NEXTera ENERGY
DUANE ARNOLD

May 11, 2018

NG-18-0054
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: 2017 Annual Radiological Environmental Operating Report

Please find as Enclosure 1 to this letter, a copy of NextEra Energy Duane Arnold, LLC's 2017 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 Michael Casey at (319) 851-7606.

Sincerely,

Dean Curtland

Dean Curtland
Site Director
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

Enclosure 1 to
NG-18-0054

Duane Arnold Energy Center

2017 Annual Radiological Environmental Operating Report

140 Pages to follow

2017

Annual Radiological Environmental Operating Report

Duane Arnold Energy Center

Cedar Rapids, Iowa

Docket No. 50-331

January 1, 2017 through December 31, 2017

NEXTera ENERGY

DUANE ARNOLD

Fact Sheet

Duane Arnold Energy Center

SITE ADDRESS
3277 DAEC Road
Palo, IA 52324

CORPORATE MEDIA LINE
(561) 694-4442

Safety Information

Built in a low-risk seismic zone: Duane Arnold is in a very seismically stable area of the country.

Constructed to withstand earthquakes and tornados: Despite the low risk from seismic events, the plant is designed to withstand earthquakes, tornados and other events stronger than ever recorded in the region.

Protected from flooding: The plant is elevated 20 feet above river level to protect against flooding.

» During 2008's historic 500-year flood, the Cedar River crested 14 feet below the plant's design flood level
» During this event, DAEC was able to continue safe and reliable operations

Seven-day power supply: Safety and cooling systems can be powered for seven days without requiring any offsite power or additional fuel.

Designed with multiple safety systems: The Nuclear Regulatory Commission has mandated several structural improvements over time, enhancing Duane Arnold's ability to deal with significant events:

» Four offsite power lines power the site's cooling system
» Two on-site diesel generators are available to provide back-up emergency power to plant safety equipment
» Multiple steam-driven cooling pumps are available to power cooling systems (do not require external power)
» Back-up batteries for all critical cooling and control room systems are stored on-site
» External cooling options (i.e. injection and fire pumps) are pre-staged on-site; can use river water for cooling

Highly trained plant operators: For one full week out of every six weeks, plant operators must prove their ability to safely operate the plant in a variety of worst-case scenarios that include earthquakes, severe storms, flooding, loss-of-power and loss of reactor core cooling.

System Information

PRIMARY SYSTEM	
Reactor Type	One General Electric Boiling Water Reactor with a net electrical output of 615 MWe
Reactor Core	368 fuel assemblies
Reactor Vessel	67' high; 15' wide
Reactor Design	General Electric Mark 1
SECONDARY SYSTEM	
Turbine/Generator	General Electric
Cooling Towers	Mechanical draft type — two towers, 12 cells each, makeup water from Cedar River

General Information

The Duane Arnold Energy Center (DAEC) is located in Palo, Iowa, approximately nine miles northwest of Cedar Rapids. It is bordered by cornfields of neighboring farms and the banks of the Cedar River.

» **Workforce**
600 during normal operations; nearly 1,500 during outage operations

» **Salaries**
Approximately $85 million annually

» **Economic impact**
Stimulates $255 million in economic activity in Iowa, $514 million nationally

» **Property taxes paid**
Approximately $3 million annually

» **Construction permit granted**
June 1970

» **Full power operating license**
February 1974

» **Commercial operation**
February 1975

For More Information:
nexteraenergyresources.com
duanearnold.com
nrc.gov

Intentionally blank

2017
Annual Radiological Environmental Operating Report

Duane Arnold Energy Center
DOCKET NUMBER. 50-331

Prepared By: _____ Date: 4-23-18
Daron Tanko

Reviewed By: _____ Date: 4/23/18
Michael Casey

Approved By: _____ Date: 4/24/18
Dean Curtland

Intentionally blank

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

DUANE ARNOLD ENERGY CENTER
CEDAR RAPIDS, IOWA
DOCKET NO. 50-331

REPORT

to the

UNITED STATES
NUCLEAR REGULATORY COMMISSION

Annual Radiological Environmental Operating Report

January 1 to December 31, 2017

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

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

APPENDICES

TABLE OF CONTENTS (continued)

PART II

Page

LIST OF TABLES

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

Appendix A

Appendix C

LIST OF FIGURES

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, 2017. 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 2017 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, a continuous air sampler is employed. Airborne particulates and activated charcoal canisters are mounted on the intake of the air sampler to collect airborne particulates and airborne iodine respectively. 2017 began with nine sampling locations. 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 canister samples are analyzed weekly for iodine-131.

Ambient gamma radiation is monitored at a total of 51 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.
- Eleven 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 (D-49) and discharge (D-51) and the site's north drainage ditch (D-107a). The samples are analyzed for gamma-emitting isotopes.

Potable groundwater is collected monthly from the Cedar Rapids treated municipal water system (D-53), the inlet to the Cedar Rapids 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. The samples are analyzed for tritium, I-131 by chemical separation to an MDC of 1 pCi/L, and gamma emitting isotopes.

For 2017, dairy cow milk is collected monthly from one indicator (D-110) and one control location (D-138) from January to December. Monthly sampling was determined to be sufficient due to the milk sampling locations more than five miles from the facility. The samples are analyzed for iodine-131 and gamma-emitting isotopes. This sampling is supplemented with goat's milk when available from indicator location (D-76).

Additional monitoring of the terrestrial environment, grain, hay, grass and broadleaf vegetation samples are collected annually, as available, from nine locations: one control (D-138) and eight indicators (D-16, D-57, D-96, D-109, D-110 and D-118). Grain, hay and broadleaf (green leafy) vegetation samples are analyzed for gamma-emitting isotopes and at least two broad leaf vegetation samples are analyzed for iodine-131. Vegetation control samples are purchased from local grocery and feed stores provided the sample source is outside the State of Iowa.

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 Groundwater Protection Program

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Groundwater Protection Program (GWPP). The GWPP is formally included within REMP and the standards are set forth in the Duane Arnold Energy Center Offsite Dose Assessment Manual, Table 6.3-2. The Groundwater Protection Program encompasses activities to ensure the protection of groundwater within the owner controlled area by sampling the groundwater, soil, precipitation, electrical vault and sewage effluent. For sewage effluent results only, refer to the Duane Arnold Energy Center, 2017 Annual Radioactive Material Release Report and Appendix E of this report for groundwater, soil, electrical vault, and precipitation sample results.

3.3 Program Execution

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

(1) Airborne Particulates / Airborne Iodine:

Air particulate / air iodine sampling was affected by power outages at two locations during the year. In most cases the power issues resulted in lower sample volumes and in a couple of cases the power outages resulted in a failure to meet the required LLD for Iodine-131. Details of the outages are listed in table 5.6. In summary location D-15 had a lower volume for the collections ending 5/5/17 and 7/7/17 resulting in a failure to reach the required LLD. Location D-40 had lower volume for the collection ending 6/2/17.

(2) Thermoluminescent Dosimetry

TLD's were found missing for the second quarter at location D-86, the third quarter at location D-40 and at for the fourth quarter at location D-41. The cause for the losses are unknown but are believed to be due to theft or vandalism.

(3) Milk

Goat's milk was unavailable at location D-76 due to limited herd production for the scheduled collections on 5/16/17, 6/8/17, 7/12/17, 8/8/17, 9/6/17 10/10/17, 11/14/17 and 12/5/17.

(4) Well Water

Well water was not available at locations D-52 for the 8/16/17 collection due to water source shutdown during the sampling period.

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, 2017). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

There were a few changes to the REMP program in 2017. Air sampling location 5A was added to the program at the beginning of the year. Goat milk sampling was conducted at location D-76 when available. Milk sampling was modified to monthly sampling from January to December. Also, well water sampling was initiated at location D-52 during 2017. Lastly, the DAEC Groundwater Protection Program was formally included within REMP. REMP and GWPP standards and requirements can be found in the Duane Arnold Energy Center 2017 Annual Radiological Material Release Report in Attachment 2, Offsite Dose Assessment Manual.

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 2017 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 2017. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2017. 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 2017. The trace levels of 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 similar at indicator and control locations (0.028 and 0.025 pCi/m3, respectively) and similar to levels observed from 1995 through 2016. The results are tabulated below.

Year	Indicators	Controls		Year	Indicators	Controls
Concentration (pCi/m^3)				Concentration (pCi/m^3)		
2000	0.026	0.027		2009	0.031	0.030
2001	0.026	0.026		2010	0.028	0.028
2002	0.027	0.027		2011	0.030	0.029
2003	0.029	0.029		2012	0.030	0.029
2004	0.028	0.028		2013	0.028	0.025
2005	0.031	0.031		2014	0.026	0.025
2006	0.029	0.027		2015	0.027	0.024
2007	0.031	0.031		2016	0.027	0.023
2008	0.029	0.029		2017	0.028	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 0.080 pCi/m3 for indicator locations and 0.073 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/m^3 with the exception of samples collected at location D-15 for the week ending 5/5/17 and 7/7/17 due to power failures to the air sampling pumps.

Ambient Radiation (TLDs)

At ten control locations, thermoluminescent dosimeter (TLD) readings averaged 16.2 mR/quarter. At locations within a half mile, one mile and three mile radius of the stack, the measurements averaged 18.3, 18.6 and 16.4 mR/quarter, respectively. The two on-site locations D-15 and D-16 averaged 16.5 and 15.4 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 49.0 mR/quarter. The TLD site D-30, located between the nearest residence and the ISFSI site averaged 20.7 mR/quarter. Calculated dose rates indicate the site is in compliance with 10 CFR 72.104 and 40 CFR 190.

Milk

Iodine-131 concentrations in milk samples were less than the LLD level of 1.0 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.

Groundwater (potable)

Tritium concentrations in ground water samples were less than the MDC of 187 pCi/L in all samples analyzed. 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 vegetation samples were less than the LLD level of 0.025 pCi/g wet weight in all samples analyzed.

With the exception of potassium-40, which was observed in all vegetation samples, 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.

Analyses for I-131 were performed on samples from locations D-49 (control) and D-61 (0.5 mi. downstream, indicator). No measurable I-131 was detected above an LLD of 0.5 pCi/L.

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 August, 2017, 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 (2.95 and 3.05 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

Six river sediments were collected in 2017 during the months of April and November, and analyzed for gamma-emitting isotopes. Potassium-40 activity ranged from 7.52 to 8.53 pCi/g dry weight at the indicator locations and between 7.88 and 9.20 pCi/g dry weight at the control location. Cs-137 was detected in one sample from the control location at a level of 0.079 pCi/gdry. The source of the Cs-137 from the river bed sample upstream of the DAEC liquid effluent outfall is from nuclear weapons testing and not plant activities.

All samples met required lower limits of detection as specified in the DAEC Offsite Dose Assessment Manual.

4.3 Ground Water Protection Program Findings

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Ground Water Protection Program except for sewage effluent results; refer to Appendix E. Sewage effluent sample results can be found in the Duane Arnold Energy Center 2017 Annual Radiological Material Release Report.

Groundwater

351 groundwater samples (non-potable water) were collected from 56 permitted monitoring wells and three permitted extraction wells in 2017. Tritium was the only plant by-product identified. Concentrations of tritium ranged from less than 145 pCi/L to 203,138 pCi/L at D-128A, monitoring

well MW-08A. An explanation of tritium mitigation can be found in the Duane Arnold Energy Center 2017 Radioactive Material Release Report. Tritium was not identified in any drinking water well on-site or at off-site wells. Tritium was not identified in any Cedar Rapids municipal drinking water sample. Lastly, the monitoring well farthest down gradient prior to reaching the boundary of the owner controlled area, MW-33A, did not indicate tritium above 177 pCi/L (+/- 86 pCi/L), which is within error limits for non-detectable range of less than 146 pCi/L.

Soil

Seven soil samples were collected in 2017, two from D-15a and two from D-16. All four samples were positive for cesium-137 with an average level of 0.12 pCi/g dry weight. Due to these results, three additional samples were collected by the State of Iowa Hygienic Laboratory from Mason City, Ames and Coralville, Iowa. The results support the conclusion that the detected cesium-137 is from nuclear weapons testing and not from plant activities.

Precipitation

72 precipitation samples were collected in 2017 from six precipitation collection locations. Tritium was consistently identified at locations D-127 and D-128. The highest tritium concentration was 4,435 pCi/L from D-127. The proximity of the plant gaseous effluent release points coupled with atmospheric conditions enables recapture of gaseous effluent, specifically tritiated water vapor, to be entrained in precipitation and deposited within the protected area. Occasionally, tritiated precipitation collects in a basin or pit. This water is then sampled and released in accordance with the Offsite Dose Assessment Manual (ODAM), "Clean" system batch release of a liquid effluent as documented in ODAM, Table 7.1-2. The ODAM can be found as attachment two of the Duane Arnold Energy Center 2017 Annual Radiological Material Release Report.

Electrical Vaults

23 electrical vaults samples were collected in 2017 from nine electrical vaults. Electrical vaults are below grade structures designed for electrical cabling. Surface water and groundwater may seep into the vaults. Tritium concentrations range from less than 146 pCi/L to 3,174 pCi/L, which is consistent with rainfall recapture of tritiated water vapor from plant gaseous effluent release points.

Storm Drains, Sluice Pond, and Drainage Ditches.

13 samples were collected in 2017 from storm drains, sluice ponds and drainage ditches. Surface water sampling from these locations is consistent with non-point source runoff sampling activities. Similar to electrical vaults, tritium recapture is the source for tritium identified with the maximum concentration of 1,719 pCi/L from D-125.

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	1.26×10^9 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 5A 6 7 11 13 15 16 40	Hiawatha Palo[c] 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 5A 6 7 11 13 15 16 40	Hiawatha Palo[c] 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, 5A, 6-8 10, 11, 13 15-23, 28-32, 33-42 43-48 82-86, 91 161-164	(Controls) (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. 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	49 50 51 107a	Lewis Access 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 56 96,109 110,118 138 (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 56 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	138 (C) 110 76	Farm near Newhall, IA Dairy Farm within 7.8 miles from Site Goat Farm ENE of site.	Monthly. Monthly. Monthly depending on availablity.	Gamma isotopic and iodine-131 analyses of each sample.

[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.

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-5A	Palo	3,470 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	Production wells A-D
D-56	Control samples from various locations	Sample location varies
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-76	Farm	2,888 meters ENE
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	On-site
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-5A	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-56					
D-57			WW		G
D-58			WW		
D-61		SW		F	
D-72			WW		
D-76		MI*			
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					

* Goat's milk sampled when available.

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
AP/AI	Gross Beta/ I-131	D-15	05/05/17	Low volume of 91 m^3 due to power outage; storms in area.
Milk	I-131/Gamma	D-76	05/16/17	Goat's milk unavailable due to limited herd production.
AP/AI	Gross Beta/ I-131	D-40	06/02/17	Low volume of 80 m^3 due to power outage.
Milk	I-131/Gamma	D-76	06/08/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-86	06/29/17	TLD missing in field.
AP/AI	Gross Beta/ I-131	D-15	07/07/17	Low volume of 2 m^3 due to power outage; not enough for viable sample results.
Milk	I-131/Gamma	D-76	07/12/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	08/08/17	Goat's milk unavailable due to limited herd production.
WW	H-3/I-131/Gamma	D-52	08/16/17	No sample sent due to water source shutdown during sampling period.
Milk	I-131/Gamma	D-76	09/06/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-40	10/02/17	TLD missing in field.
Milk	I-131/Gamma	D-76	10/10/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	11/14/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	12/05/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-41	01/05/18	TLD missing in field.

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	Duane Arnold Energy Center	Docket No.	50-331
Location of Facility	Linn, Iowa (County, State)	Reporting Period	January-December, 2017

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean: Location [d]	Location with Highest Annual Mean: Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results
Airborne Pathway							
Airborne Particulates (pCi/m^3)	GB 416	0.003	0.028 (415/415) (0.010-0.056)	D-07, Shellsburg	0.029 (52/52) (0.010-0.060)	0.025 (52/52) (0.011-0.052)	0
	GS 36						
	Be-7	0.020	0.080 (32/32) (0.007-0.062)	D-3, Hiawatha	0.089 (4/4) (0.070-0.107)	0.073 (4/4) (0.050-0.093)	0
	Mn-54	0.0015	< LLD			< LLD	0
	Fe-59	0.0037	< LLD			< LLD	0
	Co-58	0.0013	< LLD			< LLD	0
	Co-60	0.0012	< LLD			< LLD	0
	Zn-65	0.0046	< LLD			< LLD	0
	Nb-95	0.0025	< LLD			< LLD	0
	Zr-95	0.0027	< LLD			< LLD	0
	Ru-103	0.0024	< LLD			< LLD	0
	Ru-106	0.0117	< LLD			< LLD	0
	Cs-134	0.0015	< LLD			< LLD	0
	Cs-137	0.0012	< LLD			< LLD	0
	Ce-141	0.0034	< LLD			< LLD	0
	Ce-144	0.0067	< LLD			< LLD	0
Airborne Iodine (pCi/m^3)	1-131 416	0.030	< LLD			< LLD	0
Direct Radiation							
TLDs (m R/quarter)							
Control Locations	Gamma 40	1.0	None	D-5A Palo SSW	18.9 (4/4) (16.4-19.1)	16.2 (40/40) (13.1-22.1)	0
Within 0.5 mi. of Stack	Gamma 80	1.0	18.3(79/79) (12.7-23.4)	D-29,0n-site 0.5 mi. W	21.8 (4/4) (20.2-23.6)	None	0
Within 1.0 mi. of Stack	Gamma 23	1.0	18.6 (24/24) (14.5-24.1)	D-48, 1 mi. NNW	21.8 (4/4) (20.7-22.7)	None	0
Within 3.0 mi. of Stack	Gamma 40	1.0	16.4 (40/40) (12.7-21.0)	D-37, E	19.1 (4/4) (18.0-21.0)	None	0
ISFSI border	Gamma 14	1.0	32.2 (14/14 (16.8-56.2))	D-161	49.0 (4/4) (16.8-56.2))	None	0

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility: Duane Arnold Energy Center
Location of Facility: Linn, Iowa (County, State)
Docket No. 50-331
Reporting Period January-December, 2017

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean: Location [d]	Location with Highest Annual Mean: Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results
Waterborne Pathway							
Surface Water (pCi/L)	H-3 60	183	< LLD	-	-	< LLD	0
	I-131 24	1.0	< LLD	-	-	< LLD	0
	Sr-89 8	0.86	< LLD	-	-	< LLD	0
	Sr-90 8	0.73	< LLD	-	-	< LLD	0
	GS 60						
	Mn-54	6.1	< LLD	-	-	< LLD	0
	Fe-59	8.3	< LLD	-	-	< LLD	0
	Co-58	5.2	< LLD	-	-	< LLD	0
	Co-60	5.0	< LLD	-	-	< LLD	0
	Zn-65	9.2	< LLD	-	-	< LLD	0
	Nb-95	4.8	< LLD	-	-	< LLD	0
	Zr-95	8.1	< LLD	-	-	< LLD	0
	I-131	9.1	< LLD	-	-	< LLD	0
	Cs-134	6.3	< LLD	-	-	< LLD	0
	Cs-137	5.3	< LLD	-	-	< LLD	0
	Ba-140	24.3	< LLD	-	-	< LLD	0
	La-140	12.5	< LLD	-	-	< LLD	0
Sediments (pCi/g dry)	GS 6						
	K-40	1.0	8.14 (4/4) (7.52-8.53)	D-49, Lewis Access Upstream	8.54 (2/2) (7.88-9.20)	8.54 (2/2) (7.88-9.20)	0
	Mn-54	0.028	< LLD	-	-	< LLD	0
	Fe-59	0.072	< LLD	-	-	< LLD	0
	Co-58	0.023	< LLD	-	-	< LLD	0
	Co-60	0.020	< LLD	-	-	< LLD	0
	Zn-65	0.052	< LLD	-	-	< LLD	0
	Nb-95	0.052	< LLD	-	-	< LLD	0
	Zr-95	0.036	< LLD	-	-	< LLD	0
	Ru-103	0.035	< LLD	-	-	< LLD	0
	Ru-106	0.166	< LLD	-	-	< LLD	0
	Cs-134	0.023	< LLD	-	-	< LLD	0
	Cs-137	0.029	< LLD	-	-	< LLD	0
	Ce-141	0.066	< LLD	-	-	< LLD	0
	Ce-144	0.178	< 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 (County, State) — Reporting Period: January-December, 2017

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean: Location [d]	Location with Highest Annual Mean: Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results
Waterborne Pathway							
Ground Water, potable (pCi/L)	1-131[1] 24	0.5	< LLD	-	-	< LLD	0
				-	-		
	H-3 24	187	< LLD	-	-	< LLD	0
	GS 24						
	Mn-54	5.4	< LLD	-	-	< LLD	0
	Fe-59	8.9	< LLD	-	-	< LLD	0
	Co-58	6.8	< LLD	-	-	< LLD	0
	Co-60	5.6	< LLD	-	-	< LLD	0
	Zn-65	8.3	< LLD	-	-	< LLD	0
	Nb-95	5.6	< LLD	-	-	< LLD	0
	Zr-95	9.2	< LLD	-	-	< LLD	0
	1-131	11.4	< LLD	-	-	< LLD	0
	Cs-134	6.4	< LLD	-	-	< LLD	0
	Cs-137	6.4	< LLD	-	-	< LLD	0
	Ba-140	30.3	< LLD	-	-	< LLD	0
	La-140	7.9	< LLD	-	-	< LLD	0
Ingestion Pathway							
Milk (pCi/L)	1-131 27	0.5	< LLD	-	-	< LLD	0
	GS 27						
	K-40	100	1478(15/15) (1271-1814)	D-76, Farm 13.4 mi. WSW	1653(3/3) (1450-1814)	1399(12/12) (1291-1560)	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	0.05	3.61 (8/8) (1.93-4.94)	D-96, Farm 7.1 mi. SSW	5.28 (2/2) (2.19-8.36)	1.82 (1/1)	0
	Mn-54	0.017	< LLD	-	-	none	0
	Fe-59	0.032	< LLD	-	-	none	0
	Co-58	0.016	< LLD	-	-	none	0
	Co-60	0.015	< LLD	-	-	none	0
	Zn-65	0.035	< LLD	-	-	none	0
	Nb-95	0.016	< LLD	-	-	none	0
	Zr-95	0.025	< LLD	-	-	none	0
	Ru-103	0.015	< LLD	-	-	none	0
	Ru-106	0.162	< LLD	-	-	none	0
	1-131	0.025	< LLD	-	-	none	0
	Cs-134	0.020	< LLD	-	-	none	0
	Cs-137	0.020	< LLD	-	-	none	0
	Ce-141	0.029	< LLD	-	-	none	0
	Ce-144	0.097	< LLD	-	-	none	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 (County, State)	Reporting Period	January-December, 2017

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean Location [d]	Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
Ingestion Pathway (cont.)							
Vegetation (Grain and Forage) (pCi/g wet)	GS	13					
	K-40	0.5	11.87 (10/10) (2.34-28.94)	D-110	23.42 (1/1)	14.18 (3/3) (2.57-25.91)	0
	Mn-54	0.044	< LLD			< LLD	0
	Fe-59	0.138	< LLD			< LLD	0
	Co-58	0.041	< LLD			< LLD	0
	Co-60	0.033	< LLD			< LLD	0
	Zn-65	0.080	< LLD			< LLD	0
	Nb-95	0.035	< LLD			< LLD	0
	Zr-95	0.060	< LLD			< LLD	0
	Ru-103	0.029	< LLD			< LLD	0
	Ru-106	0.364	< LLD			< LLD	0
	I-131	0.055	< LLD			< LLD	0
	Cs-134	0.047	< LLD			< LLD	0
	Cs-137	0.046	< LLD			< LLD	0
	Ce-141	0.138	< LLD			< LLD	0
	Ce-144	0.372	< LLD			< LLD	0
Fish (pCi/g wet)	GS	8					
	K-40	1.0	2.95 (4/4) (2.80-3.03)	D-61, Downstream, 0.4 mi. SSE	3.05 (4/4) (2.65-3.62	3.05 (4/4) (2.65-3.62)	0 0
	Mn-54	0.056	< LLD			< LLD	0
	Fe-59	0.160	< LLD			< LLD	0
	Co-58	0.080	< LLD			< LLD	0
	Co-60	0.034	< LLD			< LLD	0
	Zn-65	0.078	< LLD			< LLD	0
	Nb-95	0.084	< LLD			< LLD	0
	Zr-95	0.117	< LLD			< LLD	0
	Ru-103	0.100	< LLD			< LLD	0
	Ru-106	0.427	< LLD			< LLD	0
	Cs-134	0.054	< LLD			< LLD	0
	Cs-137	0.050	< LLD			< LLD	0
	Ce-141	0.111	< LLD			< LLD	0
	Ce-144	0.265	< LLD			< LLD	0

[a] GB = Gross beta; GS = Gamma spectroscopy

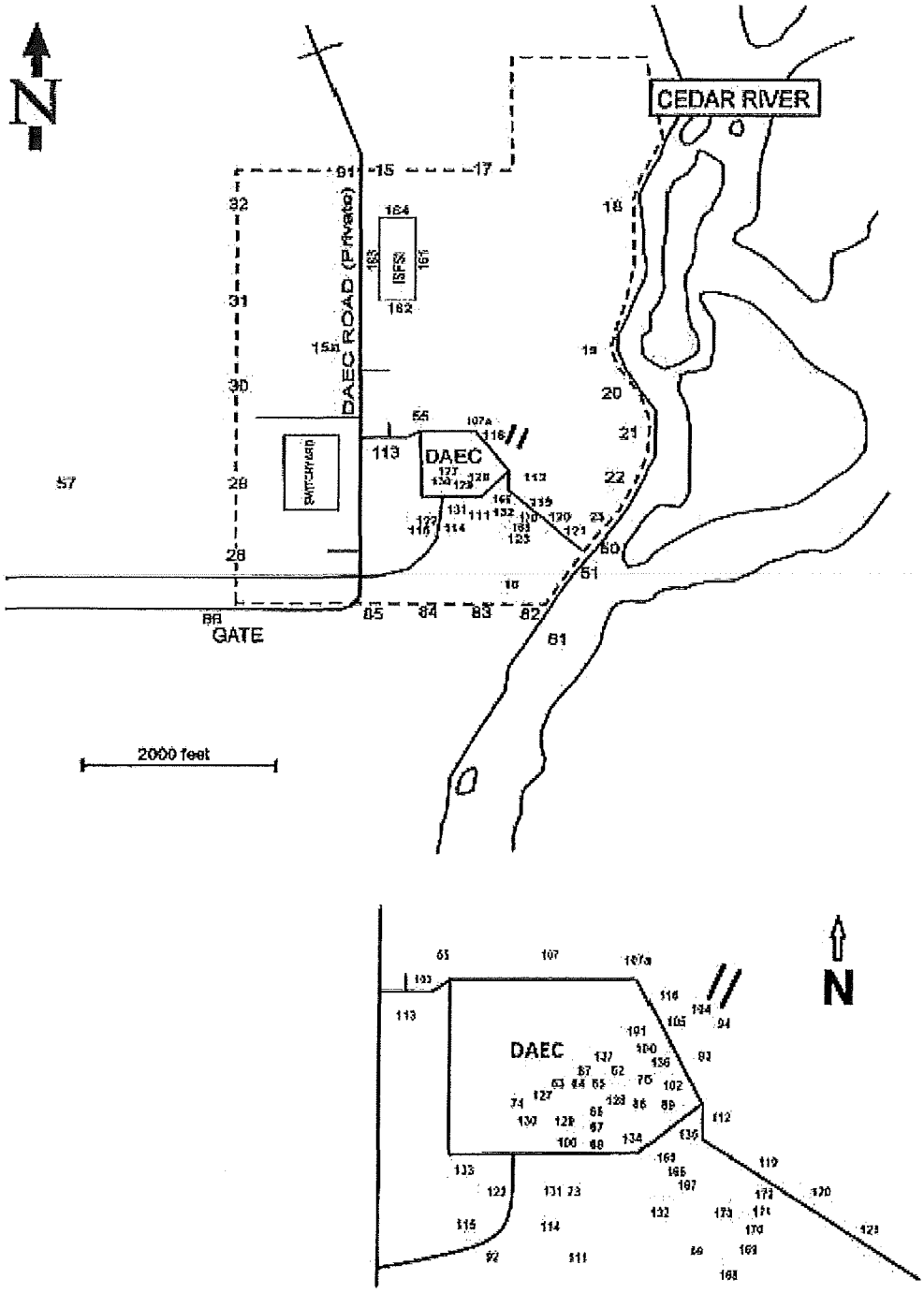
[b] LLD = Nominal lower limit of detection based on 4.66 sigma counting error for the background sample.

[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.

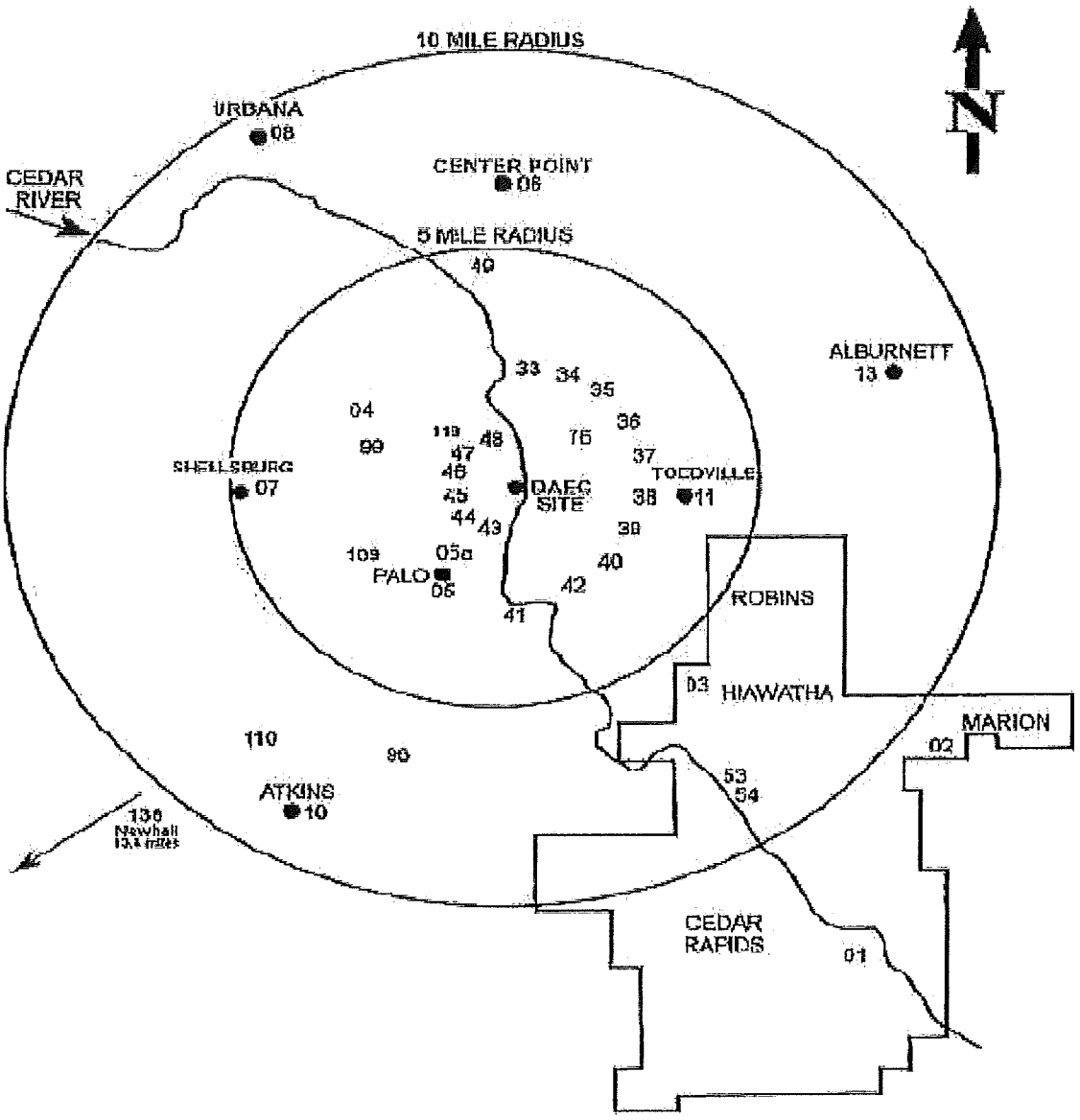
Figure 5.1 Radiological Environmental Monitoring Program Sampling Stations near the Duane Arnold Energy Center.



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.

Figure 5-2
Radiological Environmental Monitoring Program
Sampling Stations Outside 0.5 Miles from DAEC



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

6.0 REFERENCES CITED

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

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

Environmental, Inc., Midwest Laboratory.

_____ 2015 Study Plan, SP-DAEC-8001, revision 24 February 12, 2015, The Operational Radiological Environmental Monitoring Program for the Duane Arnold Energy Center, Cedar Rapids, Iowa

_____ 2001 through 2015. Environmental Radiological Monitoring Program for the Duane Arnold Energy Center, Annual Report - Part II, Data Tabulations and Analyses, January - December, 2001 – 2015.

_____1984 to 2000. (formerly Teledyne Brown Engineering, Environmental Services, Midwest Laboratory) Environmental Radiological Monitoring Program for the Duane Arnold Energy Center, Annual Report - Part II, Data Tabulations and Analyses, January - December, 1983 - 1999.

_____1982 to 1984. (formerly Hazleton Environmental Sciences Corporation) Environmental Radiation Monitoring for the Duane Arnold Energy Center, Annual Report - Part II, Data Tabulations and Analyses, January - December 1981 - 1983.

_____2017. Quality Manual, Rev. 4, 19 June 2017.

_____2012. Quality Assurance Program Manual, Rev. 3, 14 November 2012.

_____2016. Quality Control Procedures Manual, Rev. 3, 03 March 2016.

_____2009. Quality Control Program, Rev. 2, 12 November 2009.

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

National Center for Radiological Health, 1968. Radiological Health and Data Reports, Vol. 9, Number 12, 730-746.

U. S. Department of Energy. 1978. Environmental Quarterly, Appendix E. Half-Life Tables, 1 January 1978, EML-334.

U. S. Nuclear Regulatory Commission. 1977. Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I.

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

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

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, 2017

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

Reviewed and Approved

Bronia Grob, M.S.
Laboratory Manager

TABLE OF CONTENTS

LIST OF TABLES

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 2017. 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
AP/AI	Gross Beta/ I-131	D-15	05/05/17	Low volume of 91 m^3 due to power outage; storms in area.
Milk	I-131/Gamma	D-76	05/16/17	Goat's milk unavailable due to limited herd production.
AP/AI	Gross Beta/ I-131	D-40	06/02/17	Low volume of 80 m^3 due to power outage.
Milk	I-131/Gamma	D-76	06/08/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-86	06/29/17	TLD missing in field.
AP/AI	Gross Beta/ I-131	D-15	07/07/17	Low volume of 2 m^3 due to power outage; not enough for viable sample results.
Milk	I-131/Gamma	D-76	07/12/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	08/08/17	Goat's milk unavailable due to limited herd production.
WW	H-3/I-131/Gamma	D-52	08/16/17	No sample sent due to water source shutdown during sampling period.
Milk	I-131/Gamma	D-76	09/06/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-40	10/02/17	TLD missing in field.
Milk	I-131/Gamma	D-76	10/10/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	11/14/17	Goat's milk unavailable due to limited herd production.
Milk	I-131/Gamma	D-76	12/05/17	Goat's milk unavailable due to limited herd production.
TLD	Gamma	D-41	01/05/18	TLD missing in field.

