2007	2.8
2000	2.5		2008	2.1
2001	2.5		2009	2.3
2002	2.9		2010	2.9
2003	3.0		2011	2.2
2004	2.7		2012	2.4

Average annual concentrations; Gross beta in drinking water.

Comparisons with data reported by the USEPA for Minneapolis drinking water samples collected from 1980 through 2005 indicate that concentrations of these nuclides are remaining fairly constant. Gamma-emitting isotopes were below detection limits in all surface water samples. There was no indication of a plant effect.

Well Water

At the four indicator and control locations, tritium measured below 500 pCi/L for all samples. Gamma isotopic results were below detection limits.

The data for 2012 were consistent with previous years results and no plant operational effects were indicated.

Goat Milk

Iodine-131 activity measured below the detection limit of 0.5 pCi/L for all samples. No gamma-emitting isotopes, excepting naturally-occurring potassium-40, were detected.

In summary, the data for 2012 showed no radiological effects of the plant operation.

Pasture Grass

Pasture grass was collected in July, August and September, 2012. Iodine-131 concentrations measured below 0.044 pCi/g wet weight in all samples. With the exceptions of naturally-occurring beryllium-7 and potassium-40, no other gamma-emitting isotopes were detected.

Crops

A vegetation collection was not required for 2012. No crops, within five miles of the plant, were found using irrigation water from the Mississippi River.

Fish

Fish were collected in May and October. Flesh was separated from the bones and analyzed by gamma spectroscopy. Only naturally-occurring potassium-40 was found in the upstream and downstream samples (3.36 and 3.34 pCi/g wet weight, respectively). Other gamma-emitting isotopes remained below detection limits. There was no indication of a plant effect.

Invertebrates

Samples were collected in September of 2012, and analyzed by gamma spectroscopy. All gamma-emitting isotopes were below detection limits. There was no indication of any plant effect.

Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediment collections were made in September of 2012 and analyzed for gamma-emitting isotopes. High water prevented a May collection. A low level of cesium-137 was detected in one downstream sample (M-15), at a concentration of 0.081 pCi/g dry weight. Similar levels of activity and distribution have been observed since 1978, and are indicative of the influence of fallout deposition. Naturally-occurring beryllium-7 and potassium-40 were also detected. There was no indication of a plant effect.

Ground Water Monitoring Program

Monitoring Wells (on-site)

Measurable tritium above 500 pCi/L was detected in 8 of 172 samples collected from the nineteen on-site monitoring wells. The activities ranged from 507 to 3,044 pCi/L, similar to concentrations seen in 2010 and 2011. The highest activities were observed at well MW-13A.

Gamma isotopic measurements were below detection limits.

Stormwater Run-off (on-site)

Tritium activity was detected in one of the six stormwater runoff samples submitted for analysis in 2012 and measured 4,479 pCi/L. Gamma isotopic results were below detection limits.

5.0 FIGURES AND TABLES

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

Medium	No.	Location Codes (and Type) [a]	Collection Type and Frequency [b]	Analysis Type and Frequency [c]
Ambient radiation (TLDs)	40	M-01A - M-14A, M-01B - M-16B M-01S - M-06S, M-01C - M-04C	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	2	M-16, M-17 (C)	G/M	I-131, GS
Pasture grass, Vegetation [d]	3	M-41, M-42, M-43(C)	3x/year	GS
Surface 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-11, M-12, M-27, M-43(C)	G/Q	H-3, GS
On-site monitoring wells	5	M-36 to M-40	G/Q	H-3, GS
	19	M-33 to M-35, M-44 to M-54	G/M	H-3, GS
Edible cultivated crops [e] -				
Leafy Vegetable	2	M-27, Available Producer (C)	G/A	I-131
Corn	1	M-19	G/A	GS
Potatoes	1	M-21	G/A	GS
Fish (one species, edible portion)	2	M-8(C), M-9	G/SA	GS
Periphyton or invertebrates	2	M-8(C), M-9	G/SA	GS
Shoreline sediment	3	M-8(C), M-9, 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] Pasture grass and vegetation collections added to supplement dairy sampling.

[e] Collected only if the plant discharges radioactive effluent into the river, then only from river irrigated fields.

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type [a]	Collection Site	Sample Type [b]	Distance and Direction from Reactor
M-1	C	Air Station M-1	AP, AI	11.0 mi @ 307°/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	0.8 mi @ 147°/SSE
M-5		Air Station M-5	AP, AI	2.6 mi @ 134°/SE
M-8	C	Upstream of Plant Intake	SW, SS, BO, F	< 1000' upstream
M-9		Downstream of Plant Discharge	SW, SS, BO, F	< 1000' downstream
M-10	C	Campbell Farm	WW	10.6 mi @ 357°/N
M-11		City of Monticello	WW	3.3 mi @ 127°/SE
M-12		Plant Well #1	WW	0.26 mi @ 252°/WSW
M-14		City of Minneapolis	DW	37.0 mi @ 132°/SE
M-15		Montissippi Park	SS	1.27 mi @ 114°/ESE
M-16		Kitzman Farm	M	3.0 mi @ 165°/SSE
M-17	C	Greninger Farm	M	7.8 mi @ 250°/WSW
M-19		River Irrigated Corn Field [c]	VE	
M-21		River Irrigated Potato Field [c]	VE	
M-27		Wise residence (Highest D/Q Garden) [c]	VE, WW	0.64 mi @ 207°/SSW
		a. Available Producer [c]	VE	> 10.0 mi.
M-33		Monitoring Well #1	WW	593' @ 299°/WNW
M-34		Monitoring Well #2	WW	749' @ 301°/WNW
M-35		Monitoring Well #3	WW	770' @ 304°/NW
M-36		Monitoring Well #4	WW	0.1 mi @ 25°/NNE
M-37		Monitoring Well #5	WW	0.1 mi @ 253°/WSW
M-38		Monitoring Well #6	WW	229' @ 228°/SW
M-39		Monitoring Well #7	WW	0.2 mi @ 66°/ENE
M-40		Monitoring Well #8	WW	0.3 mi @ 150°/SSE
M-41		Training Center	VE	0.8 mi @ 151°/SSE
M-42		Biology Station Road	VE	0.6 mi @ 134°/SE
M-43	C	Imholte Farm	VE, WW	12.3 mi @ 313°/NW
M-44		Monitoring Well #9	WW	0.1 mi @ 310°/NW
M-45		Monitoring Well #10	WW	0.1 mi @ 292°/WNW
M-46		Monitoring Well #11	WW	0.1 mi @ 283°/WNW
M-47		Monitoring Well #12A	WW	0.1 mi @ 330°/NW
M-48		Monitoring Well #12B	WW	0.1 mi @ 326°/NW
M-49		Monitoring Well #13A	WW	0.12 mi @ 316°/NW
M-50		Monitoring Well #13B	WW	0.12 mi @ 316°/NW
M-51		Monitoring Well #9B	WW	0.1 mi @ 310°/NW
M-52		Monitoring Well #14	WW	0.17 mi @ 306°/NW
M-53		Monitoring Well #15A	WW	751' @ 14°/NNE
M-54		Monitoring Well #15B	WW	750' @ 14°/NNE
		Storm water Runoff		0.1 mi @ 27°/NE

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
General Area of the Site Boundary				
M-01A		Sherburne Ave. So.	TLD	0.75 mi @ 353°/N
M-02A		Sherburne Ave. So.	TLD	0.79 mi @ 23°/NNE
M-03A		Sherburne Ave. So.	TLD	1.29 mi @ 55°/NE
M-04A		Biology Station Road	TLD	0.5 mi @ 86°/E
M-05A		Biology Station Road	TLD	0.48 mi @ 118°/ESE
M-06A		Biology Station Road	TLD	0.54 mi @ 135°/SE
M-07A		County Road 75	TLD	0.5 mi @ 155°/SSE
M-08A		County Road 75	TLD	0.48 mi @ 172°/S
M-09A		County Road 75	TLD	0.38 mi @ 209°/SSW
M-10A		County Road 75	TLD	0.38 mi @ 226°/SW
M-11A		County Road 75	TLD	0.4 mi @ 239°/WSW
M-12A		County Road 75	TLD	0.5 mi @ 262°/W
M-13A		North Boundary Road	TLD	0.89 mi @ 324°/NW
M-14A		North Boundary Road	TLD	0.78 mi @ 334°/NNW
Approximately 4 to 5 miles Distant from the Plant				
M-01B		Sherco #1 Air Station	TLD	4.66 mi @ 02°/N
M-02B		County Road 11	TLD	4.4 mi @ 18°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 51°/NE
M-04B		County Road 73 (196th St.)	TLD	4.2 mi @ 67°/ENE
M-05B		City of Big Lake	TLD	4.3 mi @ 89°/E
M-06B		County Road 14 and 196th St.	TLD	4.3 mi @ 117°/ESE
M-07B		Monte Industrial Drive	TLD	4.3 mi @ 136°/SE
M-08B		Residence, Hwy 25 & Davidson Ave.	TLD	4.6 mi @ 162°/SSE
M-09B		Weinand Farm	TLD	4.7 mi @ 178°/S
M-10B		Reisewitz Farm, Acacia Ave.	TLD	4.2 mi @ 204°/SSW
M-11B		Vanlith Farm, 97th Ave.	TLD	4.0 mi @ 228°/SW
M-12B		Lake Maria State Park	TLD	4.2 mi @ 254°/WSW
M-13B		Bridgewater Station	TLD	4.1 mi @ 270°/W
M-14B		Anderson Residence, Cty Rd. 111	TLD	4.3 mi @ 289°/WNW
M-15B		Red Oak Wild Bird Farm	TLD	4.3 mi @ 309°/NW
M-16B		Sand Plain Research Farm	TLD	4.4 mi @ 341°/NNW

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
Special Interest Locations				
M-01S		Osowski Fun Market	TLD	0.66 mi @ 242°/WSW
M-02S		Krone Residence	TLD	0.5 mi @ 224°/SW
M-03S		Big Oaks Park	TLD	1.53 mi @ 102°/ESE
M-04S		Pinewood School	TLD	2.3 mi @ 131°/SE
M-05S		Rivercrest Christian Academy	TLD	3.0 mi @ 118°/ESE
M-06S		Monte Public Works	TLD	2.6 mi @ 134°/SE
M-01C	C	Kirchenbauer Farm	TLD	11.5 mi @ 323°/NW
M-02C	C	County Roads 4 and 15	TLD	11.2 mi @ 47°/NE
M-03C	C	County Rd 19 and Jason Ave.	TLD	11.6 mi @ 130°/SE
M-04C	C	Maple Lake Water Tower	TLD	10.3 mi @ 226°/ SW
Protected Area				
ISFSI-1		ISFSI-1 (neutron) and I-01 (gamma)	TLD	NE corner of ISFSI
ISFSI-2		ISFSI-2 (neutron) and I-02 (gamma)	TLD	North side of ISFSI, center
ISFSI-3		ISFSI-3 (neutron) and I-03 (gamma)	TLD	NW corner of ISFSI
ISFSI-4		ISFSI-4 (neutron) and I-04 (gamma)	TLD	West side of ISFSI, middle
ISFSI-5		ISFSI-5 (neutron) and I-05 (gamma)	TLD	West side of ISFSI, at center of array
ISFSI-6		ISFSI-6 (neutron) and I-06 (gamma)	TLD	SW corner of ISFSI
ISFSI-7		ISFSI-7 (neutron) and I-07 (gamma)	TLD	South side of ISFSI, center
ISFSI-8		ISFSI-8 (neutron) and I-08 (gamma)	TLD	SE corner of ISFSI
ISFSI-9		ISFSI-9 (neutron) and I-09 (gamma)	TLD	East side of ISFSI, at center of array
ISFSI-10		ISFSI-10 (neutron) and I-10 (gamma)	TLD	East side of ISFSI, middle
ISFSI-11		ISFSI-11 (neutron) and I-11 (gamma)	TLD	OCA fence south, on exit road
ISFSI-12		ISFSI-12 (neutron) and I-12 (gamma)	TLD	OCA fence middle, on exit road
ISFSI-13		ISFSI-13 (neutron) and I-13 (gamma)	TLD	OCA fence north, on exit road
ISFSI-14		ISFSI-14 (neutron)	TLD	Posted with TLD M12A
ISFSI-15		ISFSI-15 (neutron)	TLD	Posted with TLD M10A
ISFSI-16		ISFSI-16 (neutron)	TLD	Posted with TLD M02S
Neutron Control A	C		TLD	Posted with TLD M03C
Neutron Control B	C		TLD	Posted with TLD M04C
Neutron Control C	C		TLD	Posted with TLD M02C
Neutron Control D	C		TLD	Posted with TLD M01C

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

[b] Sample Codes:

AP	Airborne particulates	F	Fish
AI	Airborne Iodine	SW	River Water
BS	Bottom (river) sediments	SS	Shoreline Sediments
BO	Bottom organisms	TLD	Thermoluminescent Dosimeter
DW	Drinking Water	VE	Vegetation / vegetables
		WW	Well Water

[c] Collected only if the plant discharges radioactive effluent into the river, then only from river irrigated fields.

Table 5.3. MISSED COLLECTIONS AND ANALYSES

All required samples were collected and analyzed as scheduled with the following exceptions:					
Sample Type	Analysis	Location (s)	Collection Date or Period	Reason for not conducting REMP as required	Plans for Preventing Recurrence
AP/AI	Beta, I-131	M-2	1/4/2012	Low sample volume. Short power outage suspected.	Power restored.
AP/AI	Beta, I-131	M-3	5/9/2012	Low timer reading, possible power failure.	Power restored.
AP/AI	Beta, I-131	M-3, M-4, M-5	5/30/2012	Low timer reading, power interruption.	Power restored.
AP	Beta, I-131	M-2, M-3	6/27/2012	Filters misaligned in holder, no particulate accumulation.	Technician training reviewed
SW	For composite	M-08	1/25/2012	Water frozen.	None Required
SW	For composite	M-08	2/1, 2/8, 2/15, 2012	Water frozen.	None Required
SW	For composite	M-08	12/15/2012	Water frozen.	None Required
WW	Gamma, H-3	M-27	1/18/2012	Outside well locked; residence vacant.	None Required
WW	Gamma, H-3	MW-14	10/17/2012	Well not collected.	Well contents frozen.
MI	Gamma, I-131	M-16, 17	1/31/2012	Milking discontinued until Spring.	None Required
MI	Gamma, I-131	M-16, 17	12/31/2012	Milking discontinued for the year.	None Required
TLD	Gamma	M-1B, M-8A	1st Qtr. 2012	TLD missing in field.	Replaced, vandalism
TLD	Gamma	M-11A	4th Qtr. 2012	TLD missing in field.	Replaced, vandalism
BO	Gamma	M-8, M-9	Spring	High water prevented sampling.	None Required
SS	Gamma	M-8, M-9	Spring	High water prevented sampling.	None Required

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

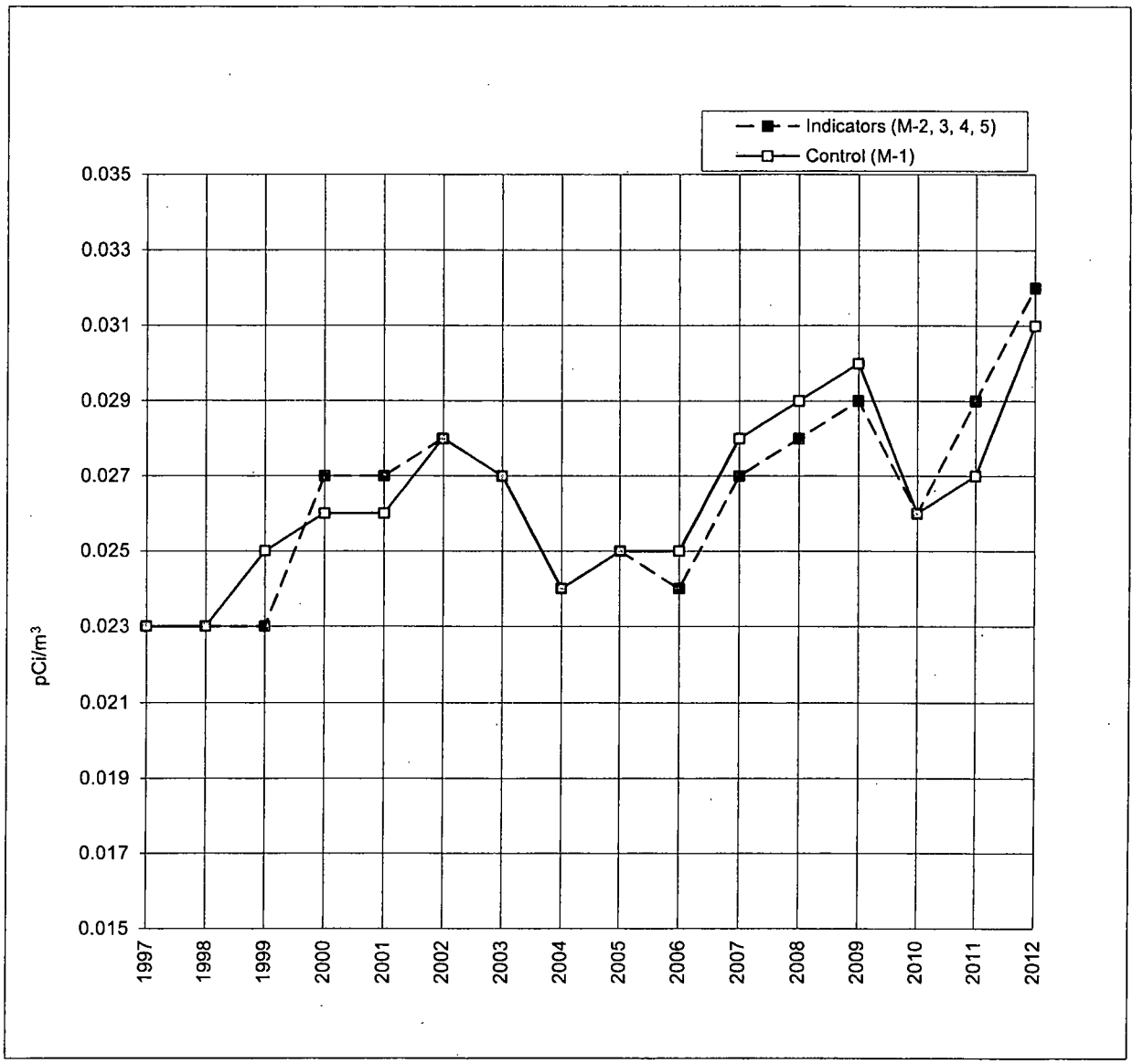

Figure 5-1. Offsite Ambient Radiation (TLDs); Inner Ring versus Outer Ring locations.

