



May 14, 2015

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TS 5.6.2

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Duane Arnold Energy Center
Docket No. 50-331
Renewed Op. License No. DPR-49

Subject: 2014 Annual Radiological Environmental Operating Report

Please find as Enclosure 1 to this letter, a copy of NextEra Energy Duane Arnold, LLC's, (hereafter, NextEra Energy Duane Arnold) 2014 Annual Radiological Environmental Operating Report for the Duane Arnold Energy Center, pursuant to the requirements of ODAM Section 8.2.2 and Technical Specification Section 5.6.2.

This letter contains no new commitments nor does it revise any existing commitments.

Should you have any questions regarding this matter, please contact David Olsen at (319) 851-8129.

Sincerely,

A handwritten signature in black ink, appearing to be "T. A. Vehec".

T. A. Vehec
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure

cc: Regional Administrator, USNRC, Region III
Resident Inspector, USNRC, Duane Arnold Energy Center
Project Manager, USNRC, Duane Arnold Energy Center

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Enclosure 1 to
NG-15-0135

Duane Arnold Energy Center
2014 Annual Radiological Environmental Operating Report

97 Pages to follow



2014
**Annual Radiological
Environmental Operating Report**

Duane Arnold Energy Center
Cedar Rapids, Iowa
Docket No. 50-331

January 1, 2014 through December 31, 2014

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2014
Annual Radiological
Environmental Operating Report

Duane Arnold Energy Center
DOCKET NUMBER. 50-331

Prepared By:

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09-May-2015

Approved By:

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Date:

09-May-2015

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DUANE ARNOLD ENERGY CENTER
CEDAR RAPIDS, IOWA
Docket No. 50-331

RADIOLOGICAL ENVIRONMENTAL
MONITORING PROGRAM (REMP)

ANNUAL REPORT - PART II
DATA TABULATIONS AND ANALYSES

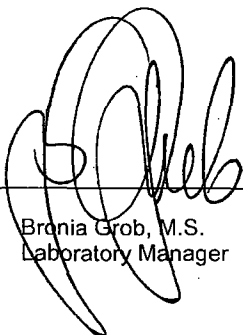
January 1 to December 31, 2014

Prepared by

ATI ENVIRONMENTAL, Inc.
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Project No. 8001

Reviewed and
Approved



Bronia Grob, M.S.
Laboratory Manager

PREFACE

Staff members of the Environmental, Inc., Midwest Laboratory were responsible for the acquisition of data presented in this report; with the exception of Appendices D and E which were completed by DAEC personnel. All environmental samples, with the exception of aquatic, were collected by personnel of DAEC. Aquatic samples were collected by the University of Iowa Hygienic Laboratory.

The report was prepared by Environmental, Inc., Midwest Laboratory, with the exception of Appendices D and E, which were prepared by DAEC personnel.

TABLE OF CONTENTS

PART I

<u>No.</u>		<u>Page</u>
	PREFACE	ii
	List of Tables	v
	List of Figures	vi
1.0	INTRODUCTION	1
2.0	SUMMARY	2
3.0	RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM	3
3.1	Program Design and Data Interpretation	3
3.2	Program Description	4
3.2.1	Environmental Monitoring	4
3.2.2	Ground Water Protection Program	5
3.3	Program Execution	5
3.4	Laboratory Procedures	6
3.5	Program Modifications	6
4.0	RESULTS AND DISCUSSION	7
4.1	Atmospheric Nuclear Detonations and Nuclear Accidents	7
4.2	Program Findings	7
5.0	TABLES AND FIGURES	10
6.0	REFERENCES CITED	25

APPENDICES

A	Interlaboratory Comparison Program Results	A-1
B	Data Reporting Conventions	B-1
C	Effluent Concentration Limits for Radioactivity in Air and Water Above Background in Unrestricted Areas	C-1
D	Summary of the Land Use Census	D-1
E	Annual Radiation Dose Assessment	E-1

TABLE OF CONTENTS (continued)

PART II

Page

Data Tabulations and Analyses..... i

LIST OF TABLES

<u>No.</u>		<u>Page</u>
5.1	Characteristic Properties of Isotopes Quantified in Gamma-spectroscopic Analyses.....	11
5.2	Sample Collection and Analysis Program.....	12
5.3	Sampling Locations, DAEC.....	14
5.4	Type and Frequency of Collections.....	16
5.5	Sample Codes for Tables 5.4 and 5.6.....	17
5.6	Program Deviations.....	18
5.7	Radiological Environmental Monitoring Program Summary.....	19

In addition, the following tables are included in the Appendices:

Appendix A

A-0	Attachment A.....	A0-2
A-1	Environmental Resource Associates (EPA DW substitute program).....	A1-1
A-2	Interlaboratory Comparison Program Results, Thermoluminescent Dosimeters (TLDs).....	A2-1
A-3	In-house Spiked Samples.....	A3-1
A-4	In-house "Blank" Samples.....	A4-1
A-5	In-house "Duplicate" Samples.....	A5-1
A-6	Department of Energy MAPEP comparison results.....	A6-1
A-7	Environmental Resource Associates (EML substitute program).....	A7-1

Appendix C

C-1	Effluent Concentration Limits for Radioactivity in Air and Water Above Background in Unrestricted Areas.....	C-2
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LIST OF FIGURES

<u>No.</u>		<u>Page</u>
5.1	Radiological Environmental Monitoring Program Sampling Stations near the Duane Arnold Energy Center	23
5.2	Radiological Environmental Monitoring Program Sampling Stations Outside 0.5 Miles	24

1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory at the Duane Arnold Energy Center, Palo, Iowa, during the period January - December, 2014. 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.

The REMP fulfills the requirements of Sections IV.B.2 and IV.B.3 of Appendix I to 10 CFR 50 for the operation of the plant. The REMP also fulfills the requirements of 10 CFR 72.44(d)(2) for operation of the ISFSI.

Tabulations of individual analyses made during the year are included in Part II of this report.

The Duane Arnold Energy Center (DAEC) is a boiling water reactor, located in Linn County, Iowa, on the Cedar River, and owned and operated by NextEra Energy Resources. Initial criticality was attained on March 23, 1974. The reactor reached 100% power on August 12, 1974. Commercial operation began on February 1, 1975.

2.0 SUMMARY

The Radiological Environmental Monitoring Program, as required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Duane Arnold Energy Center, is herein described. Results for the year 2014 are summarized and discussed.

Program findings show only background levels of radioactivity in the environmental samples collected in the vicinity of the Duane Arnold Energy Center.

No effect on the environment is indicated in the areas surrounding the site of the Duane Arnold Energy Center.

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

3.1 Program Design and Data Interpretation

The purpose of the Radiological Environmental Monitoring Program at the Duane Arnold Energy Center (DAEC) is to assess the impact of the plant on its environment. For this purpose, samples are collected from the air, terrestrial, and aquatic environments and analyzed for radioactive content. In addition, ambient gamma radiation levels are monitored by thermoluminescent dosimeters (TLDs).

Sources of environmental radiation include the following:

- (1) Natural background radiation arising from cosmic rays and primordial radionuclides;
- (2) Fallout from atmospheric nuclear detonations;
- (3) Releases from nuclear power plants; and
- (4) Industrial and medical radioactive waste.

In interpreting the data, effects due to the DAEC operation 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 DAEC 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 station effect would be indicated if the radiation level at an indicator location was significantly larger than that at the control location. The difference would have to be greater than could be accounted for by typical fluctuations in radiation levels arising from other sources.

An additional interpretive technique involves analyses for specific radionuclides present in the environmental samples collected from the DAEC site. The DAEC's monitoring program includes analyses for strontium-90 and iodine-131, which are fission products, and tritium, which is produced by cosmic rays, atmospheric nuclear detonations, and also by nuclear power plants. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, and cerium-144. These 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 ten (10) days after reactor shutdown. On the other hand, ten (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). 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 next group, manganese-54, cobalt-58 and -60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of nuclear power plant effluents, but are not produced in significant quantities by nuclear detonations. Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occurring isotope, were chosen as calibration monitors and provide a comparison between levels of naturally occurring radionuclides and radionuclides that could be attributed to the operation of the plant.

Characteristic properties of isotopes quantified in gamma-spectroscopic analysis are presented in Table 5.1. Other means of distinguishing sources of environmental radiation can be employed in interpreting the data. Current radiation levels can be compared with previous levels, including those measured before the Plant became operational. Results of the DAEC'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

3.2.1 Environmental Monitoring

The sampling and analysis schedule for the Radiological Environmental Monitoring Program (REMP) at the DAEC is summarized in Table 5.2 and is briefly reviewed below. Table 5.3 defines the sampling location codes used in Table 5.2 and specifies for each location its distance, direction, and sector relative to the reactor site. The types of samples collected at each location and the frequency of collections are presented in Table 5.4 using codes defined in Table 5.5.

To monitor the air environment, airborne particulates are collected on membrane filters by continuous pumping at nine locations. Airborne iodine is collected by continuous pumping through charcoal filters. Eight of the nine locations are indicators and one is a control (D-13). Filters are changed and counted weekly. Particulate filters are analyzed for gross beta activity. If gross beta activity exceeds ten times the yearly mean of the control samples, gamma isotopic analysis is performed. Quarterly composites of airborne particulates from each location are analyzed for gamma emitting isotopes. Charcoal filter samples are analyzed weekly for iodine-131.

Ambient gamma radiation is monitored at a total of 50 locations. A TLD is placed at each location and exchanged and analyzed quarterly. The TLD locations are distributed as follows:

- Two on-site locations
- Eighteen in a circle within a 0.5 mi. radius from the DAEC stack.
- Six in 22.5° sectors within 1 mi. from the DAEC stack.
- Ten in 22.5° sectors between 1 and 3 miles from the DAEC stack.
- Ten control locations greater than 3 miles from the DAEC stack.
- Four along sections of the Independent Spent Fuel Storage Installation (ISFSI) fence line.

Surface water is collected monthly from four river locations, D-49 (Lewis Access, Control, 4 mi. upstream), D-50 (Inlet), D-51 (Discharge) and D-61 (downstream of Discharge) and also from Pleasant Creek Lake (D-99). The monthly samples are analyzed for tritium and gamma-emitting isotopes. Additional analyses are performed on samples collected from the control and indicator locations, D-49 and D-61. Analyses for low-level iodine-131 are performed on monthly collections and quarterly composites are prepared and analyzed for strontium-89 and strontium-90.

The aquatic environment is also monitored by upstream and downstream (D-49 and D-61) semiannual collections of fish. River bottom sediment is collected semiannually at the plant's intake and discharge (D-50 and D-51) and the site's north drainage ditch (D-107a). The samples are analyzed for gamma-emitting isotopes.

Potable ground water is collected quarterly from a treated municipal water system (D-53), the inlet to the municipal water treatment system (D-54), three indicator locations (D-55, D-57, D-58) and one control location (D-72). The samples are analyzed for tritium and gamma emitting isotopes. Any positive identification of a reactor by-product material initiates analyses for hard to detect isotopes of Ni-63, Sr-89, Sr-90, Fe-55 and gross alpha. Beginning in the fourth quarter of 2014 all samples were analyzed to a lower MDA of 2 pCi/L for I-131.

Milk is collected monthly from one indicator and one control location during the non-grazing season, October through April, and biweekly during the grazing season, May 1 through September 30. The samples are analyzed for iodine-131 and gamma-emitting isotopes.

For additional monitoring of the terrestrial environment, grain, hay and broad leaf vegetation samples are collected annually, as available, from nine locations: one control (D-138) and eight indicators (D-16, D-57, D-58, D-72, D-96, D-109 and D-118). Grain, hay and broad leaf (green leafy) vegetation samples are analyzed for gamma-emitting isotopes and at least two broad leaf vegetation samples are analyzed for iodine-131.

If any of the cattle grazing on-site are slaughtered for home use, a meat sample is collected. The sample is analyzed for gamma-emitting isotopes.

3.2.2 Ground Water Protection Program

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Ground Water Protection Program. For results from these analyses, refer to the Duane Arnold Energy Center, 2014 Annual Radioactive Material Release Report.

3.3 Program Execution

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

(1) Airborne Particulates / Airborne Iodine:

A partial air particulate / air iodine sample (165 m³) at location D-13, for the week ending 02/07/14. Lower volume suspected due to power outage.

A partial air particulate / air iodine sample (214 m³) and the week ending 02/13/14. Lower volume suspected due to power outage.

A partial air particulate / air iodine sample (140 m³) was collected at location D-15, for the week ending 04/16/14 due to a power outage.

A partial air particulate / air iodine sample (103 m³) was collected at location D-15, for the week ending 05/16/14 due to a power outage.

A partial air particulate / air iodine sample (310 m³) was collected at location D-15, for the week ending 07/11/14, due to a power outage.

No Air particulate / air iodine sample at location D-13, for the weeks ending 07/17/14 and the week ending 07/24/14 due to power outage at the sampler.

(2) Thermoluminescent Dosimetry

The fourth quarter, 2014 TLD at location D-17 was missing in the field. The TLD was replaced.

(3) Vegetation

Vegetation samples were not readily available from locations D-58, D-72 and D-138 for 2014.

(4) Surface Water

Surface water was not available at locations D49 and D-99 for both the 1/22/14 and 2/4/14 collections due to frozen water conditions.

Surface water was not available at location D-99 for the 12/20/14 collection due to frozen water conditions.

3.4 Laboratory Procedures

The Iodine-131 analyses in milk and water were made using a sensitive radiochemical procedure involving separation of iodine using an ion-exchange method, solvent extraction and subsequent beta counting. Levels of iodine-131 in vegetation and concentrations of airborne iodine-131 in charcoal samples were determined by gamma spectroscopy.

Gamma-spectroscopic analyses are performed using high-purity germanium (HPGe) detectors. The gamma isotopic analysis provides a spectrum with an energy range from 80 to 2048 KeV. Specific isotopes included in the gamma library are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, Nb-95, Ru-103, Ru-106, I-131, Ba-La-140, Cs-134, Cs-137, Ce-141, and Ce-144. Naturally occurring gamma-emitters, such as Be-7, K-40 and Ra daughters, are frequently detected but may not be listed.

Tritium was measured by liquid scintillation spectrometry.

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, 2014). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

Starting in the fourth quarter of 2014, REMP well water samples were analyzed for low level I-131 (MDA < 2 pCi/L).

4.0 RESULTS AND DISCUSSION

All collections and analyses were made as scheduled, except for those listed in Table 5.6.

Results are summarized in Table 5.7 as recommended by the Nuclear Regulatory Commission. For each type of analysis and sample medium, the table lists the mean and range of all indicator and control locations, as well as that location with the highest mean and range.

Tabulated results of measurements are not included in this section, although reference to these results will be made in discussion. A complete tabulation of results for 2014 is contained in Part II of the Annual Report on the Radiological Environmental Monitoring Program for the Duane Arnold Energy Center.

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported accidents involving significant release to the environment at nuclear reactor facilities in 2014. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2014. The last reported test was conducted on October 16, 1980 by the People's Republic of China.

4.2 Program Findings

Results obtained show background levels of radioactivity in the environmental samples collected outside of the Owner Controlled Area in 2014. The trace levels of strontium-90 and cesium-137, still measurable in soil and sediments are attributed to deposition of fallout from previous decades.

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were almost identical at indicator and control locations (0.026 and 0.025 pCi/m³, respectively) and similar to levels observed from 1995 through 2012. The results are tabulated below.

<u>Year</u>	<u>Indicators</u>	<u>Controls</u>		<u>Year</u>	<u>Indicators</u>	<u>Controls</u>
Concentration (pCi/m ³)				Concentration (pCi/m ³)		
1999	0.026	0.027		2007	0.031	0.031
2000	0.026	0.027		2008	0.029	0.029
2001	0.026	0.026		2009	0.031	0.030
2002	0.027	0.027		2010	0.028	0.028
2003	0.029	0.029		2011	0.030	0.029
2004	0.028	0.028		2012	0.030	0.029
2005	0.031	0.031		2013	0.028	0.025
2006	0.029	0.027		2014	0.026	0.025

Average annual gross beta concentrations in airborne particulates.

4.2 Program Findings, Airborne Particulates (continued)

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955), was detected in all samples, with an average activity of 0.068 pCi/m³ for indicator locations and 0.063 pCi/m³ for the control location. No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

Airborne Iodine

Levels of airborne iodine-131 measured below the required limit of 0.030 pCi/m³ for all samples.

Ambient Radiation (TLDs)

At ten control locations, thermoluminescent dosimeter (TLD) readings averaged 14.6 mR/quarter. At locations within a half mile, one mile and three mile radius of the stack, the measurements averaged 16.3, 16.8 and 14.1 mR/quarter, respectively. The two on-site locations D-15 and D-16 averaged 14.7 and 13.5 mR/quarter respectively. These average measurements are similar to the estimated average natural background radiation for Middle America, 19.5 mR/quarter, which is based on data on Pages 71 and 108 of the report, "Natural Background Radiation in the United States" (National Council on Radiation Protection and Measurements, 1975). The terrestrial absorbed dose (uncorrected for structural and body shielding) ranges from 8.8 to 18.8 mrad/quarter and averages 11.5 mrad/quarter for Middle America. Cosmic radiation and cosmogenic radionuclides contribute 8.0 mrad/quarter for a total average of 19.5 mrad/quarter. No plant effect is indicated.

ISFSI Facility Operations Monitoring

Four TLDs, placed directionally along the ISFSI fence line, averaged 29.9 mR/quarter. The TLD site D-30, located between the nearest residence and the ISFSI site averaged 16.5 mR/qr. Calculated dose rates indicate the site is in compliance with 10 CFR 72.104 and 40 CFR 190.

Milk

There was no iodine-131 activity detected in milk samples. Iodine-131 measured below a detection limit of 0.5 pCi/L.

No gamma-emitting isotopes, excepting naturally occurring potassium-40, were detected in any milk samples. This is consistent with findings that most radiocontaminants in feed do not find their way into milk due to the selective metabolism of the cow. The common exceptions are radioisotopes of potassium, cesium, strontium, barium, and iodine (National Center for Radiological Health, 1968).

No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

Ground Water (potable)

No measurable tritium activity was detected above an LLD of 176 pCi/L. Gamma-emitting isotopes were below detection limits.

No reactor by-product radionuclides could be identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

4.2 Program Findings (continued)

Vegetation

Iodine-131 concentrations in broadleaf vegetation were below the LLD level of 0.030 pCi/g wet weight in all samples.

With the exception of potassium-40, which was observed in all vegetation samples (broadleaf, grain, and forage), all other gamma-emitting isotopes were below detection limits. No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

Surface Water

Surface water was tested for tritium and gamma emitting isotopes in sixty samples from five locations. No measurable tritium activity was detected above an LLD of 183 pCi/L. I-131 was detected in two samples collected in February at locations D-50 (control) at 11.2 pCi/L and D-61 (0.5 mile downstream, indicator) at 7.9 pCi/L. Since the I-131 was detected at both the plant intake and the downstream locations, there is no indication of a plant origin.

Analyses for I-131 were performed on samples from locations D-49 (control) and D-61 (0.5 mi. downstream, indicator). The February I-131 chemistry result for location D-61 showed a positive result of 9.3 pCi/L which was consistent with the gamma result on that same sample. There was no sample available at location D-49 in February due to frozen conditions (see table 5.6 page 18).

Quarterly composites were also prepared from the samples collected at locations D-49 and D-61 and tested for strontium-89 and strontium-90. All samples tested below detection limits.

No plant effect on surface water is indicated.

Fish

Fish were collected in June and September, 2014, and analyzed for gamma-emitting isotopes. With the exception of naturally-occurring potassium-40, no gamma-emitting isotopes were identified in edible portions of fish. The potassium-40 level was similar at both the indicator and control locations (3.42 and 3.38 pCi/g wet, respectively).

No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

River Sediments

River sediments were collected in May and November, 2014, and analyzed for gamma-emitting isotopes. Potassium-40 activity ranged from 5.45 to 8.29 pCi/g dry weight and averaged 7.16 pCi/g dry weight.

No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

Ground Water Protection Program

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Ground Water Protection Program. For results from these analyses, refer to the Duane Arnold Energy Center, 2014 Annual Radioactive Material Release Report.

5.0 TABLES AND FIGURES

Table 5.1 Characteristic properties of isotopes quantified in gamma-spectroscopic analyses.

Designation	Comment	Isotope	Half-life ^a
Naturally Occurring			
A. Cosmogenic	Produced by interaction of cosmic rays with atmosphere	Be-7	53.2 d
B. Terrestrial	Primordial	K-40	1.26 x 10 ⁹ y
II. Fission Products ^b			
Nuclear accidents and detonations constitute the major environmental source.			
A. Short-lived		I-131	8.04 d
		Ba-140	12.8 d
B. Other than Short-lived		Nb-95	35.15 d
		Zr-95	65 d
		Ru-103	39.35 d
		Ru-106	368.2 d
		Cs-134	2.061 y
		Cs-137	30.174 y
		Ce-141	32.5 d
		Ce-144	284.31 d
III. Activation Products			
Typically found in nuclear power plant effluents			
		Mn-54	312.5 d
		Fe-59	45.0 d
		Co-58	70.78 d
		Co-60	5.26 y
		Zn-65	245 d

^a Half-lives are taken from Appendix E of Environmental Quarterly, 1 January 1978, EML-334 (U. S. Department of Energy, 1978).

^b Includes fission-product daughters.

Table 5.2 Sample collection and analysis program.

Sampling Location ^a				
Exposure Pathway and/or Sample Type	Sample Point	Description	Sampling and Collection Frequency	Type and Frequency of Analysis ^b
Airborne Particulates	3 5 6 7 11 13 15 16 40	Hiawatha Palo Center Point Shellsburg Toddville Alburnett (C) On-site North On-site South Wickiup Hill	Continuous operation of sampler with sample collection at least once per week or as required by dust loading	Analyze for gross beta activity more than 72 hours after filter change. Perform gamma isotopic analysis on each sample having gross beta activity greater than ten times the yearly mean of the control samples. Composite weekly samples to form a quarterly composite (by location). Analyze quarterly composite for gamma isotopic.
Airborne Iodine	3 5 6 7 11 13 15 16 40	Hiawatha Palo Center Point Shellsburg Toddville Alburnett (C) On-site North On-site South Wickiup Hill	Continuous operation of sampler with sample collection at least once per week.	Analyze each cartridge for iodine-131.
Ambient Radiation	1-3, 5-8 10, 11, 13 15-23, 28-32, 33-42 43-48 82-86, 91 161-164	(Controls) (Indicators) Within 0.5 mile of Stack Within 3.0 miles of Stack Within 1.0 mile of Stack ISFSI Fence line	One dosimeter continuously at each location. Dosimeters are changed at least quarterly.	Read gamma radiation dose quarterly.
Surface Water	49 50 51 61 99	Lewis Access (C) Plant Intake Plant Discharge ~ ½ mi. downstream from Plant Discharge Pleasant Creek Lake	Once per month.	Gamma isotopic and tritium analysis for each sample (by location). Locations 49 and 61, analyses for low-level I-131. Quarterly composites for Sr-89, Sr-90.

Table 5.2 Sample collection and analysis program, (continued).

Sampling Location ^a				
Exposure Pathway and/or Sample Type	Sample Point	Description	Sampling and Collection Frequency	Type and Frequency of Analysis ^b
Ground Water	53 54 55 57, 58 72 (C)	Treated Municipal Water Inlet to Municipal Water Treatment System On-site well Wells off-site and within 4 km of DAEC	Grab sample at least once per quarter	Analysis gamma emitting isotopes, iodine-131 and tritium on quarterly samples. Iodine-131 analyzed to an MDA of < 2 pCi/L. If reactor by-product gamma emitters are identified, or if tritium concentrations measure > MDA, then analyze for Ni-63, Sr-89, Sr-90 and alpha emitters.
River Sediment	50 51 107a	Plant Intake (C) Plant Discharge North Drainage Ditch (on-site)	At least once every six months.	Gamma isotopic analysis of each sample
Vegetation	16,57 58,72, 96,109 118 138 (C)	Farms raising food crops	Annually at harvest time. Two samples of each: grain, green leafy, and forage.	Gamma isotopic analysis, including iodine-131, on each sample.
Fish	49 61	Cedar River upstream of DAEC not influenced by effluent (C) Downstream of DAEC in influence of effluent	One sample per 6 months (once during January through June and once during July through December).	Gamma isotopic analysis on edible portions.
Milk ^c	138 (C) 110	Farm near Newhall, IA Dairy Farm within 7.8 miles from Site	At least once per two weeks during the grazing season. At least once per month during the non-grazing season.	<u>During the grazing season:</u> Gamma isotopic and iodine-131 analyses of each sample. <u>During the non-grazing season:</u> Gamma isotopic and iodine-131 analyses of each sample.
Meat ^d		On-site	Annually	Gamma Isotopic

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

^b Gamma isotopic analysis and analysis for gamma-emitting nuclides refer to high resolution gamma ray spectrum analysis.

^c The grazing season is considered to be May 1 through September 30.

^d Only sampled when meat is butchered for home use.

Table 5.3 Sampling locations, Duane Arnold Energy Center.