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/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	238	0.030 ± 0.004	07-07-17	285	0.041 ± 0.004
01-12-17	272	0.051 ± 0.005	07-14-17	285	0.025 ± 0.004
01-20-17	315	0.038 ± 0.004	07-21-17	288	0.031 ± 0.004
01-26-17	232	0.030 ± 0.005	07-28-17	285	0.028 ± 0.004
02-02-17	276	0.025 ± 0.004			
			08-04-17	285	0.029 ± 0.004
02-10-17	314	0.034 ± 0.004	08-11-17	284	0.030 ± 0.004
02-17-17	274	0.025 ± 0.004	08-18-17	288	0.030 ± 0.004
02-24-17	273	0.032 ± 0.004	08-25-17	283	0.031 ± 0.004
03-03-17	273	0.034 ± 0.004	09-01-17	286	0.033 ± 0.004
03-10-17	276	0.020 ± 0.004	09-08-17	287	0.036 ± 0.004
03-17-17	271	0.022 ± 0.004	09-15-17	285	0.056 ± 0.005
03-24-17	276	0.027 ± 0.004	09-22-17	285	0.040 ± 0.004
03-30-17	247	0.019 ± 0.004	09-29-17	274	0.047 ± 0.005
1st Quarter Mean ± s.d.		0.030 ± 0.009	3rd Quarter Mean ± s.d.		0.035 ± 0.009
04-07-17	332	0.015 ± 0.003	10-06-17	276	0.030 ± 0.004
04-13-17	253	0.026 ± 0.004	10-13-17	271	0.027 ± 0.004
04-20-17	292	0.023 ± 0.004	10-20-17	275	0.032 ± 0.004
04-28-17	330	0.016 ± 0.003	10-27-17	275	0.021 ± 0.004
			11-03-17	274	0.020 ± 0.004
05-05-17	290	0.017 ± 0.003			
05-12-17	292	0.025 ± 0.004	11-10-17	273	0.038 ± 0.004
05-19-17	292	0.024 ± 0.004	11-17-17	274	0.040 ± 0.005
05-26-17	289	0.014 ± 0.003	11-22-17	196	0.035 ± 0.005
06-02-17	294	0.015 ± 0.003	12-01-17	351	0.025 ± 0.003
06-09-17	290	0.026 ± 0.004	12-08-17	273	0.041 ± 0.005
06-16-17	295	0.029 ± 0.004	12-14-17	236	0.040 ± 0.005
06-23-17	287	0.025 ± 0.004	12-22-17	317	0.039 ± 0.004
06-30-17	286	0.016 ± 0.003	12-29-17	275	0.039 ± 0.005
2nd Quarter Mean ± s.d.		0.021 ± 0.006	4th Quarter Mean ± s.d.		0.033 ± 0.007
			Cumulative Average		0.030

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

Location: D-5A (Palo)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	247	0.031 ± 0.004	07-07-17	285	0.041 ± 0.004
01-12-17	283	0.052 ± 0.005	07-14-17	289	0.026 ± 0.004
01-20-17	318	0.031 ± 0.004	07-21-17	283	0.030 ± 0.004
01-26-17	241	0.033 ± 0.005	07-28-17	285	0.023 ± 0.004
02-02-17	279	0.027 ± 0.004			
			08-04-17	286	0.011 ± 0.003 [b]
02-10-17	318	0.034 ± 0.004	08-11-17	285	0.031 ± 0.004
02-17-17	277	0.028 ± 0.004	08-18-17	284	0.025 ± 0.004
02-24-17	276	0.035 ± 0.004	08-25-17	282	0.027 ± 0.004
03-03-17	284	0.025 ± 0.004	09-01-17	285	0.028 ± 0.004
03-10-17	280	0.022 ± 0.004	09-08-17	288	0.031 ± 0.004
03-17-17	274	0.028 ± 0.004	09-15-17	284	0.060 ± 0.005
03-24-17	276	0.028 ± 0.004	09-22-17	285	0.036 ± 0.004
03-30-17	240	0.018 ± 0.004	09-29-17	285	0.037 ± 0.004
1st Quarter Mean ± s.d.		0.030 ± 0.008	3rd Quarter Mean ± s.d.		0.031 ± 0.011
04-07-17	314	0.015 ± 0.003	10-06-17	272	0.025 ± 0.004
04-13-17	242	0.021 ± 0.004	10-13-17	270	0.025 ± 0.004
04-20-17	277	0.023 ± 0.004	10-20-17	273	0.033 ± 0.004
04-28-17	315	0.018 ± 0.003	10-27-17	271	0.021 ± 0.004
			11-03-17	268	0.019 ± 0.004
05-05-17	273	0.017 ± 0.003			
05-12-17	280	0.022 ± 0.004	11-10-17	273	0.036 ± 0.004
05-19-17	282	0.022 ± 0.003	11-17-17	272	0.045 ± 0.005
05-26-17	272	0.015 ± 0.003	11-22-17	193	0.045 ± 0.006
06-02-17	275	0.017 ± 0.003	12-01-17	348	0.034 ± 0.004
06-09-17	273	0.027 ± 0.004	12-08-17	270	0.041 ± 0.005
06-16-17	277	0.027 ± 0.004	12-14-17	234	0.028 ± 0.004
06-23-17	271	0.022 ± 0.004	12-22-17	312	0.045 ± 0.004
06-30-17	275	0.017 ± 0.003	12-29-17	269	0.037 ± 0.005
2nd Quarter Mean ± s.d.		0.020 ± 0.004	4th Quarter Mean ± s.d.		0.033 ± 0.009
			Cumulative Average		0.029

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

[b] Filter light.

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

Location: D-6 (Center Point)
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	267	0.030 ± 0.005	07-07-17	277	0.026 ± 0.004
01-12-17	264	0.048 ± 0.005	07-14-17	276	0.023 ± 0.004
01-20-17	405	0.033 ± 0.004	07-21-17	279	0.012 ± 0.003
01-26-17	270	0.034 ± 0.005	07-28-17	276	0.024 ± 0.004
02-02-17	284	0.023 ± 0.004			
			08-04-17	277	0.028 ± 0.004
02-10-17	324	0.033 ± 0.004	08-11-17	276	0.030 ± 0.004
02-17-17	282	0.024 ± 0.004	08-18-17	279	0.026 ± 0.004
02-24-17	281	0.031 ± 0.004	08-25-17	274	0.027 ± 0.004
03-03-17	284	0.029 ± 0.004	09-01-17	276	0.035 ± 0.005
03-10-17	283	0.021 ± 0.004	09-08-17	279	0.035 ± 0.004
03-17-17	281	0.023 ± 0.004	09-15-17	276	0.062 ± 0.005
03-24-17	284	0.028 ± 0.004	09-22-17	276	0.035 ± 0.004
03-30-17	241	0.013 ± 0.003	09-29-17	277	0.037 ± 0.004
1st Quarter Mean ± s.d.		0.028 ± 0.008	3rd Quarter Mean ± s.d.		0.031 ± 0.012
04-07-17	312	0.015 ± 0.003	10-06-17	278	0.028 ± 0.004
04-13-17	238	0.025 ± 0.004	10-13-17	276	0.026 ± 0.004
04-20-17	273	0.018 ± 0.003	10-20-17	278	0.033 ± 0.004
04-28-17	313	0.013 ± 0.003	10-27-17	277	0.023 ± 0.004
			11-03-17	276	0.019 ± 0.003
05-05-17	281	0.016 ± 0.003			
05-12-17	276	0.024 ± 0.004	11-10-17	279	0.033 ± 0.004
05-19-17	277	0.019 ± 0.003	11-17-17	277	0.039 ± 0.004
05-26-17	281	0.012 ± 0.003	11-22-17	197	0.036 ± 0.005
06-02-17	278	0.009 ± 0.003	12-01-17	377	0.030 ± 0.003
06-09-17	276	0.029 ± 0.004	12-08-17	293	0.038 ± 0.004
06-16-17	278	0.027 ± 0.004	12-14-17	254	0.034 ± 0.005
06-23-17	274	0.018 ± 0.003	12-22-17	340	0.034 ± 0.004
06-30-17	278	0.021 ± 0.004	12-29-17	291	0.033 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.031 ± 0.006
			Cumulative Average		0.027

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

Location: D-7 (Shellsburg)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	279	0.030 ± 0.004	07-07-17	277	0.034 ± 0.004
01-12-17	286	0.039 ± 0.005	07-14-17	279	0.025 ± 0.004
01-20-17	436	0.037 ± 0.004	07-21-17	276	0.026 ± 0.004
01-26-17	288	0.029 ± 0.005	07-28-17	276	0.030 ± 0.004
02-02-17	265	0.026 ± 0.004			
			08-04-17	277	0.041 ± 0.004
02-10-17	300	0.035 ± 0.004	08-11-17	276	0.030 ± 0.004
02-17-17	262	0.026 ± 0.004	08-18-17	278	0.030 ± 0.004
02-24-17	261	0.033 ± 0.004	08-25-17	277	0.032 ± 0.004
03-03-17	278	0.029 ± 0.004	09-01-17	280	0.035 ± 0.004
03-10-17	283	0.017 ± 0.003	09-08-17	282	0.035 ± 0.004
03-17-17	281	0.029 ± 0.004	09-15-17	279	0.060 ± 0.005
03-24-17	285	0.026 ± 0.004	09-22-17	279	0.038 ± 0.004
03-30-17	240	0.015 ± 0.004	09-29-17	280	0.036 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.007	3rd Quarter Mean ± s.d.		0.035 ± 0.009
04-07-17	322	0.010 ± 0.003	10-06-17	280	0.031 ± 0.004
04-13-17	245	0.028 ± 0.004	10-13-17	279	0.024 ± 0.004
04-20-17	282	0.023 ± 0.004	10-20-17	281	0.031 ± 0.004
04-28-17	322	0.019 ± 0.003	10-27-17	280	0.018 ± 0.003
			11-03-17	280	0.018 ± 0.003
05-05-17	275	0.012 ± 0.003			
05-12-17	284	0.022 ± 0.004	11-10-17	281	0.035 ± 0.004
05-19-17	277	0.022 ± 0.004	11-17-17	280	0.038 ± 0.004
05-26-17	275	0.016 ± 0.003	11-22-17	216	0.040 ± 0.005
06-02-17	278	0.021 ± 0.004	12-01-17	388	0.018 ± 0.003
06-09-17	276	0.027 ± 0.004	12-08-17	301	0.043 ± 0.004
06-16-17	280	0.032 ± 0.004	12-14-17	261	0.037 ± 0.005
06-23-17	274	0.022 ± 0.004	12-22-17	349	0.036 ± 0.004
06-30-17	278	0.018 ± 0.003	12-29-17	300	0.037 ± 0.004
2nd Quarter Mean ± s.d.		0.021 ± 0.006	4th Quarter Mean ± s.d.		0.031 ± 0.009
			Cumulative Average		0.029

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

Location: D-11 (Toddville)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	269	0.030 ± 0.004	07-07-17	276	0.034 ± 0.004
01-12-17	263	0.053 ± 0.005	07-14-17	276	0.018 ± 0.003
01-20-17	413	0.038 ± 0.004	07-21-17	279	0.021 ± 0.004
01-26-17	274	0.034 ± 0.005	07-28-17	276	0.020 ± 0.003
02-02-17	278	0.027 ± 0.004			
			08-04-17	277	0.025 ± 0.004
02-10-17	317	0.030 ± 0.004	08-11-17	270	0.032 ± 0.004
02-17-17	277	0.026 ± 0.004	08-18-17	273	0.030 ± 0.004
02-24-17	275	0.032 ± 0.004	08-25-17	269	0.027 ± 0.004
03-03-17	262	0.022 ± 0.004	09-01-17	271	0.027 ± 0.004
03-10-17	277	0.022 ± 0.004	09-08-17	273	0.034 ± 0.004
03-17-17	275	0.023 ± 0.004	09-15-17	270	0.053 ± 0.005
03-24-17	279	0.027 ± 0.004	09-22-17	270	0.035 ± 0.004
03-30-17	233	0.013 ± 0.003	09-29-17	272	0.037 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.010	3rd Quarter Mean ± s.d.		0.030 ± 0.009
04-07-17	315	0.014 ± 0.003	10-06-17	272	0.031 ± 0.004
04-13-17	240	0.027 ± 0.004	10-13-17	269	0.025 ± 0.004
04-20-17	276	0.019 ± 0.003	10-20-17	273	0.032 ± 0.004
04-28-17	316	0.018 ± 0.003	10-27-17	271	0.021 ± 0.004
			11-03-17	271	0.021 ± 0.004
05-05-17	261	0.011 ± 0.003			
05-12-17	278	0.019 ± 0.004	11-10-17	269	0.036 ± 0.004
05-19-17	297	0.022 ± 0.003	11-17-17	269	0.043 ± 0.005
05-26-17	275	0.011 ± 0.003	11-22-17	192	0.039 ± 0.006
06-02-17	279	0.017 ± 0.003	12-01-17	344	0.033 ± 0.004
06-09-17	276	0.022 ± 0.004	12-08-17	267	0.039 ± 0.005
06-16-17	280	0.025 ± 0.004	12-14-17	231	0.035 ± 0.005
06-23-17	274	0.015 ± 0.003	12-22-17	310	0.039 ± 0.004
06-30-17	278	0.013 ± 0.003	12-29-17	266	0.033 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.005	4th Quarter Mean ± s.d.		0.033 ± 0.007
			Cumulative Average		0.028

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

Location: D-13 (Alburnett)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	360	0.029 ± 0.004	07-07-17	271	0.027 ± 0.004
01-12-17	324	0.039 ± 0.005	07-14-17	271	0.025 ± 0.004
01-20-17	245	0.033 ± 0.004	07-21-17	274	0.019 ± 0.004
01-26-17	373	0.030 ± 0.005	07-28-17	270	0.017 ± 0.003
02-02-17	279	0.021 ± 0.004			
			08-04-17	271	0.024 ± 0.004
02-10-17	300	0.031 ± 0.004	08-11-17	270	0.025 ± 0.004
02-17-17	262	0.027 ± 0.004	08-18-17	273	0.031 ± 0.004
02-24-17	263	0.032 ± 0.004	08-25-17	269	0.027 ± 0.004
03-03-17	265	0.031 ± 0.004	09-01-17	271	0.027 ± 0.004
03-10-17	265	0.028 ± 0.004	09-08-17	273	0.029 ± 0.004
03-17-17	260	0.027 ± 0.004	09-15-17	270	0.052 ± 0.005
03-24-17	265	0.027 ± 0.004	09-22-17	270	0.033 ± 0.004
03-30-17	223	0.016 ± 0.004	09-29-17	272	0.031 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.006	3rd Quarter Mean ± s.d.		0.028 ± 0.009
04-07-17	299	0.016 ± 0.003	10-06-17	272	0.025 ± 0.004
04-13-17	228	0.018 ± 0.004	10-13-17	270	0.027 ± 0.004
04-20-17	263	0.021 ± 0.004	10-20-17	273	0.028 ± 0.004
04-28-17	298	0.014 ± 0.003	10-27-17	271	0.019 ± 0.003
			11-03-17	271	0.015 ± 0.003
05-05-17	295	0.013 ± 0.003			
05-12-17	278	0.018 ± 0.003	11-10-17	273	0.033 ± 0.004
05-19-17	205	0.019 ± 0.004	11-17-17	272	0.032 ± 0.004
05-26-17	295	0.014 ± 0.003	11-22-17	194	0.040 ± 0.006
06-02-17	299	0.011 ± 0.003	12-01-17	347	0.022 ± 0.003
06-09-17	296	0.019 ± 0.003	12-08-17	270	0.024 ± 0.004
06-16-17	298	0.012 ± 0.003	12-14-17	234	0.033 ± 0.005
06-23-17	293	0.015 ± 0.003	12-22-17	314	0.029 ± 0.004
06-30-17	272	0.017 ± 0.003	12-29-17	294	0.036 ± 0.004
2nd Quarter Mean ± s.d.		0.016 ± 0.003	4th Quarter Mean ± s.d.		0.028 ± 0.007
			Cumulative Average		0.025

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

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

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	246	0.034 ± 0.004	07-07-17		ND[c]
01-12-17	278	0.048 ± 0.005	07-14-17	274	0.026 ± 0.004
01-20-17	327	0.036 ± 0.004	07-21-17	275	0.027 ± 0.004
01-26-17	243	0.022 ± 0.004	07-28-17	273	0.021 ± 0.004
02-02-17	268	0.024 ± 0.004			
			08-04-17	273	0.026 ± 0.004
02-10-17	303	0.035 ± 0.004	08-11-17	267	0.030 ± 0.004
02-17-17	265	0.031 ± 0.004	08-18-17	266	0.028 ± 0.004
02-24-17	265	0.034 ± 0.004	08-25-17	264	0.027 ± 0.004
03-03-17	267	0.017 ± 0.004	09-01-17	265	0.023 ± 0.004
03-10-17	266	0.022 ± 0.004	09-08-17	268	0.030 ± 0.004
03-17-17	264	0.029 ± 0.004	09-15-17	264	0.054 ± 0.005
03-24-17	268	0.027 ± 0.004	09-22-17	265	0.032 ± 0.004
03-30-17	252	0.013 ± 0.003	09-29-17	265	0.038 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.009	3rd Quarter Mean ± s.d.		0.030 ± 0.009
04-07-17	338	0.011 ± 0.003	10-06-17	267	0.032 ± 0.004
04-13-17	257	0.021 ± 0.004	10-13-17	264	0.027 ± 0.004
04-20-17	298	0.017 ± 0.003	10-20-17	266	0.032 ± 0.004
04-28-17	337	0.015 ± 0.003	10-27-17	265	0.024 ± 0.004
			11-03-17	265	0.020 ± 0.004
05-05-17	91	0.007 ± 0.007 [b]			
05-12-17	299	0.020 ± 0.003	11-10-17	276	0.032 ± 0.004
05-19-17	269	0.024 ± 0.004	11-17-17	274	0.037 ± 0.004
05-26-17	277	0.013 ± 0.003	11-22-17	195	0.043 ± 0.006
06-02-17	271	0.017 ± 0.003	12-01-17	352	0.024 ± 0.003
06-09-17	274	0.031 ± 0.004	12-08-17	273	0.039 ± 0.005
06-16-17	254	0.028 ± 0.004	12-14-17	236	0.038 ± 0.005
06-23-17	270	0.018 ± 0.003	12-22-17	315	0.037 ± 0.004
06-30-17	261	0.021 ± 0.004	12-29-17	272	0.036 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.007	4th Quarter Mean ± s.d.		0.032 ± 0.007
			Cumulative Average		0.027

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

[b] Low volume due to power outage; storms in area. I-131 result = 0.036 pCi/m^3 due to low volume.

See Section 2.0, Program Deviations.

[c] "ND" = No data; see Section 2.0, Program Deviations.

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

Location: D-16 (On-site)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	244	0.030 ± 0.004	07-07-17	268	0.031 ± 0.004
01-12-17	270	0.043 ± 0.005	07-14-17	269	0.021 ± 0.004
01-20-17	317	0.035 ± 0.004	07-21-17	269	0.014 ± 0.003
01-26-17	236	0.029 ± 0.005	07-28-17	268	0.024 ± 0.004
02-02-17	286	0.023 ± 0.004			
			08-04-17	267	0.025 ± 0.004
02-10-17	303	0.042 ± 0.004	08-11-17	270	0.026 ± 0.004
02-17-17	266	0.025 ± 0.004	08-18-17	270	0.029 ± 0.004
02-24-17	263	0.031 ± 0.004	08-25-17	268	0.025 ± 0.004
03-03-17	270	0.029 ± 0.004	09-01-17	271	0.030 ± 0.004
03-10-17	265	0.025 ± 0.004	09-08-17	274	0.037 ± 0.004
03-17-17	264	0.024 ± 0.004	09-15-17	270	0.048 ± 0.005
03-24-17	266	0.031 ± 0.004	09-22-17	271	0.030 ± 0.004
03-30-17	227	0.014 ± 0.004	09-29-17	271	0.039 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.008	3rd Quarter Mean ± s.d.		0.029 ± 0.009
04-07-17	303	0.019 ± 0.003	10-06-17	273	0.022 ± 0.004
04-13-17	230	0.024 ± 0.004	10-13-17	270	0.023 ± 0.004
04-20-17	265	0.022 ± 0.004	10-20-17	272	0.035 ± 0.004
04-28-17	303	0.017 ± 0.003	10-27-17	271	0.027 ± 0.004
			11-03-17	270	0.018 ± 0.004
05-05-17	267	0.016 ± 0.003			
05-12-17	275	0.024 ± 0.004	11-10-17	274	0.040 ± 0.005
05-19-17	261	0.021 ± 0.004	11-17-17	271	0.043 ± 0.005
05-26-17	270	0.013 ± 0.003	11-22-17	185	0.047 ± 0.006
06-02-17	266	0.019 ± 0.004	12-01-17	334	0.030 ± 0.004
06-09-17	267	0.027 ± 0.004	12-08-17	259	0.039 ± 0.005
06-16-17	272	0.028 ± 0.004	12-14-17	224	0.040 ± 0.005
06-23-17	265	0.021 ± 0.004	12-22-17	299	0.043 ± 0.004
06-30-17	269	0.019 ± 0.004	12-29-17	258	0.041 ± 0.005
2nd Quarter Mean ± s.d.		0.021 ± 0.004	4th Quarter Mean ± s.d.		0.035 ± 0.009
			Cumulative Average		0.028

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

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

Location: D-40 (Wickiup Hill)
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-05-17	239	0.033 ± 0.005	07-07-17	263	0.032 ± 0.004
01-12-17	246	0.044 ± 0.005	07-14-17	260	0.022 ± 0.004
01-20-17	372	0.034 ± 0.004	07-21-17	262	0.025 ± 0.004
01-26-17	244	0.034 ± 0.005	07-28-17	264	0.024 ± 0.004
02-02-17	278	0.021 ± 0.004			
			08-04-17	265	0.026 ± 0.004
02-10-17	317	0.042 ± 0.004	08-11-17	263	0.030 ± 0.004
02-17-17	268	0.027 ± 0.004	08-18-17	255	0.026 ± 0.004
02-24-17	267	0.028 ± 0.004	08-25-17	263	0.026 ± 0.004
03-03-17	275	0.028 ± 0.004	09-01-17	257	0.032 ± 0.005
03-10-17	269	0.024 ± 0.004	09-08-17	263	0.029 ± 0.004
03-17-17	267	0.028 ± 0.004	09-15-17	260	0.050 ± 0.005
03-24-17	269	0.027 ± 0.004	09-22-17	256	0.033 ± 0.004
03-30-17	229	0.014 ± 0.004	09-29-17	263	0.032 ± 0.004
1st Quarter Mean ± s.d.		0.029 ± 0.008	3rd Quarter Mean ± s.d.		0.030 ± 0.007
04-07-17	306	0.016 ± 0.003	10-06-17	260	0.026 ± 0.004
04-13-17	233	0.027 ± 0.004	10-13-17	256	0.027 ± 0.004
04-20-17	267	0.025 ± 0.004	10-20-17	265	0.030 ± 0.004
04-28-17	306	0.018 ± 0.003	10-27-17	256	0.019 ± 0.004
			11-03-17	261	0.015 ± 0.003
05-05-17	273	0.016 ± 0.003			
05-12-17	270	0.027 ± 0.004	11-10-17	259	0.030 ± 0.004
05-19-17	274	0.019 ± 0.003	11-17-17	275	0.044 ± 0.005
05-26-17	261	0.017 ± 0.004	11-22-17	193	0.030 ± 0.005
06-02-17	80	0.019 ± 0.009 [b]	12-01-17	348	0.028 ± 0.003
06-09-17	257	0.023 ± 0.004	12-08-17	272	0.023 ± 0.004
06-16-17	267	0.027 ± 0.004	12-14-17	236	0.033 ± 0.005
06-23-17	261	0.020 ± 0.004	12-22-17	314	0.036 ± 0.004
06-30-17	252	0.012 ± 0.003	12-29-17	271	0.033 ± 0.004
2nd Quarter Mean ± s.d.		0.021 ± 0.005	4th Quarter Mean ± s.d.		0.029 ± 0.007
			Cumulative Average		0.027

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.

[b] Low volume due to power outage. See Section 2.0, Program Deviations.

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- 1705	DAP- 3685	DAP- 5561	DAP- 6780
Volume (m³)	3537	3821	3700	3566
Be-7	0.072 ± 0.019	0.11 ± 0.017	0.11 ± 0.021	0.070 ± 0.018
Mn-54	< 0.0012	< 0.0010	< 0.0011	< 0.0015
Fe-59	< 0.0017	< 0.0020	< 0.0029	< 0.0032
Co-58	< 0.0007	< 0.0006	< 0.0011	< 0.0011
Co-60	< 0.0005	< 0.0012	< 0.0009	< 0.0012
Zn-65	< 0.0018	< 0.0011	< 0.0009	< 0.0030
Nb-95	< 0.0013	< 0.0013	< 0.0010	< 0.0014
Zr-95	< 0.0019	< 0.0014	< 0.0020	< 0.0013
Ru-103	< 0.0013	< 0.0008	< 0.0009	< 0.0020
Ru-106	< 0.0065	< 0.0071	< 0.0062	< 0.0117
Cs-134	< 0.0011	< 0.0009	< 0.0008	< 0.0012
Cs-137	< 0.0008	< 0.0007	< 0.0007	< 0.0012
Ce-141	< 0.0014	< 0.0014	< 0.0023	< 0.0031
Ce-144	< 0.0053	< 0.0033	< 0.0052	< 0.0047
Location	D-5A			
Lab Code	DAP- 1706	DAP- 3686	DAP- 5562	DAP- 6781
Volume (m³)	3592	3627	3707	3525
Be-7	0.072 ± 0.017	0.10 ± 0.017	0.092 ± 0.017	0.070 ± 0.016
Mn-54	< 0.0009	< 0.0008	< 0.0005	< 0.0011
Fe-59	< 0.0018	< 0.0023	< 0.0017	< 0.0016
Co-58	< 0.0006	< 0.0007	< 0.0007	< 0.0007
Co-60	< 0.0004	< 0.0005	< 0.0007	< 0.0011
Zn-65	< 0.0012	< 0.0011	< 0.0008	< 0.0014
Nb-95	< 0.0014	< 0.0010	< 0.0013	< 0.0013
Zr-95	< 0.0016	< 0.0019	< 0.0013	< 0.0012
Ru-103	< 0.0015	< 0.0008	< 0.0010	< 0.0011
Ru-106	< 0.0071	< 0.0062	< 0.0050	< 0.0060
Cs-134	< 0.0010	< 0.0010	< 0.0008	< 0.0008
Cs-137	< 0.0009	< 0.0009	< 0.0004	< 0.0008
Ce-141	< 0.0013	< 0.0016	< 0.0013	< 0.0020
Ce-144	< 0.0040	< 0.0040	< 0.0062	< 0.0035
Location	D-6			
Lab Code	DAP- 1708	DAP- 3687	DAP- 5563	DAP- 6782
Volume (m³)	3749	3634	3599	3694
Be-7	0.070 ± 0.013	0.084 ± 0.015	0.092 ± 0.014	0.061 ± 0.015
Mn-54	< 0.0005	< 0.0008	< 0.0006	< 0.0006
Fe-59	< 0.0017	< 0.0021	< 0.0015	< 0.0023
Co-58	< 0.0007	< 0.0012	< 0.0006	< 0.0009
Co-60	< 0.0009	< 0.0005	< 0.0003	< 0.0006
Zn-65	< 0.0010	< 0.0008	< 0.0010	< 0.0012
Nb-95	< 0.0008	< 0.0013	< 0.0011	< 0.0008
Zr-95	< 0.0019	< 0.0016	< 0.0016	< 0.0018
Ru-103	< 0.0007	< 0.0008	< 0.0012	< 0.0012
Ru-106	< 0.0040	< 0.0053	< 0.0058	< 0.0062
Cs-134	< 0.0006	< 0.0012	< 0.0007	< 0.0010
Cs-137	< 0.0007	< 0.0007	< 0.0010	< 0.0006
Ce-141	< 0.0013	< 0.0014	< 0.0017	< 0.0013
Ce-144	< 0.0024	< 0.0031	< 0.0046	< 0.0041

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

Units: pCi/m^3

Location	D-7			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1709	DAP- 3688	DAP- 5564	DAP- 6783
Volume (m^3)	3743	3668	3616	3777
Be-7	0.069 ± 0.018	0.092 ± 0.020	0.089 ± 0.015	0.063 ± 0.013
Mn-54	< 0.0008	< 0.0007	< 0.0006	< 0.0010
Fe-59	< 0.0010	< 0.0015	< 0.0014	< 0.0020
Co-58	< 0.0006	< 0.0012	< 0.0005	< 0.0008
Co-60	< 0.0004	< 0.0005	< 0.0006	< 0.0009
Zn-65	< 0.0014	< 0.0008	< 0.0016	< 0.0019
Nb-95	< 0.0015	< 0.0010	< 0.0010	< 0.0011
Zr-95	< 0.0018	< 0.0016	< 0.0016	< 0.0022
Ru-103	< 0.0016	< 0.0008	< 0.0013	< 0.0008
Ru-106	< 0.0065	< 0.0033	< 0.0044	< 0.0070
Cs-134	< 0.0010	< 0.0012	< 0.0008	< 0.0009
Cs-137	< 0.0009	< 0.0007	< 0.0008	< 0.0010
Ce-141	< 0.0015	< 0.0015	< 0.0022	< 0.0022
Ce-144	< 0.0053	< 0.0036	< 0.0043	< 0.0050
Location	D-11			
Lab Code	DAP- 1710	DAP- 3689	DAP- 5565	DAP- 6785
Volume (m^3)	3692	3645	3554	3505
Be-7	0.055 ± 0.013	0.080 ± 0.016	0.095 ± 0.015	0.059 ± 0.014
Mn-54	< 0.0008	< 0.0008	< 0.0009	< 0.0006
Fe-59	< 0.0011	< 0.0015	< 0.0014	< 0.0018
Co-58	< 0.0007	< 0.0009	< 0.0009	< 0.0007
Co-60	< 0.0004	< 0.0009	< 0.0009	< 0.0006
Zn-65	< 0.0017	< 0.0008	< 0.0014	< 0.0010
Nb-95	< 0.0008	< 0.0010	< 0.0012	< 0.0014
Zr-95	< 0.0015	< 0.0013	< 0.0022	< 0.0015
Ru-103	< 0.0007	< 0.0011	< 0.0007	< 0.0013
Ru-106	< 0.0053	< 0.0041	< 0.0069	< 0.0048
Cs-134	< 0.0006	< 0.0008	< 0.0008	< 0.0008
Cs-137	< 0.0005	< 0.0006	< 0.0007	< 0.0005
Ce-141	< 0.0018	< 0.0014	< 0.0017	< 0.0015
Ce-144	< 0.0040	< 0.0037	< 0.0028	< 0.0028
Location	D-13			
Lab Code	DAP- 1711	DAP- 3690	DAP- 5566	DAP- 6786
Volume (m^3)	3683	3620	3526	3554
Be-7	0.061 ± 0.014	0.087 ± 0.018	0.093 ± 0.015	0.050 ± 0.016
Mn-54	< 0.0006	< 0.0009	< 0.0009	< 0.0010
Fe-59	< 0.0011	< 0.0018	< 0.0015	< 0.0020
Co-58	< 0.0005	< 0.0011	< 0.0004	< 0.0008
Co-60	< 0.0008	< 0.0010	< 0.0004	< 0.0008
Zn-65	< 0.0007	< 0.0011	< 0.0007	< 0.0012
Nb-95	< 0.0009	< 0.0012	< 0.0016	< 0.0007
Zr-95	< 0.0009	< 0.0011	< 0.0014	< 0.0019
Ru-103	< 0.0008	< 0.0007	< 0.0007	< 0.0019
Ru-106	< 0.0061	< 0.0058	< 0.0036	< 0.0081
Cs-134	< 0.0006	< 0.0009	< 0.0007	< 0.0009
Cs-137	< 0.0005	< 0.0008	< 0.0007	< 0.0008
Ce-141	< 0.0017	< 0.0014	< 0.0018	< 0.0024
Ce-144	< 0.0034	< 0.0038	< 0.0028	< 0.0060

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

Units: pCi/m^3

Location	D-15			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1712	DAP- 3691	DAP- 5567	DAP- 6787
Volume (m^3)	3513	3496	3220	3522
Be-7	0.080 ± 0.019	0.093 ± 0.016	0.094 ± 0.016	0.071 ± 0.013
Mn-54	< 0.0008	< 0.0008	< 0.0005	< 0.0006
Fe-59	< 0.0013	< 0.0019	< 0.0012	< 0.0013
Co-58	< 0.0008	< 0.0009	< 0.0007	< 0.0007
Co-60	< 0.0012	< 0.0007	< 0.0007	< 0.0006
Zn-65	< 0.0017	< 0.0012	< 0.0013	< 0.0006
Nb-95	< 0.0017	< 0.0005	< 0.0007	< 0.0004
Zr-95	< 0.0019	< 0.0020	< 0.0009	< 0.0015
Ru-103	< 0.0015	< 0.0011	< 0.0015	< 0.0007
Ru-106	< 0.0075	< 0.0081	< 0.0050	< 0.0088
Cs-134	< 0.0010	< 0.0008	< 0.0008	< 0.0007
Cs-137	< 0.0010	< 0.0007	< 0.0007	< 0.0007
Ce-141	< 0.0027	< 0.0015	< 0.0020	< 0.0018
Ce-144	< 0.0053	< 0.0039	< 0.0045	< 0.0039
Location	D-16			
Lab Code	DAP- 1713	DAP- 3692	DAP- 5568	DAP- 6788
Volume (m^3)	3479	3513	3505	3460
Be-7	0.075 ± 0.023	0.086 ± 0.016	0.088 ± 0.016	0.077 ± 0.019
Mn-54	< 0.0009	< 0.0010	< 0.0005	< 0.0015
Fe-59	< 0.0018	< 0.0016	< 0.0011	< 0.0037
Co-58	< 0.0005	< 0.0009	< 0.0004	< 0.0007
Co-60	< 0.0005	< 0.0005	< 0.0004	< 0.0010
Zn-65	< 0.0008	< 0.0017	< 0.0013	< 0.0046
Nb-95	< 0.0015	< 0.0015	< 0.0010	< 0.0015
Zr-95	< 0.0022	< 0.0019	< 0.0019	< 0.0016
Ru-103	< 0.0012	< 0.0007	< 0.0010	< 0.0024
Ru-106	< 0.0070	< 0.0060	< 0.0034	< 0.0081
Cs-134	< 0.0009	< 0.0011	< 0.0007	< 0.0015
Cs-137	< 0.0007	< 0.0006	< 0.0008	< 0.0012
Ce-141	< 0.0025	< 0.0015	< 0.0010	< 0.0024
Ce-144	< 0.0048	< 0.0035	< 0.0031	< 0.0067
Location	D-40			
Lab Code	DAP- 1714	DAP- 3693	DAP- 5569	DAP- 6789
Volume (m^3)	3539	3306	3395	3466
Be-7	0.084 ± 0.020	0.093 ± 0.018	0.064 ± 0.017	0.069 ± 0.019
Mn-54	< 0.0010	< 0.0011	< 0.0013	< 0.0011
Fe-59	< 0.0027	< 0.0020	< 0.0018	< 0.0018
Co-58	< 0.0009	< 0.0011	< 0.0013	< 0.0010
Co-60	< 0.0007	< 0.0011	< 0.0008	< 0.0008
Zn-65	< 0.0010	< 0.0020	< 0.0027	< 0.0011
Nb-95	< 0.0011	< 0.0015	< 0.0025	< 0.0014
Zr-95	< 0.0023	< 0.0014	< 0.0027	< 0.0022
Ru-103	< 0.0015	< 0.0009	< 0.0018	< 0.0019
Ru-106	< 0.0049	< 0.0069	< 0.0094	< 0.0076
Cs-134	< 0.0011	< 0.0012	< 0.0012	< 0.0011
Cs-137	< 0.0006	< 0.0007	< 0.0011	< 0.0010
Ce-141	< 0.0023	< 0.0015	< 0.0029	< 0.0034
Ce-144	< 0.0065	< 0.0039	< 0.0049	< 0.0050

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

Units: mR/91 days

Control Locations	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-1	18.1 ± 1.3	18.0 ± 1.6	14.7 ± 1.2	18.1 ± 1.6
D-2	16.1 ± 1.0	14.7 ± 1.3	14.7 ± 1.4	13.4 ± 1.1
D-3	16.6 ± 1.1	14.5 ± 0.7	13.1 ± 1.3	14.5 ± 0.7
D-5	19.1 ± 1.1	17.7 ± 1.2	16.4 ± 1.2	17.4 ± 0.6
D-5A	22.1 ± 0.3	19.9 ± 1.4	15.1 ± 0.8	18.5 ± 1.1
D-6	16.8 ± 1.0	17.4 ± 1.4	14.2 ± 1.0	16.1 ± 1.0
D-7	15.7 ± 0.9	13.6 ± 0.9	13.2 ± 1.3	13.9 ± 1.0
D-8	19.7 ± 1.0	16.6 ± 1.0	16.4 ± 1.3	16.5 ± 1.0
D-10	19.1 ± 1.7	15.9 ± 1.0	17.9 ± 1.3	15.7 ± 0.9
D-11	15.6 ± 0.7	14.0 ± 1.6	13.2 ± 0.8	13.9 ± 0.6
D-13	16.7 ± 0.8	18.4 ± 1.8	13.5 ± 1.0	15.3 ± 1.1
Mean ± s.d.	17.8 ± 2.0	16.4 ± 2.1	14.8 ± 1.6	15.8 ± 1.8
Within 0.5 mi. of Stack				
D-15	17.5 ± 0.9	16.8 ± 0.7	14.5 ± 1.1	17.3 ± 0.6
D-16	17.3 ± 1.0	15.1 ± 1.2	14.7 ± 1.1	14.4 ± 1.0
D-17	22.0 ± 0.8	22.3 ± 1.3	21.4 ± 0.9	21.0 ± 1.2
D-18	19.6 ± 1.5	16.6 ± 0.7	17.2 ± 1.5	17.1 ± 0.7
D-19	19.1 ± 1.3	15.4 ± 1.4	16.5 ± 1.2	15.7 ± 1.1
D-20	20.1 ± 0.9	19.2 ± 1.6	17.9 ± 1.3	18.5 ± 1.9
D-21	21.2 ± 1.0	16.6 ± 0.8	19.2 ± 1.1	15.7 ± 0.7
D-22	18.8 ± 1.1	16.7 ± 1.2	16.8 ± 1.2	15.6 ± 1.0
D-23	15.3 ± 1.1	16.1 ± 1.0	12.7 ± 1.1	15.0 ± 1.0
D-28	22.4 ± 1.7	18.6 ± 0.8	21.1 ± 1.8	17.7 ± 1.0
D-29	21.4 ± 0.9	23.6 ± 1.3	20.2 ± 0.9	22.2 ± 0.9
D-30	20.8 ± 1.0	21.9 ± 2.0	18.7 ± 1.3	21.3 ± 1.8
D-31	20.5 ± 1.4	19.8 ± 2.1	19.9 ± 1.6	18.9 ± 1.5
D-32	20.5 ± 0.9	21.8 ± 1.1	19.0 ± 1.0	21.3 ± 1.1
D-82	17.2 ± 0.7	16.8 ± 1.0	14.7 ± 1.1	16.9 ± 1.0
D-83	19.3 ± 0.8	17.9 ± 1.2	15.9 ± 1.2	20.1 ± 0.9
D-84	19.0 ± 1.2	16.4 ± 0.9	17.7 ± 1.3	17.5 ± 0.9
D-85	18.7 ± 0.6	20.5 ± 1.2	16.4 ± 0.9	22.2 ± 1.3
D-86	20.5 ± 1.2	ND[a]	16.6 ± 1.4	15.9 ± 0.6
D-91	18.2 ± 1.1	16.5 ± 1.4	15.7 ± 1.3	19.7 ± 1.3
Mean ± s.d.	19.5 ± 1.8	18.3 ± 2.6	17.3 ± 2.3	18.2 ± 2.5

[a] "ND" = No data; see Section 2.0, Program Deviations.