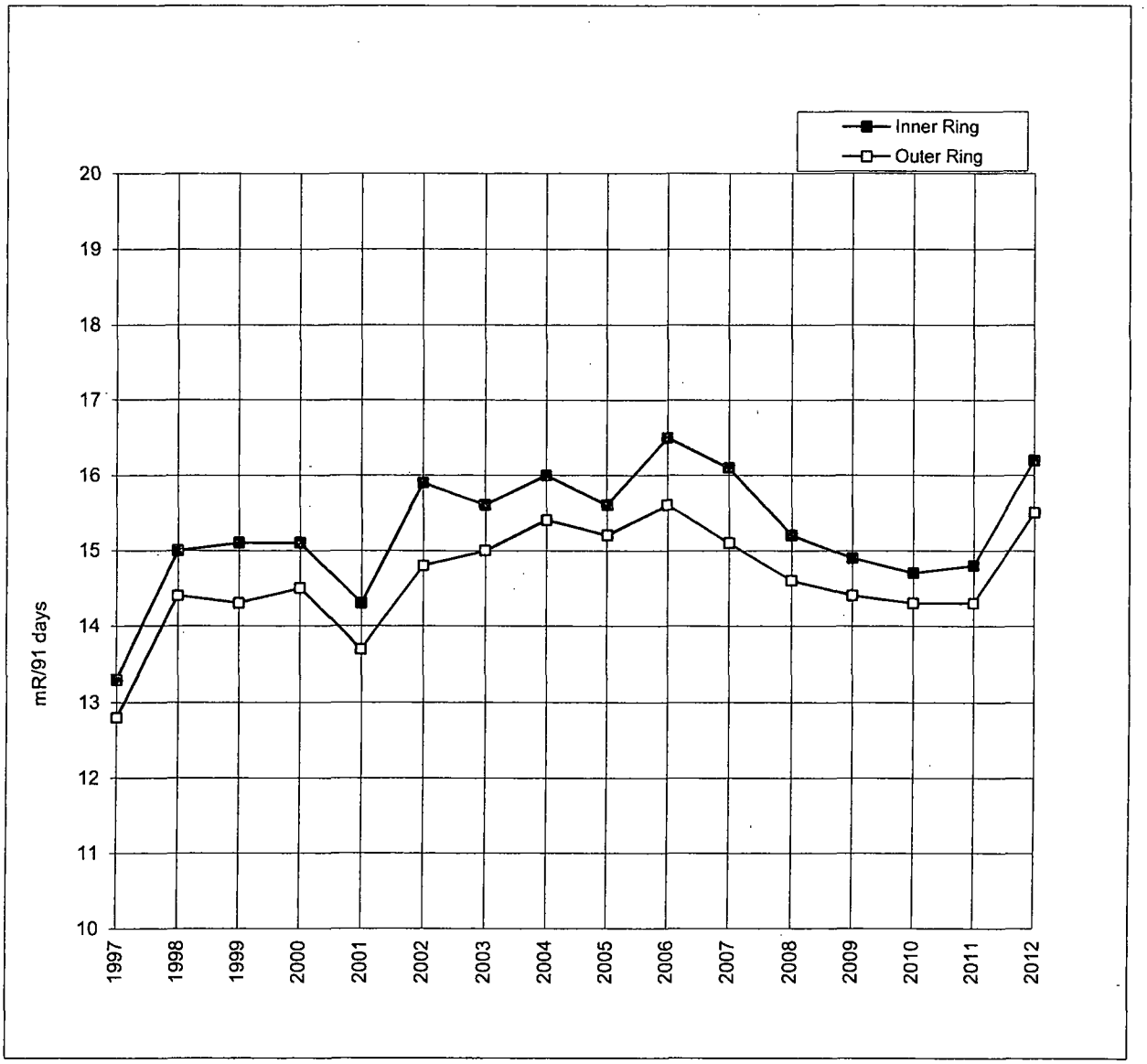

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2012
	(County, State)		

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Direct Radiation							
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 54	3.0	16.2 (54/54) (12.7-19.1)	M-11A, County Rd 75, 0.4 mi @ 250°/WSW	17.8 (3/3) (17.0-18.3)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 63	3.0	15.5 (63/63) (12.1-18.3)	M-09B, Weinand Farm 4.7 mi @ 180°/S	17.2 (4/4) (15.9-18.3)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 24	3.0	15.0 (24/24) (11.9-17.9)	M-06S, Mont. Pub. Wks. 2.7 mi @ 136°/SE	17.6 (4/4) (17.2-17.9)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 16	3.0	None	M-03C, Rte. 19 & Jason, 11.6 mi @ 130°/SE	18.2 (4/4) (17.3-18.7)	16.9 (16/16) (15.5-18.7)	0
Airborne Pathway							
Airborne Particulates (pCi/m^3)	GB 259	0.002	0.032 (206/206) (0.011-0.087)	M-4, Air Station 0.8 mi @ 147°/SSE	0.033 (52/52) (0.013-0.087)	0.031 (53/53) (0.011-0.097)	0
	GS 20						
	Be-7	0.015	0.066 (16/16) (0.042-0.100)	M-4, Air Station 0.8 mi @ 147°/SSE	0.068 (4/4) (0.046-0.091)	0.064 (4/4) (0.041-0.094)	0
	Mn-54	0.0009	< LLD	-	-	< LLD	0
	Co-58	0.0007	< LLD	-	-	< LLD	0
	Co-60	0.0009	< LLD	-	-	< LLD	0
	Zn-65	0.0015	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0013	< LLD	-	-	< LLD	0
	Ru-103	0.0011	< LLD	-	-	< LLD	0
	Ru-106	0.0068	< LLD	-	-	< LLD	0
	Cs-134	0.0008	< LLD	-	-	< LLD	0
	Cs-137	0.0008	< LLD	-	-	< LLD	0
	Ba-La-140	0.0022	< LLD	-	-	< LLD	0
	Ce-141	0.0014	< LLD	-	-	< LLD	0
	Ce-144	0.0045	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 259	0.03	< LLD	-	-	< LLD	0

Table 5.4 Radiological 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, 2012

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Waterborne Pathway							
River Water (pCi/L)	H-3 8	500	< LLD	-	-	< LLD	0
	GS 24						
	Mn-54	10	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	10	< LLD	-	-	< LLD	0
	Co-60	10	< 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	31	< LLD	-	-	< LLD	0
Drinking Water (pCi/L)	GB 12	1.0	2.4 (11/12) (2.0-3.1)	M-14, Minneapolis 37.0 mi. @ 132° /SE	2.4 (11/12) (2.0-3.1)	None	0
	I-131 12	1.0	< LLD	-	-	None	0
	H-3 4	500	< LLD	-	-	None	0
	GS 12						
	Mn-54	10	< LLD	-	-	None	0
	Fe-59	30	< LLD	-	-	None	0
	Co-58	10	< LLD	-	-	None	0
	Co-60	10	< 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	36	< LLD	-	-	None	0
Well Water (pCi/L)	H-3 15	500	< LLD	-	-	< LLD	0
	GS 15						
	Mn-54	10	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	10	< LLD	-	-	< LLD	0
	Co-60	10	< 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	46	< LLD	-	-	< LLD	0

Table 5.4 Radiological 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, 2012

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Waterborne Pathway							
Invertebrates (pCi/g wet)	GS 2						
	Be-7	0.58	< LLD	-	-	< LLD	0
	K-40	1.08	< LLD	-	-	< LLD	0
	Mn-54	0.051	< LLD	-	-	< LLD	0
	Fe-59	0.17	< LLD	-	-	< LLD	0
	Co-58	0.072	< LLD	-	-	< LLD	0
	Co-60	0.052	< LLD	-	-	< LLD	0
	Zn-65	0.097	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.12	< LLD	-	-	< LLD	0
	Ru-103	0.091	< LLD	-	-	< LLD	0
	Ru-106	0.39	< LLD	-	-	< LLD	0
	Cs-134	0.046	< LLD	-	-	< LLD	0
	Cs-137	0.055	< LLD	-	-	< LLD	0
	Ba-La-140	0.39	< LLD	-	-	< LLD	0
	Ce-144	0.30	< LLD	-	-	< LLD	0
Shoreline Sediments (pCi/g dry)	GS 3						
	Be-7	0.18	0.71 (2/2) (0.33-1.09)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	1.09 (1/1)	< LLD	0
	K-40	0.10	9.84 (2/2) (8.85-10.82)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	10.82 (1/1)	10.02 (1/1)	0
	Mn-54	0.020	< LLD	-	-	< LLD	0
	Fe-59	0.042	< LLD	-	-	< LLD	0
	Co-58	0.026	< LLD	-	-	< LLD	0
	Co-60	0.016	< LLD	-	-	< LLD	0
	Zn-65	0.035	< LLD	-	-	< LLD	0
	Nb-95	0.032	< LLD	-	-	< LLD	0
	Zr-95	0.023	< LLD	-	-	< LLD	0
	Ru-103	0.027	< LLD	-	-	< LLD	0
	Ru-106	0.14	< LLD	-	-	< LLD	0
	Cs-134	0.014	< LLD	-	-	< LLD	0
	Cs-137	0.014	0.081 (1/2)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	0.081 (1/1)	< LLD	0
	Ba-La-140	0.059	< LLD	-	-	< LLD	0
	Ce-144	0.12	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2012
	(County, State)		

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Ingestion Pathway							
Milk (pCi/L)	I-131 30	0.5	< LLD	-	-	< LLD	0
	GS 30						
	K-40	200	1816 (15/15) (1436-1982)	M-16, Kitzman 3.0 mi @ 165°/SSE	1816 (15 /15) (1436-1982)	1771 (15/15) (1512-2082)	0
	Cs-134	5	< LLD	-	-	< LLD	0
	Cs-137	5	< LLD	-	-	< LLD	0
	Ba-La-140	5	< LLD	-	-	< LLD	0
Vegetation (Pasture Grass, Weeds, Leaves) (pCi/gwet)	GS 9						
	Mn-54	0.011	< LLD	-	-	< LLD	0
	Fe-59	0.031	< LLD	-	-	< LLD	0
	Co-58	0.010	< LLD	-	-	< LLD	0
	Co-60	0.012	< LLD	-	-	< LLD	0
	Zn-65	0.030	< LLD	-	-	< LLD	0
	Nb-95	0.014	< LLD	-	-	< LLD	0
	I-131	0.044	< LLD	-	-	< LLD	0
	Cs-134	0.010	< LLD	-	-	< LLD	0
	Cs-137	0.014	< LLD	-	-	< LLD	0
Fish (pCi/g wet)	GS 6						
	K-40	0.10	3.34 (3/3) (3.02-3.58)	M-08, Upstream < 1000' of discharge	3.36 (3/3) (3.24-3.51)	3.36 (3/3) (3.24-3.51)	0
	Mn-54	0.018	< LLD	-	-	< LLD	0
	Fe-59	0.055	< LLD	-	-	< LLD	0
	Co-58	0.023	< LLD	-	-	< LLD	0
	Co-60	0.013	< LLD	-	-	< LLD	0
	Zn-65	0.037	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.027	< LLD	-	-	< LLD	0
	Cs-134	0.018	< LLD	-	-	< LLD	0
	Cs-137	0.015	< LLD	-	-	< LLD	0
	Ba-La-140	0.043	< LLD	-	-	< LLD	0
	Ce-144	0.11	< LLD	-	-	< LLD	0

[a] GB = gross beta, GS = gamma scan.

[b] LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample.

[c] Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

[d] Locations are specified: (1) by name, and/or station code and (2) by distance (miles) and direction relative to reactor site.

[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten time the typical preoperational value for the medium or location.

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APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

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

January, 2012 through December, 2012

Appendix A

Interlaboratory Comparison Program Results

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

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

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

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters, when available, and internal laboratory testing.

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

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

Table A-5 lists REMP specific analytical results from the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Complete analytical data for duplicate analyses is available upon request.

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

Results in Table A-7 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory precision at the 1 sigma level for various analyses. The acceptance criteria in Table A-3 is set at ± 2 sigma.

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

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One standard deviation for single determination
Gamma Emitters	5 to 100 pCi/liter or kg	5.0 pCi/liter
	> 100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5.0 pCi/liter
	> 50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	5.0 pCi/liter
	> 30 pCi/liter or kg	10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter	5.0 pCi/liter
	> 20 pCi/liter	25% of known value
Gross beta	≤ 100 pCi/liter	5.0 pCi/liter
	> 100 pCi/liter	5% of known value
Tritium	≤ 4,000 pCi/liter	$\pm 1\sigma = 169.85 \times (\text{known})^{0.0933}$
	> 4,000 pCi/liter	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	6 pCi/liter
	> 55 pCi/liter	10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤ 35 pCi/liter	6 pCi/liter
	> 35 pCi/liter	15% of known value
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
	> 100 pCi/liter	10% of known value
Other Analyses [b]	---	20% of known value

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

[b] Laboratory limit.