Sampling Location		
Code	Location Description	Distance and Direction from Site Stack
D-1	Cedar Rapids	20,800 meters SE
D-2	Marion	16,900 meters ESE
D-3	Hiawatha	10,800 meters SE
D-5	Palo	4,500 meters SSW
D-6	Center Point	9,660 meters N
D-7	Shellsburg	7,950 meters W
D-8	Urbana	15,000 meters NNW
D-10	Atkins	13,600 meters SSW
D-11	Toddville	4,980 meters E
D-13	Alburnett	14,500 meters ENE
D-15	On-site, North-Northwest	1,050 meters NNW
D-16	On-site, South-Southeast	520 meters SSE
D-17	On-site, N	1,050 meters N
D-18	On-site, NNE	630 meters NNE
D-19	On-site, NE	590 meters NE
D-20	On-site, ENE	550 meters ENE
D-21	On-site, ENE	515 meters ENE
D-22	On-site, ESE	535 meters ESE
D-23	On-site, SE	490 meters SE
D-28	On-site, WSW	730 meters WSW
D-29	On-site, W	630 meters W
D-30	On-site, WNW	640 meters WNW
D-31	On-site, NW	1,020 meters NW
D-32	On-site, NNW	1,110 meters NNW
D-33	3 mile ring	4,340 meters N
D-34	3 mile ring	3,930 meters NNE
D-35	3 mile ring	2,800 meters NE
D-36	3 mile ring	3,500 meters ENE
D-37	3 mile ring	2,960 meters E
D-38	3 mile ring	3,180 meters ESE
D-39	3 mile ring	2,510 meters SE
D-40	3 mile ring	2,430 meters SSE
D-41	3 mile ring	5,680 meters S
D-42	3 mile ring	4,380 meters SSE
D-43	1 mile ring	1,590 meters SSW
D-44	1 mile ring	1,580 meters WSW
D-45	1 mile ring	1,420 meters W
D-46	1 mile ring	1,580 meters WNW
D-47	1 mile ring	1,760 meters NW
D-48	1 mile ring	1,680 meters NNW

Table 5.3 Sampling locations, Duane Arnold Energy Center (continued).

Sampling Location		
Code	Location Description	Distance and Direction from Site Stack
D-49	Lewis Access, upstream of DAEC	6,750 meters NNW
D-50	Plant Intake	560 meters SE
D-51	Plant Discharge	600 meters SE
D-53	Treated Municipal Water	13,900 meters SE
D-54	Inlet, Municipal Water Treatment System	13,900 meters SE
D-55	Production Well	
D-57	Farm (Off-site Well)	805 meters W
D-58	Farm (Off-site Well)	974 meters WSW-SW
D-61	Downstream of plant discharge	670 meters SSE
D-72	Farm	3,200 meters SSW
D-82	On-site, SSE	660 meters SSE
D-83	On-site, SSE	620 meters SSE
D-84	On-site, S	610 meters S
D-85	On-site, SSW	660 meters SSW
D-86	On-site, SW	850 meters SW
D-91	On-site, NNW	1,090 meters NNW
D-96	Farm	11,400 meters SSW
D-99	Pleasant Creek Lake	3,880 meters WNW
D-107a	North Drainage Ditch	
D-109	Farm	5,890 meters SW
D-110	Farm	12,700 meters SW
D-118	Farm	2,230 meters NW
D-138	Farm	21,600 meters WSW
D-161	ISFSI Fence East	On-site
D-162	ISFSI Fence South	On-site
D-163	ISFSI Fence West	On-site
D-164	ISFSI Fence North	On-site

Table 5.4 Type and Frequency of collection.

Location	Weekly	Monthly	Quarterly	Semiannually	Annually
D-1			TLD		
D-2			TLD		
D-3	AP, AI		TLD		
D-5	AP, AI		TLD		
D-6	AP, AI		TLD		
D-7	AP, AI		TLD		
D-8			TLD		
D-10			TLD		
D-11	AP, AI		TLD		
D-13	AP, AI		TLD		
D-15	AP, AI		TLD		
D-16	AP, AI		TLD		G
D-17 to D-23			TLD		
D-28 to D-39			TLD		
D-40	AP, AI		TLD		
D-41 to D-48			TLD		
D-49		SW		F	
D-50		SW		BS	
D-51		SW		BS	
D-53			WW		
D-54			WW		
D-55			WW		
D-57			WW		G
D-58			WW		G
D-61		SW		F	
D-72			WW		G
D-82 to D-86			TLD		
D-91			TLD		
D-96					G
D-99		SW			
D-107A				BS	
D-109					G
D-110		MI*			
D-118					G
D-138		MI*			G
D-161 to D-164			TLD		
On-site					ME

* Biweekly during the grazing season.

Table 5.5. Sample codes used in Table 5.4 and Table 5.6.

Code	Description
AP	Airborne Particulates
AI	Airborne Iodine
TLD	Thermoluminescent Dosimeter
MI	Milk
WW	Well Water
G	Vegetation
ME	Meat
SW	Surface Water
F	Fish
BS	River Sediment

Table 5.6. Program Deviations, Duane Arnold Energy Center.

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
SW	H-3 / I-131/Gamma	D-49	01-22-14	Water frozen.
SW	H-3 / Gamma	D-99	01-22-14	Water frozen.
SW	H-3 / I-131/Gamma	D-49	02-04-14	Water frozen.
SW	H-3 /Gamma	D-99	02-04-14	Water frozen.
SW	H-3 /Gamma	D-99	12-20-14	Water frozen.
AP/AI	Gross Beta / I-131	D-13	02-07-14	Low volume due to power outage
AP/AI	Gross Beta / I-131	D-13	02-13-14	Low volume due to power outage
AP/AI	Gross Beta / I-131	D-15	04-16-14	Low volume due to power outage
AP/AI	Gross Beta / I-131	D-15	05-16-14	Low volume due to power outage
AP/AI	Gross Beta / I-131	D-15	07-11-14	Low volume due to power outage.
AP/AI	Gross Beta / I-131	D-13	07-17-14	Power off to sampler.
AP/AI	Gross Beta / I-131	D-13	07-24-14	Power off to sampler.
TLD	Ambient Gamma	D-17	4th Qtr. 2014	TLD missing in the field, TLD replaced.
G	Gamma	D-58	2014	Vegetation not readily available.
G	Gamma	D-72	2014	Vegetation not readily available.
G	Gamma	D-138	2014	Vegetation not readily available.

In no instance did missed analyses affect minimum sampling requirements as specified in the ODAM.

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	<u>Duane Arnold Energy Center</u>	Docket No.	<u>50-331</u>
Location of Facility	<u>Linn, Iowa</u>	Reporting Period	<u>January-December, 2014</u>
	(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			
Airborne Pathway								
Airborne Particulates (pCi/m ³)	GB	466	0.003	0.026 (416/416) (0.002-0.060)	D-3, Hiawatha 7 mi. SE	0.028 (52/52) (0.014-0.060)	0.025 (50/50) (0.011-0.064)	0
	GS	36						
	Be-7		0.020	0.063 (32/32) (0.038-0.084)	D-40, Toddville 3.0 mi. SSE	0.068 (4/4) (0.056-0.080)	0.063 (4/4) (0.039-0.089)	0
	Mn-54		0.0011	< LLD			< LLD	0
	Fe-59		0.0027	< LLD			< LLD	0
	Co-58		0.0011	< LLD			< LLD	0
	Co-60		0.0012	< LLD			< LLD	0
	Zn-65		0.0019	< LLD			< LLD	0
	Nb-95		0.0018	< LLD			< LLD	0
	Zr-95		0.0021	< LLD			< LLD	0
	Ru-103		0.0019	< LLD			< LLD	0
	Ru-106		0.0103	< LLD			< LLD	0
	Cs-134		0.0012	< LLD			< LLD	0
	Cs-137		0.0015	< LLD			< LLD	0
Ce-141		0.0028	< LLD			< LLD	0	
Ce-144		0.0075	< LLD			< LLD	0	
Airborne Iodine (pCi/m ³)	I-131	466	0.030	< LLD		< LLD	0	
Direct Radiation								
TLDs (mR/quarter)								
Control Locations	Gamma	40	1.0	None	D-8, Urbana 10 mi. NW	17.0 (4/4) (11.7-17.7)	14.6 (40/40) (10.5-18.9)	0
Within 0.5 mi. of Stack	Gamma	79	1.0	16.3 (79/79) (9.3-22.5)	D-29, On-site 0.5 mi. W	20.6 (4/4) (17.7-22.5)	None	0
Within 1.0 mi. of Stack	Gamma	24	1.0	16.8 (24/24) (11.7-23.3)	D-46, 1 mi. WNW	19.3 (4/4) (16.2-23.3)	None	0
Within 3.0 mi. of Stack	Gamma	40	1.0	14.1 (40/40) (10.3-21.0)	D-41, 3.5 mi. S	17.3 (4/4) (15.8-20.0)	None	0
ISFSI border	Gamma	16	1.0	29.9 (16/16) (11.3-53.2)	D-161 ISFSI Fence	47.9 (4/4) (42.5-53.2)	None	0

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	<u>Duane Arnold Energy Center</u>	Docket No.	<u>50-331</u>
Location of Facility	<u>Linn, Iowa</u>	Reporting Period	<u>January-December, 2014</u>
	(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			
Waterborne Pathway								
Surface Water (pCi/L)	H-3	55	183	< LLD	-	-	< LLD	0
	I-131	24	0.5	9.3 (1/12)	D-61, 0.5 mi., Downstream	-	< LLD	0
	Sr-89	8	0.9	< LLD	-	-	< LLD	0
	Sr-90	8	0.8	< LLD	-	-	< LLD	0
	GS	55						
	Mn-54		5.1	< LLD	-	-	< LLD	0
	Fe-59		6.9	< LLD	-	-	< LLD	0
	Co-58		4.0	< LLD	-	-	< LLD	0
	Co-60		4.5	< LLD	-	-	< LLD	0
	Zn-65		7.3	< LLD	-	-	< LLD	0
	Nb-95		4.9	< LLD	-	-	< LLD	0
	Zr-95		6.9	< LLD	-	-	< LLD	0
	I-131		8.5	7.9 (1/33) ^f	D-50, Plant Intake	11.2 (1/22) ^f	11.2 (1/22) ^f	0
	Cs-134		4.6	< LLD	-	-	< LLD	0
	Cs-137		4.8	< LLD	-	-	< LLD	0
Ba-140		19.6	< LLD	-	-	< LLD	0	
La-140		4.1	< LLD	-	-	< LLD	0	
Sediments (pCi/g dry)	GS	6						
	K-40		1.0	6.76 (4/4) (5.45-8.03)	D-50, Plant Intake	7.97 (2/2) (7.65-8.29)	7.97 (2/2) (7.65-8.29)	0
	Mn-54		0.018	< LLD	-	-	< LLD	0
	Fe-59		0.039	< LLD	-	-	< LLD	0
	Co-58		0.016	< LLD	-	-	< LLD	0
	Co-60		0.011	< LLD	-	-	< LLD	0
	Zn-65		0.033	< LLD	-	-	< LLD	0
	Nb-95		0.024	< LLD	-	-	< LLD	0
	Zr-95		0.026	< LLD	-	-	< LLD	0
	Ru-103		0.018	< LLD	-	-	< LLD	0
	Ru-106		0.115	< LLD	-	-	< LLD	0
	Cs-134		0.012	< LLD	-	-	< LLD	0
	Cs-137		0.015	< LLD	-	-	< LLD	0
	Ce-141		0.043	< LLD	-	-	< LLD	0
Ce-144		0.094	< LLD	-	-	< LLD	0	

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility Duane Arnold Energy Center Docket No. 50-331
 Location of Facility Linn, Iowa Reporting Period January-December, 2014
 (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			
Waterborne Pathway								
Ground Water, potable (pCi/L)	H-3	24	176	< LLD	-	-	< LLD	0
	I-131	6	0.5	< LLD	-	-	< LLD	0
	GS	24						
	Mn-54		2.9	< LLD	-	-	< LLD	0
	Fe-59		5.5	< LLD	-	-	< LLD	0
	Co-58		3.7	< LLD	-	-	< LLD	0
	Co-60		2.0	< LLD	-	-	< LLD	0
	Zn-65		5.7	< LLD	-	-	< LLD	0
	Nb-95		3.8	< LLD	-	-	< LLD	0
	Zr-95		5.3	< LLD	-	-	< LLD	0
	I-131		10.3	< LLD	-	-	< LLD	0
	Cs-134		3.3	< LLD	-	-	< LLD	0
	Cs-137		3.2	< LLD	-	-	< LLD	0
	Ba-140		22.6	< LLD	-	-	< LLD	0
La-140		3.6	< LLD	-	-	< LLD	0	
Ingestion Pathway								
Milk (pCi/L)	I-131	38	0.5	< LLD	-	-	< LLD	0
	GS	38						
	K-40		100	1382 (19/19) (1161-1644)	D-110, Farm 7.9 mi. SW	1382 (19/19) (1161-1644)	1362 (19/19) (1088-1764)	0
	Cs-134		5	< LLD	-	-	< LLD	0
	Cs-137		5	< LLD	-	-	< LLD	0
	Ba-140		60	< LLD	-	-	< LLD	0
	La-140		5	< LLD	-	-	< LLD	0
Broadleaf Vegetation (pCi/g wet)	GS	3						
	K-40		0.5	4.18 (3/3) (1.81-6.69)	D-15 On-site	6.69 (1/1) D-15, on-site	none	0
	Mn-54		0.014	< LLD	-	-	none	0
	Fe-59		0.038	< LLD	-	-	none	0
	Co-58		0.013	< LLD	-	-	none	0
	Co-60		0.018	< LLD	-	-	none	0
	Zn-65		0.049	< LLD	-	-	none	0
	Nb-95		0.018	< LLD	-	-	none	0
	Zr-95		0.032	< LLD	-	-	none	0
	Ru-103		0.019	< LLD	-	-	none	0
	Ru-106		0.121	< LLD	-	-	none	0
	I-131		0.033	< LLD	-	-	none	0
	Cs-134		0.016	< LLD	-	-	none	0
	Cs-137		0.017	< LLD	-	-	none	0
Ce-141		0.046	< LLD	-	-	none	0	
Ce-144		0.176	< LLD	-	-	none	0	

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	<u>Duane Arnold Energy Center</u>	Docket No.	<u>50-331</u>
Location of Facility	<u>Linn, Iowa</u>	Reporting Period	<u>January-December, 2014</u>
	(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		
Ingestion Pathway (cont.)							
Vegetation (Grain and Forage) (pCi/g wet)	GS	8					
	K-40	0.5	5.31 (7/7) (2.61-14.59)	D-96 Farm, 8 miles SSW	8.6 (2/2)	none	0
	Mn-54	0.023	< LLD	-	-	none	0
	Fe-59	0.063	< LLD	-	-	none	0
	Co-58	0.023	< LLD	-	-	none	0
	Co-60	0.025	< LLD	-	-	none	0
	Zn-65	0.047	< LLD	-	-	none	0
	Nb-95	0.033	< LLD	-	-	none	0
	Zr-95	0.055	< LLD	-	-	none	0
	Ru-103	0.023	< LLD	-	-	none	0
	Ru-106	0.234	< LLD	-	-	none	0
	I-131	0.051	< LLD	-	-	none	0
	Cs-134	0.025	< LLD	-	-	none	0
	Cs-137	0.030	< LLD	-	-	none	0
Ce-141	0.047	< LLD	-	-	none	0	
Ce-144	0.171	< LLD	-	-	none	0	
Fish (pCi/g wet)	GS	8					
	K-40	1.0	3.42 (4/4) (3.26-3.64)	D-61, Downstream	3.42 (4/4) (3.26-3.64)	3.38 (4/4) (3.08-3.94)	0
	Mn-54	0.021	< LLD	-	-	< LLD	0
	Fe-59	0.073	< LLD	-	-	< LLD	0
	Co-58	0.028	< LLD	-	-	< LLD	0
	Co-60	0.016	< LLD	-	-	< LLD	0
	Zn-65	0.040	< LLD	-	-	< LLD	0
	Nb-95	0.040	< LLD	-	-	< LLD	0
	Zr-95	0.049	< LLD	-	-	< LLD	0
	Ru-103	0.042	< LLD	-	-	< LLD	0
	Ru-106	0.163	< LLD	-	-	< LLD	0
	Cs-134	0.022	< LLD	-	-	< LLD	0
	Cs-137	0.019	< LLD	-	-	< LLD	0
	Ce-141	0.060	< LLD	-	-	< LLD	0
Ce-144	0.133	< LLD	-	-	< LLD	0	

^a GB = Gross beta; GS = Gamma spectroscopy

^b LLD = Nominal lower limit of detection based on 4.66 sigma counting error for the background sample.

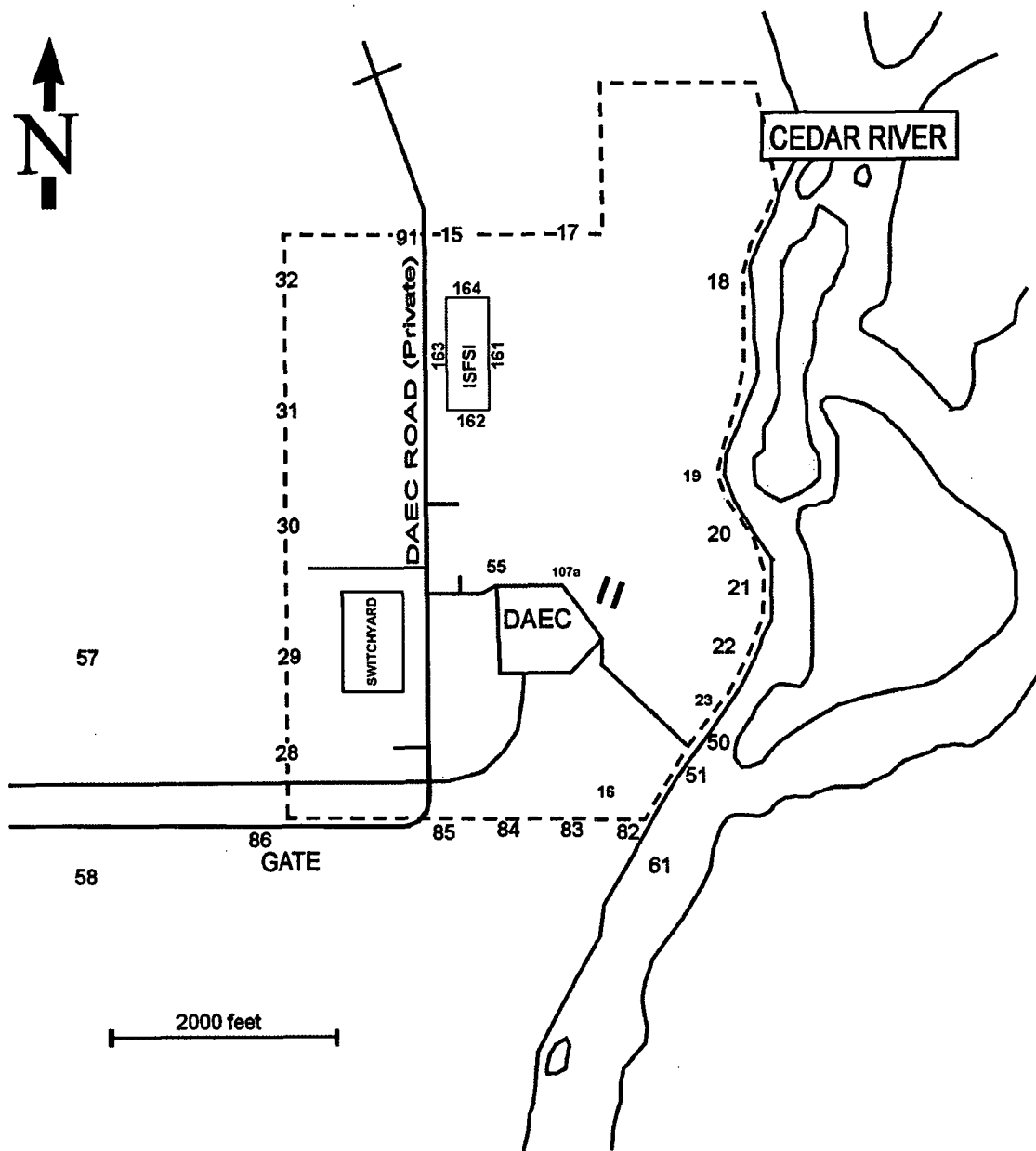
^c Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

^d Locations are specified by: (1) Name and code (Table 5.3); and (2) distance, direction and sector relative to reactor site.

^e Non-routine results are those which exceed ten times the control station value for the location. If a control station value is not available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.

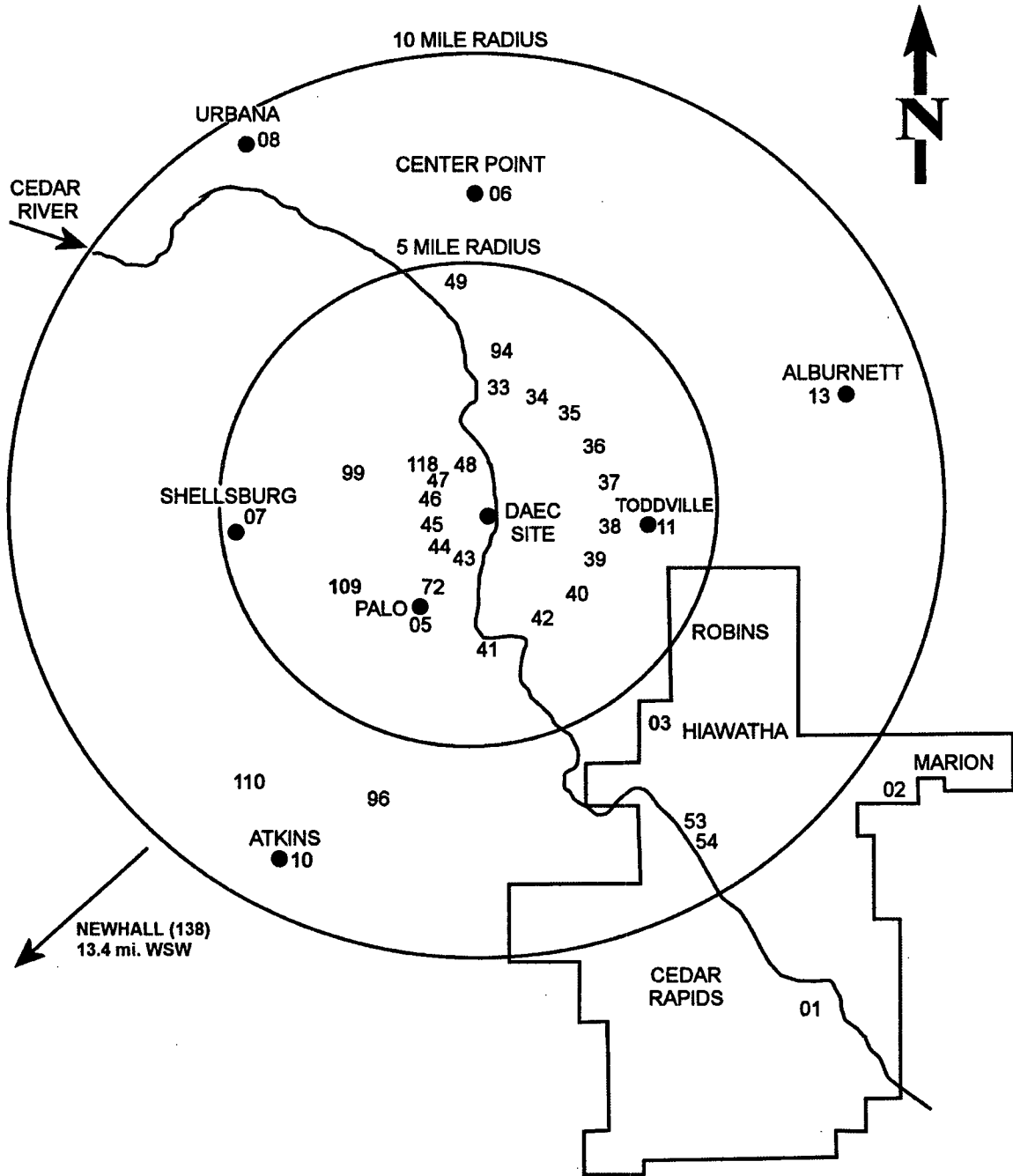
^f See section 4.2 page 9 for a discussion of I-131 in surface water.

Figure 5.1 Radiological Environmental Monitoring Program
 Sampling Stations near the Duane Arnold Energy Center.



See Table 5.3 for sampling locations and Table 5.4 for Type and Frequency of collection.

Figure 5.2. Radiological Environmental Monitoring Program Sampling Stations Outside 0.5 Miles.



See Table 5.3 for sampling locations and Table 5.4 for Type and Frequency of collection.

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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, 2014 through December, 2014

Appendix A

Interlaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples 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 > 100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89 ^b	5 to 50 pCi/liter or kg > 50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90 ^b	2 to 30 pCi/liter or kg > 30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter > 20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤ 100 pCi/liter > 100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤ 4,000 pCi/liter > 4,000 pCi/liter	± 1σ = 169.85 x (known) ^{0.0933} 10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129 ^b	≤ 55 pCi/liter > 55 pCi/liter	6 pCi/liter 10% of known value
Uranium-238, Nickel-63 ^b Technetium-99 ^b	≤ 35 pCi/liter > 35 pCi/liter	6 pCi/liter 15% of known value
Iron-55 ^b	50 to 100 pCi/liter > 100 pCi/liter	10 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	Analysis	Concentration (pCi/L)			Acceptance
			Laboratory Result ^b	ERA Result ^c	Control Limits	
ERW-1384	4/7/2014	Sr-89	40.29 ± 5.76	36.70	27.50 ± 43.60	Pass
ERW-1384	4/7/2014	Sr-90	24.08 ± 2.35	26.50	19.20 ± 30.90	Pass
ERW-1385	4/7/2014	Ba-133	78.23 ± 3.93	87.90	74.00 ± 96.70	Pass
ERW-1385	4/7/2014	Co-60	62.75 ± 3.53	64.20	57.80 ± 73.10	Pass
ERW-1385	4/7/2014	Cs-134	44.97 ± 3.99	44.30	35.50 ± 48.70	Pass
ERW-1385	4/7/2014	Cs-137	88.54 ± 4.93	89.10	80.20 ± 101.00	Pass
ERW-1385	4/7/2014	Zn-65	249.1 ± 10.4	235.0	212.0 - 275.0	Pass
ERW-1388	4/7/2014	Gr. Alpha	56.70 ± 2.47	61.00	31.90 ± 75.80	Pass
ERW-1388	4/7/2014	Gr. Beta	32.10 ± 1.20	33.00	21.40 ± 40.70	Pass
ERW-1391	4/7/2014	I-131	25.52 ± 1.12	25.70	21.30 ± 30.30	Pass
ERW-1394	4/7/2014	Ra-226	12.30 ± 0.61	12.40	9.26 ± 14.30	Pass
ERW-1394	4/7/2014	Ra-228	5.08 ± 1.16	4.26	2.46 ± 5.86	Pass
ERW-1394	4/7/2014	Uranium	10.76 ± 0.74	10.20	7.95 ± 11.80	Pass
ERW-1397	4/7/2014	H-3	8982 ± 279	8770	7610 - 9650	Pass
ERW-5382	10/6/2014	Sr-89	29.40 ± 5.32	31.40	22.80 ± 38.10	Pass
ERW-5382	10/6/2014	Sr-90	19.19 ± 1.85	21.80	15.60 ± 25.70	Pass
ERW-5385	10/6/2014	Ba-133	43.54 ± 4.54	49.10	40.30 ± 54.50	Pass
ERW-5385	10/6/2014	Cs-134	81.95 ± 7.49	89.80	73.70 ± 98.80	Pass
ERW-5385	10/6/2014	Cs-137	95.76 ± 5.50	98.80	88.90 ± 111.00	Pass
ERW-5385	10/6/2014	Co-60	90.25 ± 2.77	92.10	82.90 ± 104.00	Pass
ERW-5385	10/6/2014	Zn-65	327.4 ± 23.3	310.0	279.0 - 362.0	Pass
ERW-5388	10/6/2014	Gr. Alpha	30.88 ± 8.05	37.60	19.40 ± 46.10	Pass
ERW-5388	10/6/2014	G. Beta	20.47 ± 4.75	27.40	17.30 ± 35.30	Pass
ERW-5392	10/6/2014	I-131	19.58 ± 2.35	20.30	16.80 ± 24.40	Pass
ERW-5394	10/6/2014	Ra-226	15.10 ± 1.81	14.70	11.00 ± 16.90	Pass
ERW-5394	10/6/2014	Ra-228	4.42 ± 0.86	4.31	2.50 ± 5.92	Pass
ERW-5394	10/6/2014	Uranium	5.51 ± 0.37	5.80	4.34 ± 6.96	Pass
ERW-5397	10/6/2014	H-3	6876 ± 383	6880	5940 - 7570	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.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO₄: Dy Cards).