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

Units: mR/91 days

Within 1.0 mi. of Stack	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-43	16.7 ± 1.0	14.9 ± 1.2	15.1 ± 1.1	16.1 ± 1.2
D-44	20.5 ± 1.0	18.0 ± 0.8	18.8 ± 1.3	19.5 ± 0.6
D-45	16.0 ± 0.9	14.5 ± 1.4	15.9 ± 1.1	15.9 ± 1.2
D-46	20.7 ± 1.2	21.7 ± 1.3	19.0 ± 1.2	24.1 ± 1.2
D-47	20.5 ± 1.1	15.7 ± 1.2	18.2 ± 1.5	17.1 ± 0.8
D-48	22.7 ± 1.1	21.2 ± 1.1	20.7 ± 1.5	22.5 ± 1.0
Mean ± s.d.	19.5 ± 2.6	17.7 ± 3.2	18.0 ± 2.1	19.2 ± 3.4
Within 3.0 mi. of Stack				
D-33	14.6 ± 0.8	13.2 ± 0.8	12.9 ± 0.9	14.2 ± 0.9
D-34	16.6 ± 0.8	12.7 ± 0.9	15.0 ± 0.9	13.8 ± 1.1
D-35	16.8 ± 0.7	17.0 ± 0.9	14.9 ± 0.9	18.4 ± 0.8
D-36	18.9 ± 0.8	15.4 ± 0.9	17.3 ± 1.0	16.9 ± 0.9
D-37	18.0 ± 1.5	19.2 ± 1.2	18.1 ± 1.6	21.0 ± 1.2
D-38	18.8 ± 1.1	17.9 ± 1.9	17.1 ± 1.5	18.9 ± 1.3
D-39	16.6 ± 0.9	15.2 ± 0.8	16.3 ± 1.3	16.1 ± 0.8
D-40	15.9 ± 1.0	14.8 ± 1.0	ND[a]	16.9 ± 0.9
D-41	18.3 ± 1.1	18.9 ± 1.2	16.5 ± 1.4	ND[a]
D-42	15.1 ± 0.9	14.5 ± 0.9	14.0 ± 1.3	15.6 ± 0.9
Mean ± s.d.	17.0 ± 1.5	15.9 ± 2.3	15.8 ± 1.7	16.9 ± 2.3
ISFSI Fenceline				
D-161	56.2 ± 2.5	43.2 ± 4.2	47.7 ± 2.5	48.7 ± 3.2
D-162	23.0 ± 1.5	20.3 ± 1.8	18.7 ± 1.6	22.0 ± 1.9
D-163	46.2 ± 2.0	39.4 ± 1.9	44.9 ± 1.7	49.8 ± 2.6
D-164	19.7 ± 1.2	16.8 ± 1.0	17.6 ± 1.2	16.9 ± 1.0
Mean ± s.d.	36.3 ± 17.7	29.9 ± 13.3	32.2 ± 16.3	34.4 ± 17.3

[a] "ND" = No data; see Section 2.0, Program Deviations.

Table 12. Milk samples, analyses for iodine-131 and gamma emitting isotopes.
Collection: Milk samples are collected monthly throughout the year.

Location		D-76[a]					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
02-07-17	DMI- 482	< 0.7	1450 ± 65	< 2.6	< 3.4	< 8.3	< 3.0
03-17-17	DMI- 1083	< 0.4	1814 ± 88	< 3.1	< 3.7	< 13.8	< 3.4
04-12-17	DMI- 1527	< 0.4	1694 ± 80	< 2.9	< 3.0	< 10.1	< 3.3
05-16-17				ND[b]			
06-08-17				ND[b]			
07-12-17				ND[b]			
08-08-17				ND[b]			
09-06-17				ND[b]			
10-10-17				ND[b]			
11-14-17				ND[b]			
12-05-17				ND[b]			

Location		D-110					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-06-16	DMI- 120	< 0.4	1390 ± 104	< 3.6	< 3.6	< 10.3	< 1.9
02-07-17	DMI- 483	< 0.4	1397 ± 93	< 2.5	< 2.6	< 11.6	< 1.7
03-15-17	DMI- 1027	< 0.5	1524 ± 71	< 2.9	< 2.1	< 5.4	< 2.2
04-06-17	DMI- 1435	< 0.4	1486 ± 110	< 3.7	< 3.8	< 14.3	< 1.9
05-16-17	DMI- 2244	< 0.3	1434 ± 89	< 2.8	< 2.9	< 11.2	< 1.9
06-08-17	DMI- 2801	< 0.3	1271 ± 110	< 4.1	< 1.9	< 13.2	< 3.6
07-12-17	DMI- 3420	< 0.3	1422 ± 106	< 3.1	< 4.1	< 11.9	< 1.4
08-08-17	DMI- 4043	< 0.5	1484 ± 104	< 3.4	< 3.3	< 15.9	< 3.4
09-06-17	DMI- 4528	< 0.5	1486 ± 112	< 3.0	< 3.5	< 11.0	< 2.4
10-10-17	DMI- 5346	< 0.4	1332 ± 113	< 3.3	< 2.3	< 10.6	< 3.4
11-14-17	DMI- 6069	< 0.3	1420 ± 114	< 3.9	< 3.2	< 8.4	< 2.4
12-05-17	DMI- 6319	< 0.3	1571 ± 112	< 3.5	< 3.8	< 7.6	< 1.8

[a] New goat's milk location as of February 2017.

[b] "ND" = No data; see Table 2.0, Program Deviations.

Table 12. Milk samples, analyses for iodine-131 and gamma emitting isotopes.
Collection: Milk samples are collected monthly throughout the year.

Location		D-138					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-06-16	DMI- 121	< 0.3	1560 ± 109	< 3.1	< 3.1	< 10.9	< 2.6
02-07-17	DMI- 484	< 0.4	1481 ± 100	< 2.6	< 3.2	< 9.3	< 0.9
03-15-17	DMI- 1028	< 0.3	1357 ± 99	< 3.3	< 3.9	< 9.8	< 2.6
04-06-17	DMI- 1436	< 0.4	1380 ± 112	< 3.6	< 3.0	< 14.5	< 2.2
05-16-17	DMI- 2245	< 0.5	1361 ± 90	< 3.0	< 1.8	< 9.7	< 2.0
06-08-17	DMI- 2802	< 0.3	1364 ± 111	< 3.5	< 3.5	< 13.1	< 1.2
07-12-17	DMI- 3421	< 0.4	1524 ± 114	< 3.2	< 2.9	< 12.3	< 2.9
08-08-17	DMI- 4044	< 0.5	1422 ± 95	< 2.9	< 3.7	< 15.2	< 0.8
09-06-17	DMI- 4529	< 0.5	1319 ± 93	< 2.9	< 1.8	< 8.7	< 1.0
10-10-17	DMI- 5347	< 0.4	1434 ± 109	< 3.3	< 3.1	< 14.2	< 2.5
11-14-17	DMI- 6070	< 0.4	1291 ± 108	< 3.8	< 3.8	< 11.5	< 2.1
12-05-17	DMI- 6320	< 0.3	1301 ± 108	< 3.0	< 3.3	< 13.5	< 1.8

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

Collection: Monthly

Units: pCi/L

Location	D-52 Drinking Water			
Lab Code	DWW- 244	DWW- 588	DWW- 1208	DWW- 1541
Date Collected	01-18-17	02-13-17	03-27-17	04-13-17
H-3	< 179	< 154	< 151	< 147
I-131	< 0.4	< 0.3	< 0.3	< 0.5
Mn-54	< 1.6	< 2.4	< 4.7	< 2.1
Fe-59	< 3.0	< 6.8	< 5.7	< 2.8
Co-58	< 1.3	< 2.3	< 3.5	< 1.8
Co-60	< 1.4	< 3.2	< 2.9	< 2.3
Zn-65	< 6.2	< 5.0	< 3.4	< 3.5
Nb-95	< 3.5	< 2.9	< 2.7	< 3.7
Zr-95	< 4.0	< 7.1	< 6.7	< 5.3
I-131	< 3.8	< 8.1	< 5.8	< 5.3
Cs-134	< 2.9	< 4.1	< 4.1	< 2.9
Cs-137	< 2.7	< 3.8	< 3.7	< 3.5
Ba-140	< 9.6	< 12.1	< 16.9	< 11.9
La-140	< 2.5	< 4.2	< 2.9	< 3.9

Lab Code	DWW- 2112	DWW- 3012	DWW- 3638	ND[a]
Date Collected	05-11-17	06-19-17	07-18-17	08-16-17
H-3	< 151	< 146	< 183	-
I-131	< 0.3	< 0.4	< 0.2	-
Mn-54	< 2.7	< 2.7	< 2.3	-
Fe-59	< 6.3	< 7.4	< 5.6	-
Co-58	< 2.0	< 3.0	< 2.4	-
Co-60	< 2.5	< 2.7	< 1.5	-
Zn-65	< 6.0	< 3.5	< 1.7	-
Nb-95	< 2.1	< 4.5	< 2.0	-
Zr-95	< 3.8	< 5.6	< 4.0	-
I-131	< 4.9	< 5.2	< 4.2	-
Cs-134	< 3.1	< 3.9	< 3.2	-
Cs-137	< 2.7	< 4.4	< 1.9	-
Ba-140	< 16.1	< 12.5	< 12.2	-
La-140	< 2.8	< 2.9	< 2.5	-

[a] "ND" = No data; see Section 2.0, Program Deviations.

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

Collection: Monthly

Units: pCi/L

Location	D-52 Drinking Water			
Lab Code	DWW- 4888	DWW- 5610	DWW- 6138	DWW- 6573
Date Collected	09-20-17	10-18-17	11-16-17	12-21-17
H-3	< 183	< 154	< 151	< 154
I-131	< 0.2	< 0.3	< 0.2	< 0.3
Mn-54	< 1.6	< 2.2	< 2.8	< 5.4
Fe-59	< 1.9	< 4.1	< 4.8	< 8.9
Co-58	< 2.4	< 2.6	< 2.5	< 4.9
Co-60	< 2.3	< 2.2	< 1.4	< 4.6
Zn-65	< 3.1	< 4.5	< 3.0	< 8.3
Nb-95	< 2.4	< 3.3	< 2.2	< 4.4
Zr-95	< 2.8	< 5.1	< 3.0	< 9.2
I-131	< 4.3	< 6.1	< 4.1	< 7.2
Cs-134	< 2.8	< 3.2	< 3.6	< 6.1
Cs-137	< 2.7	< 3.3	< 2.5	< 6.4
Ba-140	< 12.2	< 13.0	< 17.1	< 30.3
La-140	< 3.2	< 2.8	< 2.9	< 7.9

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

Collection: Monthly

Units: pCi/L

Location	D-53 Treated Municipal Water, Drinking Water			
Lab Code	DWW- 245	DWW- 589	DWW- 1209	DWW- 1542
Date Collected	01-18-17	02-13-17	03-27-17	04-13-17
H-3	< 179	< 154	< 151	< 147
I-131	< 0.3	< 0.3	< 0.3	< 0.3
Mn-54	< 3.2	< 3.1	< 2.5	< 2.4
Fe-59	< 5.5	< 6.4	< 3.9	< 4.2
Co-58	< 3.2	< 3.1	< 2.9	< 1.3
Co-60	< 3.1	< 2.2	< 2.2	< 1.9
Zn-65	< 5.2	< 7.9	< 2.7	< 5.4
Nb-95	< 2.4	< 2.0	< 3.2	< 1.8
Zr-95	< 6.3	< 2.9	< 4.1	< 2.7
I-131	< 5.3	< 6.6	< 4.0	< 4.3
Cs-134	< 4.0	< 3.1	< 3.1	< 2.4
Cs-137	< 2.3	< 2.6	< 2.9	< 3.4
Ba-140	< 12.1	< 17.9	< 10.8	< 10.6
La-140	< 2.5	< 3.9	< 1.8	< 2.5

Lab Code	DWW- 2113	DWW- 3013	DWW- 3639	DWW- 4270
Date Collected	05-11-17	06-19-17	07-18-17	08-16-17
H-3	< 151	< 146	< 183	< 147
I-131	< 0.4	< 0.3	< 0.5	< 0.4
Mn-54	< 2.2	< 3.7	< 3.2	< 2.7
Fe-59	< 6.7	< 4.6	< 7.4	< 5.8
Co-58	< 1.8	< 6.8	< 3.1	< 1.8
Co-60	< 1.9	< 5.6	< 2.8	< 2.4
Zn-65	< 3.4	< 5.2	< 1.8	< 3.8
Nb-95	< 2.6	< 5.6	< 3.2	< 2.8
Zr-95	< 2.3	< 6.9	< 7.1	< 3.6
I-131	< 5.0	< 7.7	< 6.8	< 6.5
Cs-134	< 3.5	< 5.2	< 4.7	< 3.0
Cs-137	< 3.1	< 3.1	< 4.7	< 3.3
Ba-140	< 11.5	< 23.3	< 19.6	< 12.9
La-140	< 2.6	< 4.9	< 4.7	< 1.9

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

Collection: Monthly

Units: pCi/L

Location	D-53 Treated Municipal Water, Drinking Water			
Lab Code	DWW- 4885	DWW- 5611	DWW- 6057	DWW- 6574
Date Collected	09-20-17	10-18-17	11-13-17	12-20-17
H-3	< 183	< 154	< 146	< 154
I-131	< 0.2	< 0.3	< 0.3	< 0.4
Mn-54	< 1.3	< 2.7	< 2.7	< 3.7
Fe-59	< 4.7	< 4.7	< 4.9	< 5.4
Co-58	< 2.6	< 2.5	< 2.1	< 3.4
Co-60	< 2.3	< 1.2	< 2.5	< 2.5
Zn-65	< 2.6	< 3.2	< 1.7	< 6.6
Nb-95	< 2.9	< 2.2	< 2.7	< 2.7
Zr-95	< 4.2	< 4.2	< 4.0	< 6.5
I-131	< 5.6	< 5.2	< 4.6	< 7.2
Cs-134	< 3.4	< 2.8	< 3.5	< 4.1
Cs-137	< 3.6	< 2.4	< 3.0	< 3.7
Ba-140	< 16.3	< 15.2	< 11.3	< 15.0
La-140	< 3.4	< 3.0	< 2.1	< 2.5

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

Collection: Monthly

Units: pCi/L

Location	D-54 Untreated Municipal Water, Drinking Water			
Lab Code	DWW- 246	DWW- 590	DWW- 1210	DWW- 1543
Date Collected	01-18-17	02-13-17	03-27-17	04-13-17
H-3	< 179	< 154	< 151	< 147
I-131	< 0.4	< 0.5	< 0.3	< 0.4
Mn-54	< 1.8	< 1.7	< 2.5	< 2.3
Fe-59	< 6.1	< 2.6	< 4.7	< 2.5
Co-58	< 3.1	< 2.3	< 2.2	< 1.6
Co-60	< 1.7	< 1.6	< 2.6	< 2.9
Zn-65	< 4.8	< 4.8	< 5.6	< 4.2
Nb-95	< 2.3	< 2.3	< 2.4	< 2.2
Zr-95	< 5.0	< 3.3	< 6.1	< 4.2
I-131	< 3.5	< 5.1	< 4.5	< 4.9
Cs-134	< 2.9	< 3.0	< 3.7	< 2.8
Cs-137	< 2.5	< 3.7	< 2.6	< 2.5
Ba-140	< 9.9	< 13.2	< 12.3	< 8.0
La-140	< 2.1	< 2.4	< 2.4	< 2.1

Lab Code	DWW- 2114	DWW- 3014	DWW- 3640	DWW- 4271
Date Collected	05-11-17	06-19-17	07-18-17	08-16-17
H-3	< 151	< 146	< 183	< 144
I-131	< 0.4	< 0.2	< 0.3	< 0.4
Mn-54	< 3.5	< 2.8	< 2.1	< 2.4
Fe-59	< 2.6	< 5.3	< 3.7	< 4.9
Co-58	< 3.5	< 2.8	< 2.0	< 1.4
Co-60	< 3.0	< 1.8	< 2.2	< 1.7
Zn-65	< 4.2	< 4.1	< 3.5	< 4.4
Nb-95	< 3.2	< 1.6	< 2.6	< 2.9
Zr-95	< 4.4	< 4.4	< 2.9	< 3.9
I-131	< 5.2	< 4.5	< 4.7	< 5.7
Cs-134	< 3.4	< 3.6	< 2.8	< 3.3
Cs-137	< 2.5	< 2.0	< 2.2	< 2.6
Ba-140	< 12.6	< 16.4	< 11.0	< 15.5
La-140	< 2.2	< 1.9	< 1.1	< 2.9

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

Collection: Monthly

Units: pCi/L

Location	D-54 Untreated Municipal Water, Drinking Water			
Lab Code	DWW- 4886	DWW- 5612	DWW- 6058	DWW- 6575
Date Collected	09-20-17	10-18-17	11-13-17	12-21-17
H-3	< 183	< 154	< 146	< 154
I-131	< 0.4	< 0.3	< 0.3	< 0.4
Mn-54	< 3.0	< 2.5	< 2.2	< 2.2
Fe-59	< 5.6	< 6.1	< 5.4	< 6.0
Co-58	< 3.2	< 3.9	< 2.5	< 3.1
Co-60	< 2.7	< 3.8	< 1.6	< 2.5
Zn-65	< 3.8	< 4.2	< 5.2	< 4.8
Nb-95	< 2.3	< 3.4	< 2.1	< 3.0
Zr-95	< 2.9	< 7.0	< 5.8	< 4.0
I-131	< 5.2	< 8.8	< 4.5	< 5.3
Cs-134	< 3.5	< 4.4	< 3.5	< 3.1
Cs-137	< 2.4	< 3.2	< 1.9	< 3.0
Ba-140	< 11.2	< 17.2	< 15.5	< 13.8
La-140	< 3.1	< 2.8	< 2.7	< 1.7

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

Collection: Quarterly

Units: pCi/L

Location	D-55 On-site Treated Drinking Water			
Lab Code	DWW- 591	DWW- 2115	DWW- 4272	DWW- 6059
Date Collected	02-13-17	05-11-17	08-16-17	11-13-17
H-3	< 154	< 151	< 144	< 146
I-131	< 0.4	< 0.4	< 0.2	< 0.2
Mn-54	< 3.4	< 1.5	< 2.7	< 3.2
Fe-59	< 8.5	< 3.5	< 7.0	< 5.0
Co-58	< 3.2	< 2.2	< 2.8	< 1.9
Co-60	< 2.2	< 1.7	< 3.5	< 2.2
Zn-65	< 3.1	< 4.8	< 6.8	< 6.1
Nb-95	< 4.7	< 2.7	< 3.2	< 3.9
Zr-95	< 4.2	< 4.5	< 5.8	< 5.9
I-131	< 11.4	< 4.9	< 7.8	< 4.5
Cs-134	< 4.2	< 3.0	< 4.2	< 3.9
Cs-137	< 3.7	< 2.5	< 2.9	< 3.6
Ba-140	< 21.2	< 10.6	< 18.3	< 13.4
La-140	< 3.4	< 1.2	< 2.2	< 3.2

Location	D-57 Untreated Drinking Water			
Lab Code	DWW- 660	DWW- 2116	DWW- 4273	DWW- 6060
Date Collected	02-13-17	05-11-17	08-14-17	11-13-17
H-3	< 187	< 151	< 144	< 146
I-131	< 0.3	< 0.3	< 0.3	< 0.2
Mn-54	< 2.8	< 2.3	< 2.9	< 3.4
Fe-59	< 7.6	< 3.1	< 3.3	< 6.8
Co-58	< 4.3	< 2.0	< 2.1	< 3.3
Co-60	< 2.7	< 2.5	< 1.7	< 2.9
Zn-65	< 5.5	< 5.2	< 2.6	< 4.4
Nb-95	< 3.1	< 2.0	< 2.4	< 2.2
Zr-95	< 6.3	< 5.6	< 4.8	< 4.1
I-131	< 8.0	< 4.4	< 5.7	< 5.0
Cs-134	< 3.9	< 3.0	< 2.8	< 3.2
Cs-137	< 3.1	< 3.0	< 2.1	< 3.8
Ba-140	< 22.7	< 11.8	< 19.3	< 14.3
La-140	< 3.7	< 4.3	< 2.6	< 2.8

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

Collection: Quarterly

Units: pCi/L

Location	D-58 Untreated Drinking Water			
Lab Code	DWW- 661	DWW- 2117	DWW- 4274	DWW- 6061
Date Collected	02-16-17	05-11-17	08-14-17	11-13-17
H-3	< 187	< 151	< 144	< 146
I-131	< 0.4	< 0.3	< 0.4	< 0.2
Mn-54	< 2.4	< 5.3	< 2.0	< 3.5
Fe-59	< 4.4	< 8.0	< 3.8	< 4.8
Co-58	< 2.7	< 6.5	< 1.7	< 4.0
Co-60	< 2.6	< 4.7	< 2.5	< 3.2
Zn-65	< 3.7	< 7.2	< 4.7	< 6.9
Nb-95	< 2.1	< 5.5	< 3.5	< 3.5
Zr-95	< 3.6	< 5.7	< 3.1	< 6.1
I-131	< 4.1	< 8.4	< 5.2	< 3.2
Cs-134	< 2.9	< 6.4	< 2.6	< 4.4
Cs-137	< 3.3	< 5.0	< 2.3	< 2.8
Ba-140	< 13.3	< 21.5	< 16.9	< 9.4
La-140	< 2.4	< 7.2	< 1.8	< 3.8

Location	D-72(C) Untreated Drinking Water			
Lab Code	DWW- 662	DWW- 2118	DWW- 4275	DWW- 6062
Date Collected	02-16-17	05-11-17	08-14-17	11-13-17
H-3	< 187	< 151	< 144	< 146
I-131	< 0.3	< 0.4	< 0.3	< 0.5
Mn-54	< 2.3	< 3.4	< 1.5	< 2.8
Fe-59	< 3.6	< 7.4	< 4.0	< 4.6
Co-58	< 2.7	< 3.9	< 2.1	< 2.9
Co-60	< 2.4	< 3.4	< 1.9	< 1.9
Zn-65	< 2.6	< 7.2	< 3.2	< 1.5
Nb-95	< 3.0	< 4.6	< 3.1	< 2.4
Zr-95	< 3.8	< 6.2	< 4.0	< 5.2
I-131	< 5.1	< 8.0	< 6.0	< 3.8
Cs-134	< 3.1	< 4.0	< 3.5	< 3.6
Cs-137	< 2.7	< 5.0	< 2.3	< 3.8
Ba-140	< 15.9	< 15.6	< 14.9	< 11.8
La-140	< 3.7	< 1.5	< 2.6	< 3.7

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

Location	D-16	D-96	D-108	D-108
Lab Code	DVE- 4630	DVE- 4631	DVE- 4632	DVE- 4633
Date Collected	09-06-17	09-07-17	09-07-17	09-07-17
Sample Type	Broadleaf	Broadleaf	Kale	Broadleaf
K-40	4.07 ± 0.41	4.65 ± 0.51	4.10 ± 0.41	4.94 ± 0.40
Mn-54	< 0.010	< 0.017	< 0.010	< 0.012
Fe-59	< 0.019	< 0.032	< 0.022	< 0.022
Co-58	< 0.014	< 0.016	< 0.010	< 0.012
Co-60	< 0.009	< 0.015	< 0.008	< 0.009
Zn-65	< 0.028	< 0.035	< 0.020	< 0.019
Nb-95	< 0.008	< 0.016	< 0.008	< 0.009
Zr-95	< 0.025	< 0.024	< 0.020	< 0.016
Ru-103	< 0.013	< 0.011	< 0.015	< 0.011
Ru-106	< 0.10	< 0.16	< 0.085	< 0.12
I-131	< 0.025	< 0.022	< 0.024	< 0.018
Cs-134	< 0.015	< 0.020	< 0.012	< 0.012
Cs-137	< 0.013	< 0.020	< 0.012	< 0.014
Ce-141	< 0.025	< 0.021	< 0.029	< 0.018
Ce-144	< 0.095	< 0.097	< 0.082	< 0.082

Location	D-108	D-110	D-118	D-118
Lab Code	DVE- 4634	DVE- 3502	DVE- 3503	DVE- 4635
Date Collected	09-07-17	07-14-17	07-14-17	09-08-17
Sample Type	Cabbage	Rhubarb	Cabbage	Cabbage
K-40	2.67 ± 0.29	4.56 ± 0.26	2.00 ± 0.16	1.93 ± 0.20
Mn-54	< 0.004	< 0.008	< 0.002	< 0.007
Fe-59	< 0.013	< 0.012	< 0.011	< 0.014
Co-58	< 0.005	< 0.009	< 0.003	< 0.006
Co-60	< 0.009	< 0.005	< 0.004	< 0.008
Zn-65	< 0.011	< 0.016	< 0.007	< 0.013
Nb-95	< 0.013	< 0.009	< 0.006	< 0.008
Zr-95	< 0.017	< 0.013	< 0.007	< 0.009
Ru-103	< 0.011	< 0.006	< 0.004	< 0.007
Ru-106	< 0.090	< 0.055	< 0.055	< 0.064
I-131	< 0.016	< 0.014	< 0.013	< 0.011
Cs-134	< 0.010	< 0.008	< 0.005	< 0.007
Cs-137	< 0.008	< 0.009	< 0.004	< 0.008
Ce-141	< 0.019	< 0.013	< 0.010	< 0.019
Ce-144	< 0.075	< 0.050	< 0.037	< 0.041

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

Location	D-138
Lab Code	DVE- 3504
Date Collected	07-14-17
Sample Type	Cabbage
K-40	3.43 ± 0.25
Mn-54	< 0.007
Fe-59	< 0.013
Co-58	< 0.005
Co-60	< 0.005
Zn-65	< 0.013
Nb-95	< 0.006
Zr-95	< 0.011
Ru-103	< 0.004
Ru-106	< 0.055
I-131	< 0.011
Cs-134	< 0.007
Cs-137	< 0.006
Ce-141	< 0.010
Ce-144	< 0.039

Table 15. Vegetation (hay and grain), analyses for gamma-emitting isotopes.
Collection: Annually
Units: pCi/g wet

Location	D-57	D-57	D-57	D-57	D-96
Lab Code	DVE- 4636	DVE- 4637	DVE- 5225	DVE- 5226	DVE- 4638
Date Collected	09-07-17	09-07-17	10-04-17	10-04-17	09-07-17
Sample Type	Hay	Soybeans	Soybeans	Corn	Hay
K-40	9.62 ± 0.54	3.46 ± 0.41	15.74 ± 0.76	2.67 ± 0.20	16.83 ± 0.62
Mn-54	< 0.027	< 0.012	< 0.020	< 0.006	< 0.024
Fe-59	< 0.049	< 0.018	< 0.041	< 0.008	< 0.053
Co-58	< 0.025	< 0.019	< 0.020	< 0.003	< 0.022
Co-60	< 0.015	< 0.015	< 0.021	< 0.006	< 0.021
Zn-65	< 0.050	< 0.022	< 0.050	< 0.007	< 0.053
Nb-95	< 0.019	< 0.019	< 0.024	< 0.007	< 0.029
Zr-95	< 0.030	< 0.019	< 0.033	< 0.009	< 0.027
Ru-103	< 0.020	< 0.013	< 0.021	< 0.008	< 0.022
Ru-106	< 0.17	< 0.14	< 0.24	< 0.038	< 0.25
I-131	< 0.042	< 0.030	< 0.041	< 0.010	< 0.052
Cs-134	< 0.023	< 0.017	< 0.019	< 0.006	< 0.023
Cs-137	< 0.028	< 0.015	< 0.020	< 0.005	< 0.023
Ce-141	< 0.043	< 0.032	< 0.026	< 0.011	< 0.053
Ce-144	< 0.14	< 0.083	< 0.12	< 0.042	< 0.17

Location	D-96	D-96	D-109	D-109	D-110
Lab Code	DVE- 5227	DVE- 5228	DVE- 4639	DVE- 5230	DVE- 4640
Date Collected	10-05-17	10-05-17	09-06-17	10-06-17	09-06-17
Sample Type	Soybeans	Corn	Hay	Corn	Hay
K-40	12.88 ± 0.44	2.82 ± 0.24	28.94 ± 1.68	2.34 ± 0.20	23.42 ± 0.64
Mn-54	< 0.010	< 0.005	< 0.044	< 0.006	< 0.014
Fe-59	< 0.020	< 0.012	< 0.138	< 0.005	< 0.038
Co-58	< 0.009	< 0.008	< 0.041	< 0.006	< 0.017
Co-60	< 0.009	< 0.007	< 0.033	< 0.003	< 0.015
Zn-65	< 0.019	< 0.014	< 0.080	< 0.014	< 0.036
Nb-95	< 0.009	< 0.008	< 0.035	< 0.005	< 0.012
Zr-95	< 0.016	< 0.015	< 0.060	< 0.008	< 0.033
Ru-103	< 0.006	< 0.008	< 0.029	< 0.006	< 0.018
Ru-106	< 0.085	< 0.071	< 0.364	< 0.059	< 0.15
I-131	< 0.007	< 0.014	< 0.055	< 0.011	< 0.032
Cs-134	< 0.008	< 0.007	< 0.047	< 0.006	< 0.016
Cs-137	< 0.008	< 0.007	< 0.046	< 0.005	< 0.018
Ce-141	< 0.011	< 0.015	< 0.095	< 0.010	< 0.034
Ce-144	< 0.052	< 0.063	< 0.372	< 0.041	< 0.14

Table 15. Vegetation (hay and grain), analyses for gamma-emitting isotopes.
Collection: Annually
Units: pCi/g wet

	Control		
Location	D-138	D-138	D-138
Lab Code	DVE- 4641	DVE- 5231	DVE- 5232
Date Collected	09-06-17	10-05-17	10-05-17
Sample Type	Hay	Soybeans	Corn
K-40	25.91 ± 0.75	14.05 ± 0.47	2.57 ± 0.19
Mn-54	< 0.025	< 0.010	< 0.005
Fe-59	< 0.030	< 0.030	< 0.013
Co-58	< 0.023	< 0.009	< 0.004
Co-60	< 0.023	< 0.006	< 0.006
Zn-65	< 0.057	< 0.026	< 0.011
Nb-95	< 0.016	< 0.008	< 0.006
Zr-95	< 0.037	< 0.009	< 0.005
Ru-103	< 0.027	< 0.010	< 0.005
Ru-106	< 0.153	< 0.071	< 0.048
Cs-134	< 0.021	< 0.010	< 0.006
Cs-137	< 0.026	< 0.009	< 0.005
Ce-141	< 0.040	< 0.018	< 0.012
Ce-144	< 0.138	< 0.056	< 0.037

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

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

Lab Code	DSW- 238	DSW- 554	DSW- 1070	DSW- 1611	DSW- 2248	DSW- 3183
Date Collected	01-18-17	02-13-17	03-16-17	04-17-17	05-15-17	06-28-17
H-3	< 179	< 156	< 145	< 155	< 155	< 149
I-131(Chemistry)	< 0.4	< 0.5	< 0.3	< 0.2	< 0.5	< 0.4
Mn-54	< 2.8	< 2.3	< 2.2	< 2.3	< 2.0	< 3.3
Fe-59	< 6.0	< 5.5	< 3.4	< 3.7	< 4.1	< 4.6
Co-58	< 1.3	< 2.3	< 2.5	< 1.9	< 1.4	< 3.5
Co-60	< 2.4	< 2.6	< 1.4	< 2.5	< 2.5	< 3.0
Zn-65	< 4.8	< 3.9	< 6.6	< 3.3	< 2.9	< 5.4
Nb-95	< 3.4	< 2.6	< 2.4	< 2.7	< 2.8	< 4.8
Zr-95	< 5.3	< 3.4	< 4.8	< 3.7	< 3.9	< 3.6
I-131	< 3.7	< 2.8	< 4.5	< 3.5	< 3.0	< 5.5
Cs-134	< 3.1	< 2.3	< 3.1	< 3.7	< 3.2	< 3.5
Cs-137	< 2.1	< 1.6	< 3.0	< 2.7	< 2.1	< 2.8
Ba-140	< 9.3	< 8.5	< 12.7	< 8.4	< 12.1	< 17.6
La-140	< 1.7	< 2.4	< 1.8	< 2.4	< 1.7	< 3.1

Lab Code	DSW- 3633	DSW- 4264	DSW- 4880	DSW- 5605	DSW- 6133	DSW- 6552
Date Collected	07-18-17	08-16-17	09-21-17	10-18-17	11-16-17	12-19-17
H-3	< 183	< 144	< 183	< 154	< 151	< 156
I-131(Chemistry)	< 0.4	< 0.4	< 0.3	< 0.3	< 0.4	< 0.3
Mn-54	< 1.7	< 3.3	< 2.2	< 2.3	< 1.8	< 1.8
Fe-59	< 4.7	< 6.8	< 3.1	< 4.2	< 6.6	< 3.3
Co-58	< 2.4	< 2.0	< 1.8	< 1.6	< 2.7	< 2.3
Co-60	< 1.6	< 2.6	< 2.3	< 3.0	< 2.8	< 2.4
Zn-65	< 5.2	< 3.9	< 3.0	< 2.3	< 4.0	< 3.2
Nb-95	< 3.2	< 2.3	< 1.7	< 3.3	< 4.4	< 3.3
Zr-95	< 4.9	< 5.3	< 3.0	< 5.1	< 3.4	< 3.3
I-131	< 3.5	< 5.3	< 3.3	< 3.7	< 6.0	< 3.4
Cs-134	< 3.0	< 3.5	< 2.6	< 3.1	< 4.4	< 2.6
Cs-137	< 1.8	< 2.2	< 1.4	< 3.1	< 2.4	< 3.0
Ba-140	< 13.2	< 17.3	< 12.7	< 15.8	< 17.8	< 12.5
La-140	< 1.4	< 2.2	< 1.1	< 2.0	< 2.5	< 2.9

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

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

Lab Code	DSW- 239	DSW- 555	DSW- 1071	DSW- 1612	DSW- 2249	DSW- 3184
Date Collected	01-18-17	02-13-17	03-16-17	04-17-17	05-15-17	06-28-17
H-3	< 179	< 156	< 145	< 155	< 155	< 149
Mn-54	< 3.6	< 3.6	< 1.6	< 2.4	< 3.6	< 2.4
Fe-59	< 3.3	< 2.5	< 6.2	< 4.9	< 7.1	< 4.4
Co-58	< 2.4	< 2.6	< 2.4	< 2.8	< 3.0	< 2.1
Co-60	< 1.8	< 1.7	< 2.6	< 1.8	< 2.1	< 2.1
Zn-65	< 2.2	< 6.1	< 4.2	< 3.0	< 3.9	< 5.6
Nb-95	< 2.2	< 2.9	< 1.6	< 2.5	< 3.0	< 3.5
Zr-95	< 3.3	< 4.4	< 2.8	< 2.9	< 4.3	< 2.8
I-131	< 5.2	< 3.2	< 3.4	< 3.4	< 9.1	< 3.5
Cs-134	< 2.8	< 2.7	< 2.5	< 3.9	< 3.5	< 3.3
Cs-137	< 2.3	< 2.9	< 3.3	< 2.2	< 3.1	< 2.1
Ba-140	< 14.4	< 9.0	< 14.0	< 17.2	< 12.8	< 11.7
La-140	< 2.5	< 2.6	< 2.1	< 1.8	< 3.6	< 2.7