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

Lab Code	Date	Concentration (pCi/L)				
		Analysis	Laboratory Result [b]	ERA Result [c]	Control Limits	Acceptance
ERW-1783	04/09/12	Sr-89	62.2 ± 6.0	58.5	46.9 - 66.3	Pass
ERW-1783	04/09/12	Sr-90	33.7 ± 2.1	37.4	27.4 - 43.1	Pass
ERW-1786	04/09/12	Ba-133	75.7 ± 4.1	82.3	69.1 - 90.5	Pass
ERW-1786	04/09/12	Co-60	71.9 ± 4.0	72.9	65.6 - 82.6	Pass
ERW-1786	04/09/12	Cs-134	70.0 ± 4.3	74.2	60.6 - 81.6	Pass
ERW-1786	04/09/12	Cs-137	151.5 ± 6.1	155.0	140.0 - 172.0	Pass
ERW-1786	04/09/12	Zn-65	108.3 ± 89.0	105.0	94.5 - 125.0	Pass
ERW-1789	04/09/12	Gr. Alpha	55.0 ± 2.4	62.9	33.0 - 78.0	Pass
ERW-1789 [d]	04/09/12	Gr. Beta	76.2 ± 1.8	44.2	29.6 - 51.5	Fail
ERW-1795	04/09/12	Ra-226	6.4 ± 0.4	5.7	4.3 - 6.9	Pass
ERW-1795	04/09/12	Ra-228	5.4 ± 1.2	4.6	2.7 - 6.3	Pass
ERW-1795	04/09/12	Uranium	56.2 ± 2.6	61.5	50.0 - 68.2	Pass
ERW-1798	04/09/12	H-3	16023 ± 355	15800	13800 - 17400	Pass
ERW-6283	10/05/12	Sr-89	41.5 ± 4.1	39.1	29.7 - 46.1	Pass
ERW-6283	10/05/12	Sr-90	19.7 ± 1.6	20.1	14.4 - 23.8	Pass
ERW-6286	10/05/12	Ba-133	82.7 ± 4.4	84.8	71.3 - 93.3	Pass
ERW-6286	10/05/12	Co-60	77.2 ± 3.7	78.3	70.5 - 88.5	Pass
ERW-6286	10/05/12	Cs-134	74.4 ± 1.5	76.6	62.6 - 84.3	Pass
ERW-6286	10/05/12	Cs-137	183.0 ± 6.2	183.0	165.0 - 203.0	Pass
ERW-6286	10/05/12	Zn-65	211.0 ± 9.9	204.0	184.0 - 240.0	Pass
ERW-6288	10/05/12	Gr. Alpha	47.0 ± 2.3	58.6	30.6 - 72.9	Pass
ERW-6288	10/05/12	Gr. Beta	33.4 ± 1.2	39.2	26.0 - 46.7	Pass
ERW-6290	10/05/12	I-131	23.3 ± 1.0	24.8	20.6 - 29.4	Pass
ERW-6295 [e]	10/05/12	Ra-226	17.5 ± 0.7	15.0	11.2 - 17.2	Fail
ERW-6295 [e]	10/05/12	Ra-228	7.4 ± 1.5	4.6	2.7 - 6.2	Fail
ERW-6295	10/05/12	Uranium	61.2 ± 1.8	62.5	50.8 - 69.3	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Associates (ERA).

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

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

[d] Sample dilution problem suspected. A new dilution was prepared and the sample reanalyzed. Result of reanalysis, 38.3 ± 1.3 pCi/L.

[e] Results of reanalyses (pCi/L): Ra-226, 16.51 ± 0.73 Ra-228, 4.85 ± 1.11. A new test was ordered from Environmental Resources Associates, results will be updated for first quarter, 2013.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).

Lab Code	Date	Description	mR Known Value	mR Lab Result ± 2 sigma	Control Limits	Acceptance
Environmental, Inc.						
2012-1	2/7/2012	30 cm.	74.87	87.22 ± 2.86	52.41 - 97.33	Pass
2012-1	2/7/2012	40 cm.	42.12	53.70 ± 4.53	29.48 - 54.76	Pass
2012-1	2/7/2012	50 cm.	26.95	33.04 ± 1.96	18.87 - 35.04	Pass
2012-1	2/7/2012	70 cm.	13.75	13.26 ± 1.15	9.63 - 17.88	Pass
2012-1	2/7/2012	75 cm.	11.98	13.38 ± 1.68	8.39 - 15.57	Pass
2012-1	2/7/2012	80 cm.	10.53	11.27 ± 0.95	7.37 - 13.69	Pass
2012-1	2/7/2012	90 cm.	8.32	7.79 ± 0.83	5.82 - 10.82	Pass
2012-1	2/7/2012	100 cm.	6.74	5.91 ± 0.25	4.72 - 8.76	Pass
2012-1	2/7/2012	110 cm.	5.57	4.63 ± 0.83	3.90 - 7.24	Pass
2012-1	2/7/2012	120 cm.	4.68	3.96 ± 1.68	3.28 - 6.08	Pass
2012-1	2/7/2012	150 cm.	2.99	2.41 ± 0.08	2.09 - 3.89	Pass
2012-1	2/7/2012	180 cm.	2.08	2.02 ± 0.25	1.46 - 2.70	Pass
Environmental, Inc.						
2012-2	9/11/2012	40 cm.	33.75	43.74 ± 1.31	23.63 - 43.88	Pass
2012-2	9/11/2012	50 cm.	21.6	25.37 ± 0.82	15.12 - 28.08	Pass
2012-2	9/11/2012	60 cm.	15	16.63 ± 0.45	10.50 - 19.50	Pass
2012-2	9/11/2012	70 cm.	11.02	10.58 ± 0.20	7.71 - 14.33	Pass
2012-2	9/11/2012	80 cm.	8.44	8.55 ± 1.18	5.91 - 10.97	Pass
2012-2	9/11/2012	90 cm.	6.67	5.75 ± 0.33	4.67 - 8.67	Pass
2012-2	9/11/2012	100 cm.	5.4	4.44 ± 0.22	3.78 - 7.02	Pass
2012-2	9/11/2012	110 cm.	4.46	3.85 ± 0.05	3.12 - 5.80	Pass
2012-2	9/11/2012	120 cm.	3.75	3.03 ± 0.71	2.63 - 4.88	Pass
2012-2	9/11/2012	150 cm.	2.4	1.82 ± 0.10	1.68 - 3.12	Pass
2012-2	9/11/2012	180 cm.	1.67	1.19 ± 0.34	1.17 - 2.17	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-41824	2/15/2012	Ra-228	24.85 ± 2.14	28.75	20.13 - 37.38	Pass
W-22712	2/27/2012	Gr. Alpha	14.59 ± 0.34	20.00	10.00 - 30.00	Pass
W-22712	2/27/2012	Gr. Alpha	43.57 ± 0.40	41.70	20.85 - 62.55	Pass
SPAP-1032	3/5/2012	Cs-134	7.06 ± 1.71	5.26	0.00 - 15.26	Pass
SPAP-1032	3/5/2012	Cs-137	102.63 ± 3.13	104.24	93.82 - 114.66	Pass
SPAP-1034	3/5/2012	Gr. Beta	44.30 ± 0.11	46.88	28.13 - 65.63	Pass
SPW-1036	3/5/2012	Cs-134	43.23 ± 3.84	39.42	29.42 - 49.42	Pass
SPW-1036	3/5/2012	Cs-137	57.44 ± 4.60	52.12	42.12 - 62.12	Pass
SPW-1036	3/5/2012	Sr-90	60.51 ± 1.93	61.52	49.22 - 73.82	Pass
SPMI-1038	3/5/2012	Cs-134	37.79 ± 4.06	39.42	29.42 - 49.42	Pass
SPMI-1038	3/5/2012	Cs-137	54.75 ± 5.09	52.12	42.12 - 62.12	Pass
SPW-1045	3/5/2012	H-3	68022 ± 746	69048	55238 - 82858	Pass
SPW-1047	3/5/2012	Ni-63	217.10 ± 3.64	206.64	144.65 - 268.63	Pass
SPW-1049	3/5/2012	C-14	3858.90 ± 12.79	4738.80	2843.28 - 6634.32	Pass
W-31412	3/14/2012	Ra-226	13.13 ± 0.36	16.70	11.69 - 21.71	Pass
SPW-1520	3/23/2012	U-238	45.67 ± 2.02	41.70	29.19 - 54.21	Pass
SPW-41825	4/10/2012	Ra-228	28.48 ± 2.51	28.35	19.85 - 36.86	Pass
WW-1547	4/16/2012	Ba-133	18.99 ± 4.67	26.70	16.70 - 36.70	Pass
WW-1547	4/16/2012	Cs-134	9.28 ± 2.82	8.68	0.00 - 18.68	Pass
WW-1547	4/16/2012	Cs-137	27.77 ± 4.49	29.70	19.70 - 39.70	Pass
W-51712	5/17/2012	Ra-226	17.29 ± 0.43	16.70	11.69 - 21.71	Pass
W-61112	6/11/2012	Gr. Alpha	22.16 ± 0.45	20.00	10.00 - 30.00	Pass
W-61112	6/11/2012	Gr. Beta	43.57 ± 0.40	45.20	35.20 - 55.20	Pass
SPAP-4418	7/25/2012	Gr. Beta	43.74 ± 0.11	46.50	27.90 - 65.10	Pass
SPAP-4420	7/25/2012	Cs-134	4.54 ± 0.73	4.60	2.76 - 6.44	Pass
SPAP-4420	7/25/2012	Cs-137	104.70 ± 2.77	103.30	92.97 - 113.63	Pass
SPMI-4422	7/25/2012	Co-60	31.43 ± 2.12	31.62	21.62 - 41.62	Pass
SPMI-4422	7/25/2012	Cs-134	16.50 ± 1.17	16.15	6.15 - 26.15	Pass
SPMI-4422	7/25/2012	Cs-137	29.60 ± 2.61	26.64	16.64 - 36.64	Pass
SPMI-4422	7/25/2012	Sr-90	31.60 ± 1.35	30.47	24.38 - 36.56	Pass
SPW-4424	7/25/2012	Co-60	38.52 ± 1.76	37.95	27.95 - 47.95	Pass
SPW-4424	7/25/2012	Cs-137	33.23 ± 2.27	32.01	22.01 - 42.01	Pass
SPW-4424	7/25/2012	Sr-90	36.56 ± 1.58	40.60	32.48 - 48.72	Pass
SPF-4426	7/25/2012	Cs-134	947.50 ± 42.50	1025.00	922.50 - 1127.50	Pass
SPF-4426	7/25/2012	Cs-137	2692.00 ± 62.40	2480.00	2232.00 - 2728.00	Pass
SPW-4428	7/25/2012	C-14	4325.70 ± 15.80	4738.80	2843.28 - 6634.32	Pass
SPW-4430	7/25/2012	H-3	70119.40 ± 773.40	67570.00	54056.00 - 81084.00	Pass
SPW-4432	7/25/2012	Ni-63	187.20 ± 3.85	206.80	144.76 - 268.84	Pass
W-81712	8/17/2012	Ra-226	14.94 ± 0.40	16.70	11.69 - 21.71	Pass
SPW-5407	8/29/2012	U-238	42.95 ± 0.11	41.70	29.19 - 54.21	Pass
SPW-18022	9/10/2012	Ra-228	29.03 ± 2.80	28.21	19.75 - 36.67	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
W-91012	9/10/2012	Gr. Alpha	19.95 ± 0.42	20.00	10.00 - 30.00	Pass
W-91012	9/10/2012	Gr. Beta	43.47 ± 0.40	45.20	35.20 - 55.20	Pass
W-100312	10/3/2012	Gr. Alpha	19.95 ± 0.41	20.00	10.00 - 30.00	Pass
W-100312	10/3/2012	Gr. Beta	44.21 ± 0.40	45.20	35.20 - 55.20	Pass
W-101812	10/18/2012	Ra-226	18.80 ± 0.43	16.70	11.69 - 21.71	Pass
ESO-7235	12/6/2012	Sr-90	138.79 ± 2.67	161.05	128.84 - 193.26	Pass
SPW-7753	12/6/2012	U-238	45.55 ± 5.05	41.70	29.19 - 54.21	Pass
SPW-18023	12/18/2012	Ra-228	31.59 ± 2.99	25.98	18.19 - 33.77	Pass

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/filter), charcoal (pCi/m^3), and solid samples (pCi/g).

[b] Laboratory codes : W (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

[c] Results are based on single determinations.

[d] Control limits are established from the precision values listed in Attachment A of this report, adjusted to ± 2σ.

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

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-41814	Water	2/15/2012	Ra-228	0.65	0.49 ± 0.36	2
W-22712	Water	2/27/2012	Gr. Alpha	0.42	-0.04 ± 0.29	1
W-22712	Water	2/27/2012	Gr. Beta	0.74	-0.54 ± 0.50	3.2
SPAP-1031	Air Filter	3/5/2012	Cs-134	1.89	-	100
SPAP-1031	Air Filter	3/5/2012	Cs-137	1.16	-	100
SPAP-1033	Air Filter	3/5/2012	Gr. Beta	0.003	0.013 ± 0.003	0.01
SPW-1035	Water	3/5/2012	Cs-134	2.40	-	10
SPW-1035	Water	3/5/2012	Cs-137	2.88	-	10
SPW-1035	Water	3/5/2012	I-131(G)	2.35	-	20
SPW-1035	Water	3/5/2012	Sr-90	0.60	-0.11 ± 0.26	1
SPMI-1037	Milk	3/5/2012	Cs-134	2.85	-	10
SPMI-1037	Milk	3/5/2012	Cs-137	3.73	-	10
SPMI-1037	Milk	3/5/2012	I-131(G)	3.24	-	20
SPW-1044	Water	3/5/2012	H-3	146.10	37.10 ± 74.40	200
SPW-1046	Water	3/5/2012	Ni-63	19.07	8.30 ± 11.79	20
SPW-1048	Water	3/5/2012	C-14	5.70	2.99 ± 3.04	200
SPW-1166	water	3/9/2012	C-14	6.79	1.11	200
W-31412	Water	3/14/2012	Ra-226	0.034	0.043 ± 0.027	1
SPW-1521	Water	3/23/2012	U-238	0.10	0.09 ± 0.11	1
W-51712	Water	4/24/2012	Ra-226	0.04	0.04 ± 0.03	1
W-61112	Water	6/11/2012	Gr. Alpha	0.47	-0.14 ± 0.32	1
W-61112	Water	6/11/2012	Gr. Beta	0.71	0.29 ± 0.51	3.2
SPW-41815	Water	7/7/2011	Ra-228	0.77	0.52 ± 0.42	2
SPAP-4417	Air Filter	7/25/2012	Gr. Beta	0.001	0.021 ± 0.003	0.01
SPMI-4421	Milk	7/25/2012	Co-60	4.29	-	10
SPMI-4421	Milk	7/25/2012	Cs-134	3.58	-	10
SPMI-4421	Milk	7/25/2012	Cs-137	4.60	-	10
SPMI-4421	Milk	7/25/2012	Sr-90	0.45	0.53 ± 0.27	1
SPW-4423	Water	7/25/2012	Co-60	1.88	-	10
SPW-4423	Water	7/25/2012	Cs-134	2.38	-	10
SPW-4423	Water	7/25/2012	Cs-137	2.80	-	10
SPW-4423	water	7/25/2012	Sr-90	0.45	0.08 ± 0.22	1
SPF-4425	Fish	7/25/2012	Co-60	6.74	-	100
SPF-4425	Fish	7/25/2012	Cs-134	7.47	-	100
SPF-4425	Fish	7/25/2012	Cs-137	9.62	-	100
SPW-4427	Water	7/25/2012	C-14	10.93	3.54 ± 5.84	200
SPW-4431	Water	7/25/2012	Ni-63	19.00	5.50 ± 11.70	20
W-81712	Water	8/17/2012	Ra-226	0.038	0.035 ± 0.030	1
SPW-5408	Water	8/29/2012	U-238	0.039	0.015 ± 0.057	1

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-18032	Water	9/10/2012	Ra-228	0.78	0.85 ± 0.46	2
W-91012	Water	9/10/2012	Gr. Alpha	0.42	0.027 ± 0.29	1
W-91012	Water	9/10/2012	Gr. Beta	0.75	-0.13 ± 0.52	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.77	-0.32 ± 0.53	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.43	0.06 ± 0.30	3.2
W-101812	Water	10/18/2012	Ra-226	0.04	0.04 ± 0.03	1
SPW-7754	Water	12/6/2012	U-238	0.10	0.02 ± 0.08	1
SPW-18033	Water	12/18/2012	Ra-228	0.98	0.43 ± 0.50	2

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

[b] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[c] Activity reported is a net activity result. For gamma spectroscopic analysis, activity detected below the LLD value is not reported.