Lab Code	Date	Description	Known Value	mR		Control Limits	Acceptance
				Lab Result	± 2 sigma		
<u>Environmental, Inc.</u>							
2014-1	5/15/2014	50 cm.	26.83	34.43 ± 3.76		18.78 - 34.88	Pass
2014-1	5/15/2014	60 cm.	18.63	22.20 ± 1.16		13.04 - 24.22	Pass
2014-1	5/15/2014	70 cm.	13.69	14.74 ± 0.80		9.58 - 17.80	Pass
2014-1	5/15/2014	75 cm.	11.93	12.68 ± 1.05		8.35 - 15.51	Pass
2014-1	5/15/2014	80 cm.	10.48	11.81 ± 0.91		7.34 - 13.62	Pass
2014-1	5/15/2014	90 cm.	8.28	7.72 ± 0.71		5.80 - 10.76	Pass
2014-1	5/15/2014	100 cm.	6.71	6.46 ± 0.71		4.70 - 8.72	Pass
2014-1	5/15/2014	110 cm.	5.54	5.25 ± 1.03		3.88 - 7.20	Pass
2014-1	5/15/2014	120 cm.	4.66	4.76 ± 0.48		3.26 - 6.06	Pass
2014-1	5/15/2014	135 cm.	3.68	2.87 ± 0.46		2.58 - 4.78	Pass
2014-1	5/15/2014	150 cm.	2.98	2.30 ± 0.15		2.09 - 3.87	Pass
2014-1	5/15/2014	165 cm.	2.46	2.09 ± 0.28		1.72 - 3.20	Pass
2014-1	5/15/2014	180 cm.	2.07	1.75 ± 0.21		1.45 - 2.69	Pass
<u>Environmental, Inc.</u>							
2014-2	12/9/2014	30 cm.	77.04	84.03 ± 8.47		53.90 - 100.20	Pass
2014-2	12/9/2014	30 cm.	77.04	83.74 ± 12.02		53.90 - 100.20	Pass
2014-2	12/9/2014	60 cm.	19.26	20.39 ± 2.37		13.50 - 25.00	Pass
2014-2	12/9/2014	60 cm.	19.26	20.33 ± 1.19		13.50 - 25.00	Pass
2014-2	12/9/2014	120 cm.	4.82	5.15 ± 0.20		3.40 - 6.30	Pass
2014-2	12/9/2014	120 cm.	4.82	5.20 ± 0.45		3.40 - 6.30	Pass
2014-2	12/9/2014	150 cm.	3.08	3.84 ± 0.61		2.20 - 4.00	Pass
2014-2	12/9/2014	150 cm.	3.08	3.17 ± 0.38		2.20 - 4.00	Pass
2014-2	12/9/2014	150 cm.	3.08	3.31 ± 0.32		2.00 - 4.00	Pass
2014-2	12/9/2014	180 cm.	2.14	2.27 ± 0.51		1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	2.23 ± 0.12		1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	2.74 ± 0.48		1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	1.97 ± 0.41		1.50 - 2.80	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	
SPW-1011	1/13/2014	Ra-228	35.47 ± 2.55	30.85	21.60 - 40.11	Pass
SPAP-103	1/13/2014	Gr. Beta	43.91 ± 0.34	44.82	26.89 - 62.75	Pass
SPAP-105	1/13/2014	Cs-134	2.46 ± 0.67	2.82	1.69 - 3.95	Pass
SPAP-105	1/13/2014	Cs-137	102.4 ± 2.7	99.9	89.9 - 109.9	Pass
SPW-107	1/13/2014	H-3	62,380 ± 707	62,246	49,797 - 74,695	Pass
SPW-129	1/15/2014	Cs-134	69.90 ± 3.71	78.00	68.00 - 88.00	Pass
SPW-129	1/15/2014	Cs-137	84.36 ± 7.06	75.77	65.77 - 85.77	Pass
SPW-129	1/15/2014	Sr-90	39.48 ± 1.52	39.20	31.36 - 47.04	Pass
SPW-130	1/15/2014	Ni-63	255.8 ± 3.8	204.0	142.8 - 265.2	Pass
SPW-133	1/15/2014	C-14	3153 ± 15	4737	2842 - 6632	Pass
SPMI-135	1/15/2014	Cs-134	76.80 ± 4.04	78.00	68.00 - 88.00	Pass
SPMI-135	1/15/2014	Cs-137	80.44 ± 6.63	75.80	65.80 - 85.80	Pass
W-12014	1/20/2014	Gr. Alpha	19.69 ± 0.41	20.00	10.00 - 30.00	Pass
W-12014	1/20/2014	Gr. Beta	30.35 ± 0.33	30.90	20.90 - 40.90	Pass
SPW-297	1/29/2014	Tc-99	104.2 ± 1.7	107.8	75.5 - 140.2	Pass
SPW-657	2/25/2014	Ra-226	15.84 ± 0.45	16.70	11.69 - 21.71	Pass
SPW-1127	3/26/2014	U-238	43.28 ± 2.56	41.72	29.20 - 54.24	Pass
SPW-1917	3/28/2014	Pu-238	27.37 ± 2.13	23.80	14.28 - 33.32	Pass
SPW-1786	4/25/2014	Tc-99	531.1 ± 8.7	539.15	377.41 - 700.90	Pass
SPW-2168	5/21/2014	Cs-134	70.90 ± 5.81	69.50	59.50 - 79.50	Pass
SPW-2168	5/21/2014	Cs-137	79.72 ± 6.49	75.17	65.17 - 85.17	Pass
SPW-2168	5/21/2014	Sr-89	83.35 ± 5.05	72.85	58.28 - 87.42	Pass
SPW-2168	5/21/2014	Sr-90	33.37 ± 1.52	38.87	31.10 - 46.64	Pass
SPMI-2170	5/21/2014	Cs-134	64.15 ± 4.93	69.50	59.50 - 79.50	Pass
SPMI-2170	5/21/2014	Cs-137	76.21 ± 6.91	75.17	65.17 - 85.17	Pass
SPMI-2170	5/21/2014	Sr-89	65.82 ± 4.89	72.85	58.28 - 87.42	Pass
SPMI-2170	5/21/2014	Sr-90	40.90 ± 1.59	38.87	31.10 - 46.64	Pass
SPW-2792	6/18/2014	U-238	44.80 ± 1.54	41.70	29.19 - 54.21	Pass
SPW-2796	6/18/2014	C-14	3495 ± 9	4,737	2,842 - 6632	Pass
WW-2836	6/30/2014	Co-60	131.8 ± 6.9	140.90	126.81 - 154.99	Pass
WW-2836	6/30/2014	Cs-137	143.8 ± 9.1	145.60	131.04 - 160.16	Pass
WW-2836	6/30/2014	H-3	6220 ± 238	6,361	5,089 - 7633	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	
SPW-3486	7/17/2014	Fe-55	2211 ± 72	2319	1855 - 2783	Pass
SPW-080714	8/7/2014	Gr. Alpha	18.42 ± 0.40	20.10	10.05 - 30.15	Pass
SPW-080714	8/7/2014	Gr. Beta	31.70 ± 0.40	32.40	22.40 - 42.40	Pass
SPW-081214	8/12/2014	Pu-238	22.59 ± 2.15	22.70	18.16 - 27.24	Pass
SPW-4093	8/13/2014	I-131(G)	59.95 ± 6.17	59.62	49.62 - 69.62	Pass
SPW-4093	8/13/2014	Sr-90	39.46 ± 1.55	38.65	28.65 - 48.65	Pass
SPW-4093	8/13/2014	Sr-89	105.5 ± 4.9	115.0	92.0 - 149.5	Pass
SPMI-4095	8/13/2014	I-131(G)	59.92 ± 6.17	59.62	49.62 - 69.62	Pass
SPMI-4095	8/13/2014	I-131	60.05 ± 0.72	59.62	47.70 - 71.54	Pass
SPW-4104	8/13/2014	Ni-63	200.1 ± 3.4	203.2	142.2 - 264.1	Pass
SPW-4106	8/13/2014	H-3	59,597 ± 695	60,261	48209 - 72313	Pass
SPW-4108	8/13/2014	Cs-134	2.45 ± 0.81	2.32	0.00 - 12.32	Pass
SPW-4108	8/13/2014	Cs-137	90.20 ± 3.74	98.56	88.56 - 108.56	Pass
SPAP-4110	8/13/2014	Gr. Beta	43.65 ± 0.11	44.19	34.19 - 54.19	Pass
SPF-4112	8/13/2014	I-131	2.64 ± 0.38	2.86	0.00 - 12.86	Pass
SPF-4112	8/13/2014	Cs-134	0.91 ± 0.03	1.03	0.00 - 11.03	Pass
SPF-4112	8/13/2014	Cs-137	2.61 ± 0.06	2.39	0.00 - 12.39	Pass
SPW-081414	8/14/2014	H-3	14,663 ± 788	17,700	14160 - 21240	Pass
W081614	8/16/2014	Ra-226	14.30 ± 0.37	16.70	11.69 - 21.71	Pass
W082614	8/26/2014	Ra-228	27.18 ± 2.13	30.49	20.49 - 40.49	Pass
SPW-090414	9/4/2014	Gr. Alpha	17.85 ± 0.39	20.10	10.05 - 30.15	Pass
SPW-090414	9/4/2014	Gr. Beta	30.03 ± 0.33	30.90	20.90 - 40.90	Pass
SPW-5124	9/29/2014	Ra-228	32.93 ± 2.38	31.94	21.94 - 41.94	Pass
W100714	10/7/2014	Gr. Alpha	18.56 ± 0.40	20.10	10.05 - 30.15	Pass
W100714	10/7/2014	Gr. Beta	27.71 ± 0.32	30.90	20.90 - 40.90	Pass
W111014	11/10/2014	Gr. Alpha	17.84 ± 0.38	20.10	10.05 - 30.15	Pass
W111014	11/10/2014	Gr. Beta	30.12 ± 0.33	30.90	20.90 - 40.90	Pass
W112514	11/25/2014	Ra-226	16.63 ± 0.41	16.70	11.69 - 21.71	Pass
W120814	12/8/2014	Gr. Alpha	19.29 ± 0.41	20.10	10.05 - 30.15	Pass
W120814	12/8/2014	Gr. Beta	27.93 ± 0.32	30.90	20.90 - 40.90	Pass
SPW-7149	12/26/2014	Ni-63	217.53 ± 3.25	203.10	142.17 - 264.03	Pass

^a Liquid sample results are reported in pCi/Liter, air filters(pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

^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 ± 2s.

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 (4.66 σ)		Acceptance Criteria (4.66 σ)
				LLD	Activity ^c	
SPW-1001	Water	1/13/2014	Ra-228	0.74	0.39 ± 0.39	2
SPAP-102	Air Particulate	1/13/2014	Gr. Beta	0.003	0.015 ± 0.003	0.01
SPAP-104	Air Particulate	1/13/2014	Cs-134	0.006	0.005 ± 0.005	0.05
SPAP-104	Air Particulate	1/13/2014	Cs-137	0.004	-0.002 ± 0.005	0.05
SPW-106	Water	1/13/2014	H-3	151.0	115.0 ± 97.0	200
SPW-128	Water	1/15/2014	Cs-134	2.85	0.59 ± 1.46	10
SPW-128	Water	1/15/2014	Cs-137	2.52	0.68 ± 1.64	10
SPW-128	Water	1/15/2014	Sr-90	0.61	0.74 ± 0.36	1
SPW-130	Water	1/15/2014	Ni-63	10.85	1.57 ± 6.60	20
SPW-133	Water	1/15/2014	C-14	13.51	3.10 ± 8.27	200
SPMI-134	Milk	1/15/2014	Cs-134	4.43	0.14 ± 2.46	10
SPMI-134	Milk	1/15/2014	Cs-137	1.92	-2.07 ± 2.48	10
W-12014	Water	1/20/2014	Gr. Alpha	0.48	-0.31 ± 0.31	2
W-12014	Water	1/20/2014	Gr. Beta	0.78	-0.24 ± 0.54	4
SPW-297	Water	1/29/2014	Tc-99	5.63	-4.42 ± 3.34	10
SPW-656	Water	2/25/2014	Ra-226	0.03	0.01 ± 0.02	1
SPW-1126	Water	3/26/2014	U-238	0.13	0.08 ± 0.12	1
SPW-1127	Water	3/26/2014	U-233/234	0.13	0.11 ± 0.13	1
SPW-1127	Water	3/26/2014	U-238	0.00	0.08 ± 0.12	1
SPW-1917	Water	3/28/2014	Pu-238	0.02	0.01 ± 0.01	1
SPW-1785	Water	4/25/2014	Tc-99	5.61	-4.33 ± 3.33	10
SPW-1831	Water	4/30/2014	I-131	0.21	0.07 ± 0.12	0.5
SPW-2167	Water	5/21/2014	Cs-134	2.29	-0.79 ± 1.35	10
SPW-2167	Water	5/21/2014	Cs-137	2.46	0.36 ± 1.48	10
SPW-2167	Water	5/21/2014	I-131(G)	2.77	0.25 ± 1.53	20
SPW-2167	Water	5/21/2014	Sr-89	0.81	0.01 ± 0.62	5
SPW-2167	Water	5/21/2014	Sr-90	0.52	0.03 ± 0.24	1
SPMI-2169	Milk	5/21/2014	Cs-134	4.45	-0.55 ± 2.39	10
SPMI-2169	Milk	5/21/2014	Cs-137	3.91	-0.52 ± 2.60	10
SPMI-2169	Milk	5/21/2014	I-131(G)	4.31	2.57 ± 2.21	20
SPMI-2169	Milk	5/21/2014	Sr-89	0.98	-0.02 ± 0.83	5
SPMI-2169	Milk	5/21/2014	Sr-90	0.61	0.35 ± 0.32	1
SPW-2793	Water	6/18/2014	U-238	0.08	0.02 ± 0.06	1

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

Lab Code	Sample Type	Date	Analysis ^b	Concentration (pCi/L) ^a		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66 σ)		
				LLD	Activity ^c	
SPW-3485	Water	7/17/2014	Fe-55	597.6	10.3 \pm 363.3	1000
SPW-4092	Water	8/13/2014	I-131(G)	3.59	0.91 \pm 1.95	20
SPW-4092	Water	8/13/2014	Cs-134	3.71	-0.31 \pm 1.77	10
SPW-4092	Water	8/13/2014	Cs-137	2.71	-2.20 \pm 1.98	10
SPW-4092	Water	8/13/2014	Sr-89	0.89	0.11 \pm 0.63	5
SPW-4092	Water	8/13/2014	Sr-90	0.52	-0.05 \pm 0.23	1
SPMI-4094	Milk	8/13/2014	I-131	0.35	0.03 \pm 0.20	0.5
SPMI-4094	Milk	8/13/2014	I-131(G)	4.50	-0.41 \pm 2.44	20
SPMI-4094	Milk	8/13/2014	Cs-134	4.30	-0.84 \pm 2.02	10
SPMI-4094	Milk	8/13/2014	Cs-137	3.45	0.96 \pm 2.51	10
SPMI-4094	Milk	8/13/2014	Sr-89	0.80	-0.19 \pm 0.79	5
SPMI-4094	Milk	8/13/2014	Sr-90	0.47	0.71 \pm 0.30	1
SPW-4103	Water	8/13/2014	Ni-63	0.12	0.02 \pm 0.07	20
SPW-4105	Water	8/13/2014	H-3	138.1	104.1 \pm 78.1	200
SPW-4107	Water	8/13/2014	I-131(G)	3.21	-3.68 \pm 1.33	20
SPW-4107	Water	8/13/2014	Cs-134	2.72	-0.62 \pm 1.49	10
SPW-4107	Water	8/13/2014	Cs-137	2.56	0.75 \pm 1.62	10
SPAP-4109	Air Particulate	8/13/2014	Gr. Beta	0.004	-0.003 \pm 0.00	0.01
SPF-4111	Fish	8/13/2014	Cs-134	0.01	0.00 \pm 0.01	100
SPF-4111	Fish	8/13/2014	Cs-137	0.01	-0.01 \pm 0.01	100
SPF-4111	Fish	8/13/2014	Co-60	0.01	0.00 \pm 0.01	100
W-081614	Water	8/16/2014	Ra-226	0.04	0.05 \pm 0.03	1
W-082614	Water	8/16/2014	Ra-228	0.62	0.29 \pm 0.40	2
W-092314	Water	9/23/2014	Ra-226	0.02	0.04 \pm 0.02	1
W-5123	Water	9/29/2014	Ra-228	0.70	0.43 \pm 0.38	2
W-100714	Water	10/7/2014	Gr. Alpha	0.39	0.04 \pm 0.28	2
W-100714	Water	10/7/2014	Gr. Beta	0.76	-0.06 \pm 0.53	4
W-111014	Water	11/10/2014	Gr. Alpha	0.39	0.01 \pm 0.28	2
W-111014	Water	11/10/2014	Gr. Beta	0.75	-0.25 \pm 0.52	4
W-112514	Water	11/25/2014	Ra-226	0.05	0.02 \pm 0.03	2
W-120814	Water	12/8/2014	Gr. Alpha	0.42	0.04 \pm 0.30	2
W-120814	Water	12/8/2014	Gr. Beta	0.74	-0.42 \pm 0.51	4
SPW-7148	Water	12/26/2014	Ni-63	10.80	-1.80 \pm 6.50	20

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m³), 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.