Lab Code	DSW- 3634	DSW- 4265	DSW- 4881	DSW- 5606	DSW- 6134	DSW- 6553
Date Collected	07-18-17	08-16-17	09-21-17	10-18-17	11-16-17	12-19-17
H-3	< 183	< 144	< 183	< 154	< 151	< 156
Mn-54	< 2.2	< 3.3	< 2.6	< 2.6	< 1.8	< 2.9
Fe-59	< 6.5	< 4.3	< 5.0	< 2.0	< 5.4	< 4.4
Co-58	< 2.3	< 2.9	< 2.0	< 1.9	< 2.1	< 3.6
Co-60	< 2.1	< 2.5	< 2.7	< 0.9	< 3.3	< 3.3
Zn-65	< 4.3	< 4.2	< 1.5	< 2.5	< 2.4	< 2.7
Nb-95	< 3.1	< 2.6	< 2.1	< 3.3	< 2.9	< 2.1
Zr-95	< 3.2	< 4.3	< 4.4	< 5.1	< 5.0	< 4.4
I-131	< 8.0	< 4.3	< 4.0	< 5.4	< 4.7	< 3.8
Cs-134	< 3.2	< 3.0	< 3.7	< 2.9	< 3.2	< 3.6
Cs-137	< 2.7	< 2.4	< 3.7	< 2.8	< 2.7	< 3.8
Ba-140	< 15.2	< 16.2	< 14.0	< 11.4	< 15.7	< 15.8
La-140	< 2.8	< 2.3	< 2.9	< 3.9	< 2.5	< 2.9

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

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

Lab Code	DSW- 240	DSW- 556	DSW- 1073	DSW- 1613	DSW- 2250	DSW- 3185
Date Collected	01-18-17	02-13-17	03-16-17	04-17-17	05-15-17	06-28-17
H-3	< 179	< 156	< 145	< 155	< 155	< 149
Mn-54	< 5.6	< 2.7	< 2.4	< 2.0	< 3.0	< 3.0
Fe-59	< 7.0	< 1.9	< 7.2	< 3.9	< 6.9	< 5.1
Co-58	< 3.4	< 2.1	< 3.3	< 2.8	< 3.1	< 2.1
Co-60	< 4.7	< 1.8	< 2.3	< 2.3	< 3.3	< 2.0
Zn-65	< 6.5	< 4.6	< 5.8	< 3.1	< 2.1	< 2.8
Nb-95	< 3.1	< 1.8	< 3.5	< 2.3	< 3.6	< 3.0
Zr-95	< 7.7	< 4.2	< 5.0	< 4.4	< 7.3	< 4.8
I-131	< 3.9	< 2.6	< 6.1	< 4.9	< 9.0	< 5.7
Cs-134	< 4.2	< 2.6	< 3.1	< 3.5	< 4.4	< 3.1
Cs-137	< 2.8	< 3.1	< 4.2	< 1.6	< 4.3	< 2.6
Ba-140	< 9.5	< 9.0	< 19.0	< 10.4	< 24.2	< 17.9
La-140	< 4.4	< 2.0	< 3.0	< 1.5	< 2.4	< 2.1

Lab Code	DSW- 3635	DSW- 4266	DSW- 4882	DSW- 5607	DSW- 6135	DSW- 6554
Date Collected	07-18-17	08-16-17	09-21-17	10-18-17	11-16-17	12-19-17
H-3	< 183	< 144	< 183	< 154	< 151	< 156
Mn-54	< 3.3	< 3.2	< 3.1	< 1.6	< 2.2	< 1.3
Fe-59	< 4.2	< 3.5	< 3.9	< 2.5	< 4.6	< 5.6
Co-58	< 2.0	< 2.1	< 2.0	< 1.5	< 1.9	< 2.4
Co-60	< 1.4	< 1.8	< 2.3	< 2.0	< 2.6	< 2.4
Zn-65	< 3.5	< 2.3	< 1.9	< 5.1	< 3.3	< 2.5
Nb-95	< 1.9	< 3.2	< 2.1	< 3.0	< 3.2	< 1.5
Zr-95	< 2.6	< 3.5	< 5.4	< 3.6	< 3.5	< 3.5
I-131	< 4.5	< 5.2	< 5.8	< 5.0	< 4.7	< 4.3
Cs-134	< 2.8	< 3.7	< 3.2	< 3.3	< 3.1	< 2.5
Cs-137	< 1.9	< 2.8	< 2.7	< 2.8	< 3.5	< 2.8
Ba-140	< 20.9	< 18.9	< 14.0	< 13.5	< 15.3	< 17.3
La-140	< 2.4	< 3.4	< 1.9	< 2.8	< 2.7	< 1.7

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- 241	DSW- 557	DSW- 1074	DSW- 1614	DSW- 2252	DSW- 3186
Date Collected	01-18-17	02-13-17	03-16-17	04-17-17	05-15-17	06-28-17
H-3	< 179	< 156	< 145	< 155	< 155	< 149
I-131(Chemistry)	< 0.4	< 0.4	< 0.3	< 0.3	< 0.3	< 0.5
Mn-54	< 1.8	< 2.4	< 1.8	< 2.2	< 2.3	< 2.4
Fe-59	< 2.3	< 5.1	< 3.1	< 5.8	< 3.8	< 2.7
Co-58	< 1.9	< 2.2	< 1.8	< 1.4	< 1.7	< 2.5
Co-60	< 1.4	< 2.3	< 2.2	< 1.1	< 1.8	< 2.0
Zn-65	< 4.0	< 3.9	< 2.8	< 2.9	< 3.0	< 3.4
Nb-95	< 2.4	< 3.5	< 3.6	< 2.2	< 3.3	< 2.6
Zr-95	< 5.1	< 6.2	< 3.7	< 3.3	< 2.3	< 4.3
I-131	< 3.3	< 3.7	< 4.0	< 3.3	< 4.4	< 3.4
Cs-134	< 2.7	< 3.5	< 3.0	< 2.9	< 2.7	< 3.2
Cs-137	< 2.1	< 2.5	< 3.5	< 2.4	< 2.5	< 3.1
Ba-140	< 8.2	< 10.8	< 8.8	< 14.2	< 12.1	< 13.9
La-140	< 2.5	< 2.6	< 1.5	< 2.0	< 1.6	< 1.6

Lab Code	DSW- 3636	DSW- 4267	DSW- 4883	DSW- 5608	DSW- 6136	DSW- 6555
Date Collected	07-18-17	08-16-17	09-21-17	10-18-17	11-16-17	12-19-17
H-3	< 183	< 144	< 183	< 154	< 151	< 156
I-131(Chemistry)	< 0.3	< 0.4	< 0.3	< 0.3	< 0.4	< 0.2
Mn-54	< 6.1	< 3.5	< 2.2	< 5.7	< 3.5	< 2.3
Fe-59	< 7.7	< 5.0	< 4.0	< 8.3	< 4.1	< 2.0
Co-58	< 5.2	< 1.5	< 1.7	< 3.0	< 2.3	< 2.7
Co-60	< 4.8	< 1.7	< 2.3	< 4.5	< 2.7	< 2.4
Zn-65	< 4.1	< 6.0	< 2.4	< 9.2	< 3.3	< 4.8
Nb-95	< 2.8	< 2.7	< 2.5	< 3.2	< 2.1	< 2.0
Zr-95	< 8.1	< 4.9	< 3.8	< 7.5	< 5.2	< 3.8
I-131	< 5.5	< 6.3	< 2.9	< 8.1	< 3.4	< 2.5
Cs-134	< 6.3	< 2.8	< 2.5	< 5.9	< 3.2	< 3.2
Cs-137	< 3.2	< 3.5	< 2.9	< 3.1	< 3.3	< 3.9
Ba-140	< 24.3	< 14.0	< 11.4	< 17.1	< 16.3	< 11.5
La-140	< 6.2	< 3.0	< 2.1	< 5.1	< 2.1	< 3.4

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

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

Lab Code	DSW- 242	DSW- 558	DSW- 1192	DSW- 1615	DSW- 2253	DSW- 3015
Date Collected	01-18-17	02-13-17	03-27-17	04-17-17	05-15-17	06-19-17
H-3	< 179	< 156	< 151	< 155	< 155	< 146
Mn-54	< 1.3	< 3.1	< 2.2	< 2.1	< 3.1	< 4.4
Fe-59	< 5.7	< 5.4	< 4.6	< 5.3	< 6.8	< 5.1
Co-58	< 1.8	< 3.5	< 2.2	< 1.9	< 3.4	< 3.4
Co-60	< 1.8	< 2.7	< 2.4	< 2.8	< 2.6	< 5.0
Zn-65	< 1.4	< 5.7	< 1.6	< 3.7	< 3.2	< 4.5
Nb-95	< 2.2	< 4.0	< 2.2	< 2.6	< 3.6	< 4.5
Zr-95	< 3.8	< 4.3	< 7.1	< 2.9	< 7.2	< 8.0
I-131	< 4.7	< 7.4	< 3.6	< 3.6	< 7.8	< 7.7
Cs-134	< 2.8	< 3.1	< 3.5	< 3.0	< 4.2	< 5.4
Cs-137	< 3.0	< 2.5	< 3.6	< 3.2	< 4.5	< 5.3
Ba-140	< 14.4	< 11.2	< 10.3	< 16.9	< 23.5	< 22.5
La-140	< 4.0	< 3.5	< 3.7	< 2.4	< 2.8	< 5.1

Lab Code	DSW- 3637	DSW- 4268	DSW- 4884	DSW- 5609	DSW- 6137	DSW- 6556
Date Collected	07-18-17	08-16-17	09-21-17	10-18-17	11-16-17	12-19-17
H-3	< 183	< 144	< 183	< 154	< 151	< 156
Mn-54	< 1.6	< 2.6	< 1.7	< 2.2	< 3.6	< 2.9
Fe-59	< 5.2	< 5.6	< 5.2	< 2.9	< 4.4	< 4.0
Co-58	< 1.8	< 2.1	< 2.7	< 2.1	< 1.6	< 2.8
Co-60	< 2.4	< 2.6	< 1.7	< 0.7	< 3.1	< 2.7
Zn-65	< 4.9	< 4.5	< 2.8	< 3.0	< 4.4	< 4.3
Nb-95	< 2.8	< 2.5	< 2.5	< 2.4	< 2.3	< 2.5
Zr-95	< 3.2	< 4.9	< 3.6	< 3.3	< 5.7	< 2.9
I-131	< 5.8	< 5.1	< 4.1	< 4.4	< 5.7	< 4.9
Cs-134	< 2.2	< 3.0	< 2.7	< 2.6	< 3.8	< 2.9
Cs-137	< 2.5	< 3.7	< 2.8	< 1.5	< 3.3	< 3.1
Ba-140	< 18.9	< 10.1	< 13.9	< 14.3	< 19.4	< 11.2
La-140	< 1.7	< 1.5	< 1.9	< 3.5	< 1.5	< 3.4

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-1100	DSW-3193	DSW-4945	DSW-6631
Sr-89	< 0.44	< 0.58	< 0.86	< 0.67
Sr-90	< 0.46	< 0.47	< 0.49	< 0.47

Location	D-61			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-1101	DSW-3194	DSW-4946	DSW-6632
Sr-89	< 0.53	< 0.63	< 0.68	< 0.61
Sr-90	< 0.53	< 0.48	< 0.73	< 0.48

Table 18. Fish, analyses of edible portion for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g wet

Location	Upstream, D-49			
Lab Code	DF- 2944	DF- 2945	DF- 4332	DF- 4333
Date Collected	06-15-17	06-15-17	08-18-17	08-18-17
Sample Type	Northern Pike	Largemouth Bass	Channel Catfish	Largemouth Bass
K-40	2.65 ± 0.42	3.09 ± 0.45	2.85 ± 0.39	3.62 ± 0.42
Mn-54	< 0.015	< 0.016	< 0.014	< 0.016
Fe-59	< 0.055	< 0.037	< 0.058	< 0.056
Co-58	< 0.015	< 0.014	< 0.020	< 0.029
Co-60	< 0.006	< 0.016	< 0.020	< 0.015
Zn-65	< 0.033	< 0.022	< 0.043	< 0.036
Nb-95	< 0.025	< 0.028	< 0.055	< 0.040
Zr-95	< 0.035	< 0.027	< 0.036	< 0.054
Ru-103	< 0.019	< 0.020	< 0.032	< 0.045
Ru-106	< 0.13	< 0.12	< 0.16	< 0.14
Cs-134	< 0.019	< 0.018	< 0.018	< 0.019
Cs-137	< 0.011	< 0.010	< 0.018	< 0.015
Ce-141	< 0.044	< 0.038	< 0.075	< 0.085
Ce-144	< 0.080	< 0.081	< 0.12	< 0.11

Table 18. Fish, analyses of edible portion for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g wet

Location	Downstream, D-61			
Lab Code	DF- 2946	DF- 2947	DF- 4335	DF- 4336
Date Collected	06-15-17	06-15-17	08-18-17	08-18-17
Sample Type	Northern Pike	Largemouth Bass	Channel Catfish	Smallmouth Bass
K-40	3.00 ± 0.78	3.03 ± 0.38	2.98 ± 0.38	2.80 ± 0.37
Mn-54	< 0.056	< 0.012	< 0.015	< 0.011
Fe-59	< 0.16	< 0.029	< 0.030	< 0.063
Co-58	< 0.080	< 0.012	< 0.016	< 0.013
Co-60	< 0.034	< 0.006	< 0.010	< 0.016
Zn-65	< 0.078	< 0.032	< 0.035	< 0.042
Nb-95	< 0.084	< 0.020	< 0.040	< 0.031
Zr-95	< 0.12	< 0.037	< 0.025	< 0.033
Ru-103	< 0.10	< 0.027	< 0.023	< 0.030
Ru-106	< 0.43	< 0.13	< 0.14	< 0.14
Cs-134	< 0.054	< 0.014	< 0.016	< 0.016
Cs-137	< 0.050	< 0.011	< 0.017	< 0.009
Ce-141	< 0.11	< 0.033	< 0.056	< 0.052
Ce-144	< 0.26	< 0.092	< 0.068	< 0.095

Table 19. River sediment, analysis for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g dry

Location	D-49 (Control)	
Lab Code	DBS- 1659	DBS- 6053
Date Collected	04-19-17	11-13-17
K-40	7.88 ± 0.50	9.20 ± 0.68
Mn-54	< 0.016	< 0.028
Fe-59	< 0.055	< 0.038
Co-58	< 0.019	< 0.023
Co-60	< 0.006	< 0.020
Zn-65	< 0.038	< 0.052
Nb-95	< 0.024	< 0.036
Zr-95	< 0.034	< 0.050
Ru-103	< 0.028	< 0.035
Ru-106	< 0.098	< 0.17
Cs-134	< 0.012	< 0.023
Cs-137	< 0.010	0.079 ± 0.029 [a]
Ce-141	< 0.063	< 0.066
Ce-144	< 0.11	< 0.18

Location	D-51 (Discharge)	
Lab Code	DBS- 1660	DBS- 6055
Date Collected	04-19-17	11-13-17
K-40	8.45 ± 0.52	7.52 ± 0.50
Mn-54	< 0.019	< 0.022
Fe-59	< 0.072	< 0.044
Co-58	< 0.019	< 0.023
Co-60	< 0.013	< 0.013
Zn-65	< 0.038	< 0.043
Nb-95	< 0.021	< 0.027
Zr-95	< 0.045	< 0.049
Ru-103	< 0.023	< 0.027
Ru-106	< 0.14	< 0.093
Cs-134	< 0.012	< 0.016
Cs-137	< 0.017	< 0.020
Ce-141	< 0.046	< 0.065
Ce-144	< 0.090	< 0.11

[a] The Cs-137 detected is from nuclear weapons testing (see Table 21).

Table 19. River sediment, analysis for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g dry

Location	D-107A (North Drainage Ditch)	
Lab Code	DBS- 1661	DBS- 6056
Date Collected	04-19-17	11-13-17
K-40	8.07 ± 0.48	8.53 ± 0.50
Mn-54	< 0.016	< 0.015
Fe-59	< 0.030	< 0.034
Co-58	< 0.022	< 0.016
Co-60	< 0.013	< 0.009
Zn-65	< 0.043	< 0.036
Nb-95	< 0.026	< 0.028
Zr-95	< 0.035	< 0.028
Ru-103	< 0.016	< 0.016
Ru-106	< 0.15	< 0.11
Cs-134	< 0.011	< 0.010
Cs-137	< 0.018	< 0.015
Ce-141	< 0.054	< 0.047
Ce-144	< 0.11	< 0.095

Table 20. Soil, analysis for strontium-90 and gamma-emitting isotopes.
Collection: Annually
Units: pCi/g dry

Location	D-15a	D-15a	D-16	D-16
Lab Code	DSO- 3970	DSO- 6391	DSO- 3971	DSO- 6392
Date Collected	08-02-17	12-06-17	08-02-17	12-06-17
Sr-90	< 0.054	< 0.039	< 0.064	< 0.043
H-3 (pCi/L)	< 160	191 ± 84	< 160	189 ± 84
K-40	12.40 ± 0.70	13.86 ± 0.76	8.98 ± 0.55	8.94 ± 0.58
Mn-54	< 0.021	< 0.025	< 0.010	< 0.018
Fe-59	< 0.042	< 0.071	< 0.041	< 0.060
Co-58	< 0.027	< 0.027	< 0.020	< 0.016
Co-60	< 0.019	< 0.023	< 0.013	< 0.006
Zn-65	< 0.047	< 0.055	< 0.035	< 0.045
Nb-95	< 0.032	< 0.031	< 0.022	< 0.031
Zr-95	< 0.045	< 0.060	< 0.028	< 0.021
Ru-103	< 0.022	< 0.033	< 0.015	< 0.017
Ru-106	< 0.14	< 0.18	< 0.11	< 0.16
Cs-134	< 0.021	< 0.018	< 0.011	< 0.018
Cs-137	0.12 ± 0.028 [a]	0.15 ± 0.037 [a]	0.12 ± 0.020 [a]	0.09 ± 0.031 [a]
Ce-141	< 0.078	< 0.060	< 0.054	< 0.057
Ce-144	< 0.17	< 0.17	< 0.074	< 0.12

[a] The Duane Arnold Energy Center collected additional soil samples in Mason City, Ames and Coralville, Iowa.

The Cs-137 detected is from nuclear weapons testing. (see table 21).

Table 21. Supplemental soil samples, analyses for gamma emitting isotopes, Sr-90 and tritium.

Collection: Supplemental

Units: pCi/g dry

The Duane Arnold Energy Center collected additional soil samples in Mason City, Ames and Coralville, Iowa. These "Supplemental Analyses" support the conclusion that the source of Cs-137 is from nuclear weapons testing.

Location	Iowa City (Coralville)	Mason City	Ames
Lab Code	DSO- 6460	DSO- 6462	DSO- 6579
Date Collected	12-06-17	12-07-17	12-06-17
Sr-90	< 0.042	< 0.042	< 0.033
H-3 (pCi/L)	< 149	< 148	< 154
K-40	13.90 ± 0.77	11.64 ± 0.71	11.26 ± 0.66
Mn-54	< 0.026	< 0.025	< 0.023
Fe-59	< 0.070	< 0.042	< 0.059
Co-58	< 0.026	< 0.023	< 0.021
Co-60	< 0.022	< 0.013	< 0.017
Zn-65	< 0.056	< 0.053	< 0.056
Nb-95	< 0.048	< 0.045	< 0.042
Zr-95	< 0.056	< 0.055	< 0.035
Ru-103	< 0.028	< 0.030	< 0.032
Ru-106	< 0.16	< 0.12	< 0.12
Cs-134	< 0.017	< 0.019	< 0.016
Cs-137	0.09 ± 0.025	0.13 ± 0.038	0.06 ± 0.034
Ce-141	< 0.071	< 0.064	< 0.060
Ce-144	< 0.16	< 0.15	< 0.17

Table 22. Groundwater Protection Program Summary.

Precipitation samples for tritium analysis. Units: pCi/L

Lab Code	Date	H-3	Lab Code	Date	H-3
D-016			D-111		
DP- 122	01/10/17	< 176	DP- 124	01/10/17	< 176
DP- 448	02/02/17	< 155	DP- 449	02/02/17	< 156
DP- 883	03/03/17	< 146	DP- 884	03/03/17	227 ± 89
DP- 1445	04/06/17	< 156	DP- 1446	04/06/17	358 ± 91
DP- 2013	05/04/17	< 148	DP- 2014	05/04/17	< 148
DP- 2719	06/05/17	< 150	DP- 2720	06/05/17	< 150
DP- 3205	07/03/17	< 178	DP- 3206	07/03/17	314 ± 97
DP- 3911	08/01/17	< 159	DP- 3913	08/01/17	164 ± 88
DP- 4500	09/05/17	< 187	DP- 4501	09/05/17	< 187
DP- 5079	10/02/17	< 144	DP- 5080	10/02/17	223 ± 80
DP- 5837	11/01/17	< 150	DP- 5839	11/01/17	198 ± 82
DP- 6330	12/04/17	195 ± 82	DP- 6332	12/04/17	571 ± 99
D-112			D-114		
DP- 125	01/10/17	< 176	DP- 126	01/10/17	< 176
DP- 450	02/02/17	< 156	DP- 451	02/02/17	< 156
DP- 885	03/03/17	< 146	DP- 886	03/03/17	604 ± 106
DP- 1448	04/06/17	< 151	DP- 1449	04/06/17	< 151
DP- 2015	05/04/17	212 ± 81	DP- 2017	05/04/17	210 ± 81
DP- 2721	06/05/17	186 ± 84	DP- 2722	06/05/17	< 150
DP- 3207	07/03/17	< 178	DP- 3208	07/03/17	< 178
DP- 3914	08/01/17	< 159	DP- 3915	08/01/17	< 159
DP- 4502	09/05/17	< 187	DP- 4503	09/05/17	< 187
DP- 5082	10/02/17	< 144	DP- 5083	10/02/17	241 ± 81
DP- 5840	11/01/17	403 ± 92	DP- 5841	11/01/17	< 150
DP- 6333	12/04/17	161 ± 80	DP- 6334	12/04/17	470 ± 95
D-127			D-128		
DP- 127	01/10/17	1271 ± 133	DP- 128	01/10/17	611 ± 114
DP- 452	02/02/17	2052 ± 153	DP- 453	02/02/17	532 ± 101
DP- 887	03/03/17	4435 ± 211	DP- 888	03/03/17	336 ± 94
DP- 1450	04/06/17	3441 ± 186	DP- 1451	04/06/17	176 ± 82
DP- 2018	05/04/17	1707 ± 139	DP- 2019	05/04/17	628 ± 101
DP- 2723	06/05/17	1435 ± 134	DP- 2724	06/05/17	476 ± 98
DP- 3209	07/03/17	910 ± 117	DP- 3210	07/03/17	545 ± 106
DP- 3916	08/01/17	1047 ± 124	DP- 3917	08/01/17	290 ± 94
DP- 4504	09/05/17	859 ± 118	DP- 4505	09/05/17	626 ± 110
DP- 5084	10/02/17	1321 ± 125	DP- 5085	10/02/17	352 ± 87
DP- 5842	11/01/17	1218 ± 125	DP- 5843	11/01/17	850 ± 111
DP- 6335	12/04/17	2452 ± 161	DP- 6336	12/04/17	391 ± 91

Table 22. Groundwater Protection Program Summary.

Precipitation, monthly collections, analyses for gamma emitting isotopes.

Location: D-016

		Concentration (pCi/L)											
Lab Code	Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{131}I	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
DP- 122	01/10/17	< 2.5	< 3.0	< 2.7	< 1.8	< 4.9	< 3.1	< 3.8	< 4.1	< 2.7	< 3.3	< 11.1	< 2.4
DP- 448	02/02/17	< 2.5	< 4.3	< 1.8	< 2.4	< 5.0	< 2.7	< 3.6	< 3.3	< 2.7	< 2.7	< 12.0	< 2.6
DP- 883	03/03/17	< 3.1	< 3.6	< 3.2	< 2.5	< 4.7	< 3.2	< 5.8	< 5.1	< 3.1	< 3.8	< 13.5	< 3.2
DP- 1445	04/06/17	< 4.5	< 7.2	< 4.1	< 4.4	< 7.6	< 5.1	< 7.3	< 6.3	< 4.4	< 4.7	< 20.0	< 5.9
DP- 2013	05/04/17	< 1.2	< 2.2	< 1.4	< 1.4	< 2.5	< 1.6	< 1.9	< 2.5	< 1.4	< 1.6	< 6.0	< 1.5
DP- 2719	06/05/17	< 1.0	< 2.5	< 1.8	< 1.6	< 2.1	< 2.1	< 2.5	< 8.3	< 1.4	< 1.2	< 18.5	< 3.0
DP- 3205	07/03/17	< 1.4	< 2.3	< 1.4	< 1.4	< 2.8	< 1.5	< 2.7	< 2.1	< 1.5	< 1.3	< 6.2	< 1.7
DP- 3911	08/01/17	< 3.5	< 7.3	< 2.9	< 4.0	< 3.5	< 3.4	< 5.8	< 6.5	< 3.5	< 3.8	< 16.0	< 3.5
DP- 4500	09/05/17	< 2.9	< 4.3	< 2.4	< 3.2	< 4.8	< 3.4	< 3.9	< 3.5	< 3.2	< 3.5	< 11.8	< 1.9
DP- 5079	10/02/17	< 6.5	< 5.5	< 5.0	< 7.1	< 7.7	< 4.4	< 12.4	< 8.0	< 8.6	< 7.3	< 21.4	< 7.1
DP- 5837	11/01/17	< 2.1	< 6.9	< 2.7	< 2.6	< 5.0	< 3.2	< 4.7	< 5.8	< 3.0	< 3.3	< 19.5	< 3.6
DP- 6330	12/04/17	< 3.9	< 7.5	< 2.8	< 4.3	< 10.0	< 4.6	< 5.0	< 5.5	< 5.1	< 5.5	< 16.0	< 5.6

Precipitation, monthly collections, analyses for gamma emitting isotopes.

Location: D-127

		Concentration (pCi/L)											
Lab Code	Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{131}I	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
DP- 1450	04/06/17	< 2.5	< 6.5	< 2.2	< 1.4	< 4.4	< 4.1	< 5.6	< 56.5 [a]	< 2.0	< 2.0	< 43.6	< 11.8
DP- 2018	05/04/17	< 2.9	< 5.0	< 2.5	< 2.7	< 3.1	< 2.6	< 4.0	< 5.7	< 2.5	< 2.6	< 13.5	< 3.5

[a] LLD for I-131 not reached due to age of sample and/or small sample size; gamma analysis requested on 05-12-17.

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-111A		(01A)	
DWW- 612	02/06/17	179 ± 89	DWW- 4133	08/08/17	< 158
DWW- 2285	05/08/17	194 ± 84	DWW- 6036	11/07/17	257 ± 84
		D-111B		(01B)	
DWW- 613	02/06/17	< 161	DWW- 4134	08/08/17	< 158
DWW- 2286	05/08/17	< 152	DWW- 6037	11/07/17	< 146
		D-112A		(02A)	
DWW- 614	02/06/17	< 161	DWW- 4135	08/08/17	< 158
DWW- 2287	05/08/17	< 152	DWW- 6038	11/07/17	168 ± 80
		D-112B		(02B)	
DWW- 615	02/06/17	< 161	DWW- 4136	08/08/17	< 158
DWW- 2288	05/08/17	< 152	DWW- 6072	11/07/17	< 146
			DWW- 6083	11/10/17	< 146
		D-113A		(03A)	
DWW- 616	02/06/17	< 161	DWW- 4137	08/08/17	< 158
DWW- 2289	05/08/17	< 152	DWW- 6084	11/08/17	155 ± 79
		D-113B		(03B)	
DWW- 617	02/06/17	< 161	DWW- 4139	08/08/17	< 158
DWW- 2290	05/08/17	< 152	DWW- 6085	11/08/17	< 146
		D-114A		(04A)	
DWW- 618	02/08/17	< 161	DWW- 4210	08/09/17	273 ± 104
DWW- 2291	05/09/17	168 ± 82	DWW- 4211	08/10/17	279 ± 105
			DWW- 6086	11/07/17	230 ± 83
		D-114B		(04B)	
DWW- 619	02/08/17	< 161	DWW- 4212	08/10/17	< 190
DWW- 2292	05/09/17	< 152	DWW- 6087	11/07/17	< 146
		D-115A		(05A)	
DWW- 620	02/06/17	< 161	DWW- 4140	08/08/17	< 158
DWW- 2293	05/08/17	< 152	DWW- 6039	11/07/17	< 146
		D-115B		(05B)	
DWW- 621	02/06/17	< 161	DWW- 4141	08/09/17	< 158
DWW- 2294	05/08/17	< 152	DWW- 6040	11/07/17	< 146
		D-116A		(06A)	
DWW- 622	02/06/17	< 161	DWW- 4142	08/08/17	< 158
DWW- 2296	05/08/17	227 ± 85	DWW- 6023	11/07/17	< 146
		D-116B		(06B)	
DWW- 623	02/06/17	< 161	DWW- 4143	08/08/17	< 158
DWW- 2297	05/08/17	< 152	DWW- 6024	11/07/17	< 146

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L.

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-127A		(07A)	
DWW- 663	02/07/17	9,202 ± 280	DWW- 3765	07/05/17	5,089 ± 213
DWW- 1530	04/10/17	16,800 ± 387	DWW- 3839	07/25/17	14,824 ± 369
DWW- 2302	05/11/17	1,966 ± 149	DWW- 4213	08/10/17	4,494 ± 206
DWW- 2579	05/23/17	28,540 ± 502	DWW- 4725	09/12/17	2,288 ± 157
DWW- 3023	05/24/17	27,733 ± 489	DWW- 5688	10/09/17	3,972 ± 191
DWW- 3025	06/02/17	3,953 ± 196	DWW- 6073	11/08/17	18,127 ± 399
DWW- 3026	06/07/17	3,692 ± 190	DWW- 6515	12/12/17	3,549 ± 192
DWW- 3035	06/12/17	1,335 ± 128			
		D-127B		(07B)	
DWW- 624	02/07/17	< 161	DWW- 4214	08/10/17	< 190
DWW- 2298	05/10/17	< 152	DWW- 6088	11/08/17	< 146
		D-128A		(08A)	
DWW- 287	01/17/17	122,901 ± 1,037			
DWW- 664	02/07/17	81,279 ± 790			
DWW- 1047	03/08/17	125,026 ± 1,035			
DWW- 1218	03/22/17	162,211 ± 1,183			
DWW- 1531	04/10/17	203,138 ± 1,321			
DWW- 2020	04/25/17	165,543 ± 1,194			
DWW- 2303	05/10/17	103,539 ± 949			
DWW- 2580	05/23/17	150,415 ± 1,143			
DWW- 3027	06/12/17	76,814 ± 806			
DWW- 3766	07/05/17	115,175 ± 922			
DWW- 3840	07/25/17	85,059 ± 869			
DWW- 4215	08/09/17	71,658 ± 739			
DWW- 4726	09/12/17	39,386 ± 583			
DWW- 5689	10/09/17	49,358 ± 600			
DWW- 6074	11/08/17	73,062 ± 791			
DWW- 6516	12/11/17	49,957 ± 657			
		D-128B		(08B)	
DWW- 665	02/07/17	745 ± 119			
DWW- 2299	05/10/17	770 ± 109			
DWW- 4216	08/09/17	485 ± 112			
DWW- 6089	11/08/17	497 ± 96			
		D-129A		(09A)	
DWW- 625	02/07/17	731 ± 113	DWW- 5690	10/09/17	722 ± 115
DWW- 2304	05/10/17	1,388 ± 132	DWW- 6090	11/08/17	489 ± 95
DWW- 2499	05/23/17	1,700 ± 141			
DWW- 3036	06/12/17	1,593 ± 136			
DWW- 4217	08/12/17	953 ± 126			
DWW- 4727	09/12/17	757 ± 108			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-129B		(09B)	
DWW- 626	02/07/17	356 ± 97			
DWW- 2300	05/10/17	359 ± 92			
DWW- 4218	08/12/17	356 ± 107			
DWW- 6091	11/08/17	395 ± 91			
		D-130A		(10A)	
DWW- 627	02/07/17	< 161			
DWW- 2312	05/10/17	177 ± 83			
DWW- 4219	08/09/17	< 190			
DWW- 6092	11/08/17	< 146			
		D-130B		(10B)	
DWW- 628	02/07/17	< 161			
DWW- 2313	05/10/17	< 152			
DWW- 4220	08/09/17	< 190			
DWW- 6093	11/08/17	< 151			
		D-131A		(11A)	
DWW- 629	02/08/17	< 161			
DWW- 2314	05/10/17	< 152			
DWW- 4221	08/10/17	387 ± 108			
DWW- 6094	11/07/17	181 ± 81			
		D-131B		(11B)	
DWW- 630	02/08/17	< 161			
DWW- 2315	05/09/17	< 152			
DWW- 4222	08/09/17	< 190			
DWW- 4223	08/10/17	< 190			
DWW- 6095	11/07/17	< 151			
		D-132A		(12A)	
DWW- 288	01/17/17	< 160			
DWW- 632	02/08/17	< 161			
DWW- 2301	05/11/17	536 ± 100			
DWW- 4144	08/09/17	< 158			
DWW- 6097	11/07/17	156 ± 80			
		D-132B		(12B)	
DWW- 633	02/08/17	< 161			
DWW- 2305	05/11/17	155 ± 81			
DWW- 4145	08/09/17	< 145			
DWW- 6098	11/07/17	< 151			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-133A		(13A)	
DWW- 634	02/08/17	< 161			
DWW- 2317	05/09/17	< 152			
DWW- 4146	08/09/17	< 158			
DWW- 6099	11/08/17	< 151			
		D-133B		(13B)	
DWW- 635	02/08/17	< 161			
DWW- 2318	05/09/17	< 152			
DWW- 4147	08/09/17	< 158			
DWW- 6100	11/08/17	< 151			
		D-134A		(14A)	
DWW- 290	01/18/17	84,317 ± 860			
DWW- 667	02/07/17	118,103 ± 950			
DWW- 1048	03/09/17	13,725 ± 349			
DWW- 1219	03/22/17	11,467 ± 322			
DWW- 1622	04/13/17	3,471 ± 187			
DWW- 2021	04/25/17	2,295 ± 157			
DWW- 2319	05/10/17	1,354 ± 130			
DWW- 2497	05/23/17	1,247 ± 126			
DWW- 3037	06/12/17	1,112 ± 121			
DWW- 3767	07/05/17	8,973 ± 272			
DWW- 3842	07/25/17	4,325 ± 209			
DWW- 4225	08/09/17	5,509 ± 224			
DWW- 4728	09/12/17	8,302 ± 275			
DWW- 5691	10/09/17	5,023 ± 210			
DWW- 6101	11/08/17	961 ± 115			
DWW- 6517	12/11/17	3,093 ± 182			
D-134B				(14B)	
DWW- 636	02/07/17	364 ± 98			
DWW- 2320	05/10/17	501 ± 98			
DWW- 4226	08/09/17	324 ± 106			
DWW- 6102	11/08/17	455 ± 94			
D-135A				(15A)	
DWW- 637	02/08/17	< 161			
DWW- 2321	05/09/17	< 153			
DWW- 4148	08/09/17	< 158			
DWW- 6103	11/07/17	< 151			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
D-135B				(15B)	
DWW- 638	02/08/17	< 161			
DWW- 2322	05/09/17	< 153			
DWW- 4149	08/09/17	< 158			
DWW- 6104	11/07/17	< 151			
D-136A				(16A)	
DWW- 639	02/07/17	< 161			
DWW- 2323	05/11/17	< 153			
DWW- 4227	08/09/17	167 ± 81			
DWW- 6105	11/08/17	< 151			
D-136B				(16B)	
DWW- 640	02/07/17	< 162			
DWW- 2324	05/11/17	< 153			
DWW- 4228	08/09/17	< 145			
DWW- 6106	11/08/17	< 151			
D-137				(17C)	
DWW- 641	02/07/17	< 162			
DWW- 2325	05/11/17	< 153			
DWW- 4229	08/09/17	182 ± 82			
DWW- 6109	11/08/17	< 151			
D-62				(18A)	
DWW- 293	01/18/17	25,083 ± 473			
DWW- 668	02/07/17	26,675 ± 459			
DWW- 1049	03/08/17	84,000 ± 850			
DWW- 1221	03/22/17	49,996 ± 660			
DWW- 1532	04/10/17	18,991 ± 410			
DWW- 2022	04/25/17	47,979 ± 646			
DWW- 2306	05/10/17	21,247 ± 435			
DWW- 2581	05/23/17	8,091 ± 274			
DWW- 3028	06/02/17	9,638 ± 294			
DWW- 3768	07/05/17	18,262 ± 376			
DWW- 3841	07/25/17	15,985 ± 383			
DWW- 4230	08/09/17	10,299 ± 305			
DWW- 4729	09/12/17	4,517 ± 209			
DWW- 5692	10/09/17	5,383 ± 216			
DWW- 6076	11/08/17	7,430 ± 261			
DWW- 6518	12/11/17	569 ± 108			
D-63				(19A)	
DWW- 642	02/07/17	< 162			
DWW- 2326	05/10/17	< 153			
DWW- 4231	08/10/17	< 145			
DWW- 6110	11/08/17	< 151			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. **Groundwater Protection Program Summary.**

Ground water, Monitoring wells, analyses for tritium [a].