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
CF-20, 21	1/3/2012	Gr. Beta	14.50 ± 0.29	15.02 ± 0.30	14.76 ± 0.21	Pass
CF-20, 21	1/3/2012	K-40	12.88 ± 0.55	12.40 ± 0.53	12.64 ± 0.38	Pass
CF-20, 21	1/3/2012	Sr-90	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.00	Pass
P-9133, 9134	1/3/2012	H-3	108.86 ± 83.03	206.60 ± 86.38	157.73 ± 59.91	Pass
U-302, 303	1/17/2012	Beta (-K40)	6.84 ± 2.91	5.24 ± 2.56	6.04 ± 1.94	Pass
S-386, 387	1/23/2012	Ac-228	0.77 ± 0.11	0.79 ± 0.14	0.78 ± 0.09	Pass
S-386, 387	1/23/2012	Bi-214	0.80 ± 0.07	0.73 ± 0.11	0.77 ± 0.07	Pass
S-386, 387	1/23/2012	Pb-214	0.74 ± 0.06	0.75 ± 0.11	0.75 ± 0.06	Pass
S-386, 387	1/23/2012	Tl-208	0.21 ± 0.02	0.21 ± 0.04	0.21 ± 0.02	Pass
S-386, 387	1/23/2012	U-235	0.05 ± 0.02	0.12 ± 0.05	0.09 ± 0.03	Pass
WW-619, 620	1/31/2012	H-3	257.20 ± 86.00	305.80 ± 88.30	281.50 ± 61.63	Pass
MI-702, 703	2/6/2012	K-40	1337.00 ± 123.00	1460.40 ± 102.00	1398.70 ± 79.90	Pass
WW-892, 893	2/17/2012	Gr. Beta	3.46 ± 0.56	3.77 ± 0.59	3.61 ± 0.41	Pass
S-850, 851	2/22/2012	Cs-134	0.14 ± 0.02	0.13 ± 0.02	0.14 ± 0.01	Pass
S-850, 851	2/22/2012	Cs-137	0.21 ± 0.03	0.22 ± 0.03	0.22 ± 0.02	Pass
W-1251, 1252	3/6/2012	Gr. Alpha	1.20 ± 0.62	1.27 ± 0.92	1.24 ± 0.55	Pass
W-1251, 1252	3/6/2012	Gr. Beta	16.86 ± 1.43	15.14 ± 1.34	16.00 ± 0.98	Pass
W-1251, 1252	3/6/2012	H-3	5235.52 ± 230.91	4893.24 ± 224.55	5064.38 ± 161.05	Pass
W-1251, 1252	3/6/2012	Tc-99	19.67 ± 3.60	14.46 ± 3.51	17.07 ± 2.51	Pass
AP-1209, 1210	3/8/2012	Be-7	0.24 ± 0.12	0.20 ± 0.11	0.22 ± 0.08	Pass
XWW-1564, 1565	3/14/2012	H-3	308.00 ± 88.00	293.00 ± 87.00	300.50 ± 61.87	Pass
SG-1438, 1439	3/19/2012	Ac-228	6.01 ± 0.30	6.23 ± 0.31	6.12 ± 0.22	Pass
SG-1438, 1439	3/19/2012	Pb-214	4.69 ± 0.49	5.20 ± 0.54	4.95 ± 0.36	Pass
WW-1585, 1586	3/19/2012	H-3	3124.50 ± 176.96	2982.38 ± 173.62	3053.44 ± 123.96	Pass
AP-2103, 2104	3/28/2012	Be-7	0.080 ± 0.016	0.076 ± 0.013	0.078 ± 0.010	Pass
AP-2166, 2167	3/28/2012	Be-7	0.061 ± 0.020	0.071 ± 0.016	0.066 ± 0.013	Pass
AP-1632, 1633	3/29/2012	Be-7	0.26 ± 0.12	0.24 ± 0.12	0.25 ± 0.08	Pass
E-1653, 1654	4/2/2012	Gr. Beta	1.53 ± 0.05	1.55 ± 0.04	1.54 ± 0.03	Pass
E-1653, 1654	4/2/2012	K-40	1.34 ± 0.13	1.36 ± 0.14	1.35 ± 0.10	Pass
SG-1677, 1678	4/2/2012	Ac-228	6.63 ± 0.37	6.49 ± 0.33	6.56 ± 0.25	Pass
SG-1677, 1678	4/2/2012	Pb-214	4.77 ± 0.16	5.07 ± 0.14	4.92 ± 0.11	Pass
SWU-1719, 1720	4/3/2012	Gr. Beta	1.16 ± 0.41	1.53 ± 0.44	1.35 ± 0.30	Pass
W-1698, 1699	4/5/2012	Gr. Beta	10.86 ± 1.49	9.42 ± 1.32	10.14 ± 1.00	Pass
W-1698, 1699	4/5/2012	Ra-226	0.41 ± 0.15	0.67 ± 0.18	0.54 ± 0.12	Pass
W-1698, 1699	4/5/2012	Ra-228	1.46 ± 0.76	1.48 ± 0.74	1.47 ± 0.53	Pass
SG-1761, 1762	4/10/2012	Ac-228	16.26 ± 0.53	16.55 ± 0.44	16.41 ± 0.34	Pass
SG-1761, 1762	4/10/2012	Pb-214	14.16 ± 1.44	15.40 ± 1.56	14.78 ± 1.06	Pass
AP-2019, 2020	4/12/2012	Be-7	0.17 ± 0.10	0.17 ± 0.08	0.17 ± 0.07	Pass
DW-2272, 2273	4/20/2012	I-131	0.52 ± 0.24	0.49 ± 0.27	0.51 ± 0.18	Pass
DW-2356, 2357	4/24/2012	Gr. Beta	12.82 ± 2.01	9.47 ± 1.74	11.14 ± 1.33	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-2403, 2404	5/1/2012	Be-7	1.77 ± 0.21	1.55 ± 0.33	1.66 ± 0.20	Pass
G-2403, 2404	5/1/2012	K-40	6.38 ± 0.50	6.93 ± 0.72	6.66 ± 0.44	Pass
BS-2445, 2446	5/1/2012	Gr. Beta	8.92 ± 1.52	9.29 ± 1.63	9.11 ± 1.11	Pass
BS-2445, 2446	5/1/2012	K-40	5.86 ± 0.38	6.22 ± 0.48	6.04 ± 0.31	Pass
SWU-2550, 2551	5/1/2012	Gr. Beta	2.07 ± 0.65	1.59 ± 0.62	1.83 ± 0.45	Pass
WW-2614, 2615	5/1/2012	Gr. Beta	2.03 ± 1.04	2.36 ± 1.14	2.20 ± 0.77	Pass
WW-2614, 2615	5/1/2012	H-3	750.60 ± 106.20	653.20 ± 102.30	701.90 ± 73.73	Pass
BS-2656, 2657	5/2/2012	Cs-137	0.13 ± 0.07	0.07 ± 0.04	0.10 ± 0.04	Pass
BS-2656, 2657	5/2/2012	K-40	10.15 ± 0.97	11.13 ± 0.90	10.64 ± 0.66	Pass
SO-2635, 2636	5/3/2012	Cs-137	0.046 ± 0.024	0.050 ± 0.027	0.048 ± 0.018	Pass
SO-2635, 2636	5/3/2012	K-40	13.20 ± 0.74	14.01 ± 0.67	13.61 ± 0.50	Pass
MI-2677, 2678	5/7/2012	K-40	1415.30 ± 131.40	1348.10 ± 109.00	1381.70 ± 85.36	Pass
VE-2719, 2720	5/7/2012	K-40	4.15 ± 0.36	4.19 ± 0.38	4.17 ± 0.26	Pass
SWU-3221, 3222	5/8/2012	Gr. Beta	1.67 ± 0.47	1.39 ± 0.45	1.53 ± 0.33	Pass
SWU-3221, 3222	5/8/2012	H-3	236.90 ± 101.90	281.90 ± 103.70	259.40 ± 72.69	Pass
WW-3073, 3074	5/14/2012	H-3	339.12 ± 145.45	337.23 ± 98.19	338.18 ± 87.74	Pass
AP-2968, 2969	5/17/2012	Be-7	0.25 ± 0.12	0.21 ± 0.09	0.23 ± 0.07	Pass
F-3031, 3032	5/22/2012	H-3	11291.00 ± 372.80	11167.00 ± 315.00	11229.00 ± 244.03	Pass
F-3031, 3032	5/22/2012	K-40	3528.90 ± 372.80	3677.20 ± 392.40	3603.05 ± 270.63	Pass
G-3094, 3095	5/23/2012	Gr. Beta	7.89 ± 0.16	8.01 ± 0.16	7.95 ± 0.11	Pass
F-3412, 3413	5/23/2012	Gr. Beta	3.46 ± 0.10	3.33 ± 0.10	3.40 ± 0.07	Pass
F-3412, 3413	5/23/2012	K-40	2.40 ± 0.38	2.55 ± 0.43	2.48 ± 0.29	Pass
MI-3067, 3068	5/24/2012	K-40	1267.20 ± 105.00	1305.70 ± 109.80	1286.45 ± 75.96	Pass
SO-3305, 3306	5/30/2012	Cs-137	0.024 ± 0.013	0.030 ± 0.015	0.027 ± 0.010	Pass
SO-3305, 3306	5/30/2012	Gr. Beta	10.95 ± 0.89	10.86 ± 0.89	10.91 ± 0.63	Pass
SO-3305, 3306	5/30/2012	Tl-208	0.068 ± 0.018	0.062 ± 0.017	0.065 ± 0.012	Pass
LW-3454, 3455	5/31/2012	Gr. Beta	2.12 ± 0.86	2.27 ± 0.77	2.20 ± 0.58	Pass
BS-3697, 3698	6/14/2012	Be-7	2.05 ± 0.19	2.27 ± 0.38	2.16 ± 0.21	Pass
BS-3697, 3698	6/14/2012	Cs-137	2.32 ± 0.39	2.26 ± 0.66	2.29 ± 0.38	Pass
BS-3697, 3698	6/14/2012	K-40	6.67 ± 0.28	6.64 ± 0.42	6.66 ± 0.25	Pass
VE-3798, 3799	6/20/2012	K-40	5.93 ± 0.38	6.03 ± 0.37	5.98 ± 0.26	Pass
WW-4790, 4791	6/20/2012	H-3	251.33 ± 86.51	372.48 ± 92.27	311.90 ± 63.24	Pass
DW-30103, 30104	6/27/2012	Ra-226	0.30 ± 0.08	0.42 ± 0.09	0.36 ± 0.06	Pass
DW-30103, 30104	6/27/2012	Ra-228	0.76 ± 0.54	0.78 ± 0.54	0.77 ± 0.38	Pass
LW-3970, 3971	6/28/2012	Gr. Beta	1.49 ± 1.06	0.72 ± 0.53	1.11 ± 0.59	Pass
DW-3949, 3950	6/29/2012	I-131	0.54 ± 0.26	0.25 ± 0.26	0.40 ± 0.18	Pass
SG-4075, 4076	7/2/2012	Ac-228	0.33 ± 0.09	0.34 ± 0.06	0.34 ± 0.05	Pass
SG-4075, 4076	7/2/2012	K-40	6.71 ± 0.58	7.20 ± 0.32	6.96 ± 0.33	Pass
SG-4075, 4076	7/2/2012	Pb-214	0.46 ± 0.05	0.49 ± 0.03	0.48 ± 0.03	Pass
AP-4390, 4391	7/3/2012	Be-7	0.09 ± 0.02	0.09 ± 0.01	0.09 ± 0.01	Pass
AP-4390, 4391	7/3/2012	Be-7	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
AP-4012, 4013	7/5/2012	Be-7	0.27 ± 0.09	0.29 ± 0.16	0.28 ± 0.09	Pass
SW-4033, 4034	7/5/2012	H-3	614.99 ± 107.99	512.31 ± 103.83	563.65 ± 74.91	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-4054, 4055	7/9/2012	K-40	7.28 ± 0.56	7.42 ± 0.63	7.35 ± 0.42	Pass
VE-4222, 4223	7/13/2012	Be-7	0.16 ± 0.08	0.22 ± 0.09	0.19 ± 0.06	Pass
VE-4222, 4223	7/13/2012	K-40	7.20 ± 0.30	6.60 ± 0.30	6.90 ± 0.21	Pass
DW-30113, 30114	7/13/2012	Ra-228	1.93 ± 0.66	1.03 ± 0.53	1.48 ± 0.42	Pass
DW-30115, 30116	7/13/2012	Gr. Alpha	7.46 ± 1.21	7.02 ± 1.14	7.24 ± 0.83	Pass
DW-30124, 30125	7/13/2012	Ra-226	1.16 ± 0.15	0.90 ± 0.12	1.03 ± 0.10	Pass
DW-30124, 30125	7/13/2012	Ra-228	1.38 ± 0.56	1.72 ± 0.60	1.55 ± 0.41	Pass
DW-30126, 30127	7/13/2012	Gr. Alpha	6.23 ± 1.16	6.75 ± 1.29	6.49 ± 0.87	Pass
AP-4433, 4434	7/19/2012	Be-7	0.17 ± 0.09	0.21 ± 0.10	0.19 ± 0.07	Pass
SG-4475, 4476	7/19/2012	Gr. Alpha	17.03 ± 4.17	15.56 ± 3.96	16.30 ± 2.88	Pass
SG-4475, 4476	7/19/2012	Gr. Beta	13.23 ± 2.61	14.36 ± 2.47	13.80 ± 1.80	Pass
WW-4685, 4686	7/24/2012	H-3	289.00 ± 99.00	375.00 ± 103.00	332.00 ± 71.43	Pass
AP-4706, 4707	7/26/2012	Be-7	0.28 ± 0.14	0.24 ± 0.14	0.26 ± 0.10	Pass
SO-4748, 4749	7/26/2012	Gr. Beta	20.45 ± 1.04	19.22 ± 0.94	19.84 ± 0.70	Pass
SO-4748, 4749	7/26/2012	Gr. Beta	20.45 ± 1.04	19.22 ± 0.94	19.84 ± 0.70	Pass
SO-4748, 4749	7/26/2012	U-233/4	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
SO-4748, 4749	7/26/2012	U-238	0.12 ± 0.02	0.11 ± 0.01	0.12 ± 0.01	Pass
VE-4832, 4833	8/1/2012	K-40	4.06 ± 0.22	4.08 ± 0.24	4.07 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-226	2.69 ± 0.22	2.79 ± 0.22	2.74 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-228	2.77 ± 0.75	1.61 ± 0.57	2.19 ± 0.47	Pass
SG-4916, 4917	8/3/2012	Ac-228	11.03 ± 0.33	11.08 ± 0.44	11.06 ± 0.28	Pass
SG-4916, 4917	8/3/2012	K-40	6.39 ± 0.80	6.98 ± 0.88	6.69 ± 0.59	Pass
F-5313, 5314	8/9/2012	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-5313, 5314	8/9/2012	Gr. Beta	4.12 ± 0.08	4.10 ± 0.08	4.11 ± 0.06	Pass
F-5313, 5314	8/9/2012	K-40	3.07 ± 0.42	3.14 ± 0.40	3.11 ± 0.29	Pass
VE-5166, 5167	8/15/2012	K-40	4.26 ± 0.28	3.66 ± 0.47	3.96 ± 0.27	Pass
VE-5376, 5377	8/22/2012	Gr. Beta	7.72 ± 0.17	7.61 ± 0.16	7.67 ± 0.12	Pass
VE-5334, 5335	8/27/2012	K-40	1.65 ± 0.17	1.72 ± 0.15	1.68 ± 0.12	Pass
VE-5481, 5482	8/28/2012	Be-7	2.52 ± 0.19	2.65 ± 0.21	2.59 ± 0.14	Pass
VE-5481, 5482	8/28/2012	K-40	5.05 ± 0.37	4.79 ± 0.39	4.92 ± 0.27	Pass
VE-5481, 5482	8/28/2012	Sr-90	0.01 ± 0.00	0.01 ± 0.01	0.01 ± 0.00	Pass
DW-30164, 30165	8/30/2012	Ra-226	1.33 ± 0.15	1.59 ± 0.17	1.46 ± 0.11	Pass
DW-30164, 30165	8/30/2012	Ra-228	2.76 ± 0.66	1.54 ± 0.56	2.15 ± 0.43	Pass
VE-5166, 5167	9/4/2012	K-40	2.05 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
ME-5607, 5608	9/4/2012	Gr. Beta	2.92 ± 0.08	2.89 ± 0.08	2.90 ± 0.06	Pass
ME-5607, 5608	9/4/2012	K-40	2.06 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
SW-5901, 5902	9/17/2012	H-3	10909.00 ± 311.00	10817.00 ± 310.00	10863.00 ± 219.56	Pass
BS-6048, 6049	9/24/2012	K-40	1.24 ± 0.20	1.18 ± 0.21	1.21 ± 0.14	Pass
AP-6482, 6483	9/27/2012	Be-7	0.09 ± 0.02	0.09 ± 0.03	0.09 ± 0.02	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-6090, 6091	10/1/2012	Be-7	3.74 ± 0.33	3.54 ± 0.30	3.64 ± 0.22	Pass
G-6090, 6091	10/1/2012	Gr. Beta	10.81 ± 0.34	10.72 ± 0.33	10.77 ± 0.24	Pass
G-6090, 6091	10/1/2012	K-40	5.99 ± 0.47	5.45 ± 0.44	5.72 ± 0.32	Pass
SO-6111, 6112	10/1/2012	Cs-137	0.06 ± 0.03	0.04 ± 0.02	0.05 ± 0.02	Pass
SO-6111, 6112	10/1/2012	K-40	19.66 ± 0.84	20.09 ± 0.80	19.88 ± 0.58	Pass
W-6795, 6796	10/1/2012	H-3	215.20 ± 88.00	292.80 ± 91.60	254.00 ± 63.51	Pass
AP-6461, 6462	10/2/2012	Be-7	0.07 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
WW-6279, 6280	10/3/2012	Gr. Beta	1.54 ± 0.68	1.67 ± 0.75	1.61 ± 0.51	Pass
W-6346, 6347	10/3/2012	Ra-226	0.30 ± 0.10	0.36 ± 0.10	0.33 ± 0.07	Pass
VE-6503, 6504	10/9/2012	K-40	5.23 ± 0.83	6.00 ± 0.45	5.62 ± 0.47	Pass
WW-6606, 6607	10/10/2012	Gr. Beta	3.18 ± 1.31	2.42 ± 1.27	2.80 ± 0.91	Pass
WW-6606, 6607	10/10/2012	H-3	273.10 ± 85.70	219.80 ± 83.10	246.45 ± 59.69	Pass
WW-7237, 7238	10/12/2012	H-3	175.44 ± 99.84	180.75 ± 100.03	178.10 ± 70.66	Pass
F-6627, 6628	10/15/2012	K-40	3.05 ± 0.39	3.23 ± 0.37	3.14 ± 0.27	Pass
VE-6669, 6670	10/16/2012	Be-7	0.48 ± 0.26	0.50 ± 0.13	0.49 ± 0.15	Pass
VE-6669, 6670	10/16/2012	K-40	4.06 ± 0.28	3.68 ± 0.26	3.87 ± 0.19	Pass
SS-6711, 6712	10/16/2012	Ac-228	0.16 ± 0.05	0.17 ± 0.06	0.17 ± 0.04	Pass
SS-6711, 6712	10/16/2012	Bi-214	0.13 ± 0.03	0.16 ± 0.03	0.14 ± 0.02	Pass
SS-6711, 6712	10/16/2012	Gr. Beta	14.20 ± 0.89	12.67 ± 0.88	13.44 ± 0.63	Pass
SS-6711, 6712	10/16/2012	Pb-212	0.15 ± 0.06	0.13 ± 0.02	0.14 ± 0.03	Pass
SS-6711, 6712	10/16/2012	Tl-208	0.06 ± 0.02	0.04 ± 0.02	0.05 ± 0.01	Pass
WW-7258, 7259	10/22/2012	H-3	214.69 ± 85.42	314.60 ± 90.25	264.65 ± 62.13	Pass
WW-7655, 7656	10/25/2012	H-3	159.00 ± 86.10	159.00 ± 86.10	159.00 ± 60.88	Pass
WW-7747, 7748	10/25/2012	H-3	156.50 ± 84.70	170.20 ± 85.30	163.35 ± 60.10	Pass
MI-6963, 6964	10/28/2012	K-40	1384.60 ± 111.70	1421.60 ± 107.60	1403.10 ± 77.55	Pass
MI-7174, 7175	11/5/2012	K-40	1283.60 ± 97.45	1293.20 ± 91.37	1288.40 ± 66.79	Pass
SG-7221, 7222	11/9/2012	Pb-214	31.49 ± 0.70	30.11 ± 0.80	30.80 ± 0.53	Pass
DW-30216, 30217	11/9/2012	Gr. Alpha	2.23 ± 0.86	2.31 ± 0.92	2.27 ± 0.63	Pass
DW-30216, 30217	11/9/2012	Ra-226	0.72 ± 0.12	0.82 ± 0.14	0.77 ± 0.09	Pass
DW-30216, 30217	11/9/2012	Ra-228	0.92 ± 0.52	1.26 ± 0.53	1.09 ± 0.37	Pass
MI-7363, 7364	11/13/2012	K-40	1304.40 ± 103.30	1496.10 ± 121.30	1400.25 ± 79.66	Pass
CF-7384, 7385	11/13/2012	K-40	11.75 ± 0.52	10.94 ± 0.59	11.35 ± 0.39	Pass
VE-7489, 7490	11/16/2012	K-40	2.22 ± 0.23	1.91 ± 0.22	2.06 ± 0.16	Pass
AP-7531, 7532	11/21/2012	Be-7	0.19 ± 0.10	0.29 ± 0.17	0.24 ± 0.10	Pass
BS-7573, 7574	11/24/2012	K-40	7.21 ± 0.41	7.57 ± 0.39	7.39 ± 0.28	Pass
LW-7865, 7866	12/5/2012	Gr. Beta	2.16 ± 0.56	1.64 ± 0.62	1.90 ± 0.42	Pass
SG-8095, 8096	12/19/2012	Ac-228	25.15 ± 0.73	25.47 ± 0.54	25.31 ± 0.45	Pass
SG-8095, 8096	12/19/2012	Gamma	26.98 ± 2.72	28.68 ± 2.89	27.83 ± 1.98	Pass