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
AP-7829, 7830	1/2/2014	Be-7	0.08 ± 0.02	0.06 ± 0.01	0.07 ± 0.01	Pass
AP-7913, 7914	1/2/2014	Be-7	0.07 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	Pass
AP-7871, 7872	1/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
S-43, 44	1/9/2014	K-40	19.28 ± 0.57	19.24 ± 0.57	19.26 ± 0.40	Pass
SG-64, 65	1/9/2014	Gr. Alpha	686.08 ± 69.97	642.46 ± 65.59	664.27 ± 47.95	Pass
SG-64, 65	1/9/2014	Ra-226	97.30 ± 9.78	92.20 ± 9.27	94.75 ± 6.74	Pass
SG-64, 65	1/9/2014	Ra-228	91.90 ± 9.30	97.10 ± 9.87	94.50 ± 6.78	Pass
S-136, 137	1/13/2014	Be-7	14.90 ± 0.39	14.88 ± 0.38	14.89 ± 0.27	Pass
S-136, 137	1/13/2014	K-40	3.29 ± 0.36	3.93 ± 0.36	3.61 ± 0.25	Pass
WW-220, 221	1/13/2014	H-3	231.85 ± 80.45	273.46 ± 82.47	252.66 ± 57.60	Pass
WW-262, 263	1/21/2014	H-3	294.80 ± 89.80	265.00 ± 88.47	279.90 ± 63.03	Pass
WW-346, 347	1/24/2014	H-3	934.97 ± 118.47	965.59 ± 119.52	950.28 ± 84.14	Pass
SWU-367, 368	1/29/2014	Gr. Beta	0.74 ± 0.38	1.31 ± 0.42	1.02 ± 0.28	Pass
F-409, 410	2/2/2014	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-409, 410	2/2/2014	Gr. Beta	3.60 ± 0.07	3.72 ± 0.07	3.66 ± 0.05	Pass
AP-7829, 7830	1/2/2014	Be-7	0.08 ± 0.02	0.06 ± 0.01	0.07 ± 0.01	Pass
AP-7913, 7914	1/2/2014	Be-7	0.07 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	Pass
AP-7871, 7872	1/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
S-43, 44	1/9/2014	K-40	19.28 ± 0.57	19.24 ± 0.57	19.26 ± 0.40	Pass
SG-64, 65	1/9/2014	Gr. Alpha	686.08 ± 69.97	642.46 ± 65.59	664.27 ± 47.95	Pass
SG-64, 65	1/9/2014	Ra-226	97.30 ± 9.78	92.20 ± 9.27	94.75 ± 6.74	Pass
SG-64, 65	1/9/2014	Ra-228	91.90 ± 9.30	97.10 ± 9.87	94.50 ± 6.78	Pass
S-136, 137	1/13/2014	Be-7	14.90 ± 0.39	14.88 ± 0.38	14.89 ± 0.27	Pass
S-136, 137	1/13/2014	K-40	3.29 ± 0.36	3.93 ± 0.36	3.61 ± 0.25	Pass
WW-220, 221	1/13/2014	H-3	231.85 ± 80.45	273.46 ± 82.47	252.66 ± 57.60	Pass
WW-262, 263	1/21/2014	H-3	294.80 ± 89.80	265.00 ± 88.47	279.90 ± 63.03	Pass
WW-346, 347	1/24/2014	H-3	934.97 ± 118.47	965.59 ± 119.52	950.28 ± 84.14	Pass
SWU-367, 368	1/29/2014	Gr. Beta	0.74 ± 0.38	1.31 ± 0.42	1.02 ± 0.28	Pass
F-409, 410	2/2/2014	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-409, 410	2/2/2014	Gr. Beta	3.60 ± 0.07	3.72 ± 0.07	3.66 ± 0.05	Pass
WW-491, 492	2/6/2014	H-3	474.00 ± 101.10	583.10 ± 105.30	528.55 ± 72.99	Pass
WW-575, 576	2/13/2014	H-3	196.69 ± 82.94	154.68 ± 80.89	175.69 ± 57.93	Pass
W-617, 618	2/14/2014	H-3	526.29 ± 97.65	579.51 ± 99.77	552.90 ± 69.80	Pass
SWU-743, 744	2/25/2014	Gr. Beta	1.61 ± 0.65	1.73 ± 0.71	1.67 ± 0.48	Pass
S-700, 701	2/26/2014	K-40	21.32 ± 0.64	21.15 ± 0.59	21.24 ± 0.44	Pass
S-806, 807	3/4/2014	K-40	24.79 ± 0.57	24.17 ± 0.59	24.48 ± 0.41	Pass
SG-928, 929	3/11/2014	Ac-228	6.78 ± 0.34	6.94 ± 0.35	6.86 ± 0.24	Pass
SG-928, 929	3/11/2014	Bi-214	5.32 ± 0.20	5.34 ± 0.22	5.33 ± 0.15	Pass
SG-928, 929	3/11/2014	K-40	4.79 ± 0.80	6.24 ± 1.01	5.52 ± 0.64	Pass
SG-928, 929	3/11/2014	Pb-212	2.70 ± 0.09	2.75 ± 0.09	2.73 ± 0.06	Pass
SG-928, 929	3/11/2014	Pb-214	5.39 ± 0.17	5.53 ± 0.17	5.46 ± 0.12	Pass
SG-928, 929	3/11/2014	Th-228	6.10 ± 2.07	4.76 ± 1.93	5.43 ± 1.42	Pass
SG-928, 929	3/11/2014	Tl-208	0.92 ± 0.06	0.91 ± 0.06	0.92 ± 0.04	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
S-2119, 2120	3/12/2014	Ac-228	0.76 ± 0.20	0.73 ± 0.21	0.75 ± 0.15	Pass
S-2119, 2120	3/12/2014	Cs-137	0.13 ± 0.05	0.11 ± 0.05	0.12 ± 0.04	Pass
S-2119, 2120	3/12/2014	K-40	17.48 ± 1.48	18.39 ± 1.53	17.94 ± 1.06	Pass
S-2119, 2120	3/12/2014	Pb-214	0.73 ± 0.18	0.63 ± 0.12	0.68 ± 0.11	Pass
F-1594, 1595	3/16/2014	Cs-137	0.02 ± 0.01	0.03 ± 0.02	0.03 ± 0.01	Pass
SO-1115, 1116	3/18/2014	Cs-137	0.06 ± 0.01	0.06 ± 0.00	0.06 ± 0.00	Pass
SO-1115, 1116	3/18/2014	Gr. Beta	23.30 ± 2.10	24.40 ± 2.20	23.85 ± 1.52	Pass
SO-1115, 1116	3/18/2014	K-40	12.63 ± 0.18	12.84 ± 0.15	12.74 ± 0.12	Pass
SO-1115, 1116	3/18/2014	U-233/4	0.11 ± 0.02	0.12 ± 0.02	0.12 ± 0.01	Pass
SO-1115, 1116	3/18/2014	U-238	0.13 ± 0.02	0.14 ± 0.02	0.14 ± 0.01	Pass
S-1033, 1034	3/19/2014	Ac-228	0.99 ± 0.20	1.13 ± 0.26	1.06 ± 0.16	Pass
S-1033, 1034	3/19/2014	Bi-214	1.02 ± 0.18	0.98 ± 0.16	1.00 ± 0.12	Pass
S-1033, 1034	3/19/2014	Cs-137	0.15 ± 0.04	0.14 ± 0.04	0.15 ± 0.03	Pass
S-1033, 1034	3/19/2014	K-40	15.39 ± 1.19	15.13 ± 1.19	15.26 ± 0.84	Pass
S-1033, 1034	3/19/2014	Pb-214	1.09 ± 0.13	0.88 ± 0.17	0.99 ± 0.11	Pass
S-1033, 1034	3/19/2014	Tl-208	0.36 ± 0.05	0.31 ± 0.05	0.34 ± 0.04	Pass
W-1094, 1095	3/23/2014	Ra-226	0.30 ± 0.20	0.70 ± 0.20	0.50 ± 0.14	Pass
W-1094, 1095	3/23/2014	Ra-228	1.10 ± 0.79	1.13 ± 0.86	1.12 ± 0.58	Pass
AP-1197, 1198	3/27/2014	Be-7	0.17 ± 0.08	0.14 ± 0.08	0.15 ± 0.05	Pass
AP-1698, 1699	3/31/2014	Be-7	0.06 ± 0.02	0.07 ± 0.02	0.07 ± 0.01	Pass
E-1218, 1219	4/1/2014	Gr. Beta	1.57 ± 0.04	1.57 ± 0.04	1.57 ± 0.03	Pass
E-1218, 1219	4/1/2014	K-40	1.26 ± 0.14	1.31 ± 0.18	1.29 ± 0.11	Pass
SWU-1260, 1261	4/1/2014	Gr. Beta	2.81 ± 0.51	2.94 ± 0.50	2.88 ± 0.36	Pass
AP-1615, 1616	4/1/2014	Be-7	0.07 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
AP-1657, 1658	4/2/2014	Be-7	0.07 ± 0.01	0.08 ± 0.01	0.07 ± 0.01	Pass
AP-1804, 1805	4/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
P-1489, 1490	4/7/2014	H-3	582.31 ± 101.85	505.07 ± 98.72	543.69 ± 70.92	Pass
BS-1531, 1532	4/16/2014	K-40	0.51 ± 0.19	0.58 ± 0.23	0.54 ± 0.15	Pass
S-1909, 1910	4/22/2014	K-40	14.71 ± 0.54	14.78 ± 0.53	14.75 ± 0.38	Pass
SWU-1867, 1868	4/29/2014	Gr. Beta	2.28 ± 0.40	1.67 ± 0.35	1.98 ± 0.27	Pass
AP-1930, 1931	5/1/2014	Be-7	0.16 ± 0.09	0.19 ± 0.11	0.17 ± 0.07	Pass
SL-1888, 1889	5/1/2014	Be-7	0.80 ± 0.04	0.76 ± 0.08	0.78 ± 0.05	Pass
SL-1888, 1889	5/1/2014	Cs-137	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	Pass
SL-1888, 1889	5/1/2014	Gr. Beta	11.57 ± 0.72	12.67 ± 0.78	12.12 ± 0.53	Pass
SL-1888, 1889	5/1/2014	K-40	1.04 ± 0.05	1.00 ± 0.09	1.02 ± 0.05	Pass
SO-1972, 1973	5/1/2014	Cs-137	0.12 ± 0.03	0.10 ± 0.02	0.11 ± 0.02	Pass
SO-1972, 1973	5/1/2014	Gr. Alpha	7.51 ± 3.24	9.09 ± 3.63	8.30 ± 2.43	Pass
SO-1972, 1973	5/1/2014	Gr. Beta	29.89 ± 3.25	31.42 ± 3.04	30.66 ± 2.23	Pass
SO-1972, 1973	5/1/2014	K-40	20.45 ± 0.85	20.88 ± 0.76	20.66 ± 0.57	Pass
W-617, 618	5/8/2014	H-3	175.13 ± 83.82	177.17 ± 83.92	176.15 ± 59.31	Pass
AP-2077, 2078	5/8/2014	Be-7	0.23 ± 0.11	0.18 ± 0.11	0.20 ± 0.08	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
S-2205, 2206	5/15/2014	Be-7	0.50 ± 0.19	0.70 ± 0.18	0.60 ± 0.13	Pass
S-2205, 2206	5/15/2014	K-40	33.60 ± 0.79	33.52 ± 0.70	33.56 ± 0.53	Pass
VE-2184, 2185	5/19/2014	Be-7	0.62 ± 0.18	0.53 ± 0.17	0.58 ± 0.12	Pass
VE-2184, 2185	5/19/2014	K-40	5.30 ± 0.44	5.14 ± 0.44	5.22 ± 0.31	Pass
DW-50102, 50103	5/20/2014	Ra-226	7.07 ± 0.76	8.31 ± 0.90	7.69 ± 0.59	Pass
DW-50102, 50103	5/20/2014	Ra-228	5.44 ± 0.85	6.02 ± 0.67	5.73 ± 0.54	Pass
SW-2226, 2227	5/21/2014	H-3	14318.00 ± 347.00	14350.00 ± 347.00	14334.00 ± 245.37	Pass
DW-50087, 50088	5/21/2014	Gr. Alpha	1.76 ± 1.09	2.67 ± 1.01	2.22 ± 0.74	Pass
DW-50090, 50091	5/21/2014	Ra-226	0.61 ± 0.09	0.47 ± 0.09	0.54 ± 0.06	Pass
DW-50090, 50091	5/21/2014	Ra-228	0.97 ± 0.41	1.26 ± 0.52	1.12 ± 0.33	Pass
DW-50098, 50099	5/21/2014	Gr. Alpha	13.04 ± 1.36	10.76 ± 1.26	11.90 ± 0.93	Pass
AP-2289, 2290	5/22/2014	Be-7	0.14 ± 0.08	0.24 ± 0.10	0.19 ± 0.06	Pass
PM-3174, 3175	5/28/2014	K-40	30.68 ± 1.30	32.64 ± 1.24	31.66 ± 0.90	Pass
G-2415, 2416	6/2/2014	Be-7	0.73 ± 0.16	0.62 ± 0.28	0.68 ± 0.16	Pass
G-2415, 2416	6/2/2014	Gr. Beta	5.89 ± 0.09	5.90 ± 0.09	5.89 ± 0.06	Pass
G-2415, 2416	6/2/2014	K-40	5.30 ± 0.49	5.19 ± 0.65	5.25 ± 0.41	Pass
VW-2541, 2542	6/4/2014	H-3	5107.00 ± 223.00	5029.00 ± 222.00	5068.00 ± 157.33	Pass
SW-2817, 2818	6/16/2014	H-3	13303.00 ± 336.00	13130.00 ± 334.00	13216.50 ± 236.88	Pass
SS-2943, 2944	6/24/2014	K-40	11.49 ± 0.79	11.81 ± 0.70	11.65 ± 0.53	Pass
S-3048, 3049	6/27/2014	K-40	42.51 ± 1.31	40.04 ± 1.39	41.28 ± 0.95	Pass
SWT-3216, 3217	7/1/2014	Gr. Beta	2.27 ± 0.94	2.53 ± 1.05	2.40 ± 0.70	Pass
AP-3699,3700	7/3/2014	Be-7	0.06 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
S-3300, 3301	7/8/2014	K-40	4.85 ± 0.97	5.91 ± 1.17	5.38 ± 0.76	Pass
S-3300, 3301	7/8/2014	Ac-228	10.23 ± 0.43	10.18 ± 0.32	10.21 ± 0.27	Pass
S-3300, 3301	7/8/2014	Ra-226	70.14 ± 2.37	72.01 ± 2.38	71.08 ± 1.68	Pass
VE-3237,3238	7/8/2014	K-40	2.54 ± 0.27	2.63 ± 0.24	2.59 ± 0.18	Pass
CF-3384,3385	7/14/2014	K-40	11.10 ± 0.58	10.69 ± 0.60	10.90 ± 0.42	Pass
S-3447,3448	7/16/2014	K-40	19.63 ± 0.64	21.03 ± 0.96	20.33 ± 0.58	Pass
VW-3573,3574	7/18/2014	H-3	381.58 ± 85.76	401.30 ± 86.67	391.44 ± 60.96	Pass
VE-3594,3595	7/22/2014	K-40	3.04 ± 0.19	3.21 ± 0.15	3.13 ± 0.12	Pass
VW-3762,3763	7/25/2014	H-3	315.47 ± 87.02	327.30 ± 87.56	321.39 ± 61.72	Pass
SWT-3867, 3868	7/29/2014	Gr. Beta	1.10 ± 0.53	1.51 ± 0.58	1.31 ± 0.39	Pass
S-3804, 3805	7/30/2014	Ac-228	0.67 ± 0.11	0.61 ± 0.10	0.64 ± 0.07	Pass
S-3804, 3805	7/30/2014	Pb-214	0.56 ± 0.05	0.51 ± 0.04	0.54 ± 0.03	Pass
LW-3931, 3932	7/31/2014	Gr. Beta	1.04 ± 0.40	0.95 ± 0.41	1.00 ± 0.29	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
G-3952,3953	8/4/2014	K-40	5.42 ± 0.42	5.35 ± 0.34	5.38 ± 0.27	Pass
G-3952,3953	8/4/2014	Be-7	1.29 ± 0.19	1.24 ± 0.16	1.27 ± 0.13	Pass
G-3952,3953	8/4/2014	Gr. Beta	8.53 ± 0.20	8.63 ± 0.20	8.58 ± 0.14	Pass
G-3952,3953	8/4/2014	H-3	140.16 ± 93.50	127.25 ± 92.99	133.70 ± 65.94	Pass
WW-4036, 4037	8/5/2014	H-3	190.60 ± 82.60	164.70 ± 81.30	177.65 ± 57.95	Pass
VE-4204,4205	8/11/2014	K-40	6.28 ± 0.38	6.60 ± 0.37	6.44 ± 0.27	Pass
WW-4394,4395	8/13/2014	H-3	1540.26 ± 136.52	1499.15 ± 135.43	1519.71 ± 96.15	Pass
VE-4183,4184	8/14/2014	K-40	5.70 ± 0.41	5.73 ± 0.34	5.72 ± 0.27	Pass
AV-4455, 4456	8/22/2014	Be-7	286.67 ± 102.30	251.99 ± 98.94	269.33 ± 71.16	Pass
AV-4455, 4456	8/22/2014	K-40	2547.90 ± 255.70	2201.40 ± 203.90	2374.65 ± 163.52	Pass
WW-4500, 4501	8/26/2014	H-3	347.00 ± 100.00	321.00 ± 98.00	334.00 ± 70.01	Pass
AP-090214A/B	9/2/2014	Gr. Beta	0.03 ± 0.04	0.03 ± 0.04	0.03 ± 0.00	Pass
SG-5089, 5090	9/19/2014	Ac-228	8.26 ± 0.63	9.48 ± 0.68	8.87 ± 0.46	Pass
SG-5089, 5090	9/19/2014	Bi-214	4.71 ± 0.29	4.41 ± 0.31	4.56 ± 0.21	Pass
SG-5194,5	10/1/2014	Gr. Alpha	276.20 ± 9.51	258.60 ± 9.26	267.40 ± 6.64	Pass
SG-5194,5	10/1/2014	Pb-214	43.56 ± 0.73	43.94 ± 0.78	43.75 ± 0.53	Pass
SG-5194,5	10/1/2014	Ac-228	59.90 ± 1.37	62.80 ± 1.73	61.35 ± 1.10	Pass
S-5632,3	10/8/2014	K-40	19.28 ± 0.88	17.94 ± 0.89	18.61 ± 0.63	Pass
S-5632,3	10/8/2014	Cs-137	0.15 ± 0.03	0.13 ± 0.03	0.14 ± 0.02	Pass
S-5632,3	10/8/2014	Tl-208	0.32 ± 0.03	0.34 ± 0.03	0.33 ± 0.02	Pass
S-5632,3	10/8/2014	Pb-212	0.92 ± 0.05	0.92 ± 0.05	0.92 ± 0.03	Pass
S-5632,3	10/8/2014	Pb-214	1.25 ± 0.08	1.09 ± 0.09	1.17 ± 0.06	Pass
S-5632,3	10/8/2014	Bi-212	1.25 ± 0.29	1.34 ± 0.47	1.29 ± 0.27	Pass
S-5632,3	10/8/2014	Ac-228	1.08 ± 0.14	1.10 ± 0.14	1.09 ± 0.10	Pass
DW-50243,4	10/13/2014	Gr. Alpha	2.99 ± 0.94	4.98 ± 1.17	3.99 ± 0.75	Pass
AP-101414A/B	10/14/2014	Gr. Beta	0.02 ± 0.00	0.02 ± 0.00	0.02 ± 0.00	Pass
SG-5590,1	10/15/2014	Pb-214	80.30 ± 8.08	73.40 ± 7.51	76.85 ± 5.52	Pass
SG-5590,1	10/15/2014	Ac-228	64.50 ± 1.87	62.80 ± 1.15	63.65 ± 1.10	Pass
DW-50251,2	10/16/2014	Ra-226	0.55 ± 0.13	0.32 ± 0.10	0.44 ± 0.08	Pass
U-5842,3	10/20/2014	H-3	7376 ± 949	7342 ± 947	7359 ± 670	Pass
CF-6074,5	10/21/2014	H-3	7509 ± 283	7969 ± 291	7739 ± 203	Pass
CF-6074,5	10/21/2014	K-40	3.09 ± 0.31	3.30 ± 0.38	3.20 ± 0.25	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
VE-6269,70	11/3/2014	K-40	6.25 ± 0.54	6.56 ± 0.49	6.41 ± 0.36	Pass
VE-6269,70	11/3/2014	Be-7	0.81 ± 0.28	0.74 ± 0.18	0.77 ± 0.17	Pass
SO-6500,1	11/5/2014	Sr-90	0.07 ± 0.03	0.07 ± 0.02	0.07 ± 0.02	Pass
SO-6500,1	11/5/2014	Gr. Alpha	11.77 ± 1.73	12.18 ± 1.62	11.98 ± 1.19	Pass
SO-6500,1	11/5/2014	Gr. Beta	26.69 ± 1.62	24.19 ± 1.13	25.44 ± 0.99	Pass
SO-6500,1	11/5/2014	U-233/4	0.14 ± 0.04	0.14 ± 0.05	0.14 ± 0.03	Pass
SO-6500,1	11/5/2014	U-238	0.18 ± 0.05	0.13 ± 0.04	0.15 ± 0.03	Pass
SO-6500,1	11/5/2014	Th-228	0.47 ± 0.11	0.34 ± 0.06	0.41 ± 0.06	Pass
SO-6500,1	11/5/2014	Th-230	0.38 ± 0.07	0.29 ± 0.05	0.34 ± 0.04	Pass
SO-6500,1	11/5/2014	Th-232	0.41 ± 0.08	0.41 ± 0.06	0.41 ± 0.05	Pass
SO-6500,1	11/5/2014	Bi-214	0.75 ± 0.02	0.78 ± 0.02	0.77 ± 0.01	Pass
SO-6500,1	11/5/2014	Pb-214	0.78 ± 0.08	0.86 ± 0.09	0.82 ± 0.06	Pass
SO-6500,1	11/5/2014	Ac-228	1.02 ± 0.11	1.13 ± 0.13	1.08 ± 0.09	Pass
SO-6500,1	11/5/2014	Cs-137	0.40 ± 0.01	0.39 ± 0.01	0.39 ± 0.01	Pass
DW-50262,3	11/10/2014	Gr. Alpha	8.95 ± 1.26	7.84 ± 1.24	8.40 ± 0.88	Pass
DW-50264,5	11/10/2014	Ra-226	3.89 ± 0.24	3.71 ± 0.20	3.80 ± 0.16	Pass
DW-50264,5	11/10/2014	Ra-228	2.96 ± 0.63	2.33 ± 0.59	2.65 ± 0.43	Pass
AP-120214A/B	12/2/2014	Gr. Beta	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	Pass
AP-120814A/B	12/8/2014	Gr. Beta	0.03 ± 0.01	0.03 ± 0.01	0.03 ± 0.00	Pass
SG-7068,9	12/19/2014	Pb-214	4.27 ± 0.23	4.38 ± 0.33	4.33 ± 0.20	Pass
SG-7068,9	12/19/2014	Ac-228	2.72 ± 0.36	3.27 ± 0.49	3.00 ± 0.30	Pass
S-7152,3	12/25/2014	K-40	20.83 ± 0.88	20.16 ± 0.62	20.49 ± 0.54	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAW-1140	2/1/2014	Gr. Alpha	0.77 ± 0.06	0.85	0.26 - 1.44	Pass
MAW-1140	2/1/2014	Gr. Beta	4.31 ± 0.08	4.19	2.10 - 6.29	Pass
MAW-1142	2/1/2014	I-129	-0.01 ± 8.00	0.00	NA	Pass
MAW-1184	2/1/2014	Fe-55	0.40 ± 3.20	0.00	-0.01 - 2.00	Pass
MAW-1184	2/1/2014	H-3	345.10 ± 10.60	321.00	225.00 - 417.00	Pass
MAW-1184	2/1/2014	Ni-63	32.40 ± 3.20	34.00	23.80 - 44.20	Pass
MAW-1184 ^f	2/1/2014	Pu-238	1.28 ± 0.12	0.83	0.58 - 1.08	Fail
MAW-1184 ^f	2/1/2014	Pu-239/240	0.91 ± 0.10	0.68	0.47 - 0.88	Fail
MAW-1184	2/1/2014	Sr-90	7.00 ± 0.70	8.51	5.96 - 11.06	Pass
MAW-1184	2/1/2014	Tc-99	8.10 ± 0.60	10.30	7.20 - 13.40	Pass
MAW-1184	2/1/2014	U-233/234	0.20 ± 0.07	0.23	0.16 - 0.29	Pass
MAW-1184	2/1/2014	U-238	1.25 ± 0.18	1.45	1.02 - 1.89	Pass
MAW-1184	2/1/2014	Co-57	27.86 ± 0.38	27.50	19.30 - 35.80	Pass
MAW-1184	2/1/2014	Co-60	15.99 ± 0.27	16.00	11.20 - 20.80	Pass
MAW-1184	2/1/2014	Cs-134	21.85 ± 0.54	23.10	16.20 - 30.00	Pass
MAW-1184	2/1/2014	Cs-137	28.74 ± 0.49	28.90	20.20 - 37.60	Pass
MAW-1184	2/1/2014	K-40	1.80 ± 2.00	0.00	0.00 - 10.00	Pass
MAW-1184	2/1/2014	Mn-54	14.06 ± 0.40	13.90	9.70 - 18.10	Pass
MAW-1184	2/1/2014	Zn-65	0.00 ± 0.19	0.00	-0.01 - 0.00	Pass
MAVE-1148	2/1/2014	Co-57	11.63 ± 0.19	10.10	7.10 - 13.10	Pass
MAVE-1148	2/1/2014	Co-60	7.28 ± 0.18	6.93	4.85 - 9.01	Pass
MAVE-1148	2/1/2014	Cs-134	6.29 ± 0.29	6.04	4.23 - 7.85	Pass
MAVE-1148	2/1/2014	Cs-137	5.18 ± 0.20	4.74	3.32 - 6.16	Pass
MAVE-1148	2/1/2014	Mn-54	9.22 ± 0.26	8.62	6.03 - 11.21	Pass
MAVE-1148	2/1/2014	Zn-65	8.59 ± 0.40	7.86	5.50 - 10.22	Pass
MAAP-1151	2/1/2014	Am-241	0.09 ± 0.02	0.09	0.06 - 0.12	Pass
MAAP-1151 ^d	2/1/2014	Co-57	1.60 ± 0.05	0.00	NA	Fail
MAAP-1151	2/1/2014	Co-60	1.38 ± 0.08	1.39	0.97 - 1.81	Pass
MAAP-1151	2/1/2014	Cs-134	1.75 ± 0.11	1.91	1.34 - 2.48	Pass
MAAP-1151	2/1/2014	Cs-137	1.81 ± 0.10	1.76	1.23 - 2.29	Pass
MAAP-1151	2/1/2014	Mn-54	0.01 ± 0.03	0.00	NA	Pass
MAAP-1151 ^f	2/1/2014	Pu-238	0.08 ± 0.02	0.00	NA	Fail
MAAP-1151	2/1/2014	Pu-239/240	0.10 ± 0.02	0.08	0.05 - 0.10	Pass
MAAP-1151	2/1/2014	Zn-65	-0.24 ± 0.09	0.00	-0.50 - 1.00	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAAP-1151	2/1/2014	U-233/234	0.03 ± 0.01	0.02	0.01 - 0.03	Pass
MAAP-1151	2/1/2014	U-238	0.13 ± 0.02	0.13	0.09 - 0.17	Pass
MAAP-1151	2/1/2014	Sr-90	1.11 ± 0.14	1.18	0.83 - 1.53	Pass
MAAP-1154	2/1/2014	Gr. Alpha	0.56 ± 0.06	1.77	0.53 - 3.01	Pass
MAAP-1154	2/1/2014	Gr. Beta	0.98 ± 0.06	0.77	0.39 - 1.16	Pass
MASO-1146	2/1/2014	Co-57	1064.50 ± 3.60	966.00	676.00 - 1256.00	Pass
MASO-1146	2/1/2014	Co-60	1.70 ± 0.50	1.22	NA ^e	Pass
MASO-1146 ^g	2/1/2014	Cs-134	6.10 ± 1.80	0.00	NA	Fail
MASO-1146	2/1/2014	Cs-137	1364.30 ± 5.30	1238.00	867.00 - 1609.00	Pass
MASO-1146	2/1/2014	K-40	728.90 ± 15.90	622.00	435.00 - 809.00	Pass
MASO-1146	2/1/2014	Mn-54	1588.00 ± 6.00	1430.00	1001.00 - 1859.00	Pass
MASO-1146	2/1/2014	Zn-65	763.50 ± 6.80	695.00	487.00 - 904.00	Pass
MASO-1146	2/1/2014	Am-241	68.20 ± 9.00	68.00	47.60 - 88.40	Pass
MASO-1146	2/1/2014	Ni-63	4.80 ± 15.30	0.00	NA	Pass
MASO-1146 ^f	2/1/2014	Pu-238	140.60 ± 15.50	96.00	67.00 - 125.00	Fail
MASO-1146 ^f	2/1/2014	Pu-239/240	102.00 ± 13.10	76.80	53.80 - 99.80	Fail
MASO-1146	2/1/2014	Sr-90	1.23 ± 1.37	0.00	NA	Pass
MASO-1146	2/1/2014	Tc-99	-0.30 ± 12.00	0.00	NA	Pass
MASO-1146 ^h	2/1/2014	U-233/234	22.90 ± 3.00	81.00	57.00 - 105.00	Fail
MASO-1146 ^h	2/1/2014	U-238	32.00 ± 3.60	83.00	58.00 - 108.00	Fail
MASO-4439	8/1/2014	Am-241	65.90 ± 6.70	85.50	59.90 - 111.20	Pass
MASO-4439	8/1/2014	Ni-63	771.62 ± 23.29	980.00	686.00 - 1274.00	Pass
MASO-4439	8/1/2014	Pu-239/240	55.63 ± 5.81	58.60	41.00 - 76.20	Pass
MASO-4439	8/1/2014	Sr-90	778.34 ± 17.82	858.00	601.00 - 1115.00	Pass
MASO-4439	8/1/2014	Tc-99	458.20 ± 9.20	589.00	412.00 - 766.00	Pass
MASO-4439	8/1/2014	Cs-134	520.60 ± 7.09	622.00	435.00 - 809.00	Pass
MASO-4439	8/1/2014	Co-57	1135.00 ± 7.40	1116.00	781.00 - 1451.00	Pass
MASO-4439	8/1/2014	Co-60	768.20 ± 7.70	779.00	545.00 - 1013.00	Pass
MASO-4439	8/1/2014	Mn-54	1050.70 ± 12.60	1009.00	706.00 - 1312.00	Pass
MASO-4439	8/1/2014	Zn-65	407.89 ± 15.03	541.00	379.00 - 703.00	Pass
MAW-4431	8/1/2014	Am-241	0.79 ± 0.08	0.88	0.62 - 1.14	Pass
MAW-4431	8/1/2014	Cs-137	18.62 ± 0.54	18.40	12.90 - 23.90	Pass
MAW-4431	8/1/2014	Co-57	24.85 ± 0.42	24.70	17.30 - 32.10	Pass
MAW-4431	8/1/2014	Co-60	12.27 ± 0.38	12.40	8.70 - 16.10	Pass
MAW-4431	8/1/2014	H-3	207.20 ± 10.60	208.00	146.00 - 270.00	Pass
MAW-4431 ⁱ	8/1/2014	Fe-55	55.10 ± 14.80	31.50	22.10 - 41.00	Fail
MAW-4431	8/1/2014	Mn-54	14.36 ± 0.53	14.00	9.80 - 18.20	Pass
MAW-4431	8/1/2014	Zn-65	11.46 ± 0.78	10.90	7.60 - 14.20	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAW-4431	8/1/2014	Tc-99	6.10 ± 0.50	6.99	4.89 - 9.09	Pass
MAW-4431	8/1/2014	Pu-238	0.59 ± 0.07	0.62	0.43 - 0.80	Pass
MAW-4431	8/1/2014	U-233/234	0.22 ± 0.04	0.21	0.14 - 0.27	Pass
MAW-4431	8/1/2014	U-238	1.25 ± 0.10	1.42	0.99 - 1.85	Pass
MAW-4493	8/1/2014	Gr. Alpha	0.93 ± 0.07	1.40	0.42 - 2.38	Pass
MAW-4493	8/1/2014	Gr. Beta	6.31 ± 1.35	6.50	3.25 - 9.75	Pass
MAAP-4433	8/1/2014	Am-241	0.06 ± 0.02	0.07	0.05 - 0.09	Pass
MAAP-4433	8/1/2014	Pu-238	0.10 ± 0.03	0.11	0.08 - 0.14	Pass
MAAP-4433	8/1/2014	Pu-239/240	0.04 ± 0.02	0.05	0.03 - 0.06	Pass
MAAP-4433	8/1/2014	Sr-90	0.74 ± 0.10	0.70	0.49 - 0.91	Pass
MAAP-4433	8/1/2014	U-233/234	0.03 ± 0.01	0.04	0.03 - 0.05	Pass
MAAP-4433	8/1/2014	U-238	0.21 ± 0.03	0.25	0.18 - 0.33	Pass
MAAP-4444	8/1/2014	Sr-89	7.82 ± 0.52	9.40	6.60 - 12.20	Pass
MAAP-4444	8/1/2014	Sr-90	0.76 ± 0.10	0.76	0.53 - 0.99	Pass
MAVE-4436	8/1/2014	Cs-134	7.49 ± 0.18	7.38	5.17 - 9.59	Pass
MAVE-4436	8/1/2014	Co-57	11.20 ± 0.19	9.20	6.40 - 12.00	Pass
MAVE-4436	8/1/2014	Co-60	6.84 ± 0.17	6.11	4.28 - 7.94	Pass
MAVE-4436	8/1/2014	Mn-54	8.11 ± 0.26	7.11	4.97 - 9.23	Pass
MAVE-4436	8/1/2014	Zn-65	7.76 ± 0.43	6.42	4.49 - 8.35	Pass

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

^b Laboratory codes as follows: MAW (water), MAAP (air filter), MASO (soil), MAVE (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 Interference from Eu-152 resulted in misidentification of Co-57.