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
D-64				(20A)	
DWW- 643	02/07/17	< 162			
DWW- 2327	05/10/17	175 ± 85			
DWW- 4232	08/10/17	< 147			
DWW- 6111	11/08/17	< 151			
D-65				(21A)	
DWW- 669	02/07/17	2,911 ± 175			
DWW- 2328	05/10/17	402 ± 96			
DWW- 4233	08/10/17	266 ± 90			
DWW- 6112	11/08/17	< 151			
D-66				(22A)	
DWW- 297	01/18/17	33,897 ± 548			
DWW- 671	02/07/17	80,168 ± 784			
DWW- 1222	03/22/17	31,109 ± 522			
DWW- 1534	04/10/17	148,375 ± 1,130			
DWW- 2023	04/25/17	85,754 ± 861			
DWW- 2307	05/10/17	97,047 ± 919			
DWW- 2582	05/23/17	73,195 ± 799			
DWW- 3029	06/12/17	62,186 ± 726			
DWW- 3769	07/05/17	44,331 ± 576			
DWW- 3843	07/25/17	16,805 ± 392			
DWW- 4234	08/09/17	20,383 ± 422			
DWW- 4730	09/12/17	14,813 ± 362			
DWW- 5693	10/09/17	74,665 ± 735			
DWW- 6077	11/08/17	48,385 ± 645			
DWW- 6519	12/11/17	14,206 ± 357			
D-67				(23A)	
DWW- 295	01/18/17	146,308 ± 1,131			
DWW- 670	02/07/17	68,811 ± 728			
DWW- 1050	03/08/17	14,994 ± 364			
DWW- 1223	03/22/17	6,117 ± 240			
DWW- 1535	04/10/17	11,296 ± 320			
DWW- 2024	04/25/17	3,865 ± 195			
DWW- 2308	05/10/17	3,428 ± 187			
DWW- 2583	05/23/17	5,223 ± 224			
DWW- 3030	06/12/17	1,698 ± 140			
DWW- 3763	07/05/17	1,899 ± 149			
DWW- 3844	07/25/17	3,058 ± 181			
DWW- 4235	08/09/17	1,696 ± 142			
DWW- 4731	09/12/17	793 ± 109			
DWW- 5694	10/09/17	776 ± 117			
DWW- 6113	11/08/17	1,628 ± 137			
DWW- 6520	12/11/17	892 ± 120			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

D-165				(24A)	
DWW- 296	01/17/17	< 160	DWW- 6114	11/08/17	< 151
DWW- 644	02/08/17	< 162			
DWW- 2329	05/09/17	< 153			
DWW- 4150	08/09/17	< 158			
D-166 [b]				(25A)[b]	
DWW- 286	01/17/17	6,281 ± 246			
DWW- 672	02/08/17	6,911 ± 247			
DWW- 754	02/22/17	7,092 ± 261			
DWW- 1075	03/08/17	5,907 ± 235			
DWW- 1224	03/22/17	3,347 ± 184			
DWW- 2330	05/09/17	301 ± 91			
D-167				(26A)	
DWW- 285	01/17/17	2,663 ± 170			
DWW- 673	02/08/17	3,552 ± 188			
DWW- 755	02/22/17	3,709 ± 196			
DWW- 1076	03/08/17	3,779 ± 193			
DWW- 1225	03/22/17	4,024 ± 199			
DWW- 1621	04/12/17	3,279 ± 182			
DWW- 2309	05/09/17	3,963 ± 199			
DWW- 3038	06/12/17	3,664 ± 190			
DWW- 4151	08/09/17	1,435 ± 134			
DWW- 6115	11/08/17	836 ± 110			
D-168A				(27A)	
DWW- 645	02/06/17	< 162			
DWW- 2331	05/08/17	< 153			
DWW- 4152	08/08/17	< 158			
DWW- 6025	11/06/17	< 146			
D-168B				(27B)	
DWW- 283	01/17/17	< 160	DWW- 6026	11/06/17	< 146
DWW- 646	02/06/17	< 162			
DWW- 2332	05/08/17	< 153			
DWW- 4153	08/08/17	< 158			
D-169A				(28A)	
DWW- 647	02/06/17	921 ± 120			
DWW- 2333	05/08/17	860 ± 115			
DWW- 4154	08/08/17	949 ± 117			
DWW- 6078	11/06/17	2,992 ± 174			
D-169B				(28B)	
DWW- 648	02/06/17	237 ± 92			
DWW- 2334	05/08/17	< 153			
DWW- 4155	08/08/17	163 ± 82			
DWW- 6027	11/06/17	< 146			
DWW- 6116	11/10/17	< 151			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

[b] MW-25A was converted to an extraction well on August 1, 2017, EW-03A.

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

D-170A				(29A)	
DWW- 291	01/17/17	8,029 ± 275	DWW- 4732	09/12/17	290 ± 87
DWW- 294	01/13/17	8,528 ± 283	DWW- 5695	10/09/17	261 ± 100
DWW- 674	01/20/17	7,326 ± 254	DWW- 6028	11/06/17	279 ± 85
DWW- 676	02/08/17	4,490 ± 206			
DWW- 757	02/22/17	3,247 ± 185			
DWW- 1077	03/08/17	2,896 ± 172			
DWW- 1226	03/22/17	3,916 ± 197			
DWW- 1618	04/12/17	4,305 ± 205			
DWW- 2134	04/25/17	4,025 ± 200			
DWW- 2310	05/08/17	3,990 ± 200			
DWW- 2585	05/23/17	4,583 ± 212			
DWW- 3031	06/12/17	4,832 ± 214			
DWW- 3770	07/05/17	12,931 ± 320			
DWW- 3846	07/25/17	446 ± 98			
DWW- 4156	08/08/17	562 ± 101			

D-170B				(29B)	
DWW- 651	02/08/17	< 162			
DWW- 2335	05/08/17	< 153			
DWW- 4157	08/08/17	< 158			
DWW- 6029	11/06/17	< 146			

D171A				(30A)	
DWW- 649	02/06/17	< 162	DWW- 6079	11/07/17	< 146
DWW- 2336	05/08/17	298 ± 91	DWW- 6118	11/10/17	< 151
DWW- 4158	08/08/17	270 ± 88			

D-171B				(30B)	
DWW- 650	02/06/17	670 ± 111			
DWW- 2338	05/08/17	< 153			
DWW- 4160	08/08/17	< 158			
DWW- 6030	11/07/17	< 146			

D172A				(31A)	
DWW- 653	02/06/17	< 162			
DWW- 2339	05/08/17	< 153			
DWW- 4161	08/08/17	< 158			
DWW- 6082	11/07/17	< 146			
DWW- 6107	11/10/17	< 151			

D-172B				(31B)	
DWW- 284	01/17/17	< 160			
DWW- 654	02/06/17	< 162			
DWW- 2340	05/08/17	< 153			
DWW- 4162	08/08/17	< 158			
DWW- 6119	11/09/17	< 151			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

Ground water, Monitoring wells, analyses for tritium [a].

D-173A				(32A)	
DWW- 289	01/13/17	3,913 ± 200	DWW- 4733	09/12/17	1,205 ± 124
DWW- 292	01/17/17	3,134 ± 182	DWW- 6031	11/07/17	306 ± 87
DWW- 677	02/06/17	1,899 ± 152			
DWW- 758	02/22/17	1,643 ± 142			
DWW- 1078	03/08/17	2,269 ± 156			
DWW- 1227	03/22/17	3,727 ± 193			
DWW- 1620	04/12/17	7,595 ± 265			
DWW- 2135	04/25/17	10,169 ± 305			
DWW- 2311	05/08/17	10,752 ± 314			
DWW- 2732	05/23/17	8,570 ± 283			
DWW- 3032	06/12/17	3,380 ± 183			
DWW- 3764	07/05/17	6,744 ± 240			
DWW- 3845	07/25/17	2,074 ± 155			
DWW- 4163	08/08/17	1,613 ± 140			
D-173B				(32B)	
DWW- 655	02/06/17	180 ± 89			
DWW- 2341	05/08/17	< 153			
DWW- 4164	08/08/17	< 158			
DWW- 6032	11/07/17	298 ± 86			
D-79				MW-33A	
DWW- 1616	04/12/17	177 ± 86	DWW- 6034	11/06/17	< 146
DWW- 2136	04/25/17	< 152			
DWW- 2342	05/08/17	< 153			
DWW- 4165	08/08/17	174 ± 83			
D-80				MW-34A	
DWW- 1617	04/12/17	< 155	DWW- 6080	11/06/17	< 146
DWW- 2137	04/25/17	< 152	DWW- 6108	11/10/17	< 151
DWW- 2343	05/08/17	190 ± 86			
DWW- 4166	08/08/17	< 158			
D-81				MW-35A	
DWW- 2138	04/25/17	< 152			
DWW- 2344	05/08/17	181 ± 85			
DWW- 3762	07/05/17	187 ± 98			
DWW- 4167	08/08/17	< 158			
DWW- 6035	11/06/17	383 ± 90			
DWW- 6521	12/11/17	331 ± 98			

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

Table 22. Groundwater Protection Program Summary.

D-119			(2MH209)		
DSW- 716	02/14/17	430 ± 101	DSW- 4314	08/21/17	811 ± 108
DSW- 2346	05/09/17	301 ± 91	DSW- 6081	11/02/17	670 ± 103
DSW- 2651	05/30/17	487 ± 97			
D-120			(2MH210)		
DSW- 717	02/14/17	302 ± 95	DSW- 4315	08/21/17	519 ± 96
DSW- 2347	05/09/17	569 ± 103			
D-121			(2MH211)		
DSW- 718	02/14/17	737 ± 113			
DSW- 4316	08/21/17	408 ± 91			
D-122			(Sluice Pond)		
DSW- 2652	05/30/17	370 ± 91			
DSW- 4317	08/21/17	< 149			
DSW- 6152	11/15/17	328 ± 90			
D-123			(S. Drainage Ditch)		
DSW- 2653	05/30/17	178 ± 82			
D-124			(N. Drainage Ditch)		
DSW- 720	02/14/17	< 162	DSW- 4319	08/21/17	< 149
DSW- 2654	05/30/17	< 153	DSW- 6154	11/15/17	< 154
D-125			(Onsite S. Storm Drain Outfall)		
DSW- 243	01/17/17	1,380 ± 134	DSW- 4320	08/21/17	1,719 ± 140
DSW- 721	02/14/17	265 ± 93	DSW- 6155	11/15/17	166 ± 82
DSW- 2655	05/30/17	1,407 ± 132			
D-89			(MH221)		
D-101			(1MH109)		
DSW- 2345	05/09/17	420 ± 97	DSW- 6022	11/02/17	440 ± 93
(1MH213)			D-25 (MH105)		
DSW- 2656	05/30/17	191 ± 82	DSW- 6020	11/03/17	< 146
MH-114			D-27 (MH-107		
DWW- 3033	06/13/17	2,272 ± 156	DWW- 6021	11/03/17	< 146
MH-219			D-24 (MH-104)		
DWW- 3034	06/13/17	3,174 ± 179	DWW- 6174	11/17/17	< 154
MH-101			MH-202		
DWW- 3039	06/14/17	459 ± 95	DWW- 3759	06/14/17	< 184
MH-102			D-26 (MH-106)		
DWW- 3040	06/14/17	269 ± 87	DWW- 6176	11/17/17	< 154
DWW- 3761	06/14/17	< 184			

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-127A (MW-07A)						
DWW- 663	2/7/2017	< 3.7	< 10.2	< 5.6	< 3.1	< 6.0	< 7.0	< 10.3	< 3.6	< 3.5	< 42.1	< 20.1 [a]
DWW- 1530	4/10/2017	< 2.9	< 7.3	< 3.1	< 2.1	< 6.2	< 3.1	< 5.5	< 2.6	< 3.4	< 25.0	< 9.6
DWW- 2302	5/11/2017	< 3.1	< 7.2	< 3.1	< 2.6	< 3.1	< 3.1	< 5.2	< 2.5	< 2.6	< 41.1	< 9.3
DWW- 2579	5/23/2017	< 3.0	< 5.9	< 3.4	< 3.2	< 3.0	< 3.7	< 5.4	< 3.0	< 3.3	< 27.3	< 7.9
DWW- 3023	5/24/2017	< 2.2	< 5.3	< 2.3	< 2.3	< 5.5	< 5.7	< 4.5	< 3.0	< 3.3	< 68.4	< 12.0 [a]
DWW- 3025	6/2/2017	< 3.2	< 9.1	< 3.2	< 3.1	< 4.8	< 5.5	< 5.6	< 2.9	< 2.5	< 42.5	< 8.0
DWW- 3026	6/7/2017	< 2.6	< 8.3	< 3.3	< 1.9	< 4.0	< 3.7	< 4.7	< 2.6	< 2.7	< 25.2	< 7.8
DWW- 3035	6/12/2017	< 3.1	< 7.7	< 3.4	< 2.9	< 4.7	< 5.4	< 6.8	< 2.7	< 2.9	< 47.0	< 7.5
DWW- 3765	7/5/2017	< 2.7	< 5.9	< 3.2	< 2.8	< 5.8	< 4.1	< 7.0	< 2.7	< 2.5	< 39.5	< 14.5
DWW- 3839	7/25/2017	< 2.9	< 5.4	< 2.3	< 2.8	< 4.0	< 4.4	< 5.3	< 2.5	< 2.5	< 22.7	< 9.4
DWW- 4213	8/10/2017	< 2.5	< 4.9	< 1.8	< 2.2	< 5.5	< 4.4	< 6.4	< 2.7	< 2.4	< 33.8	< 10.2
DWW- 4725	9/12/2017	< 2.8	< 6.5	< 2.1	< 3.1	< 4.3	< 4.8	< 5.6	< 2.9	< 2.7	< 26.4	< 6.2
DWW- 5688	10/9/2017	< 2.5	< 5.5	< 2.1	< 2.2	< 3.6	< 2.9	< 5.5	< 2.9	< 2.0	< 25.6	< 7.9
DWW- 6073	11/8/2017	< 2.7	< 6.5	< 2.7	< 1.4	< 5.0	< 4.2	< 4.7	< 2.8	< 3.2	< 29.7	< 6.8
DWW- 6515	12/12/2017	< 3.0	< 7.9	< 3.3	< 2.0	< 6.1	< 4.8	< 6.9	< 2.8	< 3.4	< 56.4	< 10.6
						D-128A (MW-08A)						
DWW- 287	1/17/2017	< 2.2	< 5.9	< 1.5	< 2.6	< 4.3	< 4.3	< 6.8	< 2.6	< 2.5	< 30.8	< 10.4
DWW- 664	2/7/2017	< 3.4	< 7.7	< 2.8	< 2.4	< 5.7	< 3.5	< 5.7	< 3.2	< 3.1	< 48.0	< 10.2
DWW- 1047	3/8/2017	< 1.9	< 4.7	< 2.1	< 2.4	< 4.8	< 3.3	< 5.6	< 2.7	< 3.1	< 39.5	< 9.6
DWW- 1218	3/22/2017	< 1.9	< 4.0	< 2.8	< 3.0	< 4.5	< 3.3	< 4.2	< 3.0	< 2.3	< 15.4	< 5.1
DWW- 1531	4/10/2017	< 3.0	< 6.2	< 2.8	< 2.4	< 5.1	< 3.9	< 6.3	< 3.0	< 2.2	< 29.8	< 6.2
DWW- 2020	4/25/2017	< 2.5	< 6.9	< 3.2	< 2.7	< 5.0	< 2.7	< 3.6	< 2.9	< 1.9	< 39.5	< 6.1
DWW- 2303	5/10/2017	< 2.3	< 5.3	< 3.0	< 2.4	< 4.0	< 4.0	< 4.6	< 3.0	< 2.3	< 25.1	< 10.2
DWW- 2580	5/23/2017	< 2.3	< 6.1	< 2.5	< 2.3	< 4.8	< 4.1	< 3.5	< 2.6	< 2.8	< 22.1	< 8.2
DWW- 3027	6/12/2017	< 2.7	< 3.1	< 2.5	< 3.1	< 4.7	< 3.5	< 4.2	< 2.5	< 2.6	< 23.2	< 5.4
DWW- 3766	7/5/2017	< 2.8	< 7.5	< 3.4	< 2.4	< 5.3	< 5.4	< 4.6	< 3.0	< 3.6	< 47.3	< 12.4
DWW- 3840	7/25/2017	< 2.5	< 6.2	< 3.0	< 1.8	< 5.1	< 3.2	< 5.4	< 2.6	< 2.4	< 43.7	< 10.8
DWW- 4215	8/9/2017	< 2.6	< 5.1	< 2.1	< 3.0	< 3.4	< 3.2	< 4.4	< 3.2	< 2.5	< 22.0	< 6.2
DWW- 4726	9/12/2017	< 2.9	< 3.8	< 2.2	< 2.3	< 4.8	< 3.8	< 4.3	< 2.8	< 2.7	< 16.7	< 4.4
DWW- 5689	10/9/2017	< 2.6	< 4.9	< 2.1	< 2.4	< 5.3	< 4.8	< 6.2	< 2.4	< 2.9	< 42.8	< 6.8
DWW- 6074	11/8/2017	< 2.7	< 4.9	< 3.4	< 2.2	< 5.7	< 5.6	< 4.3	< 2.7	< 2.6	< 54.1	< 8.3
DWW- 6516	12/11/2017	< 2.9	< 3.9	< 3.0	< 2.5	< 5.7	< 5.0	< 5.0	< 2.6	< 2.5	< 36.5	< 11.0

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-128B (MW-08B)						
						D-129A (MW-09A)						
DWW- 2304	5/10/2017	< 2.3	< 5.9	< 3.5	< 2.8	< 4.2	< 6.2	< 5.6	< 3.3	< 2.3	< 74.2	< 25.3 [a]
DWW- 2499	5/23/2017	< 1.1	< 3.8	< 1.0	< 1.3	< 2.7	< 1.5	< 3.1	< 1.6	< 1.6	< 13.3	< 2.9
DWW- 3036	6/12/2017	< 2.7	< 6.9	< 2.7	< 2.3	< 5.4	< 3.8	< 5.7	< 2.5	< 2.7	< 30.2	< 6.7
						D-132A (MW-12A)						
						D-134A (MW-14A)						
DWW- 290	1/18/2017	< 2.9	< 8.8	< 1.9	< 2.2	< 5.5	< 4.2	< 5.7	< 2.6	< 2.7	< 46.8	< 11.1
DWW- 667	2/7/2017	< 2.6	< 5.8	< 3.4	< 2.7	< 4.4	< 4.6	< 5.9	< 2.6	< 2.4	< 27.9	< 11.6
DWW- 1048	3/9/2017	< 2.1	< 7.4	< 3.2	< 2.5	< 4.4	< 4.0	< 5.3	< 2.5	< 3.0	< 28.0	< 10.1
DWW- 1219	3/22/2017	< 1.6	< 5.6	< 3.2	< 2.4	< 5.6	< 3.1	< 5.6	< 2.7	< 2.0	< 20.3	< 5.3
DWW- 1622	4/13/2017	< 2.2	< 5.0	< 3.4	< 2.8	< 6.1	< 4.2	< 5.3	< 2.8	< 3.5	< 24.1	< 8.1
DWW- 2021	4/25/2017	< 2.9	< 4.2	< 3.4	< 3.2	< 4.8	< 2.9	< 4.9	< 2.7	< 3.3	< 29.0	< 7.7
DWW- 2319	5/10/2017	< 1.1	< 3.7	< 1.8	< 1.6	< 2.3	< 2.9	< 2.8	< 1.7	< 1.1	< 37.1	< 15.3 [a]
DWW- 2497	5/23/2017	< 1.6	< 5.4	< 1.5	< 1.7	< 3.2	< 2.5	< 3.8	< 1.5	< 1.8	< 32.2	< 7.2
DWW- 3037	6/12/2017	< 2.9	< 4.5	< 3.3	< 2.0	< 5.2	< 3.2	< 4.7	< 2.4	< 2.6	< 35.0	< 8.8
DWW- 3767	7/5/2017	< 2.7	< 7.9	< 3.3	< 2.6	< 5.5	< 4.8	< 6.5	< 2.6	< 2.9	< 27.0	< 9.4
DWW- 3842	7/25/2017	< 2.5	< 7.8	< 3.6	< 1.8	< 4.7	< 4.2	< 3.7	< 2.7	< 2.8	< 35.3	< 11.0
DWW- 4225	8/9/2017	< 2.4	< 5.0	< 2.4	< 2.6	< 4.2	< 3.7	< 4.3	< 3.1	< 2.7	< 25.3	< 10.4
DWW- 4728	9/12/2017	< 3.1	< 3.0	< 2.2	< 1.8	< 5.8	< 3.8	< 4.9	< 2.6	< 3.0	< 24.6	< 5.1
DWW- 5691	10/9/2017	< 2.5	< 5.1	< 2.4	< 2.3	< 3.7	< 3.3	< 6.0	< 3.0	< 2.2	< 33.3	< 11.0
DWW- 6517	12/11/2017	< 2.9	< 5.8	< 3.0	< 1.5	< 2.8	< 4.2	< 5.1	< 2.5	< 2.0	< 42.2	< 12.6

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and/or smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-62 (MW-18A)						
DWW- 293	1/18/2017	< 2.4	< 5.6	< 1.8	< 2.3	< 3.8	< 3.3	< 5.0	< 2.8	< 3.1	< 19.1	< 5.0
DWW- 668	2/7/2017	< 3.1	< 5.6	< 3.0	< 1.7	< 4.7	< 4.2	< 6.5	< 2.5	< 2.3	< 41.3	< 10.8
DWW- 1049	3/8/2017	< 3.0	< 5.0	< 1.9	< 2.2	< 5.8	< 4.4	< 5.3	< 2.7	< 3.0	< 41.1	< 8.6
DWW- 1221	3/22/2017	< 2.8	< 5.6	< 3.1	< 1.7	< 6.1	< 2.9	< 5.0	< 2.6	< 3.4	< 27.4	< 6.4
DWW- 1532	4/10/2017	< 3.2	< 7.5	< 3.1	< 3.4	< 7.3	< 4.2	< 8.0	< 3.3	< 3.0	< 30.1	< 4.7
DWW- 2022	4/25/2017	< 2.9	< 8.8	< 2.0	< 2.3	< 5.1	< 4.3	< 4.1	< 2.7	< 2.5	< 24.7	< 10.3
DWW- 2306	5/10/2017	< 3.5	< 8.8	< 2.4	< 2.2	< 2.9	< 5.0	< 4.5	< 3.0	< 3.1	< 31.2	< 7.6
DWW- 2581	5/23/2017	< 2.3	< 4.7	< 3.0	< 2.9	< 5.9	< 3.7	< 4.3	< 3.1	< 2.3	< 17.7	< 7.2
DWW- 3028	6/2/2017	< 2.1	< 5.6	< 3.0	< 2.9	< 4.2	< 4.1	< 4.7	< 3.1	< 2.4	< 24.3	< 10.6
DWW- 3768	7/5/2017	< 2.8	< 8.1	< 3.7	< 2.6	< 5.7	< 3.9	< 6.3	< 2.9	< 1.8	< 55.7	< 15.2 [a]
DWW- 3841	7/25/2017	< 2.0	< 7.7	< 4.2	< 2.6	< 5.8	< 5.5	< 6.5	< 2.9	< 2.8	< 26.8	< 5.7
DWW- 4230	8/9/2017	< 2.4	< 5.1	< 2.2	< 2.7	< 4.0	< 3.9	< 4.5	< 2.9	< 2.8	< 27.7	< 7.6
DWW- 4729	9/12/2017	< 2.8	< 6.3	< 3.3	< 2.7	< 6.0	< 4.2	< 5.9	< 2.8	< 3.2	< 22.0	< 6.2
DWW- 5692	10/9/2017	< 2.9	< 7.7	< 2.7	< 1.4	< 5.9	< 3.7	< 7.3	< 2.9	< 2.9	< 59.4	< 17.7 [a]
DWW- 6076	11/8/2017	< 2.8	< 7.8	< 3.5	< 2.8	< 5.7	< 5.5	< 5.3	< 2.5	< 2.2	< 39.0	< 8.0
						D-63 (MW-19A)						
						D-64 (MW-20A)						
						D-65 (MW-21A)						
DWW- 669	2/7/2017	< 2.7	< 6.7	< 2.7	< 2.9	< 5.7	< 4.4	< 4.5	< 2.8	< 3.2	< 47.6	< 6.0

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and/or smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-66 (MW-22A)						
DWW- 297	1/18/2017	< 1.9	< 4.1	< 2.2	< 2.5	< 4.3	< 3.0	< 3.9	< 3.3	< 2.3	< 15.0	< 5.0
DWW- 671	2/7/2017	< 3.0	< 6.7	< 2.6	< 2.2	< 5.6	< 3.8	< 7.2	< 3.0	< 2.4	< 31.2	< 11.9
DWW- 1222	3/22/2017	< 2.2	< 6.3	< 3.1	< 3.2	< 5.1	< 5.2	< 5.9	< 3.1	< 2.4	< 32.8	< 7.3
DWW- 1534	4/10/2017	< 2.9	< 7.7	< 3.1	< 3.2	< 5.9	< 3.9	< 5.8	< 2.8	< 2.9	< 31.7	< 9.1
DWW- 2023	4/25/2017	< 2.3	< 7.9	< 2.7	< 2.6	< 3.2	< 4.0	< 4.6	< 2.5	< 2.9	< 42.1	< 7.4
DWW- 2307	5/10/2017	< 2.9	< 9.0	< 2.5	< 2.6	< 5.8	< 2.6	< 6.7	< 2.7	< 2.4	< 33.1	< 7.0
DWW- 2582	5/23/2017	< 2.1	< 4.9	< 2.7	< 2.9	< 3.8	< 3.5	< 4.5	< 2.8	< 2.2	< 19.8	< 6.7
DWW- 3029	6/12/2017	< 2.0	< 4.5	< 2.6	< 2.4	< 4.2	< 3.4	< 4.0	< 3.0	< 2.1	< 18.4	< 6.9
DWW- 3769	7/5/2017	< 2.6	< 5.0	< 3.9	< 2.1	< 4.9	< 6.0	< 7.3	< 2.7	< 2.9	< 74.9	< 10.0 [a]
DWW- 3843	7/25/2017	< 3.0	< 6.5	< 3.0	< 2.8	< 5.3	< 3.7	< 4.6	< 2.7	< 2.8	< 43.4	< 12.6
DWW- 4234	8/9/2017	< 2.5	< 5.2	< 2.4	< 2.6	< 4.0	< 3.6	< 4.7	< 3.2	< 2.6	< 28.3	< 11.4
DWW- 4730	9/12/2017	< 2.2	< 5.9	< 2.0	< 1.7	< 4.9	< 2.4	< 5.1	< 2.8	< 2.6	< 27.1	< 8.4
DWW- 5693	10/9/2017	< 2.6	< 6.3	< 2.2	< 2.8	< 4.4	< 5.3	< 5.9	< 2.5	< 3.3	< 35.4	< 10.3
DWW- 6077	11/8/2017	< 2.6	< 3.9	< 3.4	< 2.4	< 5.1	< 3.8	< 7.0	< 2.4	< 2.9	< 33.5	< 9.1
DWW- 6519	12/11/2017	< 2.6	< 8.2	< 3.0	< 2.6	< 5.4	< 4.5	< 3.9	< 2.8	< 2.9	< 39.2	< 15.6 [a]
						D-67 (MW-23A)						
DWW- 295	1/18/2017	< 2.9	< 4.2	< 3.3	< 2.9	< 4.3	< 2.9	< 3.3	< 3.1	< 2.9	< 24.5	< 9.4
DWW- 670	2/7/2017	< 2.6	< 5.5	< 3.0	< 2.6	< 4.5	< 4.8	< 5.8	< 2.5	< 2.7	< 37.3	< 9.5
DWW- 1050	3/8/2017	< 2.9	< 4.7	< 3.8	< 3.2	< 5.0	< 4.9	< 5.9	< 3.1	< 2.9	< 33.2	< 9.2
DWW- 1223	3/22/2017	< 2.7	< 4.3	< 3.4	< 2.8	< 5.2	< 4.0	< 7.3	< 2.9	< 2.9	< 36.5	< 10.3
DWW- 1535	4/10/2017	< 3.1	< 6.4	< 3.2	< 1.7	< 5.1	< 4.1	< 2.7	< 2.6	< 3.0	< 26.4	< 7.8
DWW- 2024	4/25/2017	< 2.6	< 7.0	< 2.7	< 2.2	< 5.9	< 4.7	< 5.4	< 2.9	< 3.6	< 30.3	< 11.8
DWW- 2308	5/10/2017	< 3.1	< 8.2	< 2.0	< 3.1	< 4.9	< 5.7	< 6.0	< 2.8	< 3.0	< 43.8	< 13.7
DWW- 2583	5/23/2017	< 2.2	< 5.2	< 3.0	< 2.7	< 4.1	< 4.1	< 4.7	< 3.3	< 2.3	< 20.3	< 8.8
DWW- 3030	6/12/2017	< 2.0	< 4.7	< 3.0	< 2.9	< 3.4	< 3.5	< 4.2	< 2.9	< 2.3	< 19.3	< 8.0
DWW- 3763	7/5/2017	< 1.9	< 3.1	< 2.0	< 1.2	< 2.3	< 2.8	< 3.3	< 1.6	< 1.8	< 37.4	< 14.6
DWW- 3844	7/25/2017	< 2.5	< 4.8	< 1.7	< 2.5	< 4.9	< 3.5	< 5.6	< 2.5	< 2.4	< 39.3	< 9.9
DWW- 4235	8/9/2017	< 2.6	< 5.7	< 2.5	< 2.8	< 3.5	< 4.0	< 4.9	< 3.3	< 2.5	< 33.0	< 10.0
DWW- 6113	11/8/2017	< 1.5	< 2.9	< 1.9	< 1.3	< 3.4	< 3.0	< 3.3	< 1.6	< 1.8	< 27.4	< 6.6

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and/or smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						25A						
DWW- 286	1/17/2017	< 2.9	< 6.5	< 3.0	< 1.7	< 5.2	< 3.9	< 6.5	< 2.5	< 2.4	< 36.2	< 7.6
DWW- 672	2/8/2017	< 2.9	< 4.2	< 1.7	< 2.3	< 4.0	< 3.6	< 5.8	< 2.6	< 2.8	< 40.1	< 10.6
DWW- 754	2/22/2017	< 2.7	< 6.5	< 2.5	< 2.9	< 4.2	< 3.9	< 4.4	< 2.7	< 2.0	< 26.5	< 7.0
DWW- 1075	3/8/2017	< 2.9	< 9.4	< 3.7	< 2.7	< 5.3	< 3.9	< 6.2	< 2.8	< 3.2	< 35.2	< 9.7
DWW- 1224	3/22/2017	< 2.4	< 5.3	< 3.3	< 1.7	< 4.2	< 3.9	< 5.9	< 2.7	< 2.4	< 26.1	< 6.8
						26A						
DWW- 285	1/17/2017	< 2.8	< 5.5	< 2.4	< 2.7	< 4.7	< 3.9	< 4.7	< 2.6	< 2.2	< 22.7	< 5.6
DWW- 673	2/8/2017	< 2.9	< 7.3	< 2.8	< 2.8	< 5.6	< 2.9	< 6.3	< 2.6	< 3.1	< 50.1	< 10.0
DWW- 755	2/22/2017	< 2.4	< 3.9	< 2.7	< 2.4	< 5.6	< 4.4	< 5.7	< 2.7	< 2.1	< 37.8	< 9.3
DWW- 1076	3/8/2017	< 2.9	< 5.2	< 2.9	< 2.6	< 4.0	< 3.6	< 4.2	< 2.6	< 3.0	< 46.0	< 9.1
DWW- 1225	3/22/2017	< 3.0	< 5.0	< 3.3	< 2.8	< 5.0	< 3.9	< 4.4	< 2.6	< 3.0	< 26.4	< 7.4
DWW- 1621	4/12/2017	< 2.5	< 6.7	< 2.9	< 2.3	< 5.4	< 3.4	< 5.3	< 2.8	< 2.9	< 27.3	< 7.1
DWW- 2309	5/9/2017	< 2.8	< 8.3	< 3.2	< 1.8	< 5.6	< 4.5	< 6.4	< 2.7	< 2.8	< 40.6	< 12.9
DWW- 3038	6/12/2017	< 2.2	< 4.6	< 2.8	< 3.0	< 3.7	< 4.0	< 4.2	< 3.2	< 2.1	< 22.3	< 9.1
DWW- 4151	8/9/2017	< 3.0	< 8.7	< 3.3	< 1.7	< 4.9	< 7.3	< 7.3	< 2.5	< 3.1	< 158.9	< 35.6 [a]
						28A						
DWW- 6078	11/6/2017	< 2.4	< 5.5	< 2.5	< 2.2	< 4.0	< 3.1	< 5.8	< 3.0	< 2.0	< 32.0	< 12.9
						29A						
DWW- 291	1/17/2017	< 2.7	< 4.4	< 2.4	< 2.5	< 5.3	< 3.8	< 4.8	< 2.7	< 3.0	< 24.2	< 8.9
DWW- 294	1/13/2017	< 2.5	< 4.6	< 2.5	< 2.4	< 4.5	< 3.8	< 5.7	< 2.5	< 3.2	< 20.7	< 3.5
DWW- 674	1/20/2017	< 2.8	< 8.5	< 3.6	< 2.6	< 4.7	< 6.7	< 6.7	< 2.7	< 3.1	< 97.5	< 19.9 [a]
DWW- 676	2/8/2017	< 2.0	< 7.0	< 2.5	< 2.1	< 4.0	< 3.3	< 5.3	< 2.6	< 3.0	< 28.1	< 7.1
DWW- 757	2/22/2017	< 2.9	< 7.4	< 1.6	< 2.1	< 5.5	< 4.6	< 4.1	< 2.6	< 2.6	< 24.1	< 8.4
DWW- 1077	3/8/2017	< 2.1	< 4.9	< 3.0	< 2.6	< 4.2	< 4.2	< 4.1	< 3.3	< 2.3	< 26.5	< 10.7
DWW- 1226	3/22/2017	< 3.0	< 6.3	< 3.3	< 3.4	< 4.9	< 2.6	< 4.4	< 2.9	< 2.9	< 23.2	< 7.6
DWW- 1618	4/12/2017	< 3.4	< 6.1	< 2.8	< 3.4	< 6.1	< 4.6	< 5.9	< 3.1	< 3.3	< 36.2	< 8.9
DWW- 2134	4/25/2017	< 2.9	< 8.0	< 3.4	< 2.2	< 4.2	< 3.6	< 4.2	< 2.7	< 2.9	< 31.0	< 9.4
DWW- 2310	5/8/2017	< 1.9	< 4.8	< 2.9	< 2.7	< 4.1	< 3.7	< 4.7	< 2.9	< 2.2	< 23.7	< 6.8
DWW- 2585	5/23/2017	< 2.1	< 5.0	< 3.0	< 2.5	< 4.2	< 3.8	< 4.7	< 2.9	< 2.1	< 22.2	< 7.4
DWW- 3031	6/12/2017	< 1.9	< 5.1	< 2.8	< 2.8	< 3.5	< 3.6	< 4.4	< 2.9	< 2.1	< 17.1	< 6.6
DWW- 3770	7/5/2017	< 2.2	< 6.0	< 3.0	< 2.9	< 4.5	< 6.7	< 7.2	< 2.9	< 2.9	< 76.5	< 24.2 [a]

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						MW-32A						
DWW- 289	1/13/2017	< 3.3	< 6.3	< 2.1	< 2.2	< 4.4	< 3.5	< 6.0	< 2.5	< 2.5	< 30.9	< 6.0
DWW- 292	1/17/2017	< 3.0	< 6.6	< 2.7	< 2.7	< 4.7	< 4.1	< 7.0	< 2.8	< 3.3	< 27.1	< 4.4
DWW- 677	2/6/2017	< 1.3	< 4.2	< 2.9	< 2.9	< 4.2	< 2.7	< 5.6	< 2.8	< 2.9	< 34.9	< 10.1
DWW- 758	2/22/2017	< 2.4	< 6.4	< 1.9	< 1.8	< 5.6	< 3.3	< 6.5	< 2.7	< 2.9	< 36.8	< 5.3
DWW- 1078	3/8/2017	< 3.0	< 7.3	< 3.6	< 2.2	< 5.4	< 5.2	< 6.3	< 2.8	< 2.9	< 50.1	< 11.7
DWW- 1227	3/22/2017	< 2.9	< 4.5	< 3.0	< 3.3	< 4.9	< 4.1	< 6.0	< 2.6	< 3.0	< 29.0	< 6.9
DWW- 1620	4/12/2017	< 2.4	< 4.5	< 2.7	< 2.6	< 4.5	< 3.9	< 5.8	< 2.8	< 3.1	< 29.1	< 6.7
DWW- 2135	4/25/2017	< 2.7	< 5.1	< 1.7	< 1.8	< 4.6	< 4.0	< 4.6	< 2.6	< 2.6	< 43.5	< 9.4
DWW- 2311	5/8/2017	< 3.1	< 4.9	< 3.1	< 2.2	< 3.9	< 2.8	< 6.6	< 2.9	< 2.6	< 28.8	< 11.3
DWW- 2732	5/23/2017	< 2.2	< 4.9	< 3.0	< 2.7	< 3.9	< 3.8	< 4.6	< 3.3	< 2.2	< 24.1	< 9.1
DWW- 3032	6/12/2017	< 1.9	< 4.7	< 2.8	< 2.9	< 4.1	< 3.6	< 4.0	< 3.0	< 2.0	< 20.2	< 6.0
DWW- 3764	7/5/2017	< 2.6	< 5.5	< 2.8	< 3.2	< 3.9	< 3.8	< 5.4	< 2.6	< 3.0	< 42.2	< 11.1
DWW- 3845	7/25/2017	< 2.7	< 5.4	< 2.4	< 2.9	< 5.3	< 4.2	< 6.3	< 2.8	< 2.9	< 40.5	< 16.7 [a]
DWW- 4163	8/8/2017	< 2.7	< 8.9	< 2.0	< 2.4	< 4.2	< 7.0	< 4.7	< 2.6	< 2.4	< 167.8	< 42.7 [a]
DWW- 4733	9/12/2017	< 3.5	< 4.1	< 1.8	< 2.7	< 3.7	< 3.9	< 6.5	< 3.0	< 4.0	< 29.3	< 4.3
						D-125 (Outfall #6)						
DWW- 243	1/17/2017	< 1.9	< 5.1	< 2.0	< 1.8	< 4.2	< 2.8	< 3.0	< 3.0	< 2.9	< 7.6	< 2.6
						MH-114						
DWW- 3033	6/13/2017	< 2.1	< 4.3	< 2.7	< 2.7	< 3.6	< 3.7	< 4.1	< 3.0	< 2.2	< 19.7	< 6.6
						MH-219						
DWW- 3034	6/13/2017	< 2.8	< 6.5	< 1.9	< 2.3	< 4.5	< 2.8	< 5.9	< 2.7	< 2.0	< 26.2	< 10.0

[a] LLDs for Ba-140 and/or La-140 not reached due to age of samples and smaller sample size.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, conditional analyses for gross alpha, iron-55, nickel-63, strontium-89 and strontium-90 [a].