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

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

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STW-1670	02/01/12	I-129	9.31 ± 0.31	12.29	8.60 - 15.98	Pass
STSO-1766 [d]	02/01/12	Am-241	88.50 ± 8.30	159.00	111.00 - 207.00	Fail
STSO-1766	02/01/12	Co-57	1352.10 ± 4.00	1179.00	825.00 - 1533.00	Pass
STSO-1766	02/01/12	Co-60	1.70 ± 0.70	1.56	1.00 - 2.00	Pass
STSO-1766	02/01/12	Cs-134	842.20 ± 4.30	828.00	580.00 - 1076.00	Pass
STSO-1766	02/01/12	Cs-137	0.40 ± 0.90	0.00	0.00 - 1.00	Pass
STSO-1766	02/01/12	K-40	1729.60 ± 22.20	1491.00	1044.00 - 1938.00	Pass
STSO-1766	02/01/12	Mn-54	647.60 ± 4.20	558.00	391.00 - 725.00	Pass
STSO-1766	02/01/12	Ni-63	781.50 ± 9.70	862.00	603.00 - 1121.00	Pass
STSO-1766	02/01/12	Pu-238	142.40 ± 9.70	136.00	97.00 - 177.00	Pass
STSO-1766	02/01/12	Pu-239/40	66.10 ± 6.40	65.80	46.10 - 85.50	Pass
STSO-1766	02/01/12	Sr-90	383.20 ± 15.30	392.00	274.00 - 510.00	Pass
STSO-1766	02/01/12	Tc-99	289.60 ± 10.90	374.00	262.00 - 486.00	Pass
STSO-1766	02/01/12	U-233/4	63.20 ± 5.40	68.10	47.70 - 88.50	Pass
STSO-1766	02/01/12	U-238	310.80 ± 12.10	329.00	230.00 - 428.00	Pass
STSO-1766	02/01/12	Zn-65	766.70 ± 6.70	642.00	449.00 - 835.00	Pass
STAP-1772	02/01/12	Am-241	0.062 ± 0.02	0.073	0.051 - 0.10	Pass
STAP-1772	02/01/12	Co-57	0.010 ± 0.01	0.00	0.000 - 1.00	Pass
STAP-1772	02/01/12	Co-60	2.40 ± 0.08	2.18	1.53 - 2.84	Pass
STAP-1772	02/01/12	Cs-134	2.33 ± 0.13	2.38	1.67 - 3.09	Pass
STAP-1772	02/01/12	Cs-137	2.07 ± 0.10	1.79	1.25 - 2.33	Pass
STAP-1772	02/01/12	Mn-54	3.77 ± 0.14	3.24	2.27 - 4.21	Pass
STAP-1772	02/01/12	Pu-238	0.003 ± 0.004	0.002	0.000 - 0.10	Pass
STAP-1772	02/01/12	Pu-239/40	0.098 ± 0.017	0.097	0.07 - 0.13	Pass
STAP-1772	02/01/12	Sr-90	-0.010 ± 0.060	0.000	-0.10 - 0.13	Pass
STAP-1772 [e]	02/01/12	U-233/4	0.016 ± 0.006	0.019	0.013 - 0.024	Pass
STAP-1772	02/01/12	U-238	0.11 ± 0.02	0.12	0.09 - 0.16	Pass
STAP-1772	02/01/12	Zn-65	3.67 ± 0.20	2.99	2.09 - 3.89	Pass
STAP-1773	02/01/12	Gr. Alpha	0.51 ± 0.05	1.20	0.40 - 2.00	Pass
STAP-1773	02/01/12	Gr. Beta	2.75 ± 0.10	2.40	1.20 - 3.60	Pass
STVE-1776	02/01/12	Co-57	14.57 ± 0.28	12.00	8.40 - 15.60	Pass
STVE-1776	02/01/12	Co-60	6.45 ± 0.23	6.05	4.24 - 7.87	Pass
STVE-1776	02/01/12	Cs-134	8.39 ± 0.29	8.43	5.90 - 10.96	Pass
STVE-1776	02/01/12	Cs-137	0.01 ± 0.09	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Mn-54	0.03 ± 0.08	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Zn-65	10.31 ± 0.67	8.90	6.23 - 11.57	Pass
STW-1960	02/01/12	Gr. Alpha	1.68 ± 0.09	2.14	0.64 - 3.64	Pass
STW-1960	02/01/12	Gr. Beta	6.33 ± 0.10	6.36	3.18 - 9.54	Pass

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STW-1964	02/01/12	Am-241	1.28 ± 0.12	1.63	1.14 - 2.12	Pass
STW-1964	02/01/12	Co-57	33.30 ± 0.40	32.90	23.00 - 42.80	Pass
STW-1964	02/01/12	Co-60	23.20 ± 0.40	23.72	16.60 - 30.84	Pass
STW-1964	02/01/12	Cs-134	0.30 ± 3.00	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Cs-137	40.10 ± 0.60	39.90	27.90 - 51.90	Pass
STW-1964 [1]	02/01/12	Fe-55	65.10 ± 9.50	81.90	57.30 - 106.50	Pass
STW-1964	02/01/12	H-3	460.00 ± 12.10	437.00	306.00 - 568.00	Pass
STW-1964	02/01/12	K-40	153.00 ± 4.20	142.00	99.00 - 185.00	Pass
STW-1964	02/01/12	Mn-54	32.70 ± 0.60	31.80	22.30 - 41.30	Pass
STW-1964	02/01/12	Ni-63	49.80 ± 2.90	60.00	42.00 - 78.00	Pass
STW-1964	02/01/12	Pu-238	0.58 ± 0.06	0.63	0.44 - 0.82	Pass
STW-1964	02/01/12	Pu-239/40	1.30 ± 0.15	1.34	0.94 - 1.74	Pass
STW-1964	02/01/12	Sr-90	0.10 ± 0.20	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Tc-99	23.70 ± 0.80	27.90	19.50 - 36.30	Pass
STW-1964	02/01/12	U-233/4	0.40 ± 0.05	0.39	0.27 - 0.51	Pass
STW-1964	02/01/12	U-238	2.67 ± 0.13	2.76	1.93 - 3.59	Pass
STW-1964	02/01/12	Zn-65	0.01 ± 0.20	0.00	0.00 - 1.00	Pass
STW-5391	08/01/12	I-129	5.73 ± 0.28	6.82	4.77 - 8.87	Pass
STSO-5392	08/01/12	Am-241	129.30 ± 12.70	111.00	78.00 - 144.00	Pass
STSO-5392	08/01/12	Ni-63	376.20 ± 20.60	406.00	284.00 - 528.00	Pass
STSO-5392	08/01/12	Pu-238	118.70 ± 9.30	105.80	74.10 - 137.50	Pass
STSO-5392	08/01/12	Pu-239/40	140.70 ± 9.90	134.00	94.00 - 174.00	Pass
STSO-5392	08/01/12	Sr-90	483.52 ± 16.47	508.00	356.00 - 660.00	Pass
STSO-5392	08/01/12	Tc-99	432.50 ± 23.10	469.00	328.00 - 610.00	Pass
STSO-5394	08/01/12	Co-57	1528.00 ± 4.10	1316.00	921.00 - 1711.00	Pass
STSO-5394	08/01/12	Co-60	592.00 ± 3.20	531.00	372.00 - 690.00	Pass
STSO-5394	08/01/12	Cs-134	933.60 ± 5.82	939.00	657.00 - 1221.00	Pass
STSO-5394	08/01/12	Cs-137	1319.80 ± 5.50	1150.00	805.00 - 1495.00	Pass
STSO-5394	08/01/12	K-40	737.30 ± 17.70	632.00	442.00 - 822.00	Pass
STSO-5394	08/01/12	Mn-54	1083.20 ± 5.20	920.00	644.00 - 1196.00	Pass
STSO-5394	08/01/12	U-233/4	55.80 ± 4.20	60.30	42.20 - 78.40	Pass
STSO-5394	08/01/12	U-238	231.20 ± 8.60	263.00	184.00 - 342.00	Pass
STSO-5394	08/01/12	Zn-65	696.10 ± 7.00	606.00	424.00 - 788.00	Pass

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STVE-5395 [g]	08/01/12	Co-57	7.44 ± 0.17	5.66	3.96 - 7.36	Fail
STVE-5395	08/01/12	Co-60	5.90 ± 0.15	5.12	3.58 - 6.66	Pass
STVE-5395	08/01/12	Cs-134	7.40 ± 0.31	6.51	4.56 - 8.46	Pass
STVE-5395	08/01/12	Cs-137	5.45 ± 0.18	4.38	3.07 - 5.69	Pass
STVE-5395	08/01/12	Mn-54	4.06 ± 0.21	3.27	2.29 - 4.25	Pass
STAP-5398	08/01/12	Gr. Alpha	0.41 ± 0.05	0.97	0.29 - 1.65	Pass
STAP-5398	08/01/12	Gr. Beta	2.11 ± 0.09	1.92	0.96 - 2.88	Pass
STAP-5401 [h]	08/01/12	Am-241	0.12 ± 0.02	0.08	0.05 - 0.10	Fail
STAP-5403	08/01/12	Co-57	1.96 ± 0.05	1.91	1.34 - 2.48	Pass
STAP-5403	08/01/12	Co-60	1.76 ± 0.07	1.73	1.21 - 2.25	Pass
STAP-5403	08/01/12	Cs-134	2.74 ± 0.18	2.74	1.92 - 3.56	Pass
STAP-5403	08/01/12	Cs-137	0.00 ± 0.03	0.00	-0.01 - 0.01	Pass
STAP-5403	08/01/12	Mn-54	2.52 ± 0.10	2.36	1.65 - 3.07	Pass
STAP-5403	08/01/12	Pu-238	0.050 ± 0.015	0.063	0.044 - 0.081	Pass
STAP-5403	08/01/12	Pu-239/40	0.001 ± 0.004	0.00081	0.000 - 0.010	Pass
STAP-5403 [i]	08/01/12	U-233/4	0.009 ± 0.011	0.014	0.010 - 0.018	Fail
STAP-5403	08/01/12	U-238	0.08 ± 0.02	0.10	0.070 - 0.130	Pass
STAP-5403	08/01/12	Zn-65	0.01 ± 0.06	0.00	-0.010 - 0.010	Pass
STW-5445	08/01/12	Fe-55	79.80 ± 4.10	89.30	62.50 - 116.10	Pass
STW-5445	08/01/12	Ni-63	74.30 ± 3.40	66.30	46.40 - 86.20	Pass
STW-5445	08/01/12	U-233/4	0.46 ± 0.05	0.45	0.32 - 0.59	Pass
STW-5445	08/01/12	U-238	3.14 ± 0.14	3.33	2.33 - 4.33	Pass
STW-5445 [j]	08/01/12	Am-241	0.64 ± 0.04	1.06	0.74 - 1.38	Fail

[a] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

[d] Investigation was inconclusive, there was not enough sample for reanalysis. ERA results (A-7) for the same matrix were acceptable.

[e] No errors found in calculation or procedure, original analysis result; 0.010 ± 0.010 Bq/filter.

[f] Reanalysis results were within limits, but low. ERA results (A-7) for the same matrix were acceptable. The efficiency factor was recalculated for the second round of MAPEP testing. Original analysis results 55.8 ± 12.6 Bq/L.

[g] Result of reanalysis; 6.74 ± 0.15 Bq/sample. Gamma emitters for the vegetation matrix exhibited a high bias, only Co-57 exceeded acceptance limits. Recounted using a geometry more closely matched to the MAPEP sample size.

[h] Result of reanalysis; 0.070 ± 0.013 Bq/filter.