^e Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

^f The high bias on the plutonium crosscheck samples was traced to contamination from a newly purchased standard.

The results of reanalysis with replacement tracer purchased from NIST:

MAW-1184	Pu-238	0.68 ± 0.10	Bq / L
MAW-1184	Pu-239/240	0.66 ± 0.10	Bq / L
MASO-1146	Pu-238	95.15 ± 8.98	Bq / kg
MASO-1146	Pu-239/240	67.21 ± 7.54	Bq / kg

Insufficient sample remained to reanalyze the Air filter sample(MAAP-1151). High bias results due to same contaminated tracer

^g False positive test. Long sample counting time lead to interference from naturalizing occurring Bi-214 in sample matrix with a close spectral energy.

^h 80% of participating laboratories were outside the acceptable range.

Parallel reanalysis was run on ERA spiked sample with acceptable results.

ⁱ Result of reanalysis Fe-55 32.63 ± 16.30 Bq / L

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^b		Control Limits	Acceptance
			Laboratory Result ^c	ERA Result ^d		
ERAP-1044	3/17/2014	Am-241	54.2 ± 3.0	59.7	36.8 - 80.8	Pass
ERAP-1044	3/17/2014	Co-60	1177.9 ± 14.3	1120.0	867.0 - 1400.0	Pass
ERAP-1044	3/17/2014	Cs-134	1010.5 ± 15.8	1010.0	643.0 - 1250.0	Pass
ERAP-1044	3/17/2014	Cs-137	938.3 ± 45.7	828.0	622.0 - 1090.0	Pass
ERAP-1044	3/17/2014	Fe-55	142.3 ± 87.3	240.0	74.4 - 469.0	Pass
ERAP-1044	3/17/2014	Gr. Alpha	52.3 ± 0.5	46.0	15.4 - 71.4	Pass
ERAP-1044	3/17/2014	Gr. Beta	64.4 ± 2.6	53.8	34.0 - 78.4	Pass
ERAP-1044	3/17/2014	Mn-54	< 4.9	0.0	NA	Pass
ERAP-1044	3/17/2014	Pu-238	63.0 ± 2.6	56.3	38.6 - 74.0	Pass
ERAP-1044	3/17/2014	Pu-239/240	52.8 ± 1.9	48.6	35.2 - 63.5	Pass
ERAP-1044	3/17/2014	Sr-90	81.4 ± 1.6	78.9	38.6 - 118.0	Pass
ERAP-1044	3/17/2014	U-233/234	30.4 ± 1.7	36.4	22.6 - 54.9	Pass
ERAP-1044	3/17/2014	U-238	30.4 ± 1.4	36.1	23.3 - 49.9	Pass
ERAP-1044	3/17/2014	Uranium	62.0 ± 3.5	74.3	41.1 - 113.0	Pass
ERAP-1044	3/17/2014	Zn-65	852.2 ± 26.1	667.0	478.0 - 921.0	Pass
ERSO-1050	3/17/2014	Am-241	426.6 ± 155.5	399.0	233.0 - 518.0	Pass
ERSO-1050	3/17/2014	Ac-228	1260.0 ± 107.0	1240.0	795.0 - 1720.0	Pass
ERSO-1050	3/17/2014	Bi-212	1331.9 ± 309.7	1240.0	330.0 - 1820.0	Pass
ERSO-1050	3/17/2014	Bi-214	1804.5 ± 50.4	1960.0	1180.0 - 2820.0	Pass
ERSO-1050	3/17/2014	Co-60	6738.8 ± 167.6	6830.0	4620.0 - 9400.0	Pass
ERSO-1050	3/17/2014	Cs-134	3262.9 ± 108.8	3390.0	2220.0 - 4070.0	Pass
ERSO-1050	3/17/2014	Cs-137	8538.6 ± 55.0	8490.0	6510.0 - 10900.0	Pass
ERSO-1050	3/17/2014	K-40	11241.3 ± 296.6	10500.0	7660.0 - 14100.0	Pass
ERSO-1050	3/17/2014	Mn-54	< 21.6	0.0	NA	Pass
ERSO-1050	3/17/2014	Pb-212	1119.6 ± 26.1	1240.0	812.0 - 1730.0	Pass
ERSO-1050	3/17/2014	Pb-214	1861.7 ± 54.9	2070.0	1210.0 - 3090.0	Pass
ERSO-1050 ^e	3/17/2014	Pu-238	1085.5 ± 167.7	578.0	348.0 - 797.0	Fail
ERSO-1050 ^e	3/17/2014	Pu-239/240	681.6 ± 128.6	471.0	308.0 - 651.0	Fail
ERSO-1050	3/17/2014	Sr-90	2338.0 ± 144.0	2780.0	1060.0 - 4390.0	Pass
ERSO-1050	3/17/2014	Th-234	3474.9 ± 226.0	3360.0	1060.0 - 6320.0	Pass
ERSO-1050	3/17/2014	U-233/234	3319.5 ± 250.2	2780.0	1060.0 - 4390.0	Pass
ERSO-1050	3/17/2014	U-238	3375.6 ± 252.6	3360.0	2080.0 - 4260.0	Pass
ERSO-1050	3/17/2014	Uranium	6810.6 ± 551.1	6910.0	3750.0 - 9120.0	Pass
ERSO-1050	3/17/2014	Zn-65	5968.0 ± 226.1	5400.0	4300.0 - 7180.0	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^b			Acceptance
			Laboratory Result ^c	ERA Result ^d	Control Limits	
ERVE-1051	3/17/2014	Am-241	1532.0 ± 149.5	1490.0	911.0 - 1980.0	Pass
ERVE-1051	3/17/2014	Cm-244	519.8 ± 94.6	516.0	253.0 - 804.0	Pass
ERVE-1051	3/17/2014	Co-60	981.2 ± 41.8	926.0	639.0 - 1290.0	Pass
ERVE-1051	3/17/2014	Cs-134	701.4 ± 58.6	646.0	415.0 - 839.0	Pass
ERVE-1051	3/17/2014	Cs-137	961.9 ± 46.3	880.0	638.0 - 1220.0	Pass
ERVE-1051	3/17/2014	K-40	32789.7 ± 758.2	31900.0	23000.0 - 44800.0	Pass
ERVE-1051	3/17/2014	Mn-54	< 25.9	0.0	NA	Pass
ERVE-1051	3/17/2014	Pu-238	2724.1 ± 259.4	2110.0	1260.0 - 2890.0	Pass
ERVE-1051	3/17/2014	Pu-239/240	4361.4 ± 323.4	3740.0	2300.0 - 5150.0	Pass
ERVE-1051	3/17/2014	Sr-90	2405.7 ± 263.2	2580.0	1470.0 - 3420.0	Pass
ERVE-1051	3/17/2014	U-233/234	1612.2 ± 162.0	1760.0	1160.0 - 2260.0	Pass
ERVE-1051	3/17/2014	U-238	1574.3 ± 159.6	1750.0	1170.0 - 2220.0	Pass
ERVE-1051	3/17/2014	Uranium	3255.4 ± 356.7	3580.0	2430.0 - 4460.0	Pass
ERVE-1051	3/17/2014	Zn-65	1124.1 ± 101.2	919.0	663.0 - 1290.0	Pass
ERW-1054	3/17/2014	Am-241	104.6 ± 3.4	114.0	76.8 - 153.0	Pass
ERW-1054	3/17/2014	Co-60	1195.2 ± 18.9	1270.0	1100.0 - 1490.0	Pass
ERW-1054	3/17/2014	Cs-134	1474.9 ± 47.5	1660.0	1220.0 - 1910.0	Pass
ERW-1054	3/17/2014	Cs-137	2591.0 ± 23.4	2690.0	2280.0 - 3220.0	Pass
ERW-1054	3/17/2014	Mn-54	< 4.3	0.0	NA	Pass
ERW-1054	3/17/2014	Pu-238	54.1 ± 3.6	44.1	32.6 - 54.9	Pass
ERW-1054	3/17/2014	Pu-239/240	185.9 ± 17.6	160.0	124.0 - 202.0	Pass
ERW-1054	3/17/2014	U-233/234	74.8 ± 6.3	82.4	61.9 - 106.0	Pass
ERW-1054	3/17/2014	U-238	76.4 ± 7.8	81.8	62.4 - 100.0	Pass
ERW-1054	3/17/2014	Uranium	154.3 ± 14.6	168.0	123.0 - 217.0	Pass
ERW-1054	3/17/2014	Zn-65	1818.5 ± 56.4	1800.0	1500.0 - 2270.0	Pass
ERW-1055 ^f	3/17/2014	Fe-55	636.3 ± 176.0	1200.0	716.0 - 1630.0	Fail
ERW-1055	3/17/2014	Gr. Alpha	120.9 ± 3.5	133.0	47.2 - 206.0	Pass
ERW-1055	3/17/2014	Gr. Beta	141.6 ± 2.3	174.0	99.6 - 258.0	Pass
ERW-1055	3/17/2014	Sr-90	873.9 ± 56.9	890.0	580.0 - 1180.0	Pass
ERW-1060	3/17/2014	H-3	5818.0 ± 230.0	5580.0	3740.0 - 7960.0	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: ERW (water), ERAP (air filter), ERSO (soil), ERVE (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.

^e The high bias on the plutonium crosscheck samples was traced to contamination from a newly purchased standard.

The results of reanalysis with replacement tracer purchased from NIST:

ERSO-1050	Pu-238	634.7 ± 98.50	Bq / kg
ERSO-1050	Pu-239/240	451.8 ± 82.80	Bq / kg

^f An error in the efficiency calculation was found. The result of recalculation was 932 pCi/L.

The sample was repeated, result of reanalysis, 1066 pCi/L.

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 and standard deviation "s" of a set of n numbers x_1, x_2, \dots, x_n are defined as follows:

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

- 4.2. Values below the highest lower limit of detection are not included in the average.
- 4.3. If all values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4. If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.
- 4.5. In rounding off, the following rules are followed:
- 4.5.1. If the 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

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

SUMMARY OF THE LAND USE CENSUS

Appendix D

Summary of the 2014 Land Use Census

The Duane Arnold Energy Land Use Census for 2014 was completed during August and September of 2014. All residences, milk animals, cattle and gardens greater than 500 square feet were identified within three miles for each of the 16 meteorological sectors. If none were identified within the three mile range, additional surveys were performed out to a distance of five miles.

There were 154 vegetable gardens identified during the performance of the 2014 Census. This number is more than the number of gardens found in the 2013 survey by 6. The distance to the nearest vegetation receptor did not change.

There was one change in the location of the nearest resident. In 2013, the "Franz Cottage" located at 4318 Power Plant Road was vacant. That house was inhabited in 2014.

There were two changes to the nearest animal receptors:

- A cattle herd 3870 meters to the SE was discontinued in 2014.
- A farm 2910 meters to the ENE raising goats in 2013 switched to Cattle in 2014.

Since the last performance of the land use census, no new drinking water wells have been identified within a two mile radius of the site.

The Cedar River was surveyed by boat on September 18th of 2014 for water use downstream of the DAEC to Cedar Rapids. This survey identified no new usages of river water from previous surveys. Recreational fishing is the only identified food pathway use of Cedar River water between the DAEC and the City of Cedar Rapids eight miles down-river.

In accordance with the DAEC's Environmental Sampling Procedure ESP 4.4, "Land Use Census", no changes in land use were identified that would adversely affect the safe operation of the DAEC, or that would warrant an update of the DAEC Updated Final Safety Analysis Report (UFSAR). Examples of land use that would warrant an UFSAR update include new hazards near the DAEC such as new gas pipelines or new installations utilizing toxic gases.

NextEra Energy Resources, Duane Arnold has committed to compliance with NEI 07-07, "Nuclear Energy Institute's Industry Ground Water Protection Initiative".

Per NEI 07-07, the following information is presented:

- No radioactive reactor by-product material was identified in samples collected by the DAEC's Radiological Environmental Monitoring Program (REMP) or the site Ground Water Protection Program (GWPP) above the threshold concentration levels for reporting.
- Ground Water Protection Program results are detailed in the site's Annual Radioactive Material Release Report.

APPENDIX E

ANNUAL RADIATION DOSE ASSESSMENT

Appendix E

Annual Radiation Dose Assessment

The annual offsite radiation dose to a member of the public was determined by assessment of environmental dosimetry results and by calculations based on monitored effluent releases.

Section A. Dose Contribution from Direct Radiation

Direct radiation dose from the operation of the DAEC was reported by TLDs placed at locations in the surrounding environment as described in the Offsite Dose Assessment Manual (ODAM).

1. Pre-operational and 2014 TLD results were evaluated with a paired difference statistical test. The evaluation concluded that there were no significant differences in the TLD populations for the 0.5 mile and 1 mile TLD populations.
2. As stated in Part 1 of this report, no plant effect was indicated by the TLDs when dose results were compared to the estimated average natural background for Middle America.

Section B. Estimated Offsite Dose from Effluent Releases

1. The contribution of dose to a member of the public most likely to be exposed from liquid and gaseous effluent releases was calculated using the Meteorological Information and Dose Assessment System (MIDAS) computer program in accordance with the ODA. The calculation methods follow those prescribed by Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".
2. Following calculation of offsite doses, the appropriateness of REMP sampling station types and locations was reviewed. The current sampling scheme was determined to be adequate for the identified receptors.

Results of the MIDAS dose calculations are displayed below.

- 1.) There were no releases of radioactive material to liquid effluents in 2014.
- 2.) The maximum dose to air at the site boundary from noble gases released was 0.0000940 mrad from gamma radiation at 588 meters towards the South-East.
- 3.) The maximum dose to air at the site boundary from noble gases released was 0.0000285 mrad beta radiation at 2416 meters towards the South-East.
- 4.) The whole body dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.000150 mrem, at 1620 meters towards the North-North-West.
- 5.) The skin dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.000150 mrem, at 1620 meters towards the North-North-West.

6.) The hypothetical maximally exposed organ due to airborne iodines and particulates with half-lives greater than eight days (excluding carbon-14) was the lungs of a child at 2450 meters towards the East-South-East, with an estimated dose equivalent of 0.00658 mrem.

7.) The hypothetical maximally exposed organ due to airborne carbon-14 was the bone of a child located 2500 meters to the East-North-East of the site. The dose was 0.071 mrem.

Conclusion

No measurable dose due to the operation of the DAEC or the DAEC ISFSI was detected by environmental TLDs in 2013. The calculated doses are below the regulatory limits stated in Appendix I to 10CFR50, 40CFR190 and 10 CFR 72.104.

Estimated Maximum Offsite Individual Doses for 2014

Type	Age Group	Distance (meters)	Direction	Dose or Dose Equivalent (mrem)	Annual 10 CFR 50, Appendix I "Limit"
Direct Radiation (as measured by TLDs)				None	*
Liquid Releases					
Whole Body Dose	Child		S	0.000000 mrem	3 mrem
Organ Dose	Child - Liver		S	0.000000 mrem	10 mrem
Noble Gas					
Gamma Air Dose		588	SE	0.0000940 mrad	10 mrad
Beta Air Dose		2416	SE	0.0000285mrad	20 mrad
Whole Body	All	1620	NNW	0.000150 mrem	5 mrem
Skin	Child	1620	NNW	0.000150 mrem	15 mrem
Particulates & Iodines					
Organ Dose	Child - Lungs	2450	ESE	0.00658 mrem	15 mrem
Carbon 14					
Organ Dose	Child - Bone	2500	ENE	0.071 mrem	15 mrem

* There is no Appendix I limit for direct radiation. It is listed here to demonstrate compliance with 40 CFR 190 limits of 25 mrem whole body and 75 mrem thyroid.



DUANE ARNOLD ENERGY CENTER
CEDAR RAPIDS, IOWA
Docket No. 50-331

RADIOLOGICAL ENVIRONMENTAL
MONITORING PROGRAM (REMP)

ANNUAL REPORT - PART II
DATA TABULATIONS AND ANALYSES

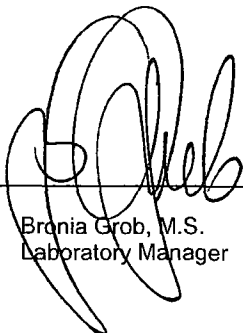
January 1 to December 31, 2014

Prepared by

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Project No. 8001

Reviewed and
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	List of Tables	iii
1.0	INTRODUCTION	iv
2.0	PROGRAM DEVIATIONS.....	v
3.0	DATA TABLES.....	vi

LIST OF TABLES

<u>No.</u>	<u>Title</u>	<u>Page</u>
1	Airborne particulates and iodine, Location D-3, analyses for gross beta and iodine-131.....	1-1
2	Airborne particulates and iodine, Location D-5, analyses for gross beta and iodine-131.....	2-1
3	Airborne particulates and iodine, Location D-6, analyses for gross beta and iodine-131.....	3-1
4	Airborne particulates and iodine, Location D-7, analyses for gross beta and iodine-131.....	4-1
5	Airborne particulates and iodine, Location D-11, analyses for gross beta and iodine-131.....	5-1
6	Airborne particulates and iodine, Location D-13, analyses for gross beta and iodine-131.....	6-1
7	Airborne particulates and iodine, Location D-15, analyses for gross beta and iodine-131.....	7-1
8	Airborne particulates and iodine, Location D-16, analyses for gross beta and iodine-131.....	8-1
9	Airborne particulates and iodine, Location D-40, analyses for gross beta and iodine-131.....	9-1
10	Airborne particulate composite samples, analysis for gamma-emitting isotopes.....	10-1
11	Ambient gamma radiation by thermoluminescent dosimeters (TLD), quarterly exposure.....	11-1
12	Milk samples, analysis for iodine-131 and gamma emitting isotopes.....	12-1
13	Ground water, Area wells, analysis for gross beta, gamma emitting isotopes and tritium.....	13-1
14	Vegetation samples (broadleaf), analysis for iodine-131 and gamma-emitting isotopes.....	14-1
15	Vegetation samples (hay and grain), analysis for gamma-emitting isotopes.....	15-1
16	Surface water samples, analysis for tritium and gamma-emitting isotopes.....	16-1
17	Surface water composites, analysis for strontium-89 and strontium-90.....	17-1
18	Fish samples, analysis for gamma-emitting isotopes	18-1
19	River sediment samples, analysis for gamma-emitting isotopes.....	19-1

1.0 INTRODUCTION

The following constitutes a supplement to the Annual Report for the Radiological Environmental Monitoring Program conducted at the Duane Arnold Energy Center, Palo, Iowa in 2013. Results of completed analyses are presented in the attached tables.

For information regarding sampling locations, type and frequency of collection, and sample codes, please refer to Part I, Tables 5.3 - 5.5 and Figures 5.1 and 5.2.

All concentrations, except gross beta and airborne iodine, are decay corrected to the time of collection. Airborne I-131 is decayed to the midpoint of the collection period.

The required values for lower limits of detection (LLD) for gamma emitting isotopes are established through the Offsite Dose Assessment Manual (ODAM). Naturally occurring radioisotopes, such as Be-7, K-40 and Ra daughters, are frequently detected, but may not be listed for every sample medium.

2.0 PROGRAM DEVIATIONS

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
SW	H-3/ I-131/ Gamma	D-49	01-22-14	Water frozen.
SW	H-3/ Gamma	D-99	01-22-14	Water frozen.
SW	H-3 / I-131/ Gamma	D-49	02-04-14	Water frozen.
SW	H-3/ Gamma	D-99	02-04-14	Water frozen.
SW	H-3/ Gamma	D-99	12-20-14	Water frozen.
AP/AI	Gross Beta/ I-131	D-13	02-07-14	Low volume due to power outage.
AP/AI	Gross Beta/ I-131	D-13	02-13-14	Low volume due to power outage.
AP/AI	Gross Beta/ I-131	D-15	04-16-14	Low volume due to power outage.
AP/AI	Gross Beta/ I-131	D-15	05-16-14	Low volume due to power outage.
AP/AI	Gross Beta/ I-131	D-15	07-11-14	Low volume due to power outage.
AP/AI	Gross Beta/ I-131	D-13	07-17-14	Power off to sampler.
AP/AI	Gross Beta/ I-131	D-13	07-24-14	Power off to sampler.
TLD	Ambient Gamma	D-17	4 th Qtr 2014	TLD missing in the field, TLD replaced.
G	Gamma	D-58	2014	Vegetation not readily available.
G	Gamma	D-72	2014	Vegetation not readily available.
G	Gamma	D-138	2014	Vegetation not readily available.

In no instance did missed analyses affect minimum sampling requirements as specified in the ODAM.

3.0 DATA TABLES

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

Location: D-3 (Hiawatha)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	204	0.042 ± 0.005	07-11-14	311	0.025 ± 0.003
01-17-14	376	0.033 ± 0.003	07-17-14	240	0.020 ± 0.004
01-24-14	290	0.023 ± 0.003	07-24-14	277	0.032 ± 0.004
02-01-14	331	0.022 ± 0.003	08-01-14	317	0.026 ± 0.004
02-07-14	251	0.029 ± 0.004	08-09-14	316	0.040 ± 0.004
02-13-14	248	0.041 ± 0.005	08-14-14	200	0.027 ± 0.005
02-19-14	250	0.042 ± 0.005	08-22-14	313	0.041 ± 0.004
02-27-14	329	0.039 ± 0.004	08-27-14	199	0.022 ± 0.005
03-07-14	334	0.033 ± 0.004	09-06-14	390	0.024 ± 0.003
03-14-14	290	0.031 ± 0.004	09-11-14	177	0.025 ± 0.005
03-22-14	331	0.017 ± 0.003	09-19-14	236	0.035 ± 0.005
03-28-14	238	0.029 ± 0.004	09-27-14	297	0.036 ± 0.004
04-03-14	237	0.032 ± 0.004	10-02-14	196	0.042 ± 0.005
1st Quarter Mean ± s.d.		0.032 ± 0.008	3rd Quarter Mean ± s.d.		0.030 ± 0.008
04-11-14	320	0.021 ± 0.003	10-09-14	268	0.022 ± 0.004
04-16-14	193	0.022 ± 0.005	10-17-14	308	0.018 ± 0.003
04-23-14	277	0.027 ± 0.004	10-23-14	225	0.022 ± 0.004
05-01-14	315	0.014 ± 0.003	10-30-14	258	0.031 ± 0.004
05-09-14	316	0.015 ± 0.003	11-07-14	236	0.025 ± 0.004
05-16-14	278	0.017 ± 0.003	11-13-14	236	0.017 ± 0.004
05-22-14	239	0.027 ± 0.004	11-21-14	307	0.028 ± 0.003
05-30-14	316	0.020 ± 0.003	11-28-14	268	0.031 ± 0.004
06-04-14	198	0.020 ± 0.005	12-04-14	232	0.041 ± 0.005
06-13-14	353	0.023 ± 0.003	12-12-14	306	0.060 ± 0.005
06-19-14	244	0.020 ± 0.004	12-17-14	191	0.051 ± 0.006
06-26-14	277	0.018 ± 0.003	12-26-14	360	0.029 ± 0.003
07-03-14	270	0.016 ± 0.003	01-02-15	274	0.033 ± 0.004
2nd Quarter Mean ± s.d.		0.020 ± 0.004	4th Quarter Mean ± s.d.		0.031 ± 0.013
Cumulative Average					0.028

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-5 (Palo)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	203	0.042 ± 0.005	07-11-14	328	0.024 ± 0.003
01-17-14	369	0.027 ± 0.003	07-17-14	251	0.024 ± 0.004
01-24-14	285	0.023 ± 0.003	07-24-14	290	0.032 ± 0.004
02-01-14	325	0.024 ± 0.003	08-01-14	336	0.026 ± 0.003
02-07-14	246	0.031 ± 0.004	08-09-14	333	0.045 ± 0.004
02-13-14	244	0.039 ± 0.005	08-14-14	209	0.009 ± 0.004
02-19-14	245	0.035 ± 0.005	08-22-14	329	0.037 ± 0.004
02-27-14	328	0.033 ± 0.004	08-27-14	210	0.023 ± 0.005
03-07-14	323	0.036 ± 0.004	09-06-14	412	0.020 ± 0.003
03-14-14	285	0.033 ± 0.004	09-11-14	208	0.022 ± 0.004
03-22-14	324	0.021 ± 0.003	09-19-14	333	0.020 ± 0.003
03-28-14	243	0.029 ± 0.004	09-27-14	322	0.032 ± 0.004
04-03-14	250	0.020 ± 0.004	10-02-14	202	0.046 ± 0.006
1st Quarter Mean ± s.d.		<u>0.030 ± 0.007</u>	3rd Quarter Mean ± s.d.		<u>0.028 ± 0.010</u>
04-11-14	318	0.022 ± 0.003	10-09-14	277	0.018 ± 0.003
04-16-14	201	0.021 ± 0.005	10-17-14	335	0.022 ± 0.003
04-23-14	283	0.025 ± 0.004	10-23-14	253	0.020 ± 0.004
05-01-14	322	0.011 ± 0.003	10-30-14	299	0.029 ± 0.004
05-09-14	323	0.016 ± 0.003	11-07-14	343	0.020 ± 0.003
05-16-14	283	0.014 ± 0.003	11-13-14	267	0.017 ± 0.003
05-22-14	242	0.025 ± 0.004	11-21-14	351	0.022 ± 0.003
05-30-14	325	0.022 ± 0.003	11-28-14	315	0.024 ± 0.003
06-04-14	200	0.018 ± 0.005	12-04-14	238	0.043 ± 0.005
06-13-14	360	0.018 ± 0.003	12-12-14	360	0.042 ± 0.004
06-19-14	248	0.020 ± 0.004	12-17-14	234	0.043 ± 0.005
06-26-14	291	0.021 ± 0.004	12-26-14	366	0.031 ± 0.003
07-03-14	252	0.017 ± 0.004	01-02-15	282	0.037 ± 0.004
2nd Quarter Mean ± s.d.		<u>0.019 ± 0.004</u>	4th Quarter Mean ± s.d.		<u>0.028 ± 0.010</u>
Cumulative Average					0.026