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 289	1/13/2017	mw-32a	12.6 ± 2.4	< 602	< 134	< 1.9	< 1.0
DWW- 294	1/13/2017	mw-29a	< 1.7	< 598	< 107	< 1.9	< 1.0
DWW- 285	1/17/2017	mw-26a	2.0 ± 0.9	< 616	< 97	< 1.7	< 1.1
DWW- 286	1/17/2017	mw-25a	3.0 ± 1.0	< 582	< 109	< 1.9	< 1.2
DWW- 287	1/17/2017	d-128a	< 1.1	< 604	< 109	< 1.7	< 1.0
DWW- 291	1/17/2017	mw-29a	11.8 ± 2.1	< 568	< 105	< 1.9	< 1.2
DWW- 292	1/17/2017	mw-32a	11.6 ± 2.0	< 565	< 119	< 1.9	< 1.1
DWW- 290	1/18/2017	d-134a	4.4 ± 1.2	< 628	< 131	< 1.5	< 1.0
DWW- 293	1/18/2017	mw-18a	1.6 ± 1.0	< 582	< 107	< 1.5	< 0.9
DWW- 295	1/18/2017	mw-23a	2.4 ± 1.6	< 571	< 101	< 1.5	< 1.0
DWW- 297	1/18/2017	mw-22a	6.9 ± 2.9	< 600	< 90	< 1.6	< 1.1
DWW- 674	1/20/2017	mw-29a	4.3 ± 1.5	< 619	< 107	< 1.8	< 1.0
DWW- 663	2/7/2017	d-127a	< 0.8	< 600	< 112	< 1.4	< 1.2
DWW- 664	2/7/2017	d-128a	< 1.0	< 623	< 106	< 2.3	< 1.3
DWW- 667	2/7/2017	d-134a	< 1.2	< 627	< 105	< 1.3	< 1.0
DWW- 668	2/7/2017	mw-18a	< 1.3	< 643	< 105	< 1.2	< 1.1
DWW- 669	2/7/2017	mw-21a	2.8 ± 1.0	< 586	< 100	< 1.4	< 1.0
DWW- 670	2/7/2017	mw-23a	< 1.3	< 631	< 106	< 1.4	< 1.0
DWW- 671	2/7/2017	mw-22a	4.9 ± 1.8	< 608	< 106	< 1.3	< 0.9
DWW- 672	2/8/2017	mw-25a	1.4 ± 0.7	< 622	< 102	< 1.3	< 0.9
DWW- 673	2/8/2017	mw-26a	1.0 ± 0.8	< 615	< 123	< 1.3	< 1.0
DWW- 676	2/8/2017	mw-29a	1.4 ± 1.0	< 611	< 125	< 1.5	< 1.1
DWW- 677	2/6/2017	mw-32a	10.7 ± 2.0	< 573	< 109	< 1.4	< 1.0
DWW- 754	2/22/2017	mw-25a	< 1.0	< 742	< 122	< 1.6	< 1.2
DWW- 755	2/22/2017	mw-26a	< 1.1	< 746	< 108	< 1.5	< 1.1
DWW- 757	2/22/2017	mw-29a	1.5 ± 0.8	< 728	< 116	< 1.3	< 1.0
DWW- 758	2/22/2017	mw-32a	3.9 ± 1.0	< 742	< 114	< 1.4	< 1.0
DWW- 1047	3/8/2017	d-128a	< 1.0	< 772	< 106	< 1.7	< 1.1
DWW- 1048	3/9/2017	d-134a	1.3 ± 0.9	< 778	< 112	< 1.8	< 1.0
DWW- 1049	3/8/2017	mw-18a	1.4 ± 0.9	< 764	< 109	< 1.6	< 1.4
DWW- 1050	3/8/2017	mw-23a	< 1.3	< 779	< 110	< 1.4	< 1.0
DWW- 1075	3/8/2017	mw-25a	< 1.2	< 760	< 97	< 1.6	< 1.1
DWW- 1076	3/8/2017	mw-26a	< 1.1	< 774	< 110	< 1.6	< 1.1
DWW- 1077	3/8/2017	mw-29a	1.2 ± 0.8	< 804	< 107	< 1.8	< 1.1
DWW- 1078	3/8/2017	mw-32a	2.3 ± 1.0	< 774	< 118	< 1.7	< 1.1
DWW- 1218	3/22/2017	d-128a	< 1.2	< 848	< 117	< 1.2	< 1.1
DWW- 1219	3/22/2017	d-134a	9.0 ± 2.0	< 869	< 120	< 1.6	< 1.3
DWW- 1221	3/22/2017	mw-18	< 1.1	< 848	< 119	< 1.3	< 1.2
DWW- 1222	3/22/2017	mw-22a	3.6 ± 1.9	< 742	< 118	< 1.2	< 1.0
DWW- 1223	3/22/2017	mw-23a	< 1.5	< 779	< 101	< 1.2	< 1.1

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

NOTE: Positive gross alpha results in groundwater are typically the result of the alpha decay of naturally occuring deposits of uranium and thorium and their daughters.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, conditional analyses for gross alpha, iron-55, nickel-63, strontium-89 and strontium-90 [a].

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 1224	3/22/2017	mw-25a	1.3 ± 1.0	< 765	< 93	< 1.4	< 1.3
DWW- 1225	3/22/2017	mw-26a	1.3 ± 0.9	< 760	< 102	< 1.2	< 1.1
DWW- 1226	3/22/2017	mw-29a	< 1.2	< 751	< 93	< 1.3	< 1.1
DWW- 1227	3/22/2017	mw-32a	2.4 ± 0.9	< 784	< 103	< 1.2	< 1.1
DWW- 1530	4/10/2017	d-127a	< 0.7	< 775	< 84	< 1.7	< 1.0
DWW- 1531	4/10/2017	d-128a	< 1.0	< 794	< 94	< 1.9	< 1.1
DWW- 1532	4/10/2017	mw-18a	1.4 ± 0.8	< 766	< 95	< 1.5	< 1.0
DWW- 1534	4/10/2017	mw-22a	1.6 ± 1.0	< 780	< 94	< 2.5	< 1.3
DWW- 1535	4/10/2017	mw-23a	< 1.2	< 814	< 107	< 1.5	< 1.0
DWW- 1618	4/12/2017	mw-29a	1.4 ± 0.8	< 743	< 94	< 1.8	< 1.2
DWW- 1620	4/12/2017	mw-32a	1.8 ± 0.8	< 738	< 93	< 2.0	< 1.2
DWW- 1621	4/12/2017	mw-26a	3.5 ± 1.0	< 726	< 90	< 1.7	< 1.1
DWW- 1622	4/13/2017	d-134a	1.3 ± 0.9	< 756	< 102	< 1.5	< 0.9
DWW- 2020	4/25/2017	d-128a	< 1.1	< 857	< 101	< 1.2	< 1.0
DWW- 2021	4/25/2017	d-134a	< 1.0	< 806	< 85	< 2.0	< 1.5
DWW- 2022	4/25/2017	mw-18a	< 1.1	< 831	< 91	< 2.5 [b]	< 1.8 [b]
DWW- 2023	4/25/2017	mw-22a	< 1.3	< 826	< 108	< 1.2	< 0.9
DWW- 2024	4/25/2017	mw-23a	< 1.3	< 826	< 106	< 1.2	< 1.0
DWW- 2134	4/25/2017	mw-29a	1.8 ± 0.9	< 836	< 105	< 1.4	< 1.2
DWW- 2135	4/25/2017	mw-32a	5.8 ± 1.2	< 847	< 113	< 1.8	< 1.3
DWW- 2310	5/8/2017	mw-29a	< 1.2	< 778	< 84	< 1.5	< 1.0
DWW- 2311	5/8/2017	mw-32a	1.5 ± 0.9	< 783	< 85	< 1.6	< 1.0
DWW- 2309	5/9/2017	mw-26a	< 1.1	< 773	< 86	< 1.7	< 1.1
DWW- 2319	5/10/2017	d-134a	< 1.2	< 766	< 85	< 2.5 [b]	< 1.0 [b]
DWW- 2303	5/10/2017	d-128a	< 1.1	< 818	< 92	< 1.6	< 1.0
DWW- 2304	5/10/2017	d-129a	< 1.1	< 802	< 87	< 3.2 [b]	< 1.4 [b]
DWW- 2306	5/10/2017	mw-18a	< 1.2	< 782	< 88	< 1.5	< 0.9
DWW- 2307	5/10/2017	mw-22a	< 1.3	< 740	< 106	< 1.3	< 1.4
DWW- 2308	5/10/2017	mw-23a	< 1.2	< 773	< 84	< 1.6	< 1.1
DWW- 2302	5/11/2017	d-127a	< 0.9	< 767	< 88	< 2.0 [b]	< 1.2 [b]
DWW- 2497	5/23/2017	d-134a	< 1.1	< 759	< 87	< 1.9 [b]	< 1.0 [b]
DWW- 2499	5/23/2017	d-129a	1.4 ± 0.9	< 739	< 86	< 1.2	< 1.1
DWW- 2579	5/23/2017	d-127a	< 0.7	< 745	< 89	< 1.5	< 1.0
DWW- 2580	5/23/2017	d-128a	< 1.1	< 741	< 87	< 1.8	< 1.1
DWW- 2581	5/23/2017	mw-18a	< 1.0	< 702	< 90	< 1.4	< 0.9
DWW- 2582	5/23/2017	mw-22a	< 0.9	< 727	< 87	< 1.4	< 0.9
DWW- 2583	5/23/2017	mw-23a	< 1.1	< 784	< 88	< 1.4	< 1.0
DWW- 2585	5/23/2017	mw-29a	1.5 ± 0.9	< 727	< 91	< 1.5	< 1.0
DWW- 2732	5/23/2017	mw-32a	1.1 ± 0.8	< 741	< 90	< 1.7	< 1.1

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

NOTE: Positive gross alpha results in groundwater are typically the result of the alpha decay of naturally occuring deposits of uranium and thorium and their daughters.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, conditional analyses for gross alpha, iron-55, nickel-63, strontium-89 and strontium-90 [a].

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 3023	5/24/2017	d-127a	< 0.7	< 681	< 89	< 2.1	< 0.9
DWW- 3025	6/2/2017	d-127a	< 1.2	< 661	< 89	< 2.4	< 1.2
DWW- 3028	6/2/2017	mw-18a	< 1.2	< 746	< 87	< 2.3	< 1.1
DWW- 3026	6/7/2017	d-127a	< 1.0	< 738	< 87	< 2.5	< 1.5
DWW- 3027	6/12/2017	d-128a	< 1.0	< 727	< 86	< 1.8	< 1.0
DWW- 3029	6/12/2017	mw-22a	1.2 ± 1.0	< 736	< 86	< 1.9	< 1.1
DWW- 3030	6/12/2017	mw-23a	< 1.0	< 709	< 90	< 1.8	< 1.0
DWW- 3031	6/12/2017	mw-29a	1.3 ± 0.9	< 736 [b]	< 86	< 1.9	< 1.1
DWW- 3032	6/12/2017	mw-32a	< 1.1	< 722	< 88	< 1.7	< 1.0
DWW- 3033	6/13/2017	mh-114	< 0.8	< 749	< 87	< 2.0	< 1.1
DWW- 3034	6/13/2017	mh-219	< 2.7	< 722	< 85	< 2.5	< 1.4
DWW- 3035	6/12/2017	d-127a	< 1.2	< 714	< 87	< 1.7	< 1.0
DWW- 3036	6/12/2017	d-129a	1.3 ± 0.8	< 718	< 86	< 1.6	< 0.9
DWW- 3037	6/12/2017	d-134a	< 1.1	< 727	< 88	< 2.3	< 1.3
DWW- 3038	6/12/2017	mw-26a	< 1.1	< 741	< 89	< 1.6	< 0.9
DWW- 3763	7/5/2017	mw-23a	2.1 ± 1.1	< 794	< 68	< 2.4	< 0.9
DWW- 3764	7/5/2017	mw-32a	1.9 ± 0.9	< 775	< 66	< 2.6	< 1.0
DWW- 3765	7/5/2017	d-127a	1.1 ± 0.7	< 804	< 67	< 2.4	< 0.9
DWW- 3766	7/5/2017	d-128a	< 1.1	< 830	< 64	< 2.3	< 0.9
DWW- 3767	7/5/2017	d-134a	< 1.2	< 794	< 67	< 2.1	< 0.9
DWW- 3768	7/5/2017	mw-18a	< 1.0	< 846	< 96	< 2.5	< 1.0
DWW- 3769	7/5/2017	mw-22a	< 1.5	< 804	< 95	< 2.6	< 1.0
DWW- 3770	7/5/2017	mw-29a	< 1.4	< 799	< 91	< 2.2	< 0.9
DWW- 3839	7/25/2017	d-127a	< 0.9	< 803	< 85	< 1.9	< 0.9
DWW- 3840	7/25/2017	d-128a	< 1.2	< 763	< 85	< 1.6	< 0.8
DWW- 3841	7/25/2017	mw-18a	< 1.1	< 740	< 85	< 1.6	< 0.8
DWW- 3842	7/25/2017	d-134a	< 1.3	< 773	< 86	< 1.6	< 0.9
DWW- 3843	7/25/2017	mw-22a	< 1.5	< 763	< 86	< 1.8	< 0.9
DWW- 3844	7/25/2017	mw-23a	< 1.7	< 740	< 86	< 1.9	< 1.0
DWW- 3845	7/25/2017	mw-32a	< 1.2	< 754	< 86	< 1.6	< 0.8
DWW- 4163	8/8/2017	mw-32a	< 1.1	< 765	< 85	< 2.5	< 1.0
DWW- 4151	8/9/2017	mw-26a	< 1.1	< 755	< 85	< 2.1	< 0.9
DWW- 4215	8/9/2017	d-128a	< 1.2	< 733	< 87	< 1.9	< 1.0
DWW- 4225	8/9/2017	d-134a	< 1.2	< 728	< 88	< 1.9	< 1.1
DWW- 4230	8/9/2017	mw-18a	< 1.2	< 741	< 86	< 1.5	< 0.9
DWW- 4234	8/9/2017	mw-22a	< 1.5	< 774	< 86	< 1.6	< 1.0
DWW- 4235	8/9/2017	mw-23a	< 1.4	< 751	< 88	< 1.7	< 1.0
DWW- 4213	8/10/2017	d-127a	< 1.2	< 745	< 86	< 1.7	< 1.4
DWW- 4725	9/12/2017	d-127a	< 1.0	< 756	< 85	< 1.3	< 0.9
DWW- 4726	9/12/2017	d-128a	< 1.3	< 800	< 87	< 1.2	< 0.8
DWW- 4728	9/12/2017	d-134a	1.9 ± 1.1	< 751	< 85	< 1.6	< 1.2
DWW- 4729	9/12/2017	mw-18a	< 1.3	< 756	< 85	< 1.5	< 1.1

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

NOTE: Positive gross alpha results in groundwater are typically the result of the alpha decay of naturally occuring deposits of uranium and thorium and their daughters.

Table 22. Groundwater Protection Program Summary.

Monitoring wells, conditional analyses for gross alpha, iron-55, nickel-63, strontium-89 and strontium-90 [a].

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 4730	9/12/2017	mw-22a	< 1.5	< 729	< 85	< 1.4	< 1.0
DWW- 4733	9/12/2017	mw-32a	< 1.1	< 751	< 85	< 1.4	< 1.0
DWW- 5688	10/9/2017	d-127a	< 0.9	< 767	< 71	< 1.7	< 0.9
DWW- 5689	10/9/2017	d-128a	< 1.3	< 740	< 68	< 1.7	< 0.9
DWW- 5691	10/9/2017	d-134a	< 1.3	< 772	< 68	< 1.4	< 0.8
DWW- 5692	10/9/2017	mw-18a	< 1.4	< 732	< 68	< 1.5	< 0.8
DWW- 5693	10/9/2017	mw-22a	< 1.4	< 732	< 71	< 1.5	< 0.9
DWW- 6073	11/8/2017	d-127a	< 0.9	< 815	< 66	< 1.8	< 1.1
DWW- 6074	11/8/2017	d-128a	< 1.3	< 800	< 66	< 1.4	< 0.9
DWW- 6076	11/8/2017	mw-18a	< 1.2	< 815	< 66	< 1.5	< 1.0
DWW- 6077	11/8/2017	mw-22a	1.0 ± 0.7	< 941	< 67	< 1.4	< 1.0
DWW- 6078	11/6/2017	mw-28a	5.8 ± 1.2	< 836	< 68	< 1.6	< 1.1
DWW- 6113	11/8/2017	mw-23a	< 1.5	< 800	< 70	< 1.7	< 1.1
DWW- 6516	12/11/2017	d-128a	< 1.6	< 665	< 67	< 1.7	< 1.0
DWW- 6517	12/11/2017	d-134a	4.6 ± 1.1	< 665	< 69	< 1.5	< 1.0
DWW- 6519	12/11/2017	mw-22a	2.0 ± 1.3	< 669	< 69	< 1.4	< 0.8
DWW- 6515	12/12/2017	d-127a	< 0.8	< 689	< 68	< 1.6	< 1.0

[a] Analyses for gamma, gross alpha, Sr-89, Sr-90, Fe-55 and Ni-63 will be performed if tritium activity > 1K pCi/L .

NOTE: Positive gross alpha results in groundwater are typically the result of the alpha decay of naturally occuring deposits of uranium and thorium and their daughters.

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS
AND INTRALABORATORY COMPARISON PROGRAM RESULTS

NOTE: Appendix A is updated four times a year. The complete appendix is included in March, June, September and December monthly progress reports only.

January, 2017 through December, 2017

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

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

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

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing 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 irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

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 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 MRAD PT Study Proficiency Testing 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 10% 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	10% 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 10% of known value
Tritium	≤ 4,000 pCi/liter > 4,000 pCi/liter	$\pm 1\sigma$ = $169.85 \times (\text{known})^{0.0933}$ 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].
RAD study

Lab Code	Date	Analysis	Concentration (pCi/L) Laboratory Result	ERA Result	Control Limits	Acceptance
ERW-95	1/9/2017	Sr-89	51.9 ± 4.6	55.5	44.3 - 63.2	Pass
ERW-95	1/9/2017	Sr-90	43.6 ± 2.4	43.1	31.8 - 49.5	Pass
ERW-97	1/9/2017	Ba-133	78.2 ± 4.1	85.6	72.0 - 94.2	Pass
ERW-97	1/9/2017	Cs-134	53.9 ± 3.8	52.6	42.4 - 57.9	Pass
ERW-97	1/9/2017	Cs-137	122 ± 6	112	101 - 126	Pass
ERW-97	1/9/2017	Co-60	117 ± 4	113	102 - 126	Pass
ERW-97	1/9/2017	Zn-65	208 ± 13	189	170 - 222	Pass
ERW-99	1/9/2017	Gr. Alpha	48.9 ± 2.4	52.3	27.3 - 65.5	Pass
ERW-99	1/9/2017	Gr. Beta	37.1 ± 1.3	41.6	27.7 - 49.0	Pass
ERW-101	1/9/2017	I-131	22.3 ± 0.6	24.3	20.2 - 28.8	Pass
ERW-103	1/9/2017	Ra-226	11.3 ± 0.4	12.7	9.5 - 14.7	Pass
ERW-103	1/9/2017	Ra-228	6.10 ± 0.90	6.20	3.8 - 8.1	Pass
ERW-103	1/9/2017	Uranium	11.8 ± 0.8	12.6	9.9 - 14.4	Pass
ERW-106	1/9/2017	H-3	12,600 ± 300	12,500	10,900 - 13,800	Pass
ERW-3344	7/10/2017	Sr-89	29.0 ± 10.0	26.4	18.4 - 32.9	Pass
ERW-3344	7/10/2017	Sr-90	33.8 ± 3.3	36.0	26.4 - 41.5	Pass
ERW-3346	7/10/2017	Ba-133	66.4 ± 4.1	66.3	55.2 - 72.9	Pass
ERW-3346	7/10/2017	Cs-134	27.0 ± 4.3	24.4	18.7 - 27.2	Pass
ERW-3346	7/10/2017	Cs-137	57.4 ± 4.5	51.6	46.4 - 59.6	Pass
ERW-3346	7/10/2017	Co-60	92.6 ± 4.4	88.6	79.7 - 99.8	Pass
ERW-3346	7/10/2017	Zn-65	32.4 ± 6.0	32.7	27.3 - 41.6	Pass
ERW-3348	7/10/2017	Gr. Alpha	23.7 ± 1.9	25.7	13.0 - 34.1	Pass
ERW-3348	7/10/2017	Gr. Beta	54.6 ± 1.6	63.0	43.5 - 69.6	Pass
ERW-3350	7/10/2017	I-131	25.4 ± 1.3	25.5	21.2 - 30.1	Pass
ERW-3352	7/10/2017	Ra-226	1.38 ± 0.15	1.29	1.07 - 1.95	Pass
ERW-3352	7/10/2017	Ra-228	6.70 ± 0.93	5.66	3.45 - 7.47	Pass
ERW-3352	7/10/2017	Uranium	58.4 ± 0.9	66.7	54.3 - 73.9	Pass
ERW-3354	7/10/2017	H-3	5,254 ± 224	5,060	4,340 - 5,570	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).

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

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported Dose [b] (mrem)	Performance Quotient (P) [c]	
Environmental, Inc.		Group 1				
2017-1	10/16/2017	Spike 1	59.0	49.3	-0.16	
2017-1	10/16/2017	Spike 2	59.0	53.2	-0.10	
2017-1	10/16/2017	Spike 3	59.0	52.7	-0.11	
2017-1	10/16/2017	Spike 4	59.0	53.4	-0.09	
2017-1	10/16/2017	Spike 5	59.0	51.8	-0.12	
2017-1	10/16/2017	Spike 6	59.0	54.0	-0.08	
2017-1	10/16/2017	Spike 7	59.0	52.0	-0.12	
2017-1	10/16/2017	Spike 8	59.0	52.6	-0.11	
2017-1	10/16/2017	Spike 9	59.0	54.6	-0.07	
2017-1	10/16/2017	Spike 10	59.0	50.4	-0.15	
2017-1	10/16/2017	Spike 11	59.0	53.9	-0.09	
2017-1	10/16/2017	Spike 12	59.0	55.7	-0.06	
2017-1	10/16/2017	Spike 13	59.0	50.2	-0.15	
2017-1	10/16/2017	Spike 14	59.0	52.4	-0.11	
2017-1	10/16/2017	Spike 15	59.0	54.3	-0.08	
2017-1	10/16/2017	Spike 16	59.0	53.2	-0.10	
2017-1	10/16/2017	Spike 17	59.0	50.1	-0.15	
2017-1	10/16/2017	Spike 18	59.0	52.3	-0.11	
2017-1	10/16/2017	Spike 19	59.0	50.3	-0.15	
2017-1	10/16/2017	Spike 20	59.0	50.7	-0.14	
2017-1	10/16/2017	Spike 21	59.0	53.1	-0.10	
2017-1	10/16/2017	Spike 22	59.0	51.5	-0.13	
2017-1	10/16/2017	Spike 23	59.0	54.4	-0.08	
2017-1	10/16/2017	Spike 24	59.0	53.3	-0.10	
2017-1	10/16/2017	Spike 25	59.0	53.7	-0.09	
2017-1	10/16/2017	Spike 26	59.0	51.6	-0.13	
2017-1	10/16/2017	Spike 27	59.0	51.5	-0.13	
2017-1	10/16/2017	Spike 28	59.0	51.6	-0.13	
2017-1	10/16/2017	Spike 29	59.0	49.9	-0.15	
2017-1	10/16/2017	Spike 30	59.0	55.3	-0.06	
Mean (Spike 1-30)				52.4	-0.11	Pass[d]
Standard Deviation (Spike 1-30)				1.7	0.03	Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a$ = 1.20 . mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventially true value) ÷ conventially true value) where the conventially true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

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

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported [b] Dose (mrem)	Performance [c] Quotient (P)	
Environmental, Inc.		Group 2				
2017-2	10/16/2017	Spike 31	186.0	164.7	-0.11	
2017-2	10/16/2017	Spike 32	186.0	172.0	-0.08	
2017-2	10/16/2017	Spike 33	186.0	167.3	-0.10	
2017-2	10/16/2017	Spike 34	186.0	160.6	-0.14	
2017-2	10/16/2017	Spike 35	186.0	171.7	-0.08	
2017-2	10/16/2017	Spike 36	186.0	177.0	-0.05	
2017-2	10/16/2017	Spike 37	186.0	176.7	-0.05	
2017-2	10/16/2017	Spike 38	186.0	165.5	-0.11	
2017-2	10/16/2017	Spike 39	186.0	174.6	-0.06	
2017-2	10/16/2017	Spike 40	186.0	172.7	-0.07	
2017-2	10/16/2017	Spike 41	186.0	167.8	-0.10	
2017-2	10/16/2017	Spike 42	186.0	161.0	-0.13	
2017-2	10/16/2017	Spike 43	186.0	166.3	-0.11	
2017-2	10/16/2017	Spike 44	186.0	172.4	-0.07	
2017-2	10/16/2017	Spike 45	186.0	173.0	-0.07	
2017-2	10/16/2017	Spike 46	186.0	169.5	-0.09	
2017-2	10/16/2017	Spike 47	186.0	169.0	-0.09	
2017-2	10/16/2017	Spike 48	186.0	166.9	-0.10	
2017-2	10/16/2017	Spike 49	186.0	165.9	-0.11	
2017-2	10/16/2017	Spike 50	186.0	166.7	-0.10	
2017-2	10/16/2017	Spike 51	186.0	161.1	-0.13	
2017-2	10/16/2017	Spike 52	186.0	173.4	-0.07	
2017-2	10/16/2017	Spike 53	186.0	173.1	-0.07	
2017-2	10/16/2017	Spike 54	186.0	160.0	-0.14	
2017-2	10/16/2017	Spike 55	186.0	166.1	-0.11	
2017-2	10/16/2017	Spike 56	186.0	164.5	-0.12	
2017-2	10/16/2017	Spike 57	186.0	163.8	-0.12	
2017-2	10/16/2017	Spike 58	186.0	159.9	-0.14	
2017-2	10/16/2017	Spike 59	186.0	165.6	-0.11	
2017-2	10/16/2017	Spike 60	186.0	165.0	-0.11	
Mean (Spike 31-60)				167.8	-0.10	Pass[d]
Standard Deviation (Spike 31-60)				5.0	0.03	Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventially true value) ÷ conventially true value) where the conventially true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
W-010417	4/29/2016	Cs-134	38.2 ± 8.1	36.2	29.0 - 43.4	Pass
W-010417	4/29/2016	Cs-137	78.0 ± 8.8	71.9	57.5 - 86.3	Pass
SPW-306	1/4/2017	Ra-226	18.1 ± 0.4	16.7	13.4 - 20.1	Pass
SPW-32	1/6/2017	H-3	17,849 ± 393	17,243	10,346 - 24,140	Pass
SPW-46	1/9/2017	Gr. Alpha	20.0 ± 0.4	20.1	16.1 - 24.1	Pass
SPW-46	1/9/2017	Gr. Beta	29.0 ± 0.3	28.9	23.1 - 34.6	Pass
SPW-92	1/11/2017	H-3	18,095 ± 397	17,243	10,346 - 24,140	Pass
SPW-142	1/12/2017	Sr-90	39.4 ± 2.3	36.6	29.3 - 43.9	Pass
SPW-155	1/19/2017	H-3	17,974 ± 400	17,243	10,346 - 24,140	Pass
SPW-186	1/23/2017	H-3	17,383 ± 366	17,243	10,346 - 24,140	Pass
SPW-232	1/19/2017	H-3	17,542 ± 368	17,243	10,346 - 24,140	Pass
SPW-304	1/26/2017	H-3	17,782 ± 400	17,243	10,346 - 24,140	Pass
SPW-333	1/30/2017	H-3	17,910 ± 406	17,243	10,346 - 24,140	Pass
SPW-353	2/2/2017	U-234	47.8 ± 2.3	41.7	33.4 - 50.0	Pass
SPW-353	2/2/2017	U-238	50.4 ± 2.4	41.7	33.4 - 50.0	Pass
W-020217	4/29/2016	Cs-134	33.7 ± 6.1	36.2	29.0 - 43.4	Pass
W-020217	4/29/2016	Cs-137	78.4 ± 7.3	71.9	57.5 - 86.3	Pass
SPW-412	2/6/2017	Sr-90	36.2 ± 2.4	36.6	29.3 - 43.9	Pass
SPW-465	2/8/2017	H-3	17,573 ± 396	17,243	10,346 - 24,140	Pass
SPW-561	2/15/2017	H-3	17,358 ± 395	17,243	10,346 - 24,140	Pass
SPW-605	2/16/2017	H-3	17,820 ± 401	17,243	10,346 - 24,140	Pass
SPW-657	2/17/2017	H-3	17,614 ± 376	17,243	10,346 - 24,140	Pass
SPW-714	2/23/2017	H-3	17,662 ± 400	17,243	10,346 - 24,140	Pass
SPW-737	2/28/2017	H-3	17,196 ± 395	17,243	10,346 - 24,140	Pass
SPAP-740	2/28/2017	Gr. Beta	38.9 ± 0.1	41.5	33.2 - 49.8	Pass
SPAP-742	2/24/2017	Cs-134	1.05 ± 0.60	0.98	0.78 - 1.18	Pass
SPAP-742	2/24/2017	Cs-137	90.4 ± 2.5	92.9	74.3 - 111.5	Pass
SPW-746	2/28/2017	Sr-90	42.8 ± 2.5	36.6	29.3 - 43.9	Pass
SPW-748	2/28/2017	C-14	4270 ± 17	4735	3788 - 5682	Pass
SPW-750	2/28/2017	Ni-63	463 ± 4	400	240 - 560	Pass
SPF-752	2/28/2017	Cs-134	1033 ± 38	1090	870 - 1300	Pass
SPF-752	2/28/2017	Cs-137	3071 ± 61	2820	2250 - 3380	Pass
SPW-781	3/1/2017	Ra-226	18.1 ± 0.4	16.7	13.4 - 20.1	Pass
SPW-783	3/1/2017	H-3	17,653 ± 400	17,243	13,794 - 20,692	Pass
W-030517	4/29/2016	Cs-134	38.0 ± 9.0	36.2	29.0 - 43.4	Pass
W-030517	4/29/2016	Cs-137	80.9 ± 9.2	71.9	57.5 - 86.3	Pass
SPW-1010	3/14/2017	H-3	17,312 ± 395	17,243	13,794 - 20,692	Pass
SPW-1026	3/16/2017	Gr. Alpha	22.4 ± 0.5	20.1	12.0 - 28.1	Pass
SPW-1026	3/16/2017	Gr. Beta	29.2 ± 0.3	28.9	17.3 - 40.4	Pass
SPW-1092	3/21/2017	H-3	17,252 ± 390	17,243	13,794 - 20,692	Pass
SPW-1151	3/24/2017	H-3	17,009 ± 388	17,243	13,794 - 20,692	Pass
SPW-1163	3/28/2017	Sr-90	39.0 ± 2.3	36.3	29.0 - 43.5	Pass
SPW-1178	3/29/2017	Ra-228	15.1 ± 1.9	16.0	9.6 - 22.4	Pass