[i] Result of reanalysis; 0.013 ± 0.005 pCi/filter. A larger sample size was used to reduce the counting error.

[j] Result of reanalysis 1.07 ± 0.06 pCi/L. The analyses of the MAPEP sample matrix resulted in recovery factors greater than 100%. A correction was made using recovery based on analysis of blank samples. A new tracer solution is on order, future samples for MAPEP testing will include batch spike and blank samples.

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERAP-1393	03/19/12	Co-60	917.5 ± 7.0	880.0	681.0 - 1100.0	Pass
ERAP-1393	03/19/12	Cs-134	586.6 ± 7.4	656.0	417.0 - 814.0	Pass
ERAP-1393	03/19/12	Cs-137	1255.9 ± 9.4	1130.0	849.0 - 1480.0	Pass
ERAP-1393	03/19/12	Mn-54	< 3.4	0.0	-	Pass
ERAP-1393	03/19/12	Zn-65	1085.2 ± 18.0	897.0	642.0 - 1240.0	Pass
ERAP-1394	03/19/12	Am-241	86.9 ± 2.9	68.8	42.4 - 93.1	Pass
ERAP-1394	03/19/12	Pu-238	70.2 ± 3.6	63.2	43.3 - 83.1	Pass
ERAP-1394	03/19/12	Pu-239/40	66.0 ± 1.0	63.0	45.6 - 82.4	Pass
ERAP-1394	03/19/12	Sr-90	112.5 ± 15.4	89.6	43.8 - 134.0	Pass
ERAP-1394	03/19/12	U-233/4	43.4 ± 0.8	47.5	29.4 - 71.6	Pass
ERAP-1394	03/19/12	U-238	44.0 ± 1.2	47.1	30.4 - 65.1	Pass
ERAP-1394	03/19/12	Uranium	89.1 ± 2.2	96.7	53.5 - 147.0	Pass
ERAP-1396	03/19/12	Gr. Alpha	81.1 ± 1.5	77.8	26.1 - 121.0	Pass
ERAP-1396	03/19/12	Gr. Beta	68.4 ± 0.7	52.5	33.2 - 76.5	Pass
ERSO-1397	03/19/12	Ac-228	1303.4 ± 89.3	1570.0	1010.0 - 2180.0	Pass
ERSO-1397	03/19/12	Am-241	856.0 ± 123.7	938.0	549.0 - 1220.0	Pass
ERSO-1397	03/19/12	Bi-212	1379.2 ± 247.2	1550.0	413.0 - 2280.0	Pass
ERSO-1397	03/19/12	Bi-214	965.2 ± 38.4	1100.0	665.0 - 1590.0	Pass
ERSO-1397	03/19/12	Co-60	3693.6 ± 32.1	3500.0	2370.0 - 4820.0	Pass
ERSO-1397	03/19/12	Cs-134	2257.3 ± 45.4	2180.0	1420.0 - 2620.0	Pass
ERSO-1397	03/19/12	Cs-137	9444.5 ± 58.4	8770.0	6720.0 - 11300.0	Pass
ERSO-1397	03/19/12	K-40	11277.0 ± 275.1	11600.0	8470.0 - 15600.0	Pass
ERSO-1397	03/19/12	Mn-54	< 21.0	0.0	-	Pass
ERSO-1397	03/19/12	Pb-212	1208.4 ± 26.3	1510.0	992.0 - 2110.0	Pass
ERSO-1397	03/19/12	Pb-214	1041.6 ± 46.9	1110.0	647.0 - 1650.0	Pass
ERSO-1397	03/19/12	Pu-238	921.0 ± 112.6	984.0	592.0 - 1360.0	Pass
ERSO-1397	03/19/12	Pu-239/40	1028.0 ± 112.6	879.0	575.0 - 1210.0	Pass
ERSO-1397	03/19/12	Sr-90	8128.0 ± 329.0	8800.0	3360.0 - 13900.0	Pass
ERSO-1397	03/19/12	Th-234	2711.3 ± 253.6	2000.0	632.0 - 3760.0	Pass
ERSO-1397	03/19/12	U-233/4	1859.3 ± 126.6	1960.0	1200.0 - 2510.0	Pass
ERSO-1397	03/19/12	U-238	2003.3 ± 130.3	2000.0	1240.0 - 2540.0	Pass
ERSO-1397	03/19/12	Uranium	3939.5 ± 283.8	4030.0	2190.0 - 5320.0	Pass
ERSO-1397	03/19/12	Zn-65	4200.4 ± 65.9	3650.0	2910.0 - 4850.0	Pass

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERVE-1400	03/19/12	Am-241	4194.8 ± 199.5	4540.0	2780.0 - 6040.0	Pass
ERVE-1400	03/19/12	Cm-244	1471.2 ± 113.1	1590.0	779.0 - 2480.0	Pass
ERVE-1400	03/19/12	Co-60	2347.8 ± 47.9	2210.0	1520.0 - 3090.0	Pass
ERVE-1400	03/19/12	Cs-134	2847.5 ± 64.0	2920.0	1880.0 - 3790.0	Pass
ERVE-1400	03/19/12	Cs-137	1503.5 ± 52.5	1340.0	972.0 - 1860.0	Pass
ERVE-1400	03/19/12	K-40	34105.7 ± 745.3	28600.0	20700.0 - 40100.0	Pass
ERVE-1400	03/19/12	Mn-54	< 26.8	0.0	-	Pass
ERVE-1400	03/19/12	Pu-238	2509.0 ± 213.6	2350.0	1400.0 - 3220.0	Pass
ERVE-1400	03/19/12	Pu-239/40	2690.4 ± 208.9	2570.0	1580.0 - 3540.0	Pass
ERVE-1400	03/19/12	Sr-90	7881.5 ± 470.8	8520.0	4860.0 - 11300.0	Pass
ERVE-1400	03/19/12	U-233/4	3149.6 ± 165.2	3610.0	2370.0 - 4640.0	Pass
ERVE-1400	03/19/12	U-238	3203.6 ± 166.5	3580.0	2390.0 - 4550.0	Pass
ERVE-1400	03/19/12	Uranium	6463.7 ± 363.2	7350.0	4980.0 - 9150.0	Pass
ERVE-1400	03/19/12	Zn-65	2701.9 ± 105.5	2310.0	1670.0 - 3240.0	Pass
ERW-1403	03/19/12	Am-241	119.9 ± 3.2	135.0	91.0 - 181.0	Pass
ERW-1403	03/19/12	Fe-55	713.7 ± 127.4	863.0	514.0 - 1170.0	Pass
ERW-1403	03/19/12	Pu-238	131.9 ± 6.4	135.0	99.9 - 168.0	Pass
ERW-1403	03/19/12	Pu-239/40	108.9 ± 10.2	112.0	86.9 - 141.0	Pass
ERW-1403	03/19/12	U-233/4	93.1 ± 7.9	105.0	78.9 - 135.0	Pass
ERW-1403	03/19/12	U-238	96.9 ± 5.5	104.0	79.3 - 128.0	Pass
ERW-1403	03/19/12	Uranium	190.0 ± 13.8	214.0	157.0 - 277.0	Pass
ERW-1405	03/19/12	Co-60	858.7 ± 5.6	875.0	760.0 - 1020.0	Pass
ERW-1405	03/19/12	Cs-134	560.4 ± 4.4	609.0	447.0 - 700.0	Pass
ERW-1405	03/19/12	Cs-137	1239.9 ± 7.4	1250.0	1060.0 - 1500.0	Pass
ERW-1405	03/19/12	Mn-54	< 7.4	0.0	-	Pass
ERW-1405	03/19/12	Sr-90	944.3 ± 26.2	989.0	644.0 - 1310.0	Pass
ERW-1405	03/19/12	Zn-65	786.9 ± 20.6	749.0	624.0 - 945.0	Pass
ERW-1406	03/19/12	Gr. Alpha	85.9 ± 3.0	103.0	36.6 - 160.0	Pass
ERW-1406	03/19/12	Gr. Beta	45.7 ± 1.6	43.7	25.0 - 64.7	Pass
ERW-1409	03/19/12	H-3	9045.0 ± 284.0	9150.0	6130.0 - 13000.0	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation). Results are reported in units of pCi/L, except for air filters (pCi/Filter), vegetation and soil (pCi/kg).

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

[d] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". Control limits are not provided.

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

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

3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows. :

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

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

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

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

4.0. Computation of Averages and Standard Deviations

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

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

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

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

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

4.5 In rounding off, the following rules are followed:

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

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

APPENDIX C

Maximum Permissible Concentrations

of Radioactivity in Air and Water

Above Background in Unrestricted Areas

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

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

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

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

[c] A natural radionuclide.

APPENDIX D

Sampling Location Maps

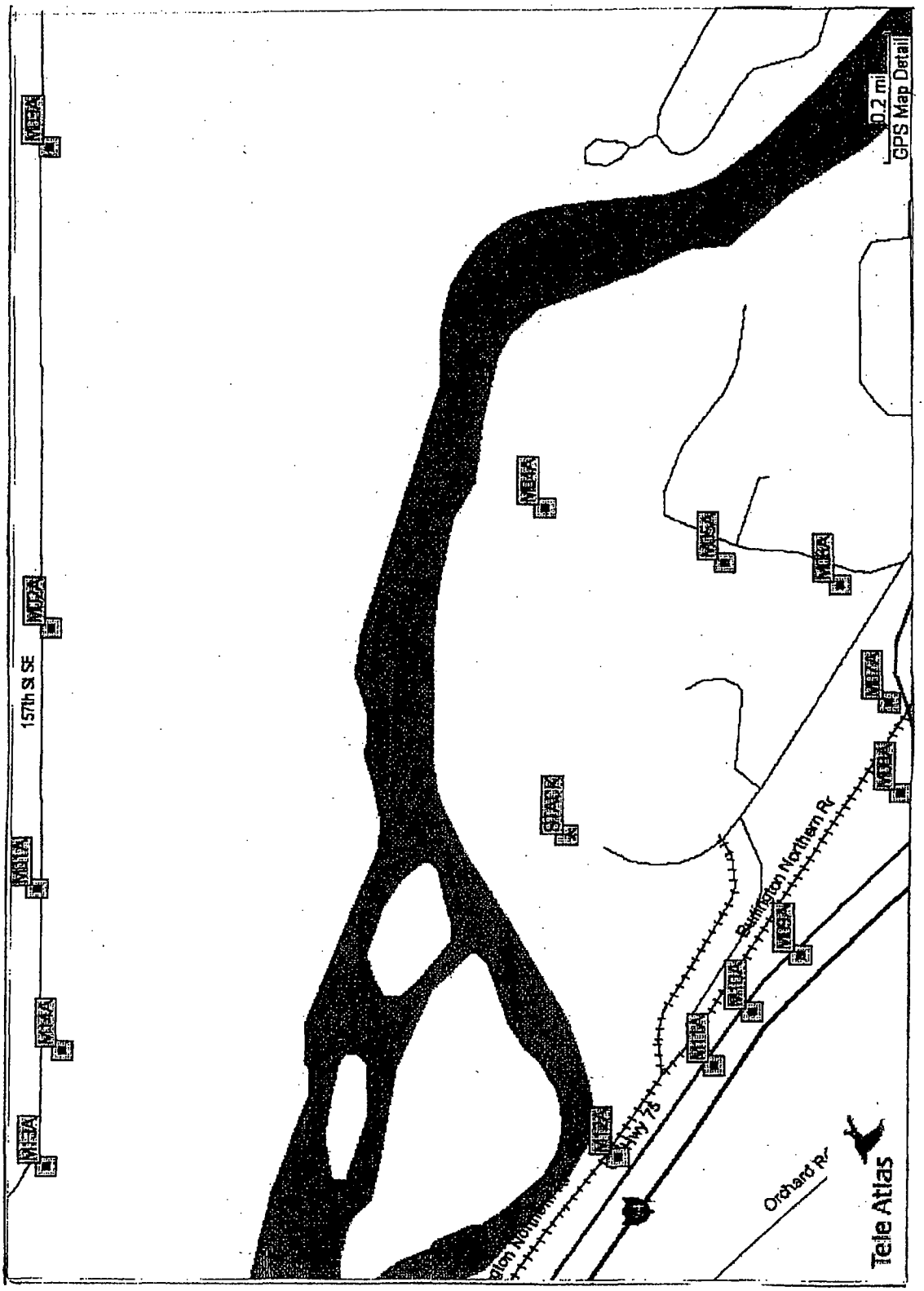

Figure D-1, Sample Collection and Analysis Program: TLD locations, Inner Ring. (Table 5.2)

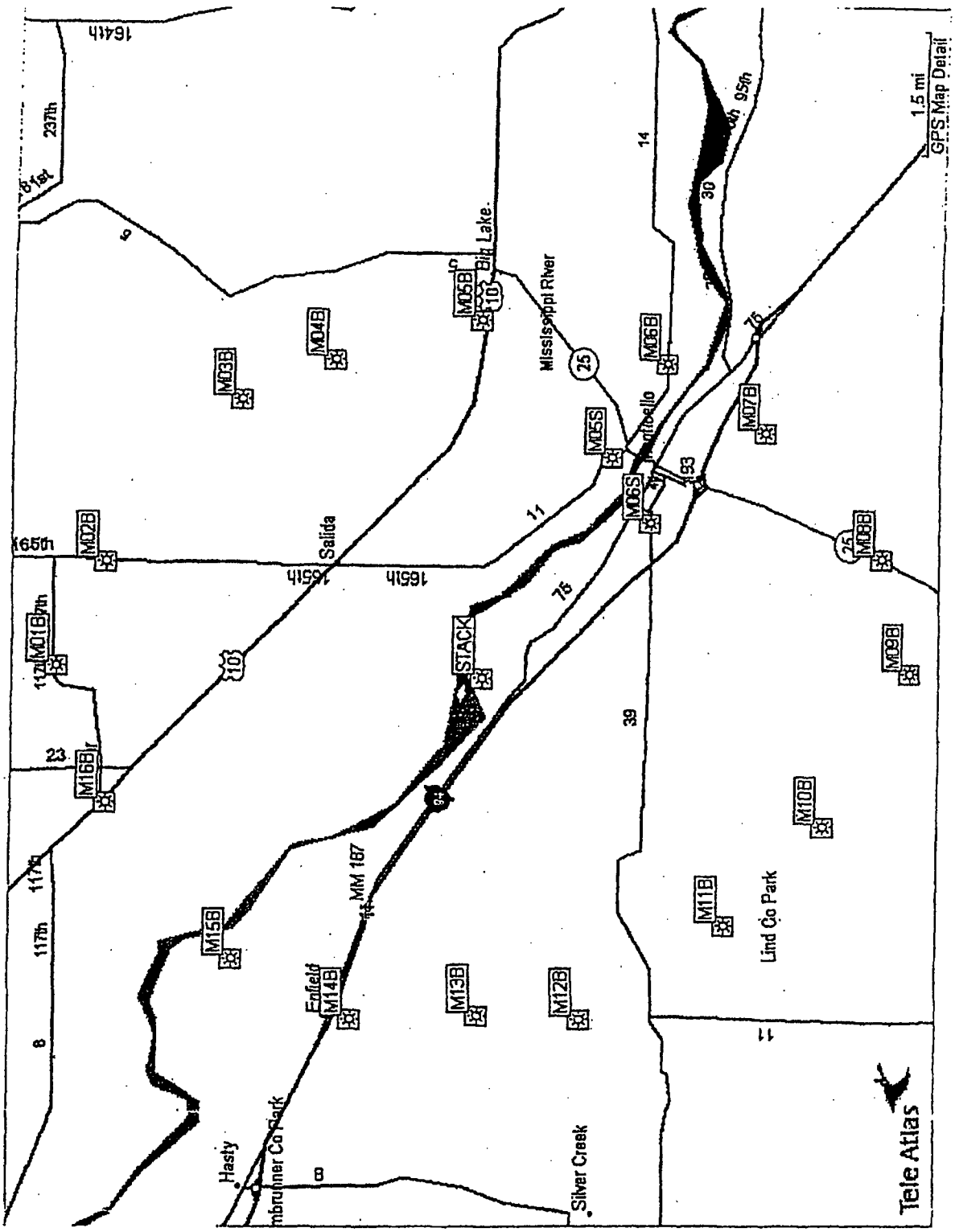

Figure D-2, Sample Collection and Analysis Program: TLD locations, Outer Ring. (Table 5.2)