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 3. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-6 (Center Point)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	197	0.046 ± 0.006	07-11-14	317	0.022 ± 0.003
01-17-14	357	0.034 ± 0.003	07-17-14	238	0.023 ± 0.004
01-24-14	276	0.032 ± 0.004	07-24-14	278	0.033 ± 0.004
02-01-14	319	0.019 ± 0.003	08-01-14	323	0.026 ± 0.004
02-07-14	241	0.033 ± 0.005	08-09-14	321	0.041 ± 0.004
02-13-14	238	0.033 ± 0.004	08-14-14	200	0.033 ± 0.005
02-19-14	240	0.040 ± 0.005	08-22-14	316	0.040 ± 0.004
02-27-14	317	0.043 ± 0.004	08-27-14	201	0.022 ± 0.005
03-07-14	321	0.035 ± 0.004	09-06-14	397	0.025 ± 0.003
03-14-14	280	0.029 ± 0.004	09-11-14	201	0.024 ± 0.005
03-22-14	318	0.019 ± 0.003	09-19-14	323	0.027 ± 0.003
03-28-14	240	0.019 ± 0.004	09-27-14	323	0.028 ± 0.003
04-03-14	246	0.033 ± 0.004	10-02-14	197	0.041 ± 0.005
<u>1st Quarter Mean ± s.d.</u>		<u>0.032 ± 0.009</u>	<u>3rd Quarter Mean ± s.d.</u>		<u>0.029 ± 0.007</u>
04-11-14	317	0.022 ± 0.003	10-09-14	279	0.015 ± 0.003
04-16-14	199	0.021 ± 0.005	10-17-14	320	0.017 ± 0.003
04-23-14	280	0.027 ± 0.004	10-23-14	240	0.019 ± 0.004
05-01-14	325	0.011 ± 0.003	10-30-14	278	0.028 ± 0.004
05-09-14	326	0.017 ± 0.003	11-07-14	318	0.018 ± 0.003
05-16-14	286	0.016 ± 0.003	11-13-14	244	0.020 ± 0.004
05-22-14	245	0.026 ± 0.004	11-21-14	318	0.030 ± 0.003
05-30-14	328	0.023 ± 0.003	11-28-14	284	0.035 ± 0.004
06-04-14	203	0.021 ± 0.005	12-04-14	248	0.039 ± 0.005
06-13-14	356	0.021 ± 0.003	12-12-14	328	0.044 ± 0.004
06-19-14	246	0.022 ± 0.004	12-17-14	209	0.042 ± 0.005
06-26-14	280	0.020 ± 0.004	12-26-14	390	0.027 ± 0.003
07-03-14	280	0.010 ± 0.003	01-02-15	300	0.032 ± 0.004
<u>2nd Quarter Mean ± s.d.</u>		<u>0.020 ± 0.005</u>	<u>4th Quarter Mean ± s.d.</u>		<u>0.028 ± 0.010</u>
<u>Cumulative Average</u>					<u>0.027</u>

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 4. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-7 (Shellsburg)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	203	0.043 ± 0.005	07-11-14	343	0.021 ± 0.003
01-17-14	369	0.034 ± 0.003	07-17-14	257	0.020 ± 0.004
01-24-14	284	0.024 ± 0.004	07-24-14	299	0.025 ± 0.004
02-01-14	325	0.024 ± 0.003	08-01-14	345	0.023 ± 0.003
02-07-14	246	0.034 ± 0.005	08-09-14	340	0.034 ± 0.004
02-13-14	244	0.036 ± 0.004	08-14-14	197	0.030 ± 0.005
02-19-14	245	0.035 ± 0.005	08-22-14	307	0.017 ± 0.003
02-27-14	328	0.017 ± 0.003	08-27-14	195	0.018 ± 0.005
03-07-14	333	0.033 ± 0.004	09-06-14	383	0.010 ± 0.002
03-14-14	294	0.027 ± 0.004	09-11-14	196	0.022 ± 0.005
03-22-14	334	0.017 ± 0.003	09-19-14	315	0.022 ± 0.003
03-28-14	253	0.028 ± 0.004	09-27-14	313	0.025 ± 0.003
04-03-14	259	0.033 ± 0.004	10-02-14	191	0.037 ± 0.005
1st Quarter Mean ± s.d.		0.030 ± 0.008	3rd Quarter Mean ± s.d.		0.024 ± 0.007
04-11-14	327	0.020 ± 0.003	10-09-14	268	0.017 ± 0.003
04-16-14	209	0.022 ± 0.005	10-17-14	310	0.015 ± 0.003
04-23-14	294	0.024 ± 0.004	10-23-14	232	0.019 ± 0.004
05-01-14	335	0.012 ± 0.003	10-30-14	271	0.022 ± 0.004
05-09-14	342	0.018 ± 0.003	11-07-14	308	0.013 ± 0.003
05-16-14	300	0.014 ± 0.003	11-13-14	246	0.013 ± 0.003
05-22-14	257	0.024 ± 0.004	11-21-14	327	0.026 ± 0.003
05-30-14	344	0.021 ± 0.003	11-28-14	298	0.027 ± 0.003
06-04-14	214	0.020 ± 0.004	12-04-14	258	0.036 ± 0.004
06-13-14	385	0.010 ± 0.002	12-12-14	344	0.048 ± 0.004
06-19-14	264	0.019 ± 0.004	12-17-14	224	0.032 ± 0.005
06-26-14	255	0.023 ± 0.004	12-26-14	406	0.011 ± 0.002
07-03-14	285	0.015 ± 0.003	01-02-15	311	0.029 ± 0.003
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.024 ± 0.011
Cumulative Average					0.024

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 5. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-11 (Toddville)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	197	0.044 ± 0.006	07-11-14	320	0.019 ± 0.003
01-17-14	358	0.038 ± 0.004	07-17-14	243	0.019 ± 0.004
01-24-14	276	0.025 ± 0.004	07-24-14	280	0.028 ± 0.004
02-01-14	315	0.023 ± 0.003	08-01-14	326	0.022 ± 0.003
02-07-14	239	0.033 ± 0.005	08-09-14	322	0.036 ± 0.004
02-13-14	236	0.035 ± 0.005	08-14-14	202	0.025 ± 0.005
02-19-14	238	0.021 ± 0.004	08-22-14	316	0.037 ± 0.004
02-27-14	338	0.038 ± 0.004	08-27-14	200	0.021 ± 0.005
03-07-14	344	0.030 ± 0.003	09-06-14	394	0.019 ± 0.003
03-14-14	300	0.029 ± 0.004	09-11-14	204	0.023 ± 0.005
03-22-14	340	0.017 ± 0.003	09-19-14	315	0.030 ± 0.004
03-28-14	257	0.027 ± 0.004	09-27-14	323	0.032 ± 0.004
04-03-14	261	0.028 ± 0.004	10-02-14	197	0.036 ± 0.005
1st Quarter Mean ± s.d.		<u>0.030 ± 0.008</u>	3rd Quarter Mean ± s.d.		<u>0.027 ± 0.007</u>
04-11-14	342	0.020 ± 0.003	10-09-14	281	0.020 ± 0.003
04-16-14	208	0.012 ± 0.004	10-17-14	320	0.013 ± 0.003
04-23-14	300	0.020 ± 0.003	10-23-14	240	0.016 ± 0.003
05-01-14	341	0.013 ± 0.003	10-30-14	278	0.027 ± 0.004
05-09-14	342	0.016 ± 0.003	11-07-14	318	0.021 ± 0.003
05-16-14	283	0.015 ± 0.003	11-13-14	244	0.016 ± 0.004
05-22-14	242	0.014 ± 0.004	11-21-14	322	0.027 ± 0.003
05-30-14	325	0.017 ± 0.003	11-28-14	292	0.027 ± 0.004
06-04-14	202	0.019 ± 0.005	12-04-14	252	0.038 ± 0.004
06-13-14	361	0.019 ± 0.003	12-12-14	332	0.037 ± 0.004
06-19-14	248	0.022 ± 0.004	12-17-14	211	0.043 ± 0.005
06-26-14	283	0.017 ± 0.003	12-26-14	391	0.027 ± 0.003
07-03-14	244	0.014 ± 0.004	01-02-15	302	0.036 ± 0.004
2nd Quarter Mean ± s.d.		<u>0.017 ± 0.003</u>	4th Quarter Mean ± s.d.		<u>0.027 ± 0.010</u>
Cumulative Average					0.025

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 6. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-13 (Alburnett)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	216	0.046 ± 0.005	07-11-14	79	0.011 ± 0.009 ^c
01-17-14	376	0.035 ± 0.003	07-17-14		ND ^d
01-24-14	290	0.025 ± 0.004	07-24-14		ND ^d
02-01-14	315	0.017 ± 0.003	08-01-14	312	0.023 ± 0.003
02-07-14	165	0.042 ± 0.006 ^b	08-09-14	317	0.036 ± 0.004
02-13-14	214	0.037 ± 0.005 ^b	08-14-14	191	0.025 ± 0.005
02-19-14	242	0.033 ± 0.005	08-22-14	306	0.033 ± 0.004
02-27-14	317	0.034 ± 0.004	08-27-14	184	0.024 ± 0.005
03-07-14	312	0.030 ± 0.004	09-06-14	329	0.027 ± 0.003
03-14-14	283	0.030 ± 0.004	09-11-14	124	0.035 ± 0.007
03-22-14	326	0.017 ± 0.003	09-19-14	247	0.032 ± 0.004
03-28-14	247	0.028 ± 0.004	09-27-14	316	0.028 ± 0.003
04-03-14	251	0.030 ± 0.004	10-02-14	197	0.034 ± 0.005
1st Quarter Mean ± s.d.		0.031 ± 0.008	3rd Quarter Mean ± s.d.		0.028 ± 0.007
04-11-14	328	0.022 ± 0.003	10-09-14	280	0.016 ± 0.003
04-16-14	205	0.017 ± 0.004	10-17-14	319	0.015 ± 0.003
04-23-14	289	0.019 ± 0.003	10-23-14	240	0.020 ± 0.004
05-01-14	328	0.011 ± 0.003	10-30-14	278	0.023 ± 0.004
05-09-14	329	0.015 ± 0.003	11-07-14	318	0.018 ± 0.003
05-16-14	278	0.013 ± 0.003	11-13-14	249	0.012 ± 0.003
05-22-14	237	0.019 ± 0.004	11-21-14	203	0.042 ± 0.005
05-30-14	318	0.019 ± 0.003	11-28-14	285	0.021 ± 0.003
06-04-14	198	0.019 ± 0.005	12-04-14	339	0.024 ± 0.003
06-13-14	352	0.017 ± 0.003	12-12-14	257	0.064 ± 0.005
06-19-14	244	0.019 ± 0.004	12-17-14	304	0.015 ± 0.003
06-26-14	274	0.022 ± 0.004	12-26-14	350	0.025 ± 0.003
07-03-14	277	0.016 ± 0.003	01-02-15	273	0.037 ± 0.004
2nd Quarter Mean ± s.d.		0.017 ± 0.003	4th Quarter Mean ± s.d.		0.026 ± 0.014
Cumulative Average					0.025

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

^b Low volume due to possible power outage.

^c Low volume due to power outage from storms; Iodine-131 concentration < 0.034 pCi/m³ due to low volume.

^d "ND" = No data; see Table 2.0, Listing of Missed Samples.

Table 7. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-15 (On-site, north)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	198	0.047 ± 0.006	07-11-14	310	0.017 ± 0.003
01-17-14	344	0.037 ± 0.004	07-17-14	241	0.002 ± 0.003
01-24-14	272	0.029 ± 0.004	07-24-14	275	0.025 ± 0.004
02-01-14	308	0.022 ± 0.003	08-01-14	319	0.024 ± 0.003
02-07-14	234	0.032 ± 0.005	08-09-14	314	0.040 ± 0.004
02-13-14	238	0.034 ± 0.004	08-14-14	199	0.029 ± 0.005
02-19-14	226	0.043 ± 0.005	08-22-14	311	0.025 ± 0.004
02-27-14	340	0.036 ± 0.004	08-27-14	198	0.029 ± 0.005
03-07-14	334	0.029 ± 0.003	09-06-14	392	0.020 ± 0.003
03-14-14	291	0.032 ± 0.004	09-11-14	193	0.020 ± 0.005
03-22-14	333	0.021 ± 0.003	09-19-14	314	0.028 ± 0.004
03-28-14	257	0.028 ± 0.004	09-27-14	315	0.030 ± 0.003
04-03-14	259	0.027 ± 0.004	10-02-14	202	0.034 ± 0.005
1st Quarter Mean ± s.d.		0.032 ± 0.008	3rd Quarter Mean ± s.d.		0.025 ± 0.009
04-11-14	325	0.023 ± 0.003	10-09-14	265	0.015 ± 0.003
04-16-14	140	0.024 ± 0.006 ^b	10-17-14	314	0.016 ± 0.003
04-23-14	293	0.027 ± 0.004	10-23-14	235	0.018 ± 0.004
05-01-14	344	0.011 ± 0.002	10-30-14	282	0.022 ± 0.003
05-09-14	333	0.015 ± 0.003	11-07-14	314	0.018 ± 0.003
05-16-14	103	0.025 ± 0.008 ^c	11-13-14	240	0.016 ± 0.004
05-22-14	232	0.021 ± 0.004	11-21-14	322	0.021 ± 0.003
05-30-14	319	0.019 ± 0.003	11-28-14	279	0.036 ± 0.004
06-04-14	195	0.020 ± 0.005	12-04-14	253	0.043 ± 0.005
06-13-14	263	0.018 ± 0.004	12-12-14	319	0.058 ± 0.004
06-19-14	244	0.006 ± 0.003 ^d	12-17-14	198	0.045 ± 0.006
06-26-14	277	0.015 ± 0.003	12-26-14	360	0.035 ± 0.003
07-03-14	138	0.019 ± 0.006 ^e	01-02-15	280	0.037 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.029 ± 0.014
Cumulative Average					0.026

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

^b Low volume due to power outage.

^c Low volume due to power outage; Iodine-131 concentration < 0.037 pCi/m³ due to low volume.

^d Filter light.

^e Low volume due to ground fault trip; Iodine-131 concentration < 0.031 pCi/m³ due to low volume.

^f Filter light.

Table 8. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-16 (On-site)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	202	0.048 ± 0.006	07-11-14	320	0.025 ± 0.003
01-17-14	348	0.039 ± 0.004	07-17-14	248	0.019 ± 0.004
01-24-14	273	0.031 ± 0.004	07-24-14	285	0.033 ± 0.004
02-01-14	332	0.017 ± 0.003	08-01-14	311	0.026 ± 0.004
02-07-14	251	0.032 ± 0.004	08-09-14	309	0.043 ± 0.004
02-13-14	256	0.038 ± 0.004	08-14-14	197	0.030 ± 0.005
02-19-14	249	0.037 ± 0.005	08-22-14	306	0.038 ± 0.004
02-27-14	332	0.039 ± 0.004	08-27-14	196	0.023 ± 0.005
03-07-14	330	0.035 ± 0.004	09-06-14	388	0.010 ± 0.002
03-14-14	287	0.027 ± 0.004	09-11-14	191	0.026 ± 0.005
03-22-14	330	0.021 ± 0.003	09-19-14	312	0.025 ± 0.003
03-28-14	255	0.030 ± 0.004	09-27-14	312	0.036 ± 0.004
04-03-14	255	0.029 ± 0.004	10-02-14	201	0.042 ± 0.005
1st Quarter Mean ± s.d.		0.033 ± 0.008	3rd Quarter Mean ± s.d.		0.029 ± 0.009
04-11-14	325	0.022 ± 0.003	10-09-14	262	0.017 ± 0.003
04-16-14	208	0.008 ± 0.004	10-17-14	310	0.017 ± 0.003
04-23-14	291	0.024 ± 0.004	10-23-14	232	0.018 ± 0.004
05-01-14	334	0.007 ± 0.002	10-30-14	290	0.029 ± 0.004
05-09-14	323	0.019 ± 0.003	11-07-14	318	0.020 ± 0.003
05-16-14	285	0.015 ± 0.003	11-13-14	239	0.016 ± 0.004
05-22-14	240	0.024 ± 0.004	11-21-14	320	0.033 ± 0.004
05-30-14	328	0.021 ± 0.003	11-28-14	275	0.024 ± 0.004
06-04-14	202	0.021 ± 0.005	12-04-14	250	0.037 ± 0.004
06-13-14	367	0.020 ± 0.003	12-12-14	315	0.057 ± 0.005
06-19-14	249	0.018 ± 0.004	12-17-14	198	0.045 ± 0.006
06-26-14	285	0.020 ± 0.004	12-26-14	356	0.027 ± 0.003
07-03-14	285	0.013 ± 0.003	01-02-15	277	0.042 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.006	4th Quarter Mean ± s.d.		0.029 ± 0.013
			Cumulative Average		0.027

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

Table 9. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: D-40

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	193	0.047 ± 0.006	07-11-14	317	0.021 ± 0.003
01-17-14	369	0.030 ± 0.003	07-17-14	239	0.018 ± 0.004
01-24-14	284	0.022 ± 0.003	07-24-14	272	0.024 ± 0.004
02-01-14	325	0.024 ± 0.003	08-01-14	317	0.021 ± 0.003
02-07-14	247	0.024 ± 0.004	08-09-14	324	0.035 ± 0.004
02-13-14	242	0.037 ± 0.005	08-14-14	202	0.026 ± 0.005
02-19-14	246	0.041 ± 0.005	08-22-14	306	0.036 ± 0.004
02-27-14	352	0.032 ± 0.004	08-27-14	195	0.023 ± 0.005
03-07-14	326	0.037 ± 0.004	09-06-14	381	0.024 ± 0.003
03-14-14	288	0.008 ± 0.003 ^b	09-11-14	199	0.021 ± 0.005
03-22-14	353	0.015 ± 0.003	09-19-14	312	0.027 ± 0.004
03-28-14	215	0.033 ± 0.005	09-27-14	308	0.034 ± 0.004
04-03-14	247	0.029 ± 0.004	10-02-14	195	0.034 ± 0.005
1st Quarter Mean ± s.d.		0.029 ± 0.011	3rd Quarter Mean ± s.d.		0.027 ± 0.006
04-11-14	327	0.023 ± 0.003	10-09-14	270	0.008 ± 0.003 ^b
04-16-14	200	0.021 ± 0.005	10-17-14	314	0.017 ± 0.003
04-23-14	285	0.024 ± 0.004	10-23-14	232	0.021 ± 0.004
05-01-14	329	0.012 ± 0.003	10-30-14	272	0.031 ± 0.004
05-09-14	322	0.016 ± 0.003	11-07-14	305	0.025 ± 0.003
05-16-14	286	0.015 ± 0.003	11-13-14	239	0.022 ± 0.004
05-22-14	236	0.026 ± 0.004	11-21-14	327	0.027 ± 0.003
05-30-14	318	0.023 ± 0.003	11-28-14	293	0.034 ± 0.004
06-04-14	199	0.011 ± 0.004	12-04-14	249	0.037 ± 0.004
06-13-14	353	0.022 ± 0.003	12-12-14	325	0.056 ± 0.004
06-19-14	244	0.022 ± 0.004	12-17-14	204	0.042 ± 0.005
06-26-14	275	0.015 ± 0.003	12-26-14	372	0.032 ± 0.003
07-03-14	237	0.012 ± 0.004	01-02-15	284	0.041 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.005	4th Quarter Mean ± s.d.		0.030 ± 0.012
Cumulative Average					0.026

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless noted otherwise.

^b Filter light.

Table 10. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite

Units: pCi/m³

Location		D-3			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Lab Code	DAP- 1799	DAP- 3693	DAP- 5989	DAP- 7430	
Volume (m ³)	3710	3595	3468	3469	
Be-7	0.050 ± 0.013	0.084 ± 0.013	0.075 ± 0.014	0.052 ± 0.014	
Mn-54	< 0.0008	< 0.0007	< 0.0006	< 0.0005	
Fe-59	< 0.0011	< 0.0007	< 0.0014	< 0.0009	
Co-58	< 0.0006	< 0.0007	< 0.0006	< 0.0007	
Co-60	< 0.0006	< 0.0007	< 0.0006	< 0.0007	
Zn-65	< 0.0013	< 0.0006	< 0.0018	< 0.0013	
Nb-95	< 0.0011	< 0.0010	< 0.0008	< 0.0007	
Zr-95	< 0.0013	< 0.0018	< 0.0015	< 0.0002	
Ru-103	< 0.0007	< 0.0008	< 0.0008	< 0.0005	
Ru-106	< 0.0069	< 0.0054	< 0.0059	< 0.0005	
Cs-134	< 0.0007	< 0.0006	< 0.0007	< 0.0008	
Cs-137	< 0.0005	< 0.0005	< 0.0005	< 0.0004	
Ce-141	< 0.0018	< 0.0011	< 0.0015	< 0.0002	
Ce-144	< 0.0032	< 0.0040	< 0.0036	< 0.0041	

Location		D-5			
Lab Code	DAP- 1800	DAP- 3694	DAP- 5991	DAP- 7431	
Volume (m ³)	3670	3646	3762	3921	
Be-7	0.063 ± 0.014	0.075 ± 0.015	0.076 ± 0.016	0.052 ± 0.013	
Mn-54	< 0.0006	< 0.0007	< 0.0010	< 0.0009	
Fe-59	< 0.0010	< 0.0012	< 0.0023	< 0.0012	
Co-58	< 0.0008	< 0.0006	< 0.0009	< 0.0005	
Co-60	< 0.0005	< 0.0008	< 0.0007	< 0.0001	
Zn-65	< 0.0009	< 0.0007	< 0.0017	< 0.0007	
Nb-95	< 0.0014	< 0.0011	< 0.0013	< 0.0009	
Zr-95	< 0.0014	< 0.0013	< 0.0018	< 0.0013	
Ru-103	< 0.0013	< 0.0006	< 0.0013	< 0.0004	
Ru-106	< 0.0102	< 0.0049	< 0.0072	< 0.0053	
Cs-134	< 0.0009	< 0.0007	< 0.0010	< 0.0006	
Cs-137	< 0.0010	< 0.0008	< 0.0008	< 0.0007	
Ce-141	< 0.0020	< 0.0013	< 0.0018	< 0.0013	
Ce-144	< 0.0056	< 0.0036	< 0.0054	< 0.0013	

Location		D-6			
Lab Code	DAP- 1801	DAP- 3695	DAP- 5992	DAP- 7432	
Volume (m ³)	3590	3670	3636	3756	
Be-7	0.055 ± 0.015	0.073 ± 0.012	0.064 ± 0.014	0.048 ± 0.016	
Mn-54	< 0.0009	< 0.0009	< 0.0008	< 0.0005	
Fe-59	< 0.0022	< 0.0015	< 0.0014	< 0.0012	
Co-58	< 0.0009	< 0.0007	< 0.0006	< 0.0004	
Co-60	< 0.0007	< 0.0008	< 0.0003	< 0.0007	
Zn-65	< 0.0009	< 0.0010	< 0.0006	< 0.0009	
Nb-95	< 0.0015	< 0.0015	< 0.0015	< 0.0008	
Zr-95	< 0.0012	< 0.0014	< 0.0013	< 0.0013	
Ru-103	< 0.0019	< 0.0013	< 0.0009	< 0.0001	
Ru-106	< 0.0103	< 0.0060	< 0.0062	< 0.0057	
Cs-134	< 0.0011	< 0.0009	< 0.0007	< 0.0007	
Cs-137	< 0.0009	< 0.0006	< 0.0009	< 0.0004	
Ce-141	< 0.0025	< 0.0023	< 0.0020	< 0.0015	
Ce-144	< 0.0069	< 0.0046	< 0.0038	< 0.0028	

Table 10. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite

Units: pCi/m³

Location		D-7			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Lab Code	DAP- 1802	DAP- 3696	DAP- 5993	DAP- 7433	
Volume (m ³)	3717	3810	3681	3802	
Be-7	0.056 ± 0.017	0.063 ± 0.011	0.065 ± 0.012	0.044 ± 0.015	
Mn-54	< 0.0008	< 0.0004	< 0.0004	< 0.0006	
Fe-59	< 0.0019	< 0.0009	< 0.0009	< 0.0008	
Co-58	< 0.0007	< 0.0005	< 0.0004	< 0.0008	
Co-60	< 0.0010	< 0.0006	< 0.0006	< 0.0007	
Zn-65	< 0.0012	< 0.0010	< 0.0007	< 0.0007	
Nb-95	< 0.0012	< 0.0008	< 0.0008	< 0.0014	
Zr-95	< 0.0013	< 0.0009	< 0.0015	< 0.0014	
Ru-103	< 0.0011	< 0.0007	< 0.0009	< 0.0009	
Ru-106	< 0.0091	< 0.0055	< 0.0038	< 0.0074	
Cs-134	< 0.0011	< 0.0006	< 0.0005	< 0.0009	
Cs-137	< 0.0015	< 0.0006	< 0.0006	< 0.0008	
Ce-141	< 0.0022	< 0.0012	< 0.0012	< 0.0013	
Ce-144	< 0.0059	< 0.0022	< 0.0027	< 0.0049	