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-1232	3/30/2017	H-3	17,150 ± 390	17,243	13,794 - 20,692	Pass
SPW-1246	3/31/2017	I-131(G)	33.0 ± 7.3	36.6	29.3 - 43.9	Pass
SPW-1246	3/31/2017	Cs-134	28.9 ± 4.6	26.6	21.3 - 31.9	Pass
SPW-1246	3/31/2017	Cs-137	80.6 ± 8.2	70.4	56.3 - 84.5	Pass
SPMI-1248	3/31/2017	I-131(G)	39.8 ± 7.0	36.6	29.3 - 43.9	Pass
SPMI-1248	3/31/2017	Cs-134	26.9 ± 5.9	26.6	21.3 - 31.9	Pass
SPMI-1248	3/31/2017	Cs-137	70.4 ± 6.9	70.4	56.3 - 84.5	Pass
SPMI-1248	3/31/2017	I-131	36.2 ± 0.6	36.6	29.3 - 43.9	Pass
SPW-1295	3/31/2017	Ra-226	17.9 ± 0.4	16.7	13.4 - 20.1	Pass
SPW-1304	4/4/2017	H-3	17,741 ± 398	17,243	13,794 - 20,692	Pass
SPW-1359	4/5/2017	I-131	44.3 ± 0.5	47.6	38.1 - 57.1	Pass
SPW-1378	4/7/2017	H-3	17,528 ± 395	17,243	13,794 - 20,692	Pass
SPW-1391	4/7/2017	Gr. Alpha	21.1 ± 0.4	20.1	12.0 - 28.1	Pass
SPW-1391	4/7/2017	Gr. Beta	27.8 ± 0.3	28.2	17.3 - 40.4	Pass
SPW-1480	4/12/2017	H-3	17,399 ± 392	17,243	13,794 - 20,692	Pass
W-041317	4/29/2016	Cs-134	34.6 ± 5.6	36.2	29.0 - 43.4	Pass
W-041317	4/29/2016	Cs-137	81.9 ± 8.0	71.9	57.5 - 86.3	Pass
SPW-1480	4/12/2017	H-3	17,399 ± 392	17,243	13,794 - 20,692	Pass
SPW-1575	4/18/2017	H-3	17,419 ± 393	17,243	13,794 - 20,692	Pass
SPW-1626	4/20/2017	Sr-90	37.2 ± 2.4	36.3	29.0 - 43.5	Pass
SPW-1658	4/21/2017	H-3	17,194 ± 391	17,243	13,794 - 20,692	Pass
SPW-1776	4/26/2017	H-3	16,609 ± 386	17,243	13,794 - 20,692	Pass
SPW-1806	4/27/2017	H-3	17,203 ± 390	17,243	13,794 - 20,692	Pass
SPW-1937	5/3/2017	H-3	16,690 ± 385	17,243	13,794 - 20,692	Pass
SPW-1971	5/5/2017	Sr-90	41.5 ± 2.2	36.3	29.0 - 43.5	Pass
SPW-2033	5/8/2017	H-3	16,780 ± 386	17,243	13,794 - 20,692	Pass
SPW-2420	5/9/2017	Ra-226	16.3 ± 0.5	16.7	13.4 - 20.1	Pass
W-051517	4/29/2016	Cs-134	36.3 ± 5.0	36.2	29.0 - 43.4	Pass
W-051517	4/29/2016	Cs-137	68.9 ± 6.6	71.9	57.5 - 86.3	Pass
SPW-2284	5/22/2017	H-3	16,935 ± 389	16,703	13,362 - 20,043	Pass
SPW-2354	5/23/2017	H-3	17,006 ± 390	16,700	13,360 - 20,040	Pass
SPW-2891	5/23/2017	Ra-226	17.5 ± 0.4	16.7	13.4 - 20.1	Pass
SPW-2418	5/23/2017	Ra-228	14.0 ± 1.8	16.0	11.2 - 20.8	Pass
SPW-2439	5/25/2017	Ra-228	13.0 ± 1.8	16.0	11.2 - 20.8	Pass
SPMI-2378	5/24/2017	Sr-89	83.7 ± 4.9	98.4	78.7 - 118.1	Pass
SPMI-2378	5/24/2017	Sr-90	39.5 ± 1.5	36.1	28.9 - 43.4	Pass
SPW-2468	5/26/2017	H-3	17,065 ± 391	16,692	13,354 - 20,031	Pass
SPW-2848	5/26/2017	I-131	56.4 ± 0.6	58.3	46.6 - 70.0	Pass
SPW-2502	6/1/2017	H-3	17,596 ± 396	16,677	13,342 - 20,012	Pass
SPW-2659	6/5/2017	H-3	17,027 ± 390	16,677	13,342 - 20,012	Pass
SPW-2790	6/9/2017	H-3	17,101 ± 392	17,101	13,325 - 19,988	Pass

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-2798	6/12/2017	H-3	16,683 ± 364	16,649	13,319 - 19,978	Pass
SPW-2943	6/19/2017	Sr-90	39.2 ± 2.3	36.1	28.9 - 43.4	Pass
SPW-3509	6/15/2017	Ra-226	17.6 ± 0.5	16.7	13.4 - 20.1	Pass
W-061317	4/29/2016	Cs-134	35.0 ± 6.2	36.2	29.0 - 43.4	Pass
W-061317	4/29/2016	Cs-137	77.4 ± 7.8	71.9	57.5 - 86.3	Pass
SPW-3041	6/23/2017	H-3	16,419 ± 378	16,620	13,296 - 19,945	Pass
SPW-3511	6/23/2017	Ra-226	15.5 ± 0.6	16.7	13.4 - 20.1	Pass
SPW-3103	6/28/2017	H-3	16,507 ± 380	16,507	13,286 - 19,929	Pass
SPW-3117	6/29/2017	Tc-99	112.7 ± 1.9	107.8	86.2 - 129.4	Pass
SPW-3513	6/29/2017	Ra-226	17.8 ± 0.5	16.7	13.4 - 20.1	Pass
SPW-3188	7/3/2017	Sr-90	38.1 ± 2.2	36.1	28.9 - 43.4	Pass
SPW-3283	7/11/2017	H-3	16,057 ± 347	16,649	13,319 - 19,978	Pass
SPW-4054	7/11/2017	Ra-226	17.7 ± 0.4	16.0	11.2 - 20.8	Pass
SPW-3467	7/14/2017	Gr. Alpha	22.3 ± 0.5	20.1	12.0 - 28.1	Pass
SPW-3467	7/14/2017	Gr. Beta	29.1 ± 0.3	28.2	17.3 - 40.4	Pass
SPW-3449	7/15/2017	H-3	17,196 ± 393	16,507	13,286 - 19,929	Pass
SPW-3548	7/19/2017	H-3	16,764 ± 386	16,507	13,286 - 19,929	Pass
SPW-3728	7/24/2017	H-3	16,117 ± 354	16,507	13,286 - 19,929	Pass
SPW-3794	7/28/2017	H-3	16,645 ± 384	16,507	13,286 - 19,929	Pass
W-072817	4/29/2016	Cs-134	38.6 ± 5.6	36.2	29.0 - 43.4	Pass
W-072817	4/29/2016	Cs-137	76.5 ± 7.6	71.9	57.5 - 86.3	Pass
SPW-3905	8/3/2017	Gr. Alpha	22.3 ± 0.5	20.1	12.0 - 28.1	Pass
SPW-3905	8/3/2017	Gr. Beta	27.6 ± 0.3	28.2	17.3 - 40.4	Pass
SPW-4030	8/9/2017	H-3	17,636 ± 403	16,507	13,286 - 19,929	Pass
SPW-4086	8/14/2017	H-3	17,472 ± 401	16,507	13,286 - 19,929	Pass
SPW-4207	8/17/2017	H-3	17,013 ± 393	16,507	13,286 - 19,929	Pass
W-083017	4/29/2016	Cs-134	34.7 ± 6.4	36.2	29.0 - 43.4	Pass
W-083017	4/29/2016	Cs-137	78.2 ± 6.7	71.9	57.5 - 86.3	Pass
SPW-4241	8/19/2017	H-3	17,222 ± 371	16,507	13,286 - 19,929	Pass
SPW-4458	9/1/2017	Ra-226	14.1 ± 1.8	16.7	13.4 - 20.1	Pass
SPW-4466	9/6/2017	Sr-89	22.8 ± 8.5	26.4	21.1 - 31.7	Pass
SPW-4466	9/6/2017	Sr-90	32.5 ± 2.1	33.8	27.0 - 40.6	Pass
SPW-4512	9/8/2017	Gr. Alpha	19.2 ± 0.4	20.1	10.1 - 30.2	Pass
SPW-4512	9/8/2017	Gr. Beta	27.8 ± 0.3	27.9	22.3 - 33.5	Pass
SPW-4586	9/9/2017	H-3	16,586 ± 362	16,507	13,286 - 19,929	Pass
SPW-4720	9/16/2017	H-3	16,439 ± 362	16,507	13,286 - 19,929	Pass
SPW-4834	9/22/2017	H-3	16,238 ± 378	16,507	13,286 - 19,929	Pass
SPW-4935	9/27/2017	H-3	16,595 ± 381	16,507	13,286 - 19,929	Pass
SPW-4937	9/27/2017	Ra-228	5.7 ± 0.9	5.8	4.1 - 7.5	Pass
W-092717	4/29/2016	Cs-134	36.0 ± 5.9	36.2	29.0 - 43.4	Pass
W-092717	4/29/2016	Cs-137	82.6 ± 8.5	71.9	57.5 - 86.3	Pass
SPW-5001	9/29/2017	H-3	16,446 ± 358	16,507	13,286 - 19,929	Pass

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-5134	10/6/2017	H-3	16,128 ± 373	16,507	13,286 - 19,929	Pass
SPW-5274	10/12/2017	H-3	16,108 ± 374	16,507	13,286 - 19,929	Pass
W-101217S	10/12/2017	Fe-55	1,491 ± 77	1,482	1,186 - 01,778	Pass
SPW-5408	10/18/2017	Ni-63	203 ± 3	199	159 - 238	Pass
SPW-5430	10/19/2017	H-3	16,453 ± 380	16,507	13,286 - 19,929	Pass
W-102017	4/29/2016	Cs-134	31.3 ± 4.9	36.2	29.0 - 43.4	Pass
W-102017	4/29/2016	Cs-137	80.4 ± 6.9	71.9	57.5 - 86.3	Pass
SPW-5674	10/25/2017	H-3	16,313 ± 380	16,507	13,286 - 19,929	Pass
SPW-5719	10/27/2017	H-3	16,113 ± 350	16,507	13,286 - 19,929	Pass
SPW-5730	10/31/2017	H-3	16,776 ± 387	16,507	13,286 - 19,929	Pass
SPW-5944	10/27/2017	Ra-226	16.4 ± 0.5	16.7	13.4 - 20.1	Pass
SPW-5915	11/9/2017	H-3	16,930 ± 390	16,507	13,286 - 19,929	Pass
SPW-5989	11/11/2017	H-3	16,084 ± 352	16,507	13,286 - 19,929	Pass
W-111417	4/29/2016	Cs-134	38.1 ± 6.2	36.2	29.0 - 43.4	Pass
W-111417	4/29/2016	Cs-137	74.0 ± 7.5	71.9	57.5 - 86.3	Pass
SPW-6121	11/16/2017	H-3	16,276 ± 378	16,507	13,286 - 19,929	Pass
SPW-6132	11/20/2017	H-3	15,897 ± 374	16,507	13,286 - 19,929	Pass
SPW-6249	11/30/2017	Ra-226	12.2 ± 0.4	12.3	9.8 - 14.8	Pass
SPW-6226	12/1/2017	H-3	16,164 ± 378	16,507	13,286 - 19,929	Pass
SPW-6318	12/7/2017	H-3	15,779 ± 372	16,507	13,286 - 19,929	Pass
W-120817	4/29/2016	Cs-134	29.5 ± 5.6	36.2	29.0 - 43.4	Pass
W-120817	4/29/2016	Cs-137	78.8 ± 9.6	71.9	57.5 - 86.3	Pass
SPW-65	12/11/2017	Ra-226	12.5 ± 0.4	12.3	9.8 - 14.8	Pass
SPW-6437	12/13/2017	Gr. Alpha	19.6 ± 0.4	20.1	10.1 - 30.2	Pass
SPW-6437	12/13/2017	Gr. Beta	28.2 ± 0.3	27.9	22.3 - 33.5	Pass
SPW-6463	12/15/2017	H-3	15,560 ± 372	16,507	13,286 - 19,929	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, gelatin 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 [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-31	Water	1/6/2017	H-3	143	71 ± 75	200
SPW-45	Water	1/9/2017	Gr. Alpha	0.41	0.09 ± 0.30	2
SPW-45	Water	1/9/2017	Gr. Beta	0.74	-0.56 ± 0.50	4
SPW-91	Water	1/11/2017	H-3	151	-23 ± 71	200
SPW-141	Water	1/12/2017	Sr-89	0.55	0.29 ± 0.47	5
SPW-141	Water	1/12/2017	Sr-90	0.67	-0.02 ± 0.31	1
SPW-154	Water	1/19/2017	H-3	155	-17 ± 73	200
SPW-185	Water	1/23/2017	H-3	176	44 ± 94	200
SPW-231	Water	1/19/2017	H-3	179	26 ± 87	200
SPW-303	Water	1/26/2017	H-3	160	8 ± 77	200
SPW-305	Water	1/4/2017	Ra-226	0.02	0.02 ± 0.01	2
SPW-307	Water	1/27/2017	I-131	0.21	0.01 ± 0.11	1.00
SPW-332	Water	1/30/2017	H-3	169	-52 ± 86	200
SPW-352	Water	2/2/2017	U-234	0.14	0.00 ± 0.08	1
SPW-352	Water	2/2/2017	U-238	0.14	0.12 ± 0.15	1
SPW-411	Water	2/6/2017	Sr-89	0.49	0.30 ± 0.35	5
SPW-411	Water	2/6/2017	Sr-90	0.52	-0.22 ± 0.21	1
SPW-464	Water	2/8/2017	H-3	155	2 ± 74	200
SPW-560	Water	2/15/2017	H-3	156	38 ± 77	200
SPW-604	Water	2/16/2017	H-3	154	59 ± 77	200
SPW-656	Water	2/17/2017	H-3	187	28 ± 94	200
SPW-713	Water	2/23/2017	H-3	161	20 ± 81	200
SPW-736	Water	2/28/2017	H-3	161	-75 ± 76	200
SPAP-739	AP	2/28/2017	Gr. Beta	0.002	0.004 ± 0.001	0.01
SPAP-741	AP	2/24/2017	Cs-134	2.27	-0.95 ± 1.29	100
SPAP-741	AP	2/24/2017	Cs-137	2.65	0.17 ± 1.67	100
SPW-747	Water	2/28/2017	C-14	161	-28 ± 97	200
SPW-749	Water	2/28/2017	Ni-63	17	-3 ± 10	200
SPF-751	Fish	2/28/2017	Cs-134	0.008	0.002 ± 0.004	100
SPF-751	Fish	2/28/2017	Cs-137	0.008	0.000 ± 0.005	100
SPW-780	Water	3/1/2017	Ra-226	0.02	0.02 ± 0.01	2
SPW-782	Water	3/1/2017	H-3	154	35 ± 78	200
SPW-3506	Water	3/1/2017	Ra-226	0.03	0.02 ± 0.02	2
SPW-836	Water	3/3/2017	I-131	0.38	0.04 ± 0.18	1
SPW-1009	Water	3/14/2017	H-3	154	-31 ± 72	200
SPW-1025	Water	3/16/2017	Gr. Alpha	0.43	-0.16 ± 0.28	2
SPW-1025	Water	3/16/2017	Gr. Beta	0.75	-0.24 ± 0.52	4
SPW-1091	Water	3/21/2017	H-3	145	60 ± 73	200
SPW-1150	Water	3/24/2017	H-3	152	-31 ± 71	200
SPW-1162	Water	3/28/2017	Sr-89	0.61	-0.39 ± 0.45	5
SPW-1162	Water	3/28/2017	Sr-90	0.52	0.18 ± 0.27	1

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-1177	Water	3/29/2017	Ra-228	0.83	-0.14 ± 0.36	2
SPW-1231	Water	3/30/2017	H-3	150	24 ± 73	200
SPW-1245	Water	3/31/2017	Cs-134	3.73	0.43 ± 2.18	100
SPW-1245	Water	3/31/2017	Cs-137	3.01	-1.23 ± 2.12	100
SPW-1245	Water	3/31/2017	I-131(G)	5.39	0.92 ± 2.15	100
SPW-1245	Water	3/31/2017	i-131	0.32	0.03 ± 0.18	1
SPMI-1247	Milk	3/31/2017	Cs-134	3.70	1.23 ± 1.96	100
SPMI-1247	Milk	3/31/2017	Cs-137	3.62	-0.84 ± 2.15	100
SPMI-1247	Milk	3/31/2017	I-131(G)	4.42	0.39 ± 2.14	100
SPW-1294	Water	3/31/2017	Ra-226	0.02	0.18 ± 0.02	2
SPW-1303	Water	4/4/2017	H-3	151	8 ± 75	200
SPW-1377	Water	4/7/2017	H-3	150	29 ± 72	200
SPW-1390	Water	4/7/2017	Gr. Alpha	0.42	0.15 ± 0.31	2
SPW-1390	Water	4/7/2017	Gr. Beta	0.73	-0.17 ± 0.51	4
SPW-1479	Water	4/12/2017	H-3	151	89 ± 77	200
SPW-1574	Water	4/18/2017	H-3	144	55 ± 79	200
SPW-1625	Water	4/20/2017	Sr-89	0.59	-0.01 ± 0.50	5
SPW-1625	Water	4/20/2017	Sr-90	0.71	0.16 ± 0.35	1
SPW-1657	Water	4/21/2017	H-3	147	34 ± 73	200
SPW-1775	Water	4/26/2017	H-3	155	67 ± 80	200
SPW-1805	Water	4/27/2017	H-3	153	15 ± 74	200
SPW-1936	Water	5/3/2017	H-3	148	33 ± 71	200
SPW-1970	Water	5/5/2017	Sr-89	0.66	0.34 ± 0.54	5
SPW-1970	Water	5/5/2017	Sr-90	0.62	-0.08 ± 0.28	1
SPW-2032	Water	5/8/2017	H-3	147	66 ± 73	200
SPW-2419	Water	5/9/2017	Ra-226	0.03	0.01 ± 0.03	2
SPW-2283	Water	5/22/2017	H-3	155	24 ± 78	200
SPW-2353	Water	5/23/2017	H-3	151	56 ± 76	200
SPW-2890	Water	5/23/2017	Ra-226	0.03	-0.01 ± 0.02	2
SPMI-2377	Milk	5/24/2017	Sr-89	0.78	0.86 ± 0.93	5
SPMI-2377	Milk	5/24/2017	Sr-90	0.49	0.95 ± 0.33	1
SPW-2438	Water	5/25/2017	Ra-228	0.90	-0.28 ± 0.38	2
SPW-2467	Water	5/26/2017	H-3	152	27 ± 77	200
SPW-2417	Water	5/26/2017	Ra-228	0.80	1.58 ± 0.54	2
SPW-2447	Water	5/26/2017	I-131	0.21	-0.05 ± 0.12	1
SPW-2501	Water	6/1/2017	H-3	151	-23 ± 70	200
SPW-2658	Water	6/5/2017	H-3	152	107 ± 78	200
SPW-2789	Water	6/9/2017	H-3	150	52 ± 77	200
SPW-2797	Water	6/12/2017	H-3	177	7 ± 93	200
SPW-2847	Water	6/14/2017	I-131	0.18	0.03 ± 0.10	1

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-3508	Water	6/15/2017	Ra-226	0.03	0.00 ± 0.02	2
SPW-2942	Water	6/19/2017	Sr-89	0.58	0.80 ± 0.53	5
SPW-2942	Water	6/19/2017	Sr-90	0.50	0.15 ± 0.25	1
SPW-3042	Water	6/23/2017	H-3	146	25 ± 74	200
SPW-3510	Water	6/23/2017	Ra-226	0.02	0.03 ± 0.02	2
SPW-3102	Water	6/28/2017	H-3	148	-7 ± 73	200
SPW-3116	Water	6/29/2017	Tc-99	5.91	-0.39 ± 3.58	10
SPW-3512	Water	6/29/2017	Ra-226	0.02	-0.01 ± 0.02	2
SPW-3187	Water	7/3/2017	Sr-89	0.62	0.00 ± 0.48	5
SPW-3187	Water	7/3/2017	Sr-90	0.48	0.07 ± 0.23	1
SPW-3282	Water	7/11/2017	H-3	178	-37 ± 84	200
SPW-4053	Water	7/11/2017	Ra-226	0.03	0.02 ± 0.02	2
SPW-3466	Water	7/14/2017	Gr. Alpha	0.42	-0.09 ± 0.28	2
SPW-3466	Water	7/14/2017	Gr. Beta	0.76	-0.18 ± 0.53	4
SPW-3448	Water	7/15/2017	H-3	150	54 ± 77	200
SPW-3727	Water	7/27/2017	Ni-63	90	18 ± 55	200
SPW-3793	Water	7/28/2017	H-3	151	47 ± 82	200
SPW-3904	Water	8/3/2017	Gr. Alpha	0.47	-0.02 ± 0.33	2
SPW-3904	Water	8/3/2017	Gr. Beta	0.75	-0.11 ± 0.52	4
SPW-4029	Water	8/9/2017	H-3	159	11 ± 79	200
SPW-4206	Water	8/17/2017	H-3	157	55 ± 76	200
SPW-4241	Water	8/19/2017	H-3	190	61 ± 96	200
SPW-4085	Water	8/14/2017	H-3	159	-28 ± 77	200
SPW-4206	Water	8/17/2017	H-3	157	55 ± 76	200
SPW-4241	Water	8/19/2017	H-3	190	61 ± 96	200
SPW-4457	Water	9/1/2017	Ra-228	0.78	-0.02 ± 0.36	2
SPW-4465	Water	9/6/2017	Sr-89	0.51	0.30 ± 0.37	5
SPW-4465	Water	9/6/2017	Sr-90	0.46	-0.09 ± 0.20	1
SPW-4585	Water	9/9/2017	H-3	187	-86 ± 83	200
SPW-5720	Water	9/13/2017	Ra-226	0.02	0.13 ± 0.02	2
SPW-4703	Water	9/15/2017	I-131	0.17	0.10 ± 0.10	1
SPW-4719	Water	9/16/2017	H-3	184	-86 ± 93	200
SPW-4833	Water	9/22/2017	H-3	150	5 ± 72	200
SPW-4934	Water	9/27/2017	H-3	148	5 ± 70	200
SPW-4936	Water	9/27/2017	Ra-228	0.80	0.55 ± 0.44	2
SPW-5000	Water	9/29/2017	H-3	183	-13 ± 90	200
SPW-5133	Water	10/6/2017	H-3	144	64 ± 71	200
SPW-5273	Water	10/12/2017	H-3	142	106 ± 72	200

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-5407	Water	10/18/2017	Ni-63	69	43 ± 43	200
SPW-5429	Water	10/19/2017	H-3	148	54 ± 72	200
SPW-5603	Water	10/23/2017	Sr-89	0.57	0.16 ± 0.47	5
SPW-5603	Water	10/23/2017	Sr-90	0.70	-0.12 ± 0.31	1
SPW-5673	Water	10/25/2017	H-3	156	-36 ± 71	200
SPW-5718	Water	10/27/2017	H-3	182	45 ± 92	200
SPW-5943	Water	10/27/2017	Ra-226	0.02	0.08 ± 0.02	2
SPW-5723	Water	10/30/2017	I-131	0.10	0.03 ± 0.07	1
SPW-5914	Water	11/09/17	H-3	149	-39 ± 68	200
SPW-5988	Water	11/11/2017	H-3	183	-8 ± 88	200
SPW-6120	Water	11/16/2017	H-3	146	83 ± 75	200
SPW-6131	Water	11/20/2017	H-3	151	16 ± 72	200
SPW-6197	Water	11/29/2017	I-131	0.38	0.01 ± 0.18	1
SPW-6248	Water	11/30/2017	Ra-226	0.03	0.15 ± 0.03	2
SPW-6225	Water	12/1/2017	H-3	154	-10 ± 72	200
SPW-6317	Water	12/7/2017	H-3	148	44 ± 74	200
SPW-64	Water	12/11/2017	Ra-226	0.03	0.18 ± 0.03	2
SPW-6436	Water	12/13/2017	Gr. Alpha	0.54	-0.17 ± 0.37	2
SPW-6436	Water	12/13/2017	Gr. Beta	0.74	0.12 ± 0.52	4
SPW-6464	Water	12/15/2017	H-3	148	31 ± 75	200

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

[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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
AP-7178,7179	1/3/2017	Be-7	0.047 ± 0.015	0.062 ± 0.017	0.054 ± 0.012	Pass
SW-6986,6987	1/3/2017	Gr. Beta	1.39 ± 0.41	0.77 ± 0.41	1.08 ± 0.29	Pass
E-66,67	1/3/2017	Gr. Beta	1.62 ± 0.05	1.45 ± 0.04	1.54 ± 0.11	Pass
E-66,67	1/3/2017	K-40	1.26 ± 0.14	1.39 ± 0.16	1.32 ± 0.11	Pass
CF-87,88	1/3/2017	Be-7	0.25 ± 0.11	0.30 ± 0.12	0.28 ± 0.08	Pass
CF-87,88	1/3/2017	K-40	7.77 ± 0.39	6.84 ± 0.37	7.31 ± 0.27	Pass
AP-011217	1/12/2017	Be-7	0.137 ± 0.078	0.139 ± 0.082	0.138 ± 0.056	Pass
MI-212,213	1/16/2017	K-40	1,515 ± 98	1,347 ± 107	1,431 ± 73	Pass
WW-321,322	1/19/2017	H-3	675 ± 118	506 ± 133	590 ± 89	Pass
WW-674,675	1/20/2017	H-3	7,326 ± 254	7,717 ± 259	7,522 ± 181	Pass
AP-012317	1/23/2017	Gr. Beta	0.034 ± 0.005	0.038 ± 0.005	0.036 ± 0.004	Pass
WW-298,299	1/24/2017	H-3	5,916 ± 239	5764 ± 237	5840 ± 168	Pass
AP-013117	1/30/2017	Gr. Beta	0.027 ± 0.004	0.028 ± 0.004	0.028 ± 0.003	Pass
WW-500,501	1/31/2017	H-3	1,058 ± 122	1,054 ± 121	1,056 ± 86	Pass
SW-391,392	1/31/2017	Gr. Beta	1.40 ± 0.56	1.62 ± 0.61	1.51 ± 0.41	Pass
SPS-370,371	2/1/2017	K-40	23.47 ± 0.66	23.11 ± 0.72	23.29 ± 0.49	Pass
AP-456,457	2/2/2017	Be-7	0.129 ± 0.076	0.167 ± 0.092	0.148 ± 0.060	Pass
AP-020217	2/2/2017	Gr. Beta	0.021 ± 0.004	0.027 ± 0.004	0.024 ± 0.003	Pass
SPS-414,415	2/3/2017	K-40	19.45 ± 1.85	21.58 ± 1.99	20.52 ± 1.36	Pass
AP-020617	2/6/2017	Gr. Beta	0.023 ± 0.004	0.023 ± 0.004	0.023 ± 0.003	Pass
AP-021417A	2/14/2017	Gr. Beta	0.031 ± 0.004	0.030 ± 0.004	0.030 ± 0.003	Pass
SPW-543	2/14/2017	Gr. Beta	7.99 ± 0.82	9.45 ± 0.88	8.72 ± 0.60	Pass
AP-021417B	2/14/2017	Gr. Beta	0.024 ± 0.004	0.028 ± 0.004	0.026 ± 0.003	Pass
WW-718,719	2/14/2017	H-3	737 ± 113	643 ± 110	690 ± 79	Pass
AP-022017	2/20/2017	Gr. Beta	0.018 ± 0.005	0.021 ± 0.005	0.020 ± 0.004	Pass
WW-755,756	2/22/2017	H-3	3,709 ± 196	3,823 ± 198	3,766 ± 139	Pass
AP-022717	2/27/2017	Gr. Beta	0.021 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
SPDW-80011,2	3/2/2017	Ra-226	7.29 ± 0.32	6.76 ± 0.30	7.03 ± 0.22	Pass
SPDW-80011,2	3/2/2017	Ra-228	4.68 ± 0.82	6.29 ± 1.03	5.49 ± 0.66	Pass
SPDW-80013,4	3/2/2017	Gr. Alpha	13.57 ± 1.43	12.44 ± 1.37	13.01 ± 0.99	Pass
WW-845,846	3/2/2017	H-3	314 ± 93	249 ± 90	281 ± 65	Pass
AP-030617	3/6/2017	Gr. Beta	0.022 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
WW-1050,1051	3/8/2017	H-3	14,994 ± 364	14,745 ± 362	14,870 ± 257	Pass
SPS-920,921	3/9/2017	K-40	23.30 ± 1.76	23.13 ± 1.64	23.21 ± 1.20	Pass
WW-1004,1005	3/13/2017	H-3	182 ± 80	158 ± 79	170 ± 56	Pass
SPS-1029,1030	3/15/2017	K-40	11.82 ± 0.68	12.01 ± 0.68	11.92 ± 0.48	Pass
AP-031517	3/15/2017	Gr. Beta	0.020 ± 0.003	0.020 ± 0.003	0.020 ± 0.002	Pass
SPDW-80037,8	3/20/2017	Gr. Alpha	4.54 ± 0.82	5.29 ± 0.91	4.91 ± 0.61	Pass
AP-032017	3/20/2017	Gr. Beta	0.021 ± 0.006	0.021 ± 0.006	0.021 ± 0.005	Pass
WW-1094,1095	3/20/2017	H-3	1,571 ± 137	1,595 ± 138	1,583 ± 175	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
WW-1175,1176	3/20/2017	H-3	218 ± 84	211 ± 84	214 ± 59	Pass
WW-1129,1130	3/21/2017	Gr. Beta	3.51 ± 1.24	2.99 ± 1.17	3.25 ± 0.85	Pass
WW-1219,1220	3/22/2017	H-3	11,467 ± 322	11,516 ± 323	11,492 ± 200	Pass
SPS-1152,1153	3/27/2017	Ac-228	20.39 ± 0.75	20.43 ± 0.88	20.41 ± 0.58	Pass
SPS-1152,1153	3/27/2017	Pb-214	17.22 ± 0.50	16.44 ± 0.52	16.83 ± 0.36	Pass
SPDW-80047,8	3/28/2017	Ra-226	2.06 ± 0.23	1.60 ± 0.32	1.83 ± 0.20	Pass
SPDW-80047,8	3/28/2017	Ra-228	0.53 ± 0.48	0.78 ± 0.49	0.66 ± 0.34	Pass
SWU-1242,1243	3/28/2017	Gr. Beta	2.04 ± 0.81	2.47 ± 0.69	2.26 ± 0.53	Pass
SPS-1198,1199	3/29/2017	K-40	16.95 ± 1.85	18.33 ± 1.71	17.64 ± 1.26	Pass
SPDW-80050,1	3/29/2017	Gr. Alpha	3.19 ± 0.80	3.39 ± 0.78	3.29 ± 0.56	Pass
SPDW-80050,1	3/29/2017	Gr. Beta	1.58 ± 0.60	2.08 ± 0.63	1.83 ± 0.44	Pass
AP-1706,1707	3/30/2017	Be-7	0.068 ± 0.018	0.072 ± 0.017	0.070 ± 0.012	Pass
SW-1381,1382	4/5/2017	H-3	402 ± 92	309 ± 88	356 ± 64	Pass
WW-1446,1447	4/6/2017	H-3	305 ± 89	358 ± 91	332 ± 64	Pass
WW-1532,1533	4/10/2017	H-3	19,124 ± 412	18,991 ± 410	19,058 ± 291	Pass
WW-1618,1619	4/12/2017	H-3	4,187 ± 203	4,305 ± 205	4,246 ± 144	Pass
SS-1553,1554	4/13/2017	Gr. Beta	7.16 ± 0.99	6.09 ± 0.91	6.63 ± 0.67	Pass
SS-1553,1554	4/13/2017	K-40	4.60 ± 0.32	4.84 ± 0.34	4.72 ± 0.23	Pass
SS-1553,1554	4/13/2017	Tl-208	0.038 ± 0.016	0.032 ± 0.011	0.035 ± 0.010	Pass
SS-1553,1554	4/13/2017	Pb-212	0.101 ± 0.015	0.096 ± 0.015	0.098 ± 0.010	Pass
SS-1553,1554	4/13/2017	Bi-214	0.094 ± 0.032	0.109 ± 0.022	0.101 ± 0.019	Pass
SS-1553,1554	4/13/2017	Ac-228	0.089 ± 0.042	0.111 ± 0.046	0.100 ± 0.031	Pass
P-2015,2016	5/4/2017	H-3	189 ± 80	212 ± 81	200 ± 57	Pass
WW-2336,2337	5/8/2017	H-3	422 ± 97	298 ± 91	360 ± 66	Pass
AP-051117	5/11/2017	Gr. Beta	0.018 ± 0.003	0.025 ± 0.004	0.021 ± 0.002	Pass
WW-2497,2498	5/23/2017	H-3	1,268 ± 127	1,247 ± 126	1,257 ± 89	Pass
WW-2583,2584	5/23/2017	H-3	5,159 ± 224	5,223 ± 126	5,191 ± 129	Pass
WW-2732,2733	5/23/2017	H-3	8,559 ± 282	8,570 ± 283	8,564 ± 200	Pass
XW-1218,1219	5/23/2017	H-3	11,467 ± 282	11,516 ± 283	11,492 ± 200	Pass
MI-2428,2429	5/24/2017	K-40	1,752 ± 137	1,805 ± 132	1,778 ± 95	Pass
SO-2562,2563	5/24/2017	K-40	7.87 ± 0.50	8.64 ± 0.49	8.25 ± 0.35	Pass
WW-3023,3024	5/24/2017	H-3	27,398 ± 486	27,733 ± 489	27,565 ± 344	Pass
SO-2453,2454	5/25/2017	Gr. Beta	14.38 ± 0.93	15.70 ± 1.06	15.04 ± 0.70	Pass
SO-2453,2454	5/25/2017	Cs-137	0.17 ± 0.03	0.18 ± 0.03	0.17 ± 0.02	Pass
SO-2453,2454	5/25/2017	K-40	9.80 ± 0.50	9.19 ± 0.57	9.50 ± 0.38	Pass
SO-2453,2454	5/25/2017	Tl-208	0.09 ± 0.02	0.10 ± 0.03	0.09 ± 0.02	Pass
SO-2453,2454	5/25/2017	Pb-212	0.29 ± 0.03	0.30 ± 0.03	0.29 ± 0.02	Pass
SO-2453,2454	5/25/2017	Bi-214	0.24 ± 0.03	0.18 ± 0.04	0.21 ± 0.03	Pass
SO-2453,2454	5/25/2017	Ra-226	0.82 ± 0.22	0.62 ± 0.27	0.72 ± 0.17	Pass
SO-2453,2454	5/25/2017	Ac-228	0.32 ± 0.07	0.28 ± 0.08	0.30 ± 0.05	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SWT-2625,2626	5/30/2017	Gr. Beta	0.64 ± 0.53	1.08 ± 0.55	0.86 ± 0.38	Pass
AP-053117	5/31/2017	Gr. Beta	0.013 ± 0.003	0.011 ± 0.003	0.012 ± 0.002	Pass
G-2646,2647	6/1/2017	Be-7	1.02 ± 0.17	1.06 ± 0.26	1.04 ± 0.15	Pass
G-2646,2647	6/1/2017	K-40	7.51 ± 0.49	6.55 ± 0.51	7.03 ± 0.36	Pass
SL-2669,70	6/1/2017	Be-7	0.34 ± 0.06	0.30 ± 0.06	0.32 ± 0.04	Pass
SL-2669,70	6/1/2017	K-40	4.35 ± 0.14	4.39 ± 0.15	4.37 ± 0.10	Pass
F-2711,2712	6/2/2017	K-40	2.56 ± 0.32	2.77 ± 0.44	2.66 ± 0.27	Pass
AP-060617	6/6/2017	Gr. Beta	0.026 ± 0.005	0.027 ± 0.005	0.027 ± 0.004	Pass
SW-2849,50	6/8/2017	H-3	8,178 ± 273	8,563 ± 279	8,371 ± 195	Pass
AP-061217	6/12/2017	Gr. Beta	0.027 ± 0.005	0.027 ± 0.005	0.027 ± 0.004	Pass
BS-3446,3447	6/12/2017	K-40	8.30 ± 0.47	8.57 ± 0.47	8.44 ± 0.33	Pass
VE-2870,2871	6/13/2017	K-40	3.65 ± 0.25	3.90 ± 0.26	3.77 ± 0.18	Pass
AP-2914,5	6/15/2017	Be-7	0.269 ± 0.146	0.212 ± 0.123	0.240 ± 0.095	Pass
AP-3067,8	6/15/2017	Be-7	0.204 ± 0.113	0.328 ± 0.126	0.266 ± 0.085	Pass
AP-061917	6/19/2017	Gr. Beta	0.020 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
AP-3610,1	6/26/2017	Be-7	0.107 ± 0.015	0.116 ± 0.021	0.111 ± 0.013	Pass
AP-062617	6/26/2017	Gr. Beta	0.017 ± 0.004	0.021 ± 0.004	0.019 ± 0.003	Pass
AP-3673,3674	7/3/2017	Be-7	0.087 ± 0.008	0.078 ± 0.008	0.083 ± 0.006	Pass
AP-3287,3288	7/6/2017	Be-7	0.207 ± 0.112	0.244 ± 0.096	0.226 ± 0.074	Pass
WW-3308,3309	7/7/2017	H-3	549 ± 108	501 ± 107	525 ± 76	Pass
VE-3362,3363	7/12/2017	K-40	2.32 ± 0.17	2.40 ± 0.16	2.36 ± 0.12	Pass
VE-3589,3590	7/18/2017	K-40	5.25 ± 0.33	4.64 ± 0.33	4.94 ± 0.23	Pass
SG-3631,3632	7/18/2017	Pb-214	3.03 ± 0.11	2.97 ± 0.11	3.00 ± 0.08	Pass
SG-3631,3632	7/18/2017	Ac-228	2.47 ± 0.22	2.56 ± 0.23	2.52 ± 0.16	Pass
WW-3846,3847	7/25/2017	H-3	505 ± 101	446 ± 98	475 ± 70	Pass
F-4509,4510	7/26/2017	K-40	0.85 ± 0.25	1.00 ± 0.25	0.93 ± 0.18	Pass
F-4509,4510	7/26/2017	Gr. Beta	1.19 ± 0.03	1.18 ± 0.03	1.18 ± 0.02	Pass
G-3804,3805	7/27/2017	Be-7	3.72 ± 0.39	3.47 ± 0.40	3.59 ± 0.28	Pass
G-3804,3805	7/27/2017	K-40	4.21 ± 0.52	4.46 ± 0.52	4.34 ± 0.33	Pass
SL-3888,3889	8/1/2017	Be-7	0.77 ± 0.04	0.73 ± 0.07	0.75 ± 0.04	Pass
SL-3888,3889	8/1/2017	K-40	0.94 ± 0.04	0.87 ± 0.08	0.90 ± 0.23	Pass
WW-4158,4159	8/8/2017	H-3	321 ± 90	270 ± 88	295 ± 63	Pass
VE-4179,4180	8/14/2017	K-40	1.84 ± 0.18	1.90 ± 0.21	1.87 ± 0.14	Pass
AP-4289,4290	8/17/2017	Be-7	0.212 ± 0.095	0.162 ± 0.080	0.187 ± 0.062	Pass
F-4333,4334	8/18/2017	K-40	3.22 ± 0.41	3.62 ± 0.42	3.42 ± 0.29	Pass
CF-4310,4311	8/21/2017	K-40	10.94 ± 0.74	11.48 ± 0.50	11.21 ± 0.45	Pass
DW-80161,80162	8/22/2017	Ra-226	1.22 ± 0.15	1.19 ± 0.17	1.21 ± 0.11	Pass
DW-80161,80162	8/22/2017	Ra-228	1.99 ± 0.63	0.70 ± 0.49	1.35 ± 0.40	Pass
VE-4398,4399	8/28/2017	Be-7	0.13 ± 0.07	0.13 ± 0.08	0.13 ± 0.05	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
VE-4398,4399	8/28/2017	K-40	3.32 ± 0.22	3.48 ± 0.25	3.40 ± 0.17	Pass
SW-4463,4464	8/29/2017	H-3	495 ± 106	491 ± 106	493 ± 75	Pass
LW-4486,4487	8/31/2017	Gr. Beta	0.425 ± 0.471	1.358 ± 0.571	0.892 ± 0.370	Pass
VE-4561,4562	9/6/2017	Be-7	5.89 ± 0.29	5.76 ± 0.25	5.83 ± 0.19	Pass
VE-4561,4562	9/6/2017	K-40	3.73 ± 0.34	3.77 ± 0.29	3.75 ± 0.22	Pass
BO-5122,5123	9/8/2017	K-40	4.50 ± 0.36	4.50 ± 0.36	4.50 ± 0.25	Pass
VE-4692,4693	9/12/2017	K-40	5.16 ± 0.13	5.31 ± 0.36	5.24 ± 0.19	Pass
SS-4650,4651	9/12/2017	K-40	10.55 ± 0.51	10.41 ± 0.54	10.48 ± 0.37	Pass
MI-4671,4672	9/13/2017	K-40	1,347 ± 115	1,283 ± 118	1,315 ± 82	Pass
MI-4671,4672	9/13/2017	Sr-90	0.7 ± 0.3	0.5 ± 0.3	0.6 ± 0.2	Pass
VE-4973,4974	9/17/2017	K-40	1.11 ± 0.15	1.17 ± 0.13	1.14 ± 0.10	Pass
F-4928,4929	9/19/2017	K-40	1.84 ± 0.31	1.68 ± 0.34	1.76 ± 0.23	Pass
S-4865,4866	9/20/2017	K-40	21.07 ± 2.39	19.09 ± 2.51	20.08 ± 1.73	Pass
VE-4907,4908	9/20/2017	K-40	3.83 ± 0.44	4.28 ± 0.31	4.05 ± 0.27	Pass
VE-4844,4845	9/21/2017	K-40	1.81 ± 0.22	1.88 ± 0.21	1.84 ± 0.15	Pass
AP-5572,5573	9/27/2017	Be-7	0.082 ± 0.015	0.075 ± 0.014	0.078 ± 0.010	Pass
LW-5145,5146	9/28/2017	Gr. Beta	0.84 ± 0.49	1.47 ± 0.57	1.16 ± 0.38	Pass
AP-092917	9/29/2017	Gr. Beta	0.038 ± 0.004	0.031 ± 0.004	0.035 ± 0.003	Pass
WW-5080,5081	10/2/2017	H-3	208 ± 79	223 ± 80	215 ± 56	Pass
AP-100217	10/2/2017	Gr. Beta	0.025 ± 0.005	0.028 ± 0.005	0.026 ± 0.003	Pass
AP-100317	10/3/2017	Gr. Beta	0.037 ± 0.004	0.033 ± 0.004	0.035 ± 0.003	Pass
S-5165,5166	10/4/2017	K-40	15.93 ± 2.30	20.34 ± 3.15	18.14 ± 1.95	Pass
VE-5228,5229	10/5/2017	K-40	3.25 ± 0.25	2.82 ± 0.24	3.04 ± 0.17	Pass
AP-100917	10/9/2017	Gr. Beta	0.021 ± 0.004	0.025 ± 0.004	0.023 ± 0.003	Pass
VE-5293,5294	10/10/2017	K-40	3.89 ± 0.30	4.08 ± 0.34	3.99 ± 0.22	Pass
DW-80184,80185	10/11/2017	Gr. Alpha	2.17 ± 0.81	2.50 ± 0.81	2.34 ± 0.57	Pass
DW-80184,80185	10/11/2017	Gr. Beta	9.45 ± 0.79	10.20 ± 0.83	9.83 ± 0.57	Pass
S-5421,5422	10/12/2017	K-40	8.82 ± 1.94	7.97 ± 0.72	8.40 ± 1.03	Pass
AP-101617	10/16/2017	Gr. Beta	0.025 ± 0.005	0.022 ± 0.004	0.024 ± 0.003	Pass
F-5658,5659	10/19/2017	K-40	2.44 ± 0.41	2.57 ± 0.39	2.51 ± 0.28	Pass
SO-5704,5705	10/25/2017	Cs-137	0.05 ± 0.02	0.04 ± 0.02	0.04 ± 0.01	Pass
SO-5704,5705	10/25/2017	K-40	10.08 ± 0.51	9.57 ± 0.56	9.83 ± 0.38	Pass
SO-5704,5705	10/25/2017	Tl-208	0.10 ± 0.02	0.09 ± 0.02	0.10 ± 0.01	Pass
SO-5704,5705	10/25/2017	Bi-214	0.34 ± 0.04	0.27 ± 0.04	0.30 ± 0.03	Pass
SO-5704,5705	10/25/2017	Pb-212	0.28 ± 0.03	0.27 ± 0.03	0.27 ± 0.02	Pass
SO-5704,5705	10/25/2017	Ra-226	1.15 ± 0.52	0.59 ± 0.22	0.87 ± 0.28	Pass
SO-5704,5705	10/25/2017	Ac-228	0.33 ± 0.05	0.31 ± 0.07	0.32 ± 0.04	Pass
SO-5704,5705	10/25/2017	Gr. Beta	18.34 ± 1.80	16.50 ± 1.03	17.42 ± 1.04	Pass
AP-5732,5733	10/26/2017	Be-7	0.139 ± 0.064	0.175 ± 0.075	0.157 ± 0.049	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SW-5753,5754	10/31/2017	H-3	220 ± 83	279 ± 86	249 ± 60	Pass
SWU-5816,5817	10/31/2017	Gr. Beta	1.51 ± 1.00	2.02 ± 1.02	1.76 ± 0.71	Pass
AP-103117	10/31/2017	Gr. Beta	0.015 ± 0.004	0.014 ± 0.004	0.015 ± 0.003	Pass
SO-5923,5924	11/1/2017	Cs-137	0.30 ± 0.04	0.31 ± 0.04	0.31 ± 0.03	Pass
SO-5923,5924	11/1/2017	K-40	10.52 ± 0.61	10.56 ± 0.67	10.54 ± 0.45	Pass
AP-5858,5859	11/2/2017	Be-7	0.145 ± 0.075	0.146 ± 0.084	0.145 ± 0.056	Pass
AP-110717	11/7/2017	Be-7	0.026 ± 0.004	0.030 ± 0.004	0.028 ± 0.003	Pass
WW-6032,6033	11/7/2017	H-3	204 ± 86	298 ± 80	251 ± 59	Pass
WW-6074,6075	11/8/2017	H-3	72,247 ± 786	73,062 ± 791	72,655 ± 558	Pass
BS-6053,6054	11/13/2017	K-40	7.99 ± 0.62	9.20 ± 0.68	8.60 ± 0.46	Pass
BS-6053,6054	11/13/2017	Cs-137	0.07 ± 0.03	0.08 ± 0.03	0.07 ± 0.02	Pass
DW-80211,80212	11/14/2017	Gr. Alpha	2.30 ± 0.80	3.60 ± 1.00	2.95 ± 0.64	Pass
DW-80211,80212	11/14/2017	Gr. Beta	9.32 ± 0.81	8.99 ± 0.81	9.16 ± 0.57	Pass
DW-80214,80215	11/14/2017	Ra-226	1.36 ± 0.22	1.35 ± 0.15	1.355 ± 0.13	Pass
DW-80214,80215	11/14/2017	Ra-228	1.41 ± 0.51	0.90 ± 0.45	1.16 ± 0.34	Pass
WW-6152,6153	11/15/2017	H-3	416 ± 94	328 ± 90	372 ± 65	Pass
SWU-6219,6220	11/28/2017	Gr. Beta	1.04 ± 0.54	1.75 ± 0.58	1.39 ± 0.39	Pass
SS-6242,6243	11/29/2017	K-40	24.17 ± 1.05	22.31 ± 1.03	23.24 ± 0.74	Pass
SS-6242,6243	11/29/2017	Cs-137	0.11 ± 0.03	0.08 ± 0.03	0.10 ± 0.02	Pass
SG-6938,6939	11/28/2017	Pb-214	15.28 ± 0.34	14.96 ± 0.43	15.12 ± 0.27	Pass
SG-6938,6939	11/28/2017	Ac-228	18.99 ± 0.59	19.92 ± 0.79	19.46 ± 0.49	Pass
AP-112817	11/28/2017	Gr. Beta	0.026 ± 0.004	0.030 ± 0.004	0.028 ± 0.003	Pass
SQ-6286,6287	12/1/2017	Gr. Alpha	70.6 ± 6.2	60.9 ± 6.0	65.8 ± 4.3	Pass
SQ-6286,6287	12/1/2017	Gr. Beta	48.9 ± 2.7	53.7 ± 2.8	51.3 ± 1.9	Pass
SQ-6286,6287	12/1/2017	Ra-226	11.3 ± 0.4	10.7 ± 0.5	11.0 ± 0.3	Pass
SQ-6286,6287	12/1/2017	Ra-228	13.5 ± 0.9	13.2 ± 1.0	13.4 ± 0.7	Pass
SG-6286,6287	12/1/2017	K-40	5.10 ± 1.82	6.65 ± 1.53	5.88 ± 1.19	Pass
AP-120417	12/4/2017	Gr. Beta	0.037 ± 0.006	0.035 ± 0.005	0.036 ± 0.004	Pass
WW-6548,6549	12/19/2017	H-3	8,428 ± 280	8,604 ± 282	8,516 ± 199	Pass
AP-122717	12/27/2017	Gr. Beta	0.047 ± 0.004	0.043 ± 0.004	0.045 ± 0.003	Pass
XAP-6762,6763	12/31/2017	Co-60	2.43 ± 1.30	2.24 ± 0.82	2.34 ± 0.77	Pass
XAP-6762,6763	12/31/2017	Cs-137	4.21 ± 1.11	4.05 ± 0.96	4.14 ± 0.73	Pass