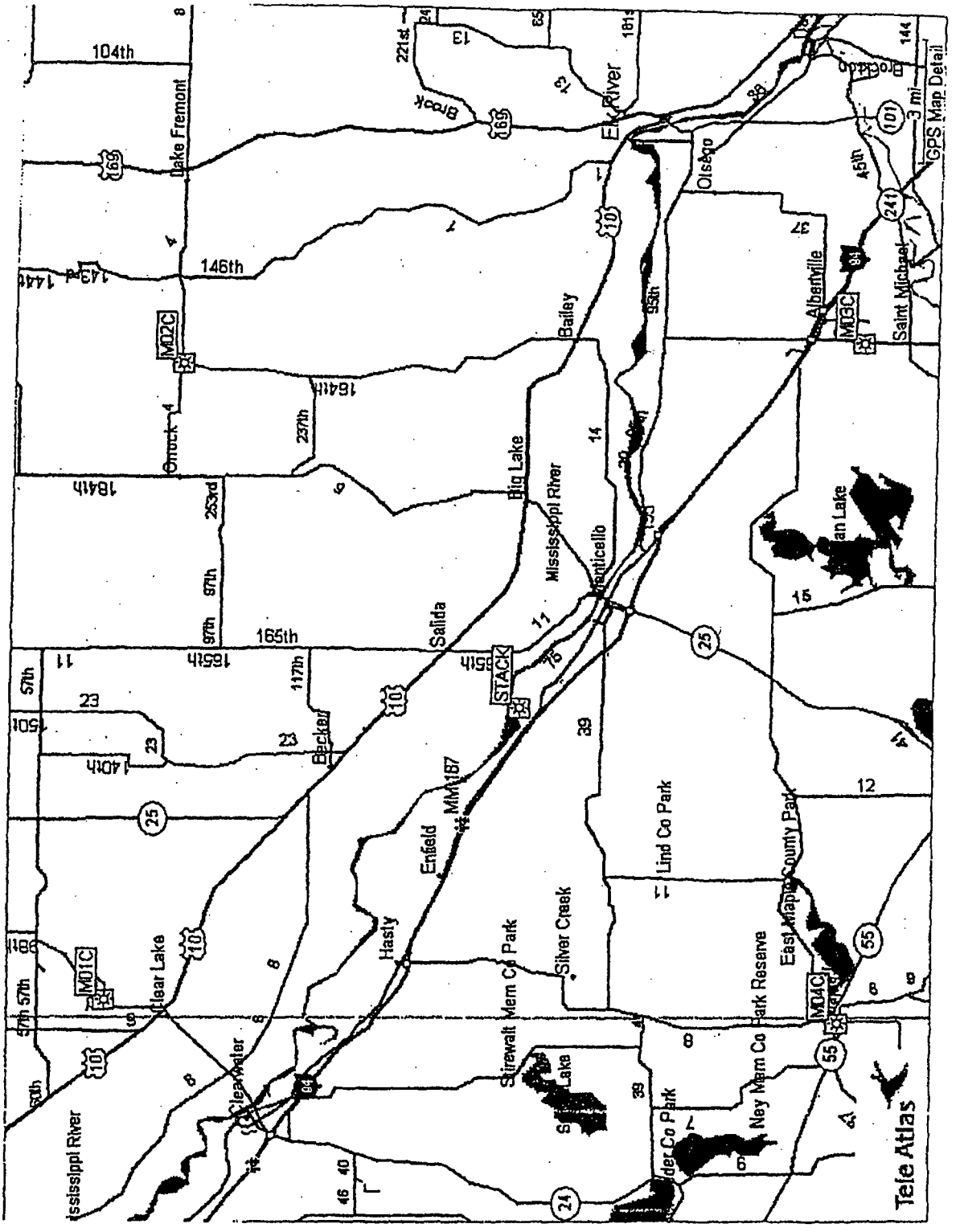

Figure D-3, Sample Collection and Analysis Program: TLD locations, Controls. (Table 5.2)

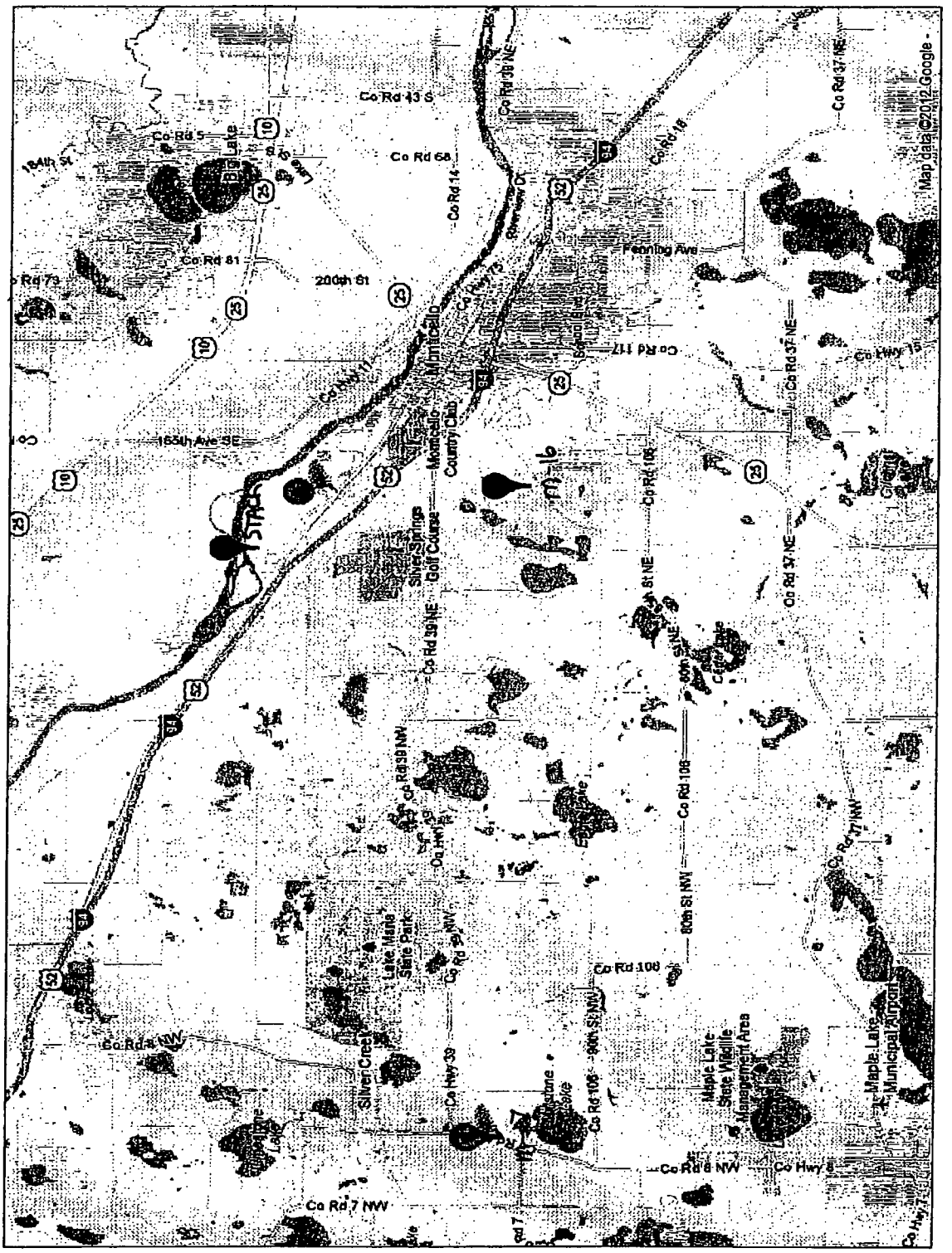

Figure D-4, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Milk Sampling locations. (Table 5.2)

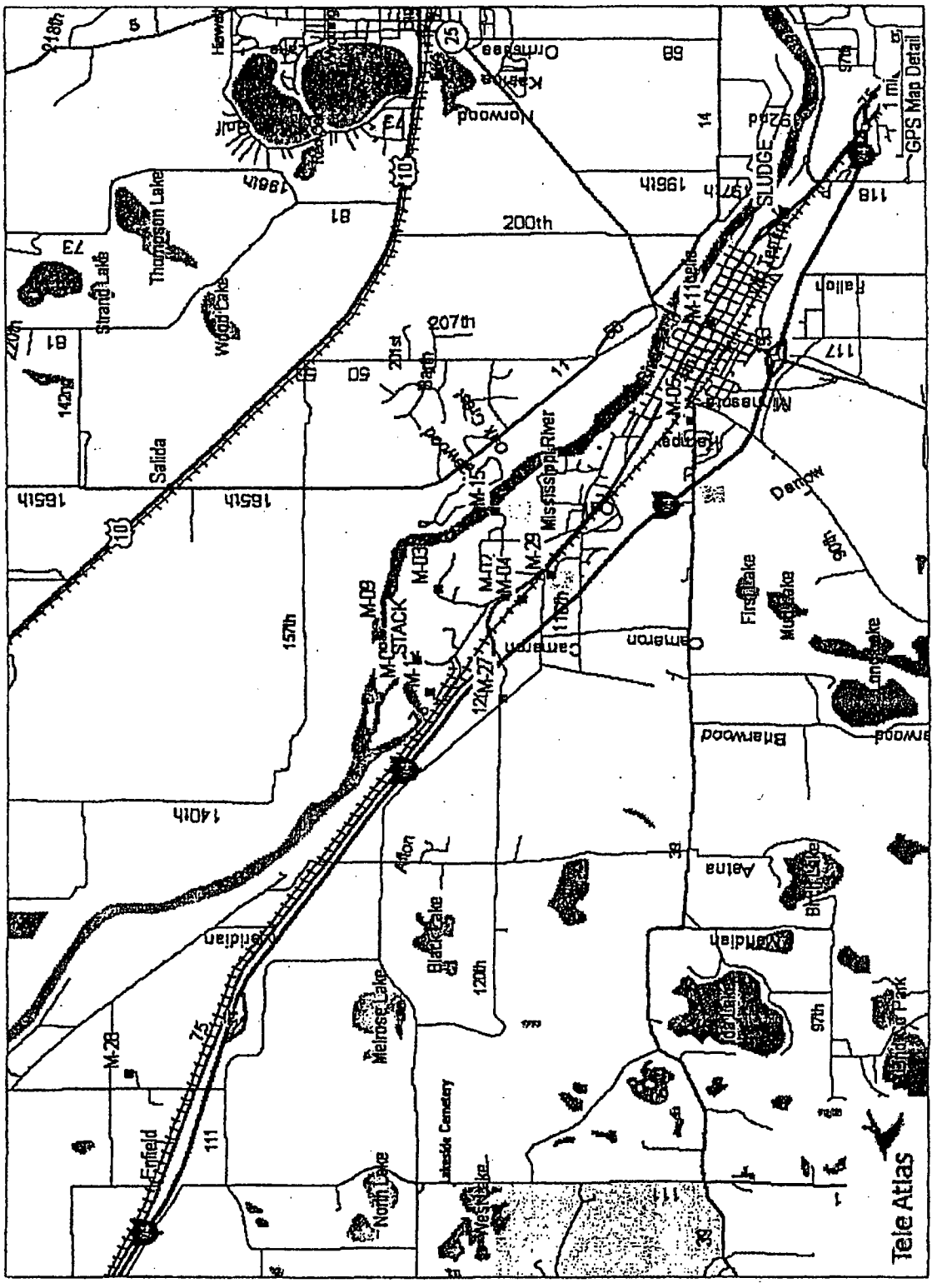

Figure D-5, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Sludge, Ground Water and Shoreline sampling locations. (Table 5.2)

APPENDIX E

Ground Water Monitoring Well Samples

1.0 INTRODUCTION

This appendix to the Radiological Environmental Monitoring Program Annual Report to the United States Nuclear Regulatory Commission summarizes and interprets results of the Ground Water Monitoring Program samples taken at the Monticello Nuclear Plant, Monticello, Minnesota, during the period January – December 2012. This sampling program was established in October of 2006 following the industry initiative on ground water monitoring.

Complete data tables for each period and sampling location, are provided in a reference document, (Environmental, Inc., Midwest Laboratory, "Complete Analyses Data Tables, January – December, 2012") available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

2.0 SUMMARY

The Ground Water Sampling Program was established following industry events where tritium was discovered in ground water surrounding commercial nuclear facilities. This program is described and the results for 2012 are summarized and discussed.

Program findings for 2012 detected low levels of tritium in monitoring wells located on the plant property. With the exception of monitoring wells MW-9A, MW-10 and MW-13A, tritium measured at or near expected natural background levels. The 2012 sample results (excluding MW-9A, MW-10 and MW-13A) all measured below the required limit of 500 pCi/L. One of six storm water runoff samples collected in October from the sanitary sewer, measured 4479 pCi/L of tritium. The remaining samples measured less than 500 pCi/L. The measurements for 2012 are well below the Environmental Protection Agency's drinking water standard of 20,000 pCi/L and present no harm to members of the public.

None of the samples monitored for gamma-emitting isotopes showed activity greater than the LLD.

A summation of the analytical data for both ground water monitoring wells and storm water runoff samples is provided in Table E-3.

3.0 Ground Water Sampling Program

3.1 Program Design and Data Interpretation

The purpose of this sampling program is to assess the impact of any tritium leaching into the environment (ground water system) from MNGP. For this purpose, water samples are collected and analyzed for tritium content.

3.2 Program Description

The sampling and analysis schedule for the Ground Water Monitoring Program is summarized in Table E-1 and briefly reviewed below. Table E-2 defines the additional sample locations and codes for the Ground Water Sampling Program.

Sampling from the groundwater monitoring wells was conducted monthly at fourteen locations and quarterly for five locations.

3.3 Program Execution

The Program was executed as described with the following exceptions:

Ground water from location MW-14, October 17, 2012, was not collected as scheduled.

Additional analyses for gamma emitting isotopes were performed on samples from each of the nineteen monitoring wells. Results are summarized in Table E-3.

3.4 Program Modifications

Two additional on-site monitoring wells MW-15A, 15B (approx. 0.14 mi / NNE) were added to the ground water program in July, 2012. Samples are analyzed for tritium and gamma emitting isotopes.

3.5 Results and Discussions

Results obtained show tritium in ground water samples at or near expected natural background levels, with the exception of monitoring wells, MW-9A, MW-10 and MW-13A.

Excluding data for wells MW-9A, MW-10 and MW-13A, the 2012 sample results are similar or slightly lower than averages seen in 2011 and within the range of expected background tritium levels in groundwater, due to tritium concentrations measured in precipitation. Sampling points in North America have shown tritium concentrations in precipitation ranging from 5 pCi/L to 157 pCi/L (Environmental Isotope Data No. 10; World Survey of Isotope Concentration in Precipitation (1988-1991).

The tritium activity detected at sites MW-9A and MW-10 ranged from a high of 770 pCi/L to < 500 pCi/L. These levels were lower than measurements taken in 2011. Previous investigations concluded that the higher tritium activity was due to a 1981 spill from the Condensate Storage Tanks, that had infiltrated the surface and migrated towards MW-9.

Tritium concentrations measured at location MW-13A were higher than previously measured in 2011. A spike in activity occurred in March and April, 2012, declined in May, and dropped through the rest of the year. Activity ranged from a high of 3044 to less than 500 pCi/L.

No groundwater sample analyzed for gamma-emitting isotopes showed activity greater than LLD.

Table E-1. Sample Collection and Analysis Program, Ground Water.

Medium	Number	Sample Codes	Collection type	Analysis Type
Ground Water Quarterly	29	MW-4, MW-5, MW-6, MW-7, MW-8	Grab	H-3
Ground Water Monthly	143	MW-1, MW-2, MW-3, MW-9A, MW-9B, MW-10, MW-11, MW-12A, MW-12B, MW-13A, MW-13B, MW-14, MW-15A, MW-15B,	Grab	H-3

Table E-2. Sampling locations for Ground Water Monitoring Wells.

Sample Type	Vendor Code	Well Number	Distance from Stack (miles)	Compass Heading from Stack	Sector
Ground Water	M-33	MW-1	0.11	299	WNW
Ground Water	M-34	MW-2	0.14	301	WNW
Ground Water	M-35	MW-3	0.15	305	NW
Ground Water	M-36	MW-4	0.1	25	NNE
Ground Water	M-37	MW-5	0.1	253	WSW
Ground Water	M-38	MW-6	229 Feet	228	SW
Ground Water	M-39	MW-7	0.2	66	ENE
Ground Water	M-40	MW-8	0.3	150	SSE
Ground Water	M-44	MW-9A	0.1	310	NW
Ground Water	M-51	MW-9B	0.1	310	NW
Ground Water	M-45	MW-10	0.1	292	WNW
Ground Water	M-46	MW-11	0.1	283	WNW
Ground Water	M-47	MW-12A	0.1	330	NW
Ground Water	M-48	MW-12B	0.1	326	NW
Ground Water	M-49	MW-13A	0.12	316	NW
Ground Water	M-50	MW-13B	0.12	316	NW
Ground Water	M-52	MW-14	0.17	306	NW
Ground Water	M-53	MW-15A	0.14	14	NNE
Ground Water	M-54	MW-15B	0.14	14	NNE

Table E-3. Ground Water Monitoring Program Summary.