Location		D-11			
Lab Code	DAP- 1803	DAP- 3697	DAP- 5994	DAP- 7434	
Volume (m ³)	3699	3721	3642	3782	
Be-7	0.064 ± 0.013	0.066 ± 0.013	0.067 ± 0.016	0.046 ± 0.011	
Mn-54	< 0.0006	< 0.0008	< 0.0009	< 0.0004	
Fe-59	< 0.0011	< 0.0006	< 0.0013	< 0.0011	
Co-58	< 0.0008	< 0.0006	< 0.0008	< 0.0011	
Co-60	< 0.0005	< 0.0004	< 0.0008	< 0.0003	
Zn-65	< 0.0011	< 0.0008	< 0.0012	< 0.0017	
Nb-95	< 0.0007	< 0.0012	< 0.0015	< 0.0014	
Zr-95	< 0.0013	< 0.0013	< 0.0011	< 0.0017	
Ru-103	< 0.0008	< 0.0008	< 0.0010	< 0.0007	
Ru-106	< 0.0070	< 0.0074	< 0.0070	< 0.0048	
Cs-134	< 0.0008	< 0.0008	< 0.0009	< 0.0009	
Cs-137	< 0.0004	< 0.0006	< 0.0009	< 0.0008	
Ce-141	< 0.0013	< 0.0018	< 0.0018	< 0.0013	
Ce-144	< 0.0031	< 0.0048	< 0.0053	< 0.0051	

Location		D-13			
Lab Code	DAP- 1804	DAP- 3698	DAP- 5995	DAP- 7435	
Volume (m ³)	3555	3655	2602	3695	
Be-7	0.055 ± 0.016	0.068 ± 0.015	0.089 ± 0.022	0.040 ± 0.013	
Mn-54	< 0.0008	< 0.0010	< 0.0010	< 0.0008	
Fe-59	< 0.0027	< 0.0008	< 0.0024	< 0.0016	
Co-58	< 0.0010	< 0.0006	< 0.0007	< 0.0005	
Co-60	< 0.0010	< 0.0009	< 0.0006	< 0.0006	
Zn-65	< 0.0012	< 0.0012	< 0.0009	< 0.0011	
Nb-95	< 0.0012	< 0.0010	< 0.0018	< 0.0012	
Zr-95	< 0.0017	< 0.0016	< 0.0019	< 0.0014	
Ru-103	< 0.0016	< 0.0012	< 0.0009	< 0.0011	
Ru-106	< 0.0051	< 0.0078	< 0.0085	< 0.0077	
Cs-134	< 0.0010	< 0.0010	< 0.0011	< 0.0012	
Cs-137	< 0.0008	< 0.0009	< 0.0008	< 0.0006	
Ce-141	< 0.0028	< 0.0013	< 0.0025	< 0.0016	
Ce-144	< 0.0064	< 0.0057	< 0.0069	< 0.0051	

Table 10. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite

Units: pCi/m³

Location					D-15				
Quarter	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		
Lab Code	DAP- 1806		DAP- 3699		DAP- 5996		DAP- 7436		
Volume (m ³)	3635		3206		3583		3661		
Be-7	0.068 ± 0.016		0.068 ± 0.016		0.062 ± 0.016		0.038 ± 0.011		
Mn-54	< 0.0004		< 0.0008		< 0.0008		< 0.0007		
Fe-59	< 0.0018		< 0.0021		< 0.0012		< 0.0009		
Co-58	< 0.0003		< 0.0008		< 0.0004		< 0.0006		
Co-60	< 0.0009		< 0.0012		< 0.0009		< 0.0008		
Zn-65	< 0.0014		< 0.0008		< 0.0009		< 0.0007		
Nb-95	< 0.0013		< 0.0011		< 0.0005		< 0.0012		
Zr-95	< 0.0012		< 0.0016		< 0.0011		< 0.0014		
Ru-103	< 0.0015		< 0.0015		< 0.0010		< 0.0004		
Ru-106	< 0.0089		< 0.0057		< 0.0068		< 0.0053		
Cs-134	< 0.0007		< 0.0010		< 0.0007		< 0.0007		
Cs-137	< 0.0007		< 0.0006		< 0.0010		< 0.0006		
Ce-141	< 0.0015		< 0.0020		< 0.0012		< 0.0011		
Ce-144	< 0.0053		< 0.0030		< 0.0050		< 0.0044		

Location					D-16				
Lab Code	DAP- 1807		DAP- 3701		DAP- 5997		DAP- 7437		
Volume (m ³)	3700		3721		3575		3642		
Be-7	0.062 ± 0.018		0.079 ± 0.018		0.062 ± 0.014		0.056 ± 0.015		
Mn-54	< 0.0008		< 0.0011		< 0.0009		< 0.0011		
Fe-59	< 0.0014		< 0.0016		< 0.0019		< 0.0019		
Co-58	< 0.0006		< 0.0007		< 0.0006		< 0.0008		
Co-60	< 0.0004		< 0.0008		< 0.0010		< 0.0005		
Zn-65	< 0.0011		< 0.0011		< 0.0012		< 0.0008		
Nb-95	< 0.0012		< 0.0009		< 0.0006		< 0.0007		
Zr-95	< 0.0013		< 0.0013		< 0.0010		< 0.0012		
Ru-103	< 0.0008		< 0.0007		< 0.0014		< 0.0007		
Ru-106	< 0.0065		< 0.0038		< 0.0043		< 0.0098		
Cs-134	< 0.0009		< 0.0010		< 0.0010		< 0.0010		
Cs-137	< 0.0003		< 0.0008		< 0.0005		< 0.0006		
Ce-141	< 0.0014		< 0.0018		< 0.0014		< 0.0016		
Ce-144	< 0.0050		< 0.0058		< 0.0049		< 0.0045		

Location					D-40				
Lab Code	DAP- 1808		DAP- 3702		DAP- 5998		DAP- 7438		
Volume (m ³)	3686		3611		3568		3686		
Be-7	0.059 ± 0.016		0.075 ± 0.017		0.080 ± 0.017		0.040 ± 0.013		
Mn-54	< 0.0008		< 0.0008		< 0.0009		< 0.0006		
Fe-59	< 0.0010		< 0.0016		< 0.0015		< 0.0015		
Co-58	< 0.0005		< 0.0003		< 0.0006		< 0.0006		
Co-60	< 0.0004		< 0.0008		< 0.0004		< 0.0007		
Zn-65	< 0.0007		< 0.0007		< 0.0006		< 0.0014		
Nb-95	< 0.0004		< 0.0010		< 0.0010		< 0.0006		
Zr-95	< 0.0011		< 0.0011		< 0.0017		< 0.0016		
Ru-103	< 0.0009		< 0.0012		< 0.0013		< 0.0011		
Ru-106	< 0.0047		< 0.0031		< 0.0074		< 0.0069		
Cs-134	< 0.0008		< 0.0008		< 0.0008		< 0.0008		
Cs-137	< 0.0006		< 0.0011		< 0.0009		< 0.0010		
Ce-141	< 0.0013		< 0.0017		< 0.0021		< 0.0015		
Ce-144	< 0.0037		< 0.0030		< 0.0047		< 0.0056		

Table 11. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD).
 Quarterly collection. Units: mR/91 days

<u>Control Locations</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
D-1	16.4 ± 0.9	12.7 ± 1.6	14.7 ± 0.9	16.8 ± 1.3
D-2	14.0 ± 0.9	10.8 ± 1.1	13.0 ± 0.9	14.6 ± 1.2
D-3	15.5 ± 1.4	10.5 ± 0.9	17.4 ± 1.0	13.7 ± 0.6
D-5	13.4 ± 0.8	14.6 ± 1.5	12.9 ± 1.1	18.9 ± 1.5
D-6	13.6 ± 0.7	14.8 ± 1.3	13.7 ± 0.9	18.3 ± 0.9
D-7	12.6 ± 0.7	12.4 ± 1.1	13.6 ± 0.7	16.3 ± 0.9
D-8	17.9 ± 0.9	14.3 ± 1.4	18.2 ± 1.0	17.6 ± 1.6
D-10	17.7 ± 1.0	11.7 ± 1.3	15.8 ± 0.9	16.0 ± 0.9
D-11	13.0 ± 1.2	12.8 ± 1.8	12.8 ± 1.2	16.2 ± 1.5
D-13	11.4 ± 0.6	13.7 ± 1.1	11.7 ± 0.7	17.5 ± 1.0
Mean ± s.d.	14.6 ± 2.2	12.9 ± 1.5	14.4 ± 2.1	16.6 ± 1.6
<u>Within 0.5 mi. of Stack</u>				
D-15	13.9 ± 1.0	12.2 ± 0.9	13.3 ± 1.1	19.6 ± 0.7
D-16	12.4 ± 0.8	14.3 ± 1.7	12.0 ± 0.8	15.2 ± 1.3
D-17	16.6 ± 0.8	19.7 ± 1.9	19.7 ± 1.0	ND ^a
D-18	14.6 ± 1.2	18.9 ± 1.1	14.8 ± 1.2	21.0 ± 0.9
D-19	14.4 ± 0.8	12.8 ± 1.4	14.8 ± 1.0	14.4 ± 1.1
D-20	14.4 ± 1.0	19.5 ± 2.1	19.1 ± 0.8	18.8 ± 1.9
D-21	18.0 ± 1.2	15.8 ± 1.0	17.8 ± 0.7	16.0 ± 1.0
D-22	15.5 ± 0.8	13.2 ± 1.0	17.8 ± 0.7	14.3 ± 0.8
D-23	10.8 ± 0.8	9.3 ± 1.0	10.3 ± 0.9	15.6 ± 0.8
D-28	16.1 ± 1.2	14.8 ± 1.0	18.0 ± 1.7	17.2 ± 0.8
D-29	17.7 ± 0.7	19.9 ± 1.1	22.5 ± 1.0	22.2 ± 1.0
D-30	14.6 ± 0.9	14.2 ± 1.6	15.6 ± 0.9	21.4 ± 1.7
D-31	16.4 ± 1.2	15.7 ± 1.4	17.0 ± 1.2	18.4 ± 1.6
D-32	18.9 ± 0.9	14.4 ± 1.2	22.0 ± 0.7	22.4 ± 1.7
D-82	15.3 ± 0.8	17.3 ± 1.2	16.4 ± 0.8	18.8 ± 0.9
D-83	13.0 ± 0.6	12.7 ± 0.9	13.3 ± 0.6	19.2 ± 1.1
D-84	14.7 ± 0.8	11.8 ± 1.2	18.5 ± 1.2	12.8 ± 1.0
D-85	14.9 ± 0.7	15.9 ± 1.1	15.5 ± 0.6	22.0 ± 0.9
D-86	15.2 ± 1.4	16.3 ± 1.4	19.2 ± 1.2	17.9 ± 1.3
D-91	14.5 ± 0.9	13.6 ± 1.5	15.5 ± 0.9	18.2 ± 1.7
Mean ± s.d.	15.1 ± 1.9	15.1 ± 2.9	16.6 ± 3.1	18.2 ± 2.9

^a"ND" = No data; see Table 2.0, Listing of Missed Samples.

Table 11. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD).

Quarterly collection.

Units: mR/91 days

<u>Within 1.0 mi. of Stack</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
D-43	14.2 ± 0.9	12.4 ± 1.5	14.9 ± 0.9	14.1 ± 1.0
D-44	16.1 ± 0.8	15.5 ± 1.0	17.4 ± 0.8	18.0 ± 0.6
D-45	14.6 ± 0.6	11.7 ± 1.5	14.4 ± 0.7	14.1 ± 1.0
D-46	16.2 ± 1.0	19.8 ± 1.4	17.9 ± 0.8	23.3 ± 1.2
D-47	17.1 ± 0.8	17.3 ± 1.5	21.0 ± 0.9	20.3 ± 1.2
D-48	16.7 ± 0.8	15.9 ± 1.6	18.2 ± 0.8	21.2 ± 1.3
Mean ± s.d.	15.8 ± 1.2	15.4 ± 3.0	17.3 ± 2.4	18.5 ± 3.8
<u>Within 3.0 mi. of Stack</u>				
D-33	10.7 ± 0.7	10.7 ± 0.9	10.7 ± 0.8	13.7 ± 0.7
D-34	13.0 ± 0.9	11.1 ± 1.2	13.3 ± 0.7	14.0 ± 0.9
D-35	14.0 ± 0.8	13.3 ± 0.9	13.7 ± 0.8	16.2 ± 1.0
D-36	13.9 ± 0.7	11.9 ± 1.0	13.8 ± 0.9	15.2 ± 1.0
D-37	16.9 ± 1.6	16.1 ± 1.0	15.1 ± 1.2	21.0 ± 0.7
D-38	14.5 ± 0.9	11.7 ± 1.2	15.3 ± 0.9	14.3 ± 1.2
D-39	14.6 ± 0.7	14.6 ± 1.2	14.7 ± 0.8	20.7 ± 1.1
D-40	11.9 ± 0.9	10.3 ± 1.0	11.5 ± 1.0	12.8 ± 0.9
D-41	15.8 ± 0.7	17.7 ± 1.7	15.8 ± 0.8	20.0 ± 1.1
D-42	11.5 ± 0.7	12.4 ± 1.1	11.1 ± 0.7	14.8 ± 1.0
Mean ± s.d.	13.7 ± 1.9	13.0 ± 2.4	13.5 ± 1.8	16.3 ± 3.1
<u>ISFSI Fenceline</u>				
D-161	50.3 ± 2.1	42.5 ± 3.4	53.2 ± 1.6	45.6 ± 2.5
D-162	16.5 ± 0.9	14.2 ± 1.2	19.7 ± 0.8	20.5 ± 1.4
D-163	48.6 ± 1.2	42.1 ± 2.7	34.4 ± 1.0	39.9 ± 1.9
D-164	13.6 ± 0.8	11.3 ± 1.1	14.1 ± 0.7	12.0 ± 0.8
Mean ± s.d.	32.2 ± 19.9	27.5 ± 17.1	30.4 ± 17.5	29.5 ± 15.9

Table 12. Milk samples, analyses for iodine-131 and gamma emitting isotopes.
 Collection: Monthly during non-grazing season (October 1 through April 30): biweekly
 during grazing season (May 1 through September 30)

Location		D-110					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-23-14	DMI- 280	< 0.4	1644 ± 116	< 4.3	< 4.1	< 16.3	< 2.8
02-11-14	DMI- 509	< 0.4	1424 ± 96	< 3.1	< 3.7	< 10.7	< 2.2
03-28-14	DMI- 1189	< 0.4	1363 ± 99	< 3.6	< 3.8	< 11.9	< 2.5
04-22-14	DMI- 1631	< 0.3	1359 ± 106	< 3.2	< 3.8	< 12.5	< 2.2
05-08-14	DMI- 2059	< 0.5	1309 ± 81	< 2.6	< 3.0	< 11.1	< 2.1
05-21-14	DMI- 2207	< 0.3	1352 ± 116	< 4.0	< 2.4	< 13.6	< 2.2
06-04-14	DMI- 2514	< 0.3	1415 ± 116	< 4.1	< 3.8	< 8.1	< 2.4
06-17-14	DMI- 2808	< 0.3	1440 ± 90	< 2.6	< 2.7	< 10.6	< 2.1
07-03-14	DMI- 3166	< 0.4	1421 ± 100	< 3.8	< 2.9	< 18.3	< 1.9
07-11-14	DMI- 3368	< 0.2	1268 ± 108	< 4.1	< 4.3	< 12.8	< 2.1
07-22-14	DMI- 3603	< 0.3	1390 ± 101	< 2.8	< 2.5	< 9.9	< 1.1
08-09-14	DMI- 4157	< 0.5	1321 ± 106	< 3.2	< 2.9	< 10.6	< 1.3
08-22-14	DMI- 4375	< 0.4	1400 ± 112	< 4.3	< 2.5	< 10.1	< 1.3
09-05-14	DMI- 4722	< 0.3	1412 ± 112	< 4.0	< 3.0	< 17.5	< 1.8
09-18-14	DMI- 4969	< 0.4	1460 ± 115	< 4.1	< 3.4	< 16.1	< 2.3
09-29-14	DMI- 5164	< 0.3	1422 ± 115	< 4.2	< 3.9	< 17.1	< 1.7
10-21-14	DMI- 5879	< 0.5	1406 ± 85	< 2.4	< 2.5	< 11.3	< 1.6
11-18-14	DMI- 6543	< 0.4	1298 ± 104	< 3.8	< 3.1	< 16.0	< 1.1
12-16-14	DMI- 7061	< 0.2	1161 ± 86	< 3.1	< 2.7	< 14.3	< 1.8

Location		D-138					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-23-14	DMI- 281	< 0.5	1764 ± 121	< 3.3	< 3.6	< 14.5	< 1.2
02-11-14	DMI- 510	< 0.4	1362 ± 107	< 3.2	< 3.9	< 12.2	< 2.5
03-28-14	DMI- 1190	< 0.3	1374 ± 97	< 2.8	< 3.0	< 9.9	< 3.1
04-22-14	DMI- 1632	< 0.4	1471 ± 105	< 3.3	< 3.8	< 15.6	< 1.8
05-08-14	DMI- 2060	< 0.4	1432 ± 95	< 2.9	< 2.3	< 9.9	< 1.5
05-21-14	DMI- 2208	< 0.4	1314 ± 115	< 3.5	< 3.9	< 11.3	< 2.1
06-04-14	DMI- 2515	< 0.4	1467 ± 116	< 3.2	< 2.8	< 9.4	< 1.7
06-17-14	DMI- 2809	< 0.3	1589 ± 106	< 2.7	< 2.9	< 10.5	< 2.8
07-03-14	DMI- 3167	< 0.5	1089 ± 93	< 3.0	< 3.6	< 12.3	< 2.9
07-11-14	DMI- 3369	< 0.2	1377 ± 114	< 3.6	< 3.0	< 17.6	< 4.0
07-22-14	DMI- 3604	< 0.3	1331 ± 88	< 2.9	< 3.5	< 8.2	< 2.3
08-09-14	DMI- 4158	< 0.5	1307 ± 101	< 2.9	< 2.4	< 14.3	< 2.4
08-22-14	DMI- 4376	< 0.3	1088 ± 107	< 3.2	< 2.9	< 13.4	< 1.4
09-05-14	DMI- 4723	< 0.3	1435 ± 108	< 3.5	< 2.9	< 9.9	< 3.0
09-18-14	DMI- 4970	< 0.3	1337 ± 102	< 3.2	< 3.3	< 10.2	< 2.7
09-29-14	DMI- 5165	< 0.5	1173 ± 100	< 3.6	< 2.3	< 14.3	< 2.3
10-21-14	DMI- 5880	< 0.2	1394 ± 107	< 3.1	< 3.8	< 9.6	< 3.0
11-18-14	DMI- 6544	< 0.4	1280 ± 108	< 3.0	< 3.0	< 13.2	< 2.3
12-16-14	DMI- 7062	< 0.2	1295 ± 107	< 3.1	< 2.9	< 12.8	< 2.1

Table 13. Well water samples, analyses for gamma emitting isotopes iodine-131^a and tritium.

Collection: Quarterly

Units: pCi/L

Location		D-53 Treated Municipal Water			
Lab Code	DWW- 690	DWW- 2610	DWW- 3936	DWW- 7017	
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14	
H-3	< 138	< 140	< 131	< 176	
I-131				< 0.4	
Mn-54	< 1.9	< 1.7	< 1.8	< 2.9	
Fe-59	< 5.1	< 4.7	< 5.5	< 3.9	
Co-58	< 1.1	< 2.0	< 2.3	< 3.7	
Co-60	< 2.0	< 1.4	< 2.0	< 1.6	
Zn-65	< 4.0	< 4.6	< 2.7	< 5.7	
Nb-95	< 1.7	< 2.4	< 3.8	< 2.6	
Zr-95	< 5.3	< 4.3	< 4.0	< 3.6	
I-131	< 3.9	< 6.1	< 10.3	< 5.5	
Cs-134	< 2.5	< 2.7	< 2.8	< 3.3	
Cs-137	< 1.5	< 1.6	< 2.5	< 3.2	
Ba-140	< 9.4	< 14.2	< 22.6	< 16.8	
La-140	< 2.1	< 1.6	< 3.6	< 3.4	

Location		D-54 Inlet to Municipal Water			
Lab Code	DWW- 691	DWW- 2611	DWW- 3937	DWW- 7018	
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14	
H-3	< 138	< 140	< 131	< 176	
I-131				< 0.5	
Mn-54	< 2.5	< 2.7	< 1.3	< 2.1	
Fe-59	< 2.2	< 4.9	< 2.6	< 4.5	
Co-58	< 2.1	< 3.6	< 2.0	< 1.9	
Co-60	< 1.6	< 1.6	< 1.9	< 1.9	
Zn-65	< 5.1	< 4.0	< 4.3	< 6.1	
Nb-95	< 3.1	< 2.6	< 3.2	< 3.0	
Zr-95	< 4.3	< 2.7	< 4.7	< 4.8	
I-131	< 3.2	< 7.2	< 8.9	< 9.7	
Cs-134	< 2.8	< 3.3	< 2.8	< 2.8	
Cs-137	< 2.7	< 3.6	< 3.1	< 3.3	
Ba-140	< 7.5	< 15.0	< 20.2	< 15.0	
La-140	< 2.8	< 2.3	< 4.0	< 3.4	

^a I-131 by chemistry analysis added in fourth quarter.

Table 13. Well water samples, analyses for gamma emitting isotopes iodine-131^a and tritium.

Collection: Quarterly

Units: pCi/L

Location		D-55 On-site Well			
Lab Code	DWW- 692	DWW- 2612	DWW- 3938	DWW- 7019	
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14	
H-3	< 138	< 140	< 131	< 176	
I-131				< 0.5	
Mn-54	< 3.7	< 2.5	< 3.9	< 2.6	
Fe-59	< 8.7	< 3.3	< 4.0	< 5.8	
Co-58	< 2.6	< 2.5	< 2.2	< 3.2	
Co-60	< 2.9	< 1.9	< 1.3	< 2.3	
Zn-65	< 8.4	< 3.0	< 5.6	< 3.6	
Nb-95	< 2.0	< 3.0	< 4.2	< 3.9	
Zr-95	< 5.2	< 5.6	< 6.3	< 5.8	
I-131	< 4.8	< 7.8	< 13.5	< 7.4	
Cs-134	< 4.4	< 3.3	< 4.0	< 3.6	
Cs-137	< 3.5	< 2.6	< 3.8	< 2.7	
Ba-140	< 21.0	< 18.3	< 26.5	< 16.7	
La-140	< 4.2	< 3.3	< 5.0	< 6.6	

Location		D-57 Bull Farm			
Lab Code	DWW- 693	DWW- 2613	DWW- 3939	DWW- 7020	
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14	
H-3	< 138	< 140	< 131	< 176	
I-131				< 0.4	
Mn-54	< 2.6	< 1.5	< 2.5	< 4.0	
Fe-59	< 4.1	< 4.0	< 3.7	< 3.2	
Co-58	< 2.5	< 1.7	< 1.6	< 2.3	
Co-60	< 2.4	< 2.4	< 2.3	< 1.3	
Zn-65	< 5.9	< 3.9	< 2.7	< 2.5	
Nb-95	< 3.2	< 2.5	< 3.1	< 2.9	
Zr-95	< 5.4	< 3.9	< 5.5	< 3.5	
I-131	< 4.1	< 8.0	< 10.2	< 6.2	
Cs-134	< 2.8	< 2.6	< 2.7	< 3.2	
Cs-137	< 2.8	< 2.8	< 3.2	< 3.2	
Ba-140	< 12.7	< 18.0	< 26.2	< 15.5	
La-140	< 2.6	< 2.9	< 4.6	< 5.3	

^aI-131 by chemistry analysis added in fourth quarter.

Table 13. Well water samples, analyses for gamma emitting isotopes iodine-131^a and tritium.

Collection: Quarterly

Units: pCi/L

Location				
D-58 Franz Farm				
Lab Code	DWW- 694	DWW- 2614	DWW- 3940	DWW- 7021
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14
H-3	< 138	< 140	< 131	< 176
I-131				< 0.5
Mn-54	< 2.6	< 2.2	< 2.1	< 2.4
Fe-59	< 2.5	< 6.2	< 5.1	< 3.6
Co-58	< 3.3	< 1.4	< 2.5	< 2.3
Co-60	< 1.5	< 2.6	< 1.4	< 2.6
Zn-65	< 4.2	< 4.6	< 1.5	< 3.5
Nb-95	< 2.4	< 1.5	< 3.0	< 4.1
Zr-95	< 5.0	< 3.4	< 5.2	< 5.1
I-131	< 4.1	< 6.1	< 11.6	< 6.4
Cs-134	< 2.6	< 3.1	< 2.6	< 3.0
Cs-137	< 3.8	< 2.0	< 1.5	< 3.1
Ba-140	< 11.9	< 15.4	< 22.6	< 20.1
La-140	< 1.6	< 2.5	< 3.5	< 4.5

Location				
D-72(C) Van Note Farm				
Lab Code	DWW- 695	DWW- 2615	DWW- 3941	DWW- 7022
Date Collected	02-24-14	06-09-14	08-01-14	12-15-14
H-3	< 138	< 140	< 131	< 176
I-131				< 0.5
Mn-54	< 2.5	< 4.1	< 2.2	< 3.6
Fe-59	< 6.2	< 6.8	< 3.9	< 5.2
Co-58	< 2.6	< 3.0	< 1.9	< 2.1
Co-60	< 2.0	< 1.3	< 2.8	< 1.8
Zn-65	< 2.8	< 4.2	< 2.2	< 3.4
Nb-95	< 2.0	< 4.4	< 2.7	< 2.7
Zr-95	< 3.1	< 7.4	< 3.4	< 2.9
I-131	< 4.2	< 8.4	< 9.6	< 8.5
Cs-134	< 2.9	< 4.0	< 2.7	< 3.0
Cs-137	< 1.9	< 4.6	< 3.1	< 2.9
Ba-140	< 11.0	< 18.0	< 21.7	< 19.5
La-140	< 2.6	< 3.2	< 5.6	< 1.9

^a I-131 by chemistry analysis added in fourth quarter.