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2012
	(County, State)		

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean Location [d]	Location with Highest Annual Mean Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
Groundwater Monitoring Wells (pCi/L)	H-3 172	500	1182 (8/172) (540-2317)	MW-13A, Onsite, 0.12 mi @ 316°/NW	2155 (3/12) (810-3044)	none	8
	GS 54						
	Mn-54	10	< LLD	-	-	none	0
	Fe-59	30	< LLD	-	-	none	0
	Co-58	10	< LLD	-	-	none	0
	Co-60	10	< 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	46	< LLD	-	-	none	0
Stormwater Runoff (pCi/L)	H-3 6	500	4479 (1/6)	Sewer Lift Station On-site	4479 (1/6)	none	1
	GS 6						
	Mn-54	10	< LLD	-	-	none	0
	Fe-59	30	< LLD	-	-	none	0
	Co-58	10	< LLD	-	-	none	0
	Co-60	10	< LLD	-	-	none	0
	Zn-65	30	< LLD	-	-	none	0
	Zr-Nb-95	15	< LLD	-	-	none	0
	I-131	30	< LLD	-	-	none	0
	Cs-134	10	< LLD	-	-	none	0
	Cs-137	10	< LLD	-	-	none	0
	Ba-La-140	15	< LLD	-	-	none	0
	Ce-144	45	< LLD	-	-	none	0

[a] GB = gross beta, GS = gamma scan.

[b] LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample.

[c] Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

[d] Locations are specified: (1) by name, and/or station code and (2) by distance (miles) and direction relative to reactor site.

[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten time the typical preoperational value for the medium or location.

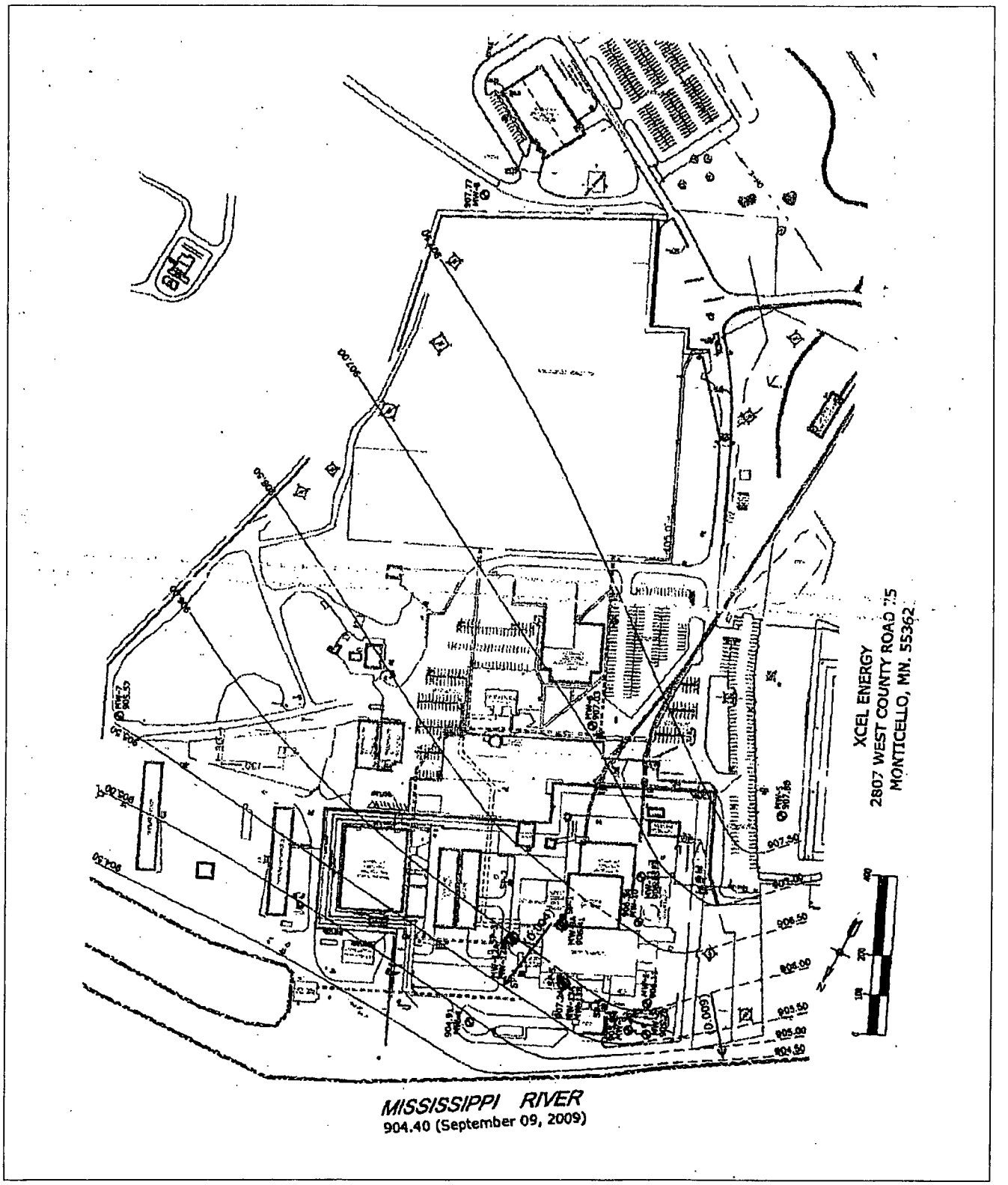

Figure E-1. Sample collection and analysis program: Ground water, On-site monitoring well locations.

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L)										
		^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
						Monitoring Well #1 (M-33)						
MWW- 272	01/17/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 897	02/21/12	< 142	-	-	-	-	-	-	-	-	-	-
MWW- 1576	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2226	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 16
MWW- 3121	05/22/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3923	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4496	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 5353	08/23/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5974	09/18/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6829	10/16/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MWW- 7630	11/21/12	178 ± 84	-	-	-	-	-	-	-	-	-	-
MWW- 8195	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #2 (M-34)						
MWW- 273	01/17/12	293 ± 87	-	-	-	-	-	-	-	-	-	-
MWW- 898	02/21/12	246 ± 87	-	-	-	-	-	-	-	-	-	-
MWW- 1577	03/23/12	182 ± 86	-	-	-	-	-	-	-	-	-	-
MWW- 2227	04/18/12	240 ± 97	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 30
MWW- 3122	05/22/12	273 ± 96	-	-	-	-	-	-	-	-	-	-
MWW- 3924	06/20/12	207 ± 97	-	-	-	-	-	-	-	-	-	-
MWW- 4498	07/19/12	235 ± 95	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 5354	08/23/12	177 ± 102	-	-	-	-	-	-	-	-	-	-
MWW- 5975	09/18/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6830	10/16/12	217 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
MWW- 7631	11/20/12	286 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 8196	12/19/12	292 ± 88	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #3 (M-35)						
MWW- 274	01/17/12	258 ± 85	-	-	-	-	-	-	-	-	-	-
MWW- 899	02/21/12	192 ± 84	-	-	-	-	-	-	-	-	-	-
MWW- 1578	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2228	04/18/12	161 ± 94	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 3123	05/22/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3925	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4499	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 5355	08/23/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5976	09/18/12	186 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 6831	10/16/12	360 ± 91 [a]	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 7632	11/20/12	241 ± 87	-	-	-	-	-	-	-	-	-	-
MWW- 8197	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #4 (M-36)						
MWW- 275	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2229	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 38
MWW- 4500	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 5357	08/22/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 6832	10/16/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
						Monitoring Well #5 (M-37)						
MWW- 276	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2230	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
MWW- 4501	07/20/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 6833	10/18/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 46

[a] Analysis was repeated; result of reanalysis, 336 ± 92 pCi/L.

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
						Monitoring Well #6 (M-38)						
MWW- 277	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2232	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 4502	07/20/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 6834	10/18/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
						Monitoring Well #7 (M-39)						
MWW- 278	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2233	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 4503	07/20/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 6835	10/18/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 35
						Monitoring Well #8 (M-40)						
MWW- 279	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2234	04/19/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 4504	07/20/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 14
MWW- 6836	10/18/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
						Monitoring Well #9A (M-44)						
MWW- 280	01/16/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 900	02/21/12	< 142	-	-	-	-	-	-	-	-	-	-
MWW- 1579	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2235	04/19/12	376 ± 107	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 3124	05/23/12	770 ± 114	-	-	-	-	-	-	-	-	-	-
MWW- 3864	06/21/12	483 ± 95	-	-	-	-	-	-	-	-	-	-
MWW- 4505	07/17/12	< 171	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5358	08/21/12	375 ± 110	-	-	-	-	-	-	-	-	-	-
MWW- 5977	09/19/12	436 ± 100	-	-	-	-	-	-	-	-	-	-
MWW- 6837	10/17/12	337 ± 90	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 32
MWW- 7633	11/19/12	< 144	-	-	-	-	-	-	-	-	-	-
MWW- 8198	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #9B (M-51)						
MWW- 281	01/16/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 901	02/21/12	< 142	-	-	-	-	-	-	-	-	-	-
MWW- 1580	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2236	04/19/12	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 3125	05/23/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3927	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4506	07/17/12	< 171	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 5359	08/21/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5978	09/19/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6839	10/17/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 35
MWW- 7634	11/19/12	< 150	-	-	-	-	-	-	-	-	-	-
MWW- 8199	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
		Monitoring Well #10 (M-45)										
MWW- 283	01/17/12	636 ± 102	-	-	-	-	-	-	-	-	-	-
MWW- 902	02/21/12	544 ± 100	-	-	-	-	-	-	-	-	-	-
MWW- 1581	03/23/12	489 ± 99	-	-	-	-	-	-	-	-	-	-
MWW- 2237	04/18/12	539 ± 113	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 3126	05/22/12	416 ± 101	-	-	-	-	-	-	-	-	-	-
MWW- 3928	06/20/12	244 ± 99	-	-	-	-	-	-	-	-	-	-
MWW- 4507	07/19/12	290 ± 98	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
MWW- 5360	08/23/12	208 ± 104	-	-	-	-	-	-	-	-	-	-
MWW- 5979	09/18/12	401 ± 99	-	-	-	-	-	-	-	-	-	-
MWW- 6840	10/16/12	418 ± 94	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 7636	11/20/12	507 ± 99	-	-	-	-	-	-	-	-	-	-
MWW- 8200	12/19/12	373 ± 92	-	-	-	-	-	-	-	-	-	-
		Monitoring Well #11 (M-46)										
MWW- 284	01/17/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 903	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1582	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2238	04/18/12	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 3127	05/22/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3929	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4508	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 5361	08/23/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5980	09/18/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6841	10/16/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
MWW- 7637	11/21/12	< 144	-	-	-	-	-	-	-	-	-	-
MWW- 8201	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-
		Monitoring Well #12A (M-47)										
MWW- 285	01/17/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 904	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1583	03/19/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2239	04/18/12	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 3128	05/22/12	189 ± 93	-	-	-	-	-	-	-	-	-	-
MWW- 3930	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4509	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 5362	08/23/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5981	09/17/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6842	10/17/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 36
MWW- 7638	11/20/12	< 144	-	-	-	-	-	-	-	-	-	-
MWW- 8203	12/20/12	< 141	-	-	-	-	-	-	-	-	-	-

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
						Monitoring Well #12B (M-48)						
MWW- 286	01/17/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 905	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1584	03/19/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2240	04/18/12	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MWW- 3129	05/22/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3931	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4510	07/19/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
MWW- 5363	08/23/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5982	09/17/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6843	10/17/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 45
MWW- 7639	11/20/12	< 144	-	-	-	-	-	-	-	-	-	-
MWW- 8204	12/20/12	< 141	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #13A (M-49)						
MWW- 287	01/17/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 906	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1585	03/19/12	2612 ± 166 [a]	-	-	-	-	-	-	-	-	-	-
MWW- 2080	04/17/12	3044 ± 176 [b]	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 10 [c]	< 10
MWW- 3130	05/22/12	810 ± 115	-	-	-	-	-	-	-	-	-	-
MWW- 3932	06/20/12	351 ± 103	-	-	-	-	-	-	-	-	-	-
MWW- 4511	07/19/12	180 ± 93	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 5364	08/22/12	206 ± 104	-	-	-	-	-	-	-	-	-	-
MWW- 5983	09/18/12	< 153	-	-	-	-	-	-	-	-	-	-
MWW- 6844	10/17/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
MWW- 7640	11/20/12	221 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 8205	12/19/12	< 141	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #13B (M-50)						
MWW- 288	01/17/12	< 152	-	-	-	-	-	-	-	-	-	-
MWW- 907	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1587	03/19/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2241	04/17/12	162 ± 80	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 3131	05/22/12	189 ± 93	-	-	-	-	-	-	-	-	-	-
MWW- 3933	06/20/12	294 ± 101	-	-	-	-	-	-	-	-	-	-
MWW- 4512	07/19/12	174 ± 93	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5365	08/22/12	219 ± 104	-	-	-	-	-	-	-	-	-	-
MWW- 5984	09/18/12	167 ± 88	-	-	-	-	-	-	-	-	-	-
MWW- 6845	10/17/12	225 ± 85	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 10
MWW- 7641	11/20/12	301 ± 92	-	-	-	-	-	-	-	-	-	-
MWW- 8206	12/19/12	222 ± 85	-	-	-	-	-	-	-	-	-	-

[a] Sample was analyzed in duplicate; result of duplicate analysis, 2283 ± 157 pCi/L.

[b] Analysis was repeated; result of reanalysis, 3234 ± 181 pCi/L.

[c] LLD for Ba-La-140 not reached due to delay in counting. Value given is activity at time of counting.

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
		Monitoring Well #14 (M-52)										
MWW- 289	01/16/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 908	02/21/12	< 154	-	-	-	-	-	-	-	-	-	-
MWW- 1588	03/23/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 2242	04/18/12	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MWW- 3132	05/22/12	< 161	-	-	-	-	-	-	-	-	-	-
MWW- 3934	06/20/12	< 145	-	-	-	-	-	-	-	-	-	-
MWW- 4513	07/20/12	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 12
MWW- 5366	08/21/12	< 156	-	-	-	-	-	-	-	-	-	-
MWW- 5985	09/17/12	< 153	-	-	-	-	-	-	-	-	-	-
	ND [a]											
MWW- 7642	11/20/12	160 ± 86 [c]	-	-	-	-	-	-	-	-	-	-
MWW- 8207	12/18/12	< 141	-	-	-	-	-	-	-	-	-	-
		Monitoring Well #15A (M-53) [b]										
MWW- 4514	07/16/12	< 171	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 6846	10/16/12	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 14
MWW- 7643	11/20/12	< 149	-	-	-	-	-	-	-	-	-	-
MWW- 8208	12/20/12	< 141	-	-	-	-	-	-	-	-	-	-
		Monitoring Well #15B (M-54) [b]										
MWW- 4515	07/16/12	< 171	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 6847	10/16/12	341 ± 90	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 7644	11/20/12	323 ± 93 [d]	-	-	-	-	-	-	-	-	-	-
MWW- 8209	12/20/12	340 ± 90	-	-	-	-	-	-	-	-	-	-
		Storm Water Run-off (SD-006)										
MxW- 1462	03/02/12	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 9
MxW- 2732	05/03/12	< 149	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MxW- 2466	05/01/12	< 157 [e]	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 42
MxW- 4480	07/18/12	< 165	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MxW- 7035	10/25/12	4479 ± 207 [f]	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MxW- 7705	11/27/12	< 152 [e]	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22

[a] ND = No Data; Sample not collected.

[b] New well added in July, 2012.

[c] Analysis was repeated; result of reanalysis, 153 ± 83 pCi/L.

[d] Analysis was repeated; result of reanalysis, 371 ± 92 pCi/L.

[e] Sample from the sanitary sewer.

[f] Analysis was repeated; result of reanalysis, 4306 ± 205 pCi/L.