Table 14. Vegetation (broadleaf), analyses for iodine-131 and other gamma-emitting isotopes.
 Collection: Annually
 Units: pCi/g wet

Location	D-15	D-57	D-118
Lab Code	DVE- 5168	DVE- 3371	DVE- 5016
Date Collected	09-27-14	07-10-14	09-10-14
Sample Type	Broadleaf	Broadleaf	Cabbage
K-40	6.69 ± 0.52	4.04 ± 0.42	1.81 ± 0.15
Mn-54	< 0.009	< 0.014	< 0.003
Fe-59	< 0.038	< 0.022	< 0.007
Co-58	< 0.011	< 0.013	< 0.005
Co-60	< 0.010	< 0.018	< 0.005
Zn-65	< 0.049	< 0.034	< 0.006
Nb-95	< 0.018	< 0.018	< 0.004
Zr-95	< 0.032	< 0.021	< 0.007
Ru-103	< 0.016	< 0.019	< 0.004
Ru-106	< 0.085	< 0.12	< 0.037
I-131	< 0.021	< 0.033	< 0.015
Cs-134	< 0.016	< 0.015	< 0.004
Cs-137	< 0.017	< 0.014	< 0.005
Ce-141	< 0.046	< 0.023	< 0.010
Ce-144	< 0.18	< 0.094	< 0.039

Table 15. Vegetation (hay and grain), analyses for gamma-emitting isotopes.

Collection: Annually

Units: pCi/g wet

Location	D-16	D-57	D-57	D-15	D-57
Lab Code	DVE- 5166	DVE- 3370	DVE- 3372	DVE- 5167	DVE- 6635
Date Collected	09-27-14	07-10-14	07-10-14	09-27-14	11-20-14
Sample Type	Forage	Clover	Wheat	Forage	Corn
K-40	3.46 ± 0.44	5.98 ± 0.63	4.70 ± 0.60	4.91 ± 0.43	2.75 ± 0.21
Mn-54	< 0.023	< 0.021	< 0.020	< 0.017	< 0.006
Fe-59	< 0.027	< 0.031	< 0.063	< 0.014	< 0.013
Co-58	< 0.016	< 0.023	< 0.021	< 0.010	< 0.004
Co-60	< 0.023	< 0.025	< 0.022	< 0.015	< 0.007
Zn-65	< 0.018	< 0.032	< 0.047	< 0.022	< 0.013
Nb-95	< 0.015	< 0.024	< 0.033	< 0.019	< 0.008
Zr-95	< 0.023	< 0.040	< 0.055	< 0.029	< 0.012
Ru-103	< 0.015	< 0.022	< 0.023	< 0.016	< 0.004
Ru-106	< 0.21	< 0.15	< 0.23	< 0.16	< 0.036
I-131	< 0.031	< 0.048	< 0.051	< 0.036	< 0.011
Cs-134	< 0.020	< 0.021	< 0.025	< 0.018	< 0.006
Cs-137	< 0.022	< 0.021	< 0.030	< 0.017	< 0.005
Ce-141	< 0.028	< 0.025	< 0.047	< 0.039	< 0.012
Ce-144	< 0.15	< 0.17	< 0.16	< 0.16	< 0.044

Location	D-96	D-96	D-109
Lab Code	DVE- 6636	DVE- 6637	DVE- 6638
Date Collected	11-18-14	11-18-14	11-18-14
Sample Type	Corn	Beans	Corn
K-40	2.61 ± 0.21	14.59 ± 0.45	3.05 ± 0.21
Mn-54	< 0.006	< 0.009	< 0.006
Fe-59	< 0.011	< 0.026	< 0.014
Co-58	< 0.004	< 0.007	< 0.004
Co-60	< 0.004	< 0.010	< 0.006
Zn-65	< 0.008	< 0.027	< 0.015
Nb-95	< 0.008	< 0.009	< 0.005
Zr-95	< 0.008	< 0.013	< 0.007
Ru-103	< 0.006	< 0.008	< 0.005
Ru-106	< 0.060	< 0.062	< 0.069
I-131	< 0.011	< 0.018	< 0.010
Cs-134	< 0.007	< 0.007	< 0.006
Cs-137	< 0.007	< 0.009	< 0.006
Ce-141	< 0.010	< 0.016	< 0.013
Ce-144	< 0.043	< 0.059	< 0.038

Table 16. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.

Collection: Monthly
 Units: pCi/L
 Location: D-49

Lab Code	01-22-14	02-04-14	DSW- 1071 03-19-14	DSW- 1647 04-22-14	DSW- 2220 05-22-14	DSW- 2958 06-25-14
H-3	ND ^a	ND ^a	< 150	< 146	< 145	< 142
I-131(Chemistry)	-	-	< 0.4	< 0.3	< 0.3	< 0.4
Mn-54	-	-	< 1.9	< 2.3	< 3.0	< 0.9
Fe-59	-	-	< 3.9	< 4.9	< 3.8	< 3.8
Co-58	-	-	< 1.5	< 3.0	< 2.6	< 1.6
Co-60	-	-	< 2.3	< 1.9	< 2.5	< 2.1
Zn-65	-	-	< 5.2	< 2.8	< 4.4	< 5.5
Nb-95	-	-	< 2.9	< 2.8	< 3.1	< 1.8
Zr-95	-	-	< 3.2	< 4.2	< 4.2	< 4.2
I-131	-	-	< 2.6	< 3.5	< 5.0	< 4.8
Cs-134	-	-	< 2.8	< 3.0	< 3.2	< 2.6
Cs-137	-	-	< 3.0	< 2.3	< 2.9	< 2.7
Ba-140	-	-	< 10.1	< 14.8	< 10.9	< 10.7
La-140	-	-	< 1.7	< 2.2	< 2.2	< 3.1

Lab Code	DSW- 3543 07-16-14	DSW- 4377 08-21-14	DSW- 4971 09-18-14	DSW- 5939 10-22-14	DSW- 6733 11-26-14	DSW- 7091 12-20-14
H-3	< 137	< 143	< 151	< 148	< 179	< 183
I-131(Chemistry)	< 0.3	< 0.3	< 0.3	< 0.2	< 0.3	< 0.5
Mn-54	< 2.9	< 1.5	< 2.9	< 3.3	< 2.5	< 3.3
Fe-59	< 4.3	< 5.7	< 4.3	< 3.7	< 3.6	< 5.9
Co-58	< 2.3	< 2.1	< 2.7	< 2.1	< 1.4	< 1.9
Co-60	< 2.6	< 2.2	< 1.5	< 2.2	< 2.1	< 2.6
Zn-65	< 4.5	< 2.6	< 3.6	< 4.7	< 4.3	< 5.9
Nb-95	< 2.6	< 1.7	< 3.8	< 3.3	< 3.8	< 2.4
Zr-95	< 5.2	< 3.4	< 4.1	< 6.9	< 5.4	< 2.9
I-131	< 7.1	< 4.7	< 5.1	< 4.6	< 5.6	< 4.4
Cs-134	< 4.2	< 3.0	< 3.7	< 3.7	< 3.8	< 3.3
Cs-137	< 3.8	< 3.0	< 4.5	< 3.1	< 2.6	< 3.1
Ba-140	< 16.6	< 12.0	< 7.4	< 14.6	< 8.6	< 14.6
La-140	< 3.6	< 2.7	< 1.9	< 1.4	< 2.2	< 2.5

^a ND = No data; see Table 2.0, Listing of Missed Samples.

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.

Collection: Monthly
 Units: pCi/L
 Location: D-50

Lab Code	DSW- 282	^a DSW- 392	^b DSW- 1072	DSW- 1648	DSW- 2221	DSW- 2959
Date Collected	01-22-14	02-04-14	03-19-14	04-22-14	05-21-14	06-25-14
H-3	< 144	< 152	< 150	< 146	< 145	< 142
Mn-54	< 2.4	< 3.5	< 4.0	< 4.5	< 5.1	< 2.8
Fe-59	< 4.9	< 5.2	< 6.9	< 6.1	< 4.5	< 2.8
Co-58	< 3.0	< 1.5	< 1.2	< 2.4	< 2.5	< 2.5
Co-60	< 1.7	< 2.9	< 3.1	< 2.1	< 1.6	< 1.8
Zn-65	< 4.9	< 3.3	< 5.4	< 3.6	< 3.6	< 2.8
Nb-95	< 2.1	< 3.2	< 1.4	< 3.6	< 3.3	< 2.1
Zr-95	< 3.9	< 5.1	< 5.4	< 5.0	< 5.6	< 4.8
I-131	< 4.1	11.2 ± 5.8	< 2.4	< 3.7	< 7.1	< 6.3
Cs-134	< 2.7	< 3.6	< 4.0	< 3.9	< 4.1	< 3.2
Cs-137	< 2.1	< 2.4	< 3.5	< 3.4	< 4.0	< 3.6
Ba-140	< 13.4	< 12.3	< 15.5	< 19.3	< 18.6	< 16.6
La-140	< 2.6	< 2.6	< 1.8	< 2.3	< 2.1	< 3.7

Lab Code	DSW- 3544	DSW- 4378	DSW- 4972	DSW- 5940	DSW- 6734	DSW- 7092
Date Collected	07-16-14	08-21-14	09-18-14	10-22-14	11-26-14	12-20-14
H-3	< 137	< 143	< 151	< 148	< 179	< 183
Mn-54	< 2.8	< 1.6	< 3.2	< 3.4	< 2.2	< 1.7
Fe-59	< 2.8	< 5.2	< 4.5	< 5.7	< 3.8	< 3.7
Co-58	< 2.5	< 1.5	< 2.1	< 1.7	< 2.3	< 2.6
Co-60	< 2.7	< 1.9	< 1.8	< 3.1	< 1.6	< 2.0
Zn-65	< 2.7	< 4.1	< 4.4	< 5.8	< 2.3	< 5.3
Nb-95	< 3.2	< 1.9	< 3.1	< 4.1	< 2.5	< 1.9
Zr-95	< 5.1	< 4.8	< 5.5	< 5.7	< 3.9	< 4.0
I-131	< 6.4	< 5.0	< 7.0	< 3.6	< 5.3	< 3.6
Cs-134	< 3.4	< 2.1	< 4.2	< 3.2	< 2.7	< 2.8
Cs-137	< 2.9	< 2.0	< 3.3	< 3.9	< 3.8	< 3.3
Ba-140	< 17.9	< 10.9	< 16.2	< 16.3	< 14.8	< 10.4
La-140	< 2.9	< 3.5	< 1.6	< 2.9	< 2.3	< 1.1

^a Sample analyzed for I-131 (by chemistry) per client request, result = 0.9±0.3 pCi/L.

^b Sample analyzed for I-131 (by chemistry) per client request, result = 8.8±0.3 pCi/L.

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.

Collection: Monthly
 Units: pCi/L
 Location: D-51

Lab Code	DSW- 283	DSW- 393	DSW- 1073	DSW- 1649	DSW- 2222	DSW- 2960
Date Collected	01-22-14	02-04-14	^a 03-19-14	04-22-14	05-21-14	06-25-14
H-3	< 144	< 152	< 150	< 146	< 145	< 142
Mn-54	< 2.1	< 1.8	< 2.2	< 2.3	< 3.0	< 2.5
Fe-59	< 4.1	< 3.0	< 5.6	< 3.3	< 3.2	< 2.1
Co-58	< 1.4	< 1.7	< 2.4	< 1.4	< 1.2	< 1.5
Co-60	< 2.1	< 1.9	< 1.9	< 1.9	< 2.8	< 1.9
Zn-65	< 1.2	< 5.5	< 3.1	< 2.8	< 3.5	< 3.8
Nb-95	< 1.5	< 4.5	< 2.7	< 2.3	< 3.7	< 3.1
Zr-95	< 3.2	< 4.0	< 3.4	< 5.8	< 3.7	< 3.2
I-131	< 4.3	< 4.4	< 4.8	< 3.7	< 8.5	< 4.8
Cs-134	< 2.9	< 3.2	< 3.7	< 2.7	< 3.9	< 2.6
Cs-137	< 2.9	< 3.5	< 2.1	< 1.8	< 2.2	< 3.3
Ba-140	< 9.6	< 11.9	< 11.5	< 12.4	< 17.6	< 13.1
La-140	< 1.6	< 2.7	< 2.9	< 2.1	< 4.0	< 1.5

Lab Code	DSW- 3545	DSW- 4379	DSW- 4973	DSW- 5941	DSW- 6735	DSW- 7093
Date Collected	07-16-14	08-21-14	09-18-14	10-22-14	11-26-14	12-20-14
H-3	< 137	< 143	< 151	< 148	< 179	< 183
Mn-54	< 2.7	< 2.3	< 3.9	< 2.6	< 3.9	< 2.5
Fe-59	< 3.1	< 6.2	< 6.5	< 4.0	< 4.9	< 4.1
Co-58	< 2.0	< 2.5	< 4.0	< 1.6	< 3.1	< 3.0
Co-60	< 2.1	< 1.4	< 3.1	< 2.6	< 3.5	< 1.4
Zn-65	< 3.5	< 5.1	< 5.6	< 3.7	< 5.8	< 2.3
Nb-95	< 2.6	< 4.0	< 4.9	< 3.8	< 3.5	< 3.1
Zr-95	< 3.2	< 3.2	< 5.2	< 5.1	< 5.4	< 4.0
I-131	< 3.5	< 8.2	< 7.3	< 3.5	< 6.3	< 2.5
Cs-134	< 2.7	< 2.5	< 4.3	< 3.3	< 4.3	< 2.1
Cs-137	< 2.0	< 2.2	< 4.8	< 2.2	< 3.3	< 2.7
Ba-140	< 15.9	< 18.4	< 14.0	< 10.4	< 16.3	< 9.6
La-140	< 2.5	< 3.2	< 4.0	< 2.9	< 2.7	< 1.7

^a Sample analyzed for I-131 (by chemistry) per client request. Result = 8.9±0.3 pCi/L.

Table 16. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.

Collection: Monthly
 Units: pCi/L
 Location: D-61

Lab Code	DSW- 285	DSW- 394	DSW- 1075	DSW- 1650	DSW- 2223	DSW- 2961
Date Collected	01-22-14	02-04-14	03-19-14	04-22-14	05-22-14	06-25-14
H-3	< 144	< 152	< 150	< 146	< 145	< 142
I-131(Chemistry)	< 0.5	9.3 ± 0.3	< 0.5	< 0.3	< 0.3	< 0.4
Mn-54	< 2.8	< 2.8	< 2.8	< 2.9	< 2.2	< 1.2
Fe-59	< 4.8	< 3.9	< 6.0	< 3.0	< 2.3	< 5.1
Co-58	< 2.5	< 1.8	< 2.8	< 2.0	< 2.4	< 1.4
Co-60	< 2.5	< 2.6	< 2.5	< 1.3	< 2.5	< 1.8
Zn-65	< 5.6	< 7.3	< 6.1	< 2.0	< 1.9	< 3.1
Nb-95	< 3.2	< 3.9	< 3.2	< 2.2	< 3.4	< 2.9
Zr-95	< 3.5	< 6.5	< 5.3	< 5.3	< 2.8	< 4.1
I-131	< 5.4	7.9 ± 4.3	< 3.9	< 2.5	< 3.2	< 4.8
Cs-134	< 3.0	< 3.0	< 3.1	< 3.1	< 3.0	< 3.1
Cs-137	< 3.3	< 2.8	< 2.7	< 3.4	< 1.7	< 2.0
Ba-140	< 16.4	< 13.6	< 14.6	< 6.5	< 8.9	< 17.1
La-140	< 2.5	< 2.7	< 2.6	< 1.6	< 3.0	< 2.6

Lab Code	DSW- 3546	DSW- 4380	DSW- 4974	DSW- 5942	DSW- 6736	DSW- 7094
Date Collected	07-16-14	08-21-14	09-18-14	10-22-14	11-26-14	12-20-14
H-3	< 137	< 143	< 151	< 148	< 179	< 183
I-131(Chemistry)	< 0.4	< 0.3	< 0.3	< 0.3	< 0.3	< 0.2
Mn-54	< 1.1	< 2.6	< 3.1	< 3.8	< 2.3	< 3.3
Fe-59	< 5.2	< 3.9	< 4.5	< 6.8	< 4.6	< 6.0
Co-58	< 1.9	< 3.0	< 2.3	< 2.6	< 2.1	< 2.9
Co-60	< 3.0	< 2.5	< 2.6	< 4.5	< 2.1	< 1.4
Zn-65	< 3.6	< 2.3	< 6.2	< 4.1	< 5.0	< 5.0
Nb-95	< 3.4	< 2.9	< 3.4	< 2.6	< 2.5	< 3.2
Zr-95	< 3.3	< 3.5	< 4.4	< 5.2	< 2.5	< 2.9
I-131	< 4.9	< 5.3	< 4.7	< 4.8	< 4.7	< 4.1
Cs-134	< 3.2	< 2.7	< 2.5	< 4.6	< 2.9	< 3.3
Cs-137	< 2.8	< 3.2	< 2.8	< 4.5	< 2.9	< 3.5
Ba-140	< 14.6	< 15.7	< 11.1	< 12.9	< 8.8	< 10.6
La-140	< 2.9	< 2.0	< 2.3	< 4.1	< 1.8	< 3.1

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.

Collection: Monthly
 Units: pCi/L
 Location: D-99

Lab Code			DSW- 1076	DSW- 1651	DSW- 2224	DSW- 2962
Date Collected	01-22-14		03-19-14	04-22-14	05-22-14	06-25-14
H-3	ND ^a		< 150	< 146	< 145	< 142
Mn-54	-	-	< 2.1	< 3.1	< 3.6	< 1.8
Fe-59	-	-	< 3.8	< 1.5	< 3.7	< 3.3
Co-58	-	-	< 0.9	< 2.3	< 2.0	< 2.8
Co-60	-	-	< 2.1	< 2.3	< 1.1	< 2.6
Zn-65	-	-	< 3.8	< 2.5	< 2.7	< 4.3
Nb-95	-	-	< 2.5	< 2.1	< 3.0	< 2.9
Zr-95	-	-	< 3.9	< 3.3	< 5.9	< 4.5
I-131	-	-	< 3.5	< 5.1	< 7.1	< 4.9
Cs-134	-	-	< 2.8	< 2.9	< 4.0	< 2.8
Cs-137	-	-	< 3.2	< 3.0	< 4.0	< 2.6
Ba-140	-	-	< 10.8	< 13.5	< 17.2	< 13.4
La-140	-	-	< 3.2	< 1.6	< 1.9	< 3.7

Lab Code	DSW- 3547	DSW- 4381	DSW- 4975	DSW- 5943	DSW- 6737	
Date Collected	07-16-14	08-21-14	09-18-14	10-22-14	11-26-14	12-20-14
H-3	< 137	< 143	< 151	< 148	< 179	ND ^a
Mn-54	< 2.7	< 1.9	< 2.5	< 2.8	< 4.0	-
Fe-59	< 4.7	< 3.9	< 4.2	< 4.2	< 4.6	-
Co-58	< 1.9	< 2.0	< 1.6	< 2.5	< 2.8	-
Co-60	< 2.4	< 2.4	< 3.0	< 1.8	< 3.2	-
Zn-65	< 5.6	< 3.4	< 2.4	< 5.8	< 7.3	-
Nb-95	< 3.8	< 3.4	< 2.8	< 2.3	< 2.8	-
Zr-95	< 5.7	< 3.8	< 3.9	< 3.4	< 6.9	-
I-131	< 7.6	< 6.7	< 5.4	< 3.2	< 5.3	-
Cs-134	< 4.2	< 2.6	< 3.1	< 2.5	< 3.9	-
Cs-137	< 3.7	< 2.2	< 2.8	< 2.8	< 3.9	-
Ba-140	< 17.4	< 18.6	< 14.3	< 11.5	< 19.6	-
La-140	< 1.8	< 4.1	< 2.2	< 1.7	< 2.6	-

^a ND = No data; see Table 2.0, Listing of Missed Samples.

Table 17. Surface water, analysis for strontium.
 Collection: Quarterly composites of monthly samples.
 Units: pCi/L

Location				
D-49				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-1107	DSW-3052	DSW-5017	DSW-7167
Sr-89	< 0.93	< 0.74	< 0.63	< 0.69
Sr-90	< 0.80	< 0.63	< 0.53	< 0.54

Location				
D-61				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-1108	DSW-3053	DSW-5018	DSW-7168
Sr-89	< 0.66	< 0.59	< 0.63	< 0.78
Sr-90	< 0.52	< 0.47	< 0.50	< 0.56

Table 18. Fish, analyses of edible portion for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/g wet

Location		Upstream, D-49			
Lab Code	DF- 2599	DF- 2600	DF- 4832	DF- 4833	
Date Collected	06-04-14	06-04-14	09-02-14	09-02-14	
Sample Type	Cyprinus Carpio	Carpiodes Sp.	Carpiodes Sp.	Moxostoma	
K-40	3.23 ± 0.38	3.08 ± 0.43	3.28 ± 0.46	3.94 ± 0.48	
Mn-54	< 0.014	< 0.011	< 0.017	< 0.012	
Fe-59	< 0.024	< 0.029	< 0.044	< 0.033	
Co-58	< 0.012	< 0.008	< 0.024	< 0.012	
Co-60	< 0.012	< 0.014	< 0.016	< 0.013	
Zn-65	< 0.039	< 0.028	< 0.040	< 0.027	
Nb-95	< 0.016	< 0.013	< 0.030	< 0.025	
Zr-95	< 0.017	< 0.026	< 0.037	< 0.027	
Ru-103	< 0.009	< 0.015	< 0.042	< 0.015	
Ru-106	< 0.062	< 0.14	< 0.16	< 0.15	
Cs-134	< 0.010	< 0.015	< 0.021	< 0.016	
Cs-137	< 0.009	< 0.017	< 0.017	< 0.014	
Ce-141	< 0.019	< 0.029	< 0.060	< 0.051	
Ce-144	< 0.069	< 0.054	< 0.12	< 0.11	

Location		Downstream, D-61			
Lab Code	DF- 2601	DF- 2602	DF- 4834	DF- 4835	
Date Collected	06-04-14	06-04-14	09-02-14	09-02-14	
Sample Type	Ictiobus Sp.	Carpiodes Sp.	Moxostoma	Carpiodes Sp.	
K-40	3.26 ± 0.41	3.64 ± 0.41	3.32 ± 0.36	3.44 ± 0.55	
Mn-54	< 0.013	< 0.011	< 0.017	< 0.021	
Fe-59	< 0.035	< 0.024	< 0.030	< 0.073	
Co-58	< 0.012	< 0.009	< 0.012	< 0.028	
Co-60	< 0.010	< 0.010	< 0.014	< 0.009	
Zn-65	< 0.015	< 0.019	< 0.022	< 0.038	
Nb-95	< 0.013	< 0.012	< 0.031	< 0.040	
Zr-95	< 0.015	< 0.009	< 0.031	< 0.049	
Ru-103	< 0.012	< 0.013	< 0.023	< 0.028	
Ru-106	< 0.12	< 0.15	< 0.12	< 0.12	
Cs-134	< 0.012	< 0.018	< 0.015	< 0.022	
Cs-137	< 0.008	< 0.015	< 0.014	< 0.019	
Ce-141	< 0.025	< 0.021	< 0.039	< 0.048	
Ce-144	< 0.10	< 0.079	< 0.083	< 0.13	

Table 19. River sediment, analysis for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/g dry

Location	D-50 (Plant Intake, Control)	
Lab Code	DBS- 2266	DBS- 6729
Date Collected	05-21-14	11-26-14
K-40	8.29 ± 0.53	7.65 ± 0.49
Mn-54	< 0.015	< 0.015
Fe-59	< 0.032	< 0.029
Co-58	< 0.016	< 0.014
Co-60	< 0.011	< 0.010
Zn-65	< 0.026	< 0.025
Nb-95	< 0.019	< 0.014
Zr-95	< 0.023	< 0.015
Ru-103	< 0.017	< 0.018
Ru-106	< 0.049	< 0.11
Cs-134	< 0.010	< 0.010
Cs-137	< 0.015	< 0.013
Ce-141	< 0.043	< 0.032
Ce-144	< 0.094	< 0.066

Location	D-51 (Discharge)	
Lab Code	DBS- 2267	DBS- 6730
Date Collected	05-21-14	11-26-14
K-40	8.03 ± 0.48	7.31 ± 0.43
Mn-54	< 0.012	< 0.012
Fe-59	< 0.032	< 0.029
Co-58	< 0.016	< 0.010
Co-60	< 0.009	< 0.008
Zn-65	< 0.030	< 0.021
Nb-95	< 0.024	< 0.006
Zr-95	< 0.016	< 0.014
Ru-103	< 0.017	< 0.013
Ru-106	< 0.054	< 0.059
Cs-134	< 0.010	< 0.009
Cs-137	< 0.011	< 0.010
Ce-141	< 0.041	< 0.013
Ce-144	< 0.059	< 0.075

Table 19. River sediment, analysis for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/g dry

Location	D-107A (North Drainage Ditch)	
Lab Code	DBS- 2268	DBS- 6731
Date Collected	05-21-14	11-26-14
K-40	6.23 ± 0.41	5.45 ± 0.42
Mn-54	< 0.018	< 0.015
Fe-59	< 0.039	< 0.016
Co-58	< 0.008	< 0.011
Co-60	< 0.010	< 0.009
Zn-65	< 0.033	< 0.026
Nb-95	< 0.020	< 0.008
Zr-95	< 0.026	< 0.023
Ru-103	< 0.012	< 0.016
Ru-106	< 0.11	< 0.098
Cs-134	< 0.012	< 0.012
Cs-137	< 0.011	< 0.010
Ce-141	< 0.043	< 0.030
Ce-144	< 0.072	< 0.089