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

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter or pCi/m3), food products, vegetation, soil and sediment (pCi/g).

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

		Concentration [a]				
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MASO-903	2/1/2017	Am-241	60.9 ± 6.9	67.0	46.9 - 87.1	Pass
MASO-903	2/1/2017	Cs-134	1360 ± 14	1550	1085 - 2015	Pass
MASO-903	2/1/2017	Cs-137	678 ± 13	611	428 - 794	Pass
MASO-903	2/1/2017	Co-57	1.63 ± 1.69	0.00	NA [c]	Pass
MASO-903	2/1/2017	Co-60	909 ± 12	891	624 - 1158	Pass
MASO-903	2/1/2017	Mn-54	1052 ± 17	967	677 - 1257	Pass
MASO-903	2/1/2017	K-40	657 ± 68	607	425 - 789	Pass
MASO-903	2/1/2017	Zn-65	-0.52 ± 7.40	0.00	NA [c]	Pass
MASO-903	2/1/2017	Ni-63	3.25 ± 7.17	0.00	NA [c]	Pass
MASO-903	2/1/2017	Pu-238	0.46 ± 0.69	0.41	NA [e]	Pass
MASO-903	2/1/2017	Pu-239/240	56.8 ± 5.9	59.8	41.9 - 77.7	Pass
MASO-903	2/1/2017	Sr-90	501 ± 17	624	437 - 811	Pass
MASO-903	2/1/2017	Tc-99	748 ± 16	656	459 - 853	Pass
MAW-849	2/1/2017	I-129	-0.05 ± 0.12	0.00	NA [c]	Pass
MAVE-905	2/1/2017	Cs-134	6.61 ± 0.16	6.95	4.87 - 9.04	Pass
MAVE-905	2/1/2017	Cs-137	4.97 ± 0.18	4.60	3.22 - 5.98	Pass
MAVE-905	2/1/2017	Co-57	-0.01 ± 0.03	0.00	NA [c]	Pass
MAVE-905	2/1/2017	Co-60	9.51 ± 0.17	8.75	6.13 - 11.38	Pass
MAVE-905	2/1/2017	Mn-54	3.67 ± 0.17	3.28	2.30 - 4.26	Pass
MAVE-905	2/1/2017	Zn-65	6.12 ± 0.44	5.39	3.77 - 7.01	Pass
MAW-847	2/1/2017	Am-241	0.679 ± 0.079	0.846	0.592 - 1.100	Pass
MAW-847	2/1/2017	Cs-134	0.03 ± 0.10	0.00	NA [c]	Pass
MAW-847	2/1/2017	Cs-137	12.7 ± 0.4	11.1	7.8 - 14.4	Pass
MAW-847 [d]	2/1/2017	Co-57	2.7 ± 0.3	28.5	20.0 - 37.1	Fail
MAW-847	2/1/2017	Co-60	13.5 ± 0.3	12.3	8.6 - 16.0	Pass
MAW-847	2/1/2017	Mn-54	16.5 ± 0.4	14.9	10.4 - 19.4	Pass
MAW-847	2/1/2017	K-40	287 ± 6	254	178 - 330	Pass
MAW-847	2/1/2017	Zn-65	-0.15 ± 0.23	0.00	NA [c]	Pass
MAW-847	2/1/2017	H-3	275 ± 10	249	174 - 324	Pass
MAW-847	2/1/2017	Fe-55	2.4 ± 13.6	1.7	NA [e]	Pass
MAW-847	2/1/2017	Ni-63	10.1 ± 2.8	12.2	8.5 - 15.9	Pass
MAW-847	2/1/2017	Pu-238	0.729 ± 0.097	0.703	0.492 - 0.914	Pass
MAW-847	2/1/2017	Pu-239/240	0.866 ± 0.102	0.934	0.654 - 1.214	Pass
MAW-847	2/1/2017	Ra-226	0.506 ± 0.053	0.504	0.353 - 0.655	Pass
MAW-847	2/1/2017	Sr-90	10.0 ± 0.8	10.1	7.1 - 13.1	Pass

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

			Concentration [a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-847	2/1/2017	Tc-99	4.77 ± 0.62	6.25	4.38 - 8.13	Pass
MAW-847	2/1/2017	U-234/233	1.19 ± 0.10	1.16	0.81 - 1.51	Pass
MAW-847	2/1/2017	U-238	1.15 ± 0.10	1.20	0.84 - 1.56	Pass
MAAP-907[f]	2/1/2017	Am-241	0.0540 ± 0.0140	0.0376	0.0263 - 0.0489	Fail
MAAP-907	2/1/2017	Cs-134	1.31 ± 0.06	1.42	0.99 - 1.85	Pass
MAAP-907	2/1/2017	Cs-137	0.797 ± 0.080	0.685	0.480 - 0.891	Pass
MAAP-907	2/1/2017	Co-57	1.86 ± 0.06	1.70	1.19 - 2.21	Pass
MAAP-907	2/1/2017	Co-60	0.86 ± 0.05	0.78	0.55 - 1.01	Pass
MAAP-907	2/1/2017	Mn-54	0.01 ± 0.03	0.00	NA [c]	Pass
MAAP-907	2/1/2017	Zn-65	1.62 ± 0.13	1.29	0.90 - 1.68	Pass
MAAP-907	2/1/2017	Pu-238	0.0530 ± 0.0190	0.0598	0.0419 - 0.0777	Pass
MAAP-907	2/1/2017	Pu-239/240	0.0490 ± 0.0160	0.0460	0.0322 - 0.0598	Pass
MAAP-907	2/1/2017	Sr-90	0.648 ± 0.120	0.651	0.456 - 0.846	Pass
MAAP-907	2/1/2017	U-234/233	0.086 ± 0.024	0.104	0.073 - 0.135	Pass
MAAP-907	2/1/2017	U-238	0.097 ± 0.024	0.107	0.075 - 0.139	Pass
MASO-4515	8/1/2017	Am-241	45.9 ± 7.0	58.8	41.2 - 76.4	Pass[g]
MASO-4515	8/1/2017	Cs-134	409 ± 7	448	314 - 582	Pass[g]
MASO-4515	8/1/2017	Cs-137	798 ± 12	722	505 - 939	Pass[g]
MASO-4515	8/1/2017	Co-57	1572 ± 10	1458	1021 - 1895	Pass[g]
MASO-4515	8/1/2017	Co-60	0.2 ± 1.4	0.00	NA [c]	Pass[g]
MASO-4515	8/1/2017	Mn-54	934 ± 13	825	578 - 1073	Pass[g]
MASO-4515	8/1/2017	K-40	704 ± 53	592	414 - 770	Pass[g]
MASO-4515	8/1/2017	Zn-65	667 ± 17	559	391 - 727	Pass[g]
MASO-4515	8/1/2017	Pu-238	101 ± 9	92	64 - 120	Pass[g]
MASO-4515	8/1/2017	Pu-239/240	74.8 ± 7.7	68.8	48.2 - 89.4	Pass[g]
MASO-4515	8/1/2017	Sr-90	252 ± 7	289	202 - 376	Pass[g]
MAW-4494	8/1/2017	I-129	2.31 ± 0.10	2.31	1.62 - 3.00	Pass
MAVE-4517	8/1/2017	Cs-134	2.40 ± 0.10	2.32	1.62 - 3.02	Pass
MAVE-4517	8/1/2017	Cs-137	-0.002 ± 0.048	0.000	NA [c]	Pass
MAVE-4517	8/1/2017	Co-57	3.3 ± 0.1	2.8	2.0 - 3.6	Pass
MAVE-4517	8/1/2017	Co-60	2.10 ± 0.10	2.07	1.45 - 2.69	Pass
MAVE-4517	8/1/2017	Mn-54	3.00 ± 0.20	2.62	1.83 - 3.41	Pass
MAVE-4517	8/1/2017	Zn-65	5.90 ± 0.30	5.37	3.76 - 6.98	Pass

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

		Concentration [a]				
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-4513	8/1/2017	Am-241	0.820 ± 0.220	0.892	0.624 - 1.160	Pass
MAW-4513	8/1/2017	Cs-134	10.3 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-4513	8/1/2017	Cs-137	17.2 ± 0.5	16.3	11.4 - 21.2	Pass
MAW-4513	8/1/2017	Co-57	12.7 ± 0.4	12.1	8.5 - 15.7	Pass
MAW-4513	8/1/2017	Co-60	10.6 ± 0.3	10.7	7.5 - 13.9	Pass
MAW-4513	8/1/2017	Mn-54	15.6 ± 0.4	14.9	10.4 - 19.4	Pass
MAW-4513	8/1/2017	Zn-65	15.9 ± 0.7	15.5	10.9 - 20.2	Pass
MAW-4513	8/1/2017	H-3	255 ± 9	258	181 - 335	Pass
MAW-4513	8/1/2017	Fe-55	21.6 ± 6.6	19.4	13.6 - 25.2	Pass
MAW-4513	8/1/2017	Ni-63	-0.1 ± 2.0	0.0	NA [c]	Pass
MAW-4513	8/1/2017	Pu-238	0.590 ± 0.080	0.603	0.422 - 0.784	Pass
MAW-4513	8/1/2017	Pu-239/240	0.740 ± 0.090	0.781	0.547 - 1.015	Pass
MAW-4513	8/1/2017	Ra-226	1.000 ± 0.100	0.858	0.601 - 1.115	Pass
MAW-4513	8/1/2017	Sr-90	7.80 ± 0.60	7.77	5.44 - 10.10	Pass
MAW-4513	8/1/2017	Tc-99	6.70 ± 0.40	6.73	4.71 - 8.75	Pass
MAW-4513	8/1/2017	U-2344/233	0.94 ± 0.06	1.01	0.71 - 1.31	Pass
MAW-4513	8/1/2017	U-238	0.97 ± 0.07	1.04	0.73 - 1.35	Pass
MAAP-4519[h]	8/1/2017	Am-241	0.0400 ± 0.0100	0.0612	0.0428 - 0.0796	Fail
MAAP-4519	8/1/2017	Cs-134	0.90 ± 0.10	1.00	0.70 - 1.30	Pass
MAAP-4519	8/1/2017	Cs-137	0.90 ± 0.10	0.82	0.57 - 1.07	Pass
MAAP-4519	8/1/2017	Co-57	0.01 ± 0.01	0.00	NA [c]	Pass
MAAP-4519	8/1/2017	Co-60	0.70 ± 0.10	0.68	0.48 - 0.88	Pass
MAAP-4519	8/1/2017	Mn-54	1.50 ± 0.10	1.30	0.91 - 1.69	Pass
MAAP-4519	8/1/2017	Zn-65	1.30 ± 0.10	1.08	0.76 - 1.40	Pass
MAAP-4519	8/1/2017	Pu-238	0.0300 ± 0.0100	0.0298	0.0209 - 0.0387	Pass
MAAP-4519	8/1/2017	Pu-239/240	0.0400 ± 0.0200	0.0468	0.0328 - 0.0608	Pass
MAAP-4519	8/1/2017	Sr-90	0.800 ± 0.100	0.801	0.561 - 1.041	Pass
MAAP-4519	8/1/2017	U-234/233	0.070 ± 0.010	0.084	0.059 - 0.109	Pass
MAAP-4519	8/1/2017	U-238	0.090 ± 0.010	0.087	0.061 - 0.113	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] Decimal point was misplaced while performing a unit conversion. The result is within control limits when the proper unit conversion is performed.

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

[f] Sample was reanalyzed in duplicate with acceptable results. Original plating was inferior to platings obtained during reanalysis. It is believed that isotopic tracer was not accurately quantified due to poor resolution of its peak.

[g] Data were erroneously submitted in units of Bq/g. All results pass MAPEP criteria when evaluated in units of Bq/Kg.

[h] Laboratory is not currently offering analysis for Am-241 in Air Particulate samples.

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

MRAD Study

Lab Code [b]	Date	Analysis	Concentration [a] Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERAP-1112	3/20/2017	Am-241	55.3 ± 2.8	76.4	47.1 - 103.0	Pass
ERAP-1112	3/20/2017	Co-60	1,230 ± 8	1030	797 - 1290	Pass
ERAP-1112	3/20/2017	Cs-134	1,110 ± 9	1100	700 - 1360	Pass
ERAP-1112	3/20/2017	Cs-137	1,810 ± 12	1,390	1,040 - 1,830	Pass
ERAP-1112 [d]	3/20/2017	Fe-55	590 ± 385	256	79.4 - 500	Fail
ERAP-1112	3/20/2017	Mn-54	< 5.14	< 50.0	0.00 - 50.0	Pass
ERAP-1112	3/20/2017	Pu-238	54.6 ± 2.8	54.3	37.2 - 71.4	Pass
ERAP-1112	3/20/2017	Pu-239/240	63.6 ± 3.0	62.0	44.9 - 81.0	Pass
ERAP-1112	3/20/2017	Sr-90	55.3 ± 8.3	52.4	25.6 - 78.5	Pass
ERAP-1112	3/20/2017	U-233/234	65.7 ± 3.0	73.1	45.3 - 110	Pass
ERAP-1112	3/20/2017	U-238	67.3 ± 3.0	72.4	46.8 - 100	Pass
ERAP-1112	3/20/2017	Zn-65	1,355 ± 16	984	705 - 1,360	Pass
ERAP-1114	3/20/2017	Gr. Alpha	106 ± 5	85.5	28.6 - 133	Pass
ERAP-1114 [e]	3/20/2017	Gr. Beta	67.6 ± 3.0	45.2	28.6 - 65.9	Fail
ERSO-1116	3/20/2017	Am-241	418 ± 98	448	262 - 582	Pass
ERSO-1116	3/20/2017	Ac-228	1,540 ± 260	1,240	795 - 1,720	Pass
ERSO-1116	3/20/2017	Bi-212	1,550 ± 90	1,240	330 - 1,820	Pass
ERSO-1116	3/20/2017	Bi-214	2,560 ± 20	2,750	1,660 - 3,960	Pass
ERSO-1116	3/20/2017	Co-60	4,620 ± 100	4,430	3,000 - 6,100	Pass
ERSO-1116	3/20/2017	Cs-134	8,340 ± 100	8,860	5,790 - 10,600	Pass
ERSO-1116	3/20/2017	Cs-137	8,420 ± 100	7,500	5,750 - 9,650	Pass
ERSO-1116	3/20/2017	K-40	13,600 ± 900	10,600	7,740 - 14,200	Pass
ERSO-1116	3/20/2017	Mn-54	< 68.1	< 1000	0.00 - 1,000	Pass
ERSO-1116	3/20/2017	Pb-212	1,060 ± 70	1,240	812 - 1,730	Pass
ERSO-1116	3/20/2017	Pb-214	2,620 ± 160	2,890	1,690 - 4,310	Pass
ERSO-1116	3/20/2017	Pu-238	424 ± 154	648	390 - 894	Pass
ERSO-1116 [f]	3/20/2017	Pu-239/240	252 ± 112	484	316 - 669	Fail
ERSO-1116 [g]	3/20/2017	Pu-239/240	436 ± 106	484	316 - 669	Pass
ERSO-1116	3/20/2017	Sr-90	7,930 ± 250	9,150	3,490 - 14,500	Pass
ERSO-1116	3/20/2017	Th-234	1,820 ± 200	1,940	614 - 3,650	Pass
ERSO-1116 [h]	3/20/2017	U-233/234	1,030 ± 130	1,950	1,190 - 2,500	Fail
ERSO-1116 [i]	3/20/2017	U-233/234	1,820 ± 200	1,950	1,190 - 2,500	Pass
ERSO-1116	3/20/2017	U-238	1,240 ± 140	1,940	1,200 - 2,460	Pass
ERSO-1116 [i]	3/20/2017	U-238	1,930 ± 200	1,940	1,200 - 2,460	Pass
ERSO-1116	3/20/2017	Zn-65	7,190 ± 240	6,090	4,850 - 8,090	Pass
ERW-1122	3/20/2017	Gr. Alpha	65.3 ± 2.4	89.5	31.8 - 139	Pass
ERW-1122	3/20/2017	Gr. Beta	54.8 ± 1.5	61.0	34.9 - 90.4	Pass
ERW-1124	3/20/2017	H-3	19,000 ± 410	19,400	13,000 - 27,700	Pass

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

MRAD Study

Lab Code [b]	Concentration [a]					
	Date	Analysis	Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERVE-1118	3/20/2017	Am-241	1,560 ± 140	1,860	1,140 - 2,470	Pass
ERVE-1118	3/20/2017	Cm-244	530 ± 80	734	360 - 1,140	Pass
ERVE-1118	3/20/2017	Co-60	1,400 ± 350	1,390	959 - 1,940	Pass
ERVE-1118	3/20/2017	Cs-134	1,650 ± 460	1,830	1,180 - 2,380	Pass
ERVE-1118	3/20/2017	Cs-137	2,580 ± 540	2,500	1,810 - 3,480	Pass
ERVE-1118	3/20/2017	K-40	32,100 ± 700	30,900	22,300 - 43,400	Pass
ERVE-1118	3/20/2017	Mn-54	< 27.3	< 300	0.00 - 300	Pass
ERVE-1118	3/20/2017	Zn-65	889 ± 64	853	615 - 1,200	Pass
ERVE-1118	3/20/2017	Pu-238	3,250 ± 210	3,250	1,940 - 4,450	Pass
ERVE-1118	3/20/2017	Pu-239/240	2,180 ± 170	2,150	1,320 - 2,960	Pass
ERVE-1118	3/20/2017	Sr-90	665 ± 135	726	414 - 963	Pass
ERVE-1118	3/20/2017	U-233/234	2,840 ± 200	3,090	2,030 - 3,970	Pass
ERVE-1118	3/20/2017	U-238	2,990 ± 200	3,060	2,040 - 3,890	Pass
ERW-1120	3/20/2017	Am-241	108 ± 7	140	94.3 - 188	Pass
ERW-1120	3/20/2017	Co-60	2,600 ± 198	2,540	2,210 - 2,970	Pass
ERW-1120	3/20/2017	Cs-134	2,380 ± 250	2,510	1,840 - 2880	Pass
ERW-1120	3/20/2017	Cs-137	1,470 ± 243	1,400	1,190 - 1,680	Pass
ERW-1120	3/20/2017	Mn-54	< 12.3	< 100	0.00 - 100	Pass
ERW-1120	3/20/2017	Pu-238	117 ± 4	128	94.7 - 159	Pass
ERW-1120	3/20/2017	Pu-239/240	74.8 ± 3.3	85.8	66.6 - 108	Pass
ERW-1120	3/20/2017	U-233/234	75.3 ± 3.2	90.3	67.8 - 116	Pass
ERW-1120	3/20/2017	U-238	76.4 ± 3.2	89.5	68.2 - 110	Pass
ERW-1120	3/20/2017	Zn-65	2,130 ± 378	1,960	1630 - 2,470	Pass
ERW-1120 [j]	3/20/2017	Fe-55	1,400 ± 403	984	587 - 1,340	Fail
ERW-1120 [k]	3/20/2017	Fe-55	1,081 ± 383	984	587 - 1,340	Pass
ERW-1120	3/20/2017	Sr-90	652 ± 12	714	465 - 944	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] Results are presented as the known values, expected laboratory precision (2 sigma, 1 determination) and control limits as provided by ERA.

[d] Fe-55 analysis result was outside the acceptable range. Recounting the sample disk for 1000 minutes resulted in 254 ± 364 with an LLD calculation of < 342. Insufficient sample was available after performing other required analyses on the sample to quantify the activity with an uncertainty less than the activity.

[e] ERA appears to have applied the standard material to the filter in a pattern closer to the center of the filter compared to previous studies and different from the filter efficiency utilized by the laboratory. This likely caused the efficency used the calculation to be understated and the result obtained by the laboratory to be overstated. For comparison the in-house spike for gross beta in AP (table A-3 SPAP-740 2/28/17) was acceptable with a ratio of 0.94 of lab result to known.

[f] Analysis result for Plutonium-239/240 was below the lower limit of acceptance.

[g] Samples were reanalyzed in duplicate with acceptable results for each. Original analysis had poor resolution possibly due to a poor elctroplating and is suspected in contributing to poor results.

[h] Analysis result for U-233/234 was below the lower limit of acceptance.

[i] The reanalysis result for U-233/234 was within the acceptance limits and U-238 reanalysis result was closer to the known value. Original analysis had poor resolution possibly due to a poor electroplating and is suspected in contributing to poor results.

[j] Fe-55 analysis result was outside acceptable range.

[k] Result of recounting was acceptable. Using available aliquot after dividing sample for other analyses leaves insufficient sample to reliably determine the activity present in sample.

APPENDIX B. DATA REPORTING CONVENTIONS

Data Reporting Conventions

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

2.0. Single Measurements

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

where: x = value of the measurement;
s = 2σ counting uncertainty (corresponding to the 95% confidence level).

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

3.0. Duplicate analyses

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

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

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

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

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

4.0. Computation of Averages and Standard Deviations

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

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

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

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

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

4.5 In rounding off, the following rules are followed:

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

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

APPENDIX C

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.

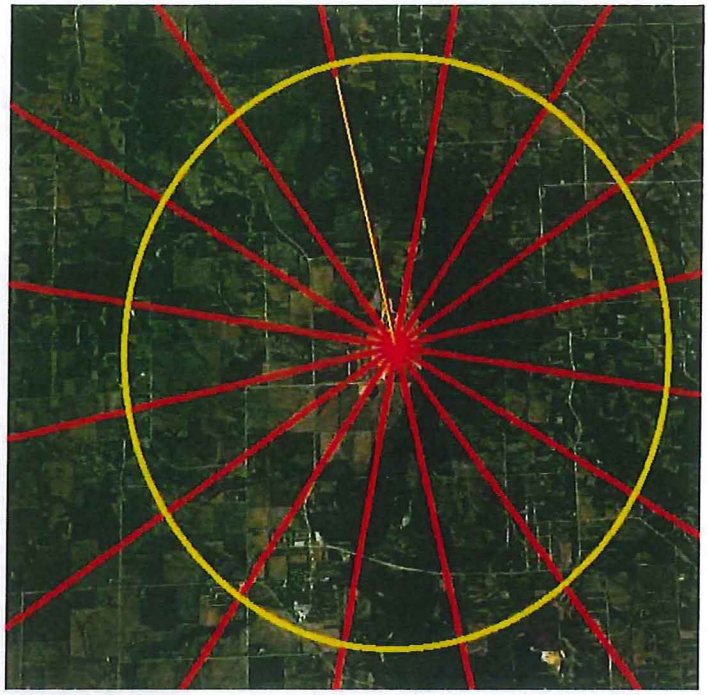
APPENDIX D

SUMMARY OF THE LAND USE CENSUS AND REMP-GWPP DATA

Appendix D

Summary of the 2017 Land Use Census and REMP-GWPP Data

The Duane Arnold Energy Center Land Use Census was completed during August-November 2017. 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 three mile range, additional surveys were performed out to a distance of five miles. The 16 meteorological sectors were identified using Google Earth and digital compass rose overlay for accuracy and precision.



The 2017 Land Use Census identified 121 gardens, which is 23 fewer gardens than in 2016 and 62 fewer gardens than in 2015. A large private garden was identified in the SSW sector and the farmer provided vegetation samples in 2017. This farm location is included as location, D-108, in ODAM, Table 5-1. Gardens were identified using Google Earth, field observation, and interviewing local residents. Five meteorological sectors had garden changes.

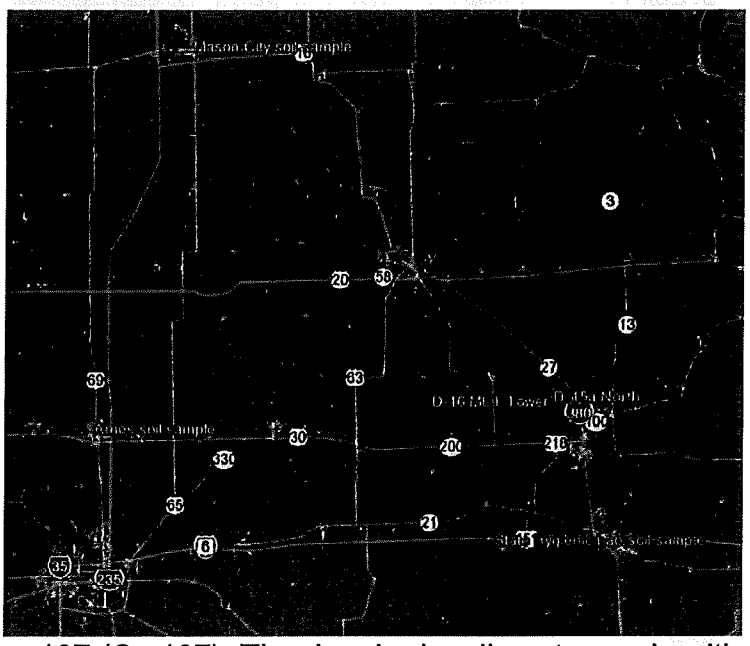
There are two new residences added to the 2017 Land Use Survey. A large housing development was observed in SE sector to the west of Feather Ridge Road and within 3-miles of the facility. There is the potential for 20 or more single family homes in 2018-2019.

In addition, the Pleasant Creek State Recreation Area has a large transient population of 50-300 people camping in RV's and tents from April to October. 2016 D/Q data analysis indicates an air sampler should be installed near this area in 2017-18. Following lengthy discussions and site investigations, an air sampler could not be installed in the NW sector on State property. Therefore, an alternate location in the NW sector on Palo Marsh Road was selected with a proposed air sampler install in 2018.

There are four nearest livestock changes attributed to field observation verification. Farms in the W, SW (2-farms), and SE sectors were observed to have goats. Solicitation letters were issued on November 11, 2017. If a farmer provides goat milk, the farm will be included as a sample location in the ODAM, Table 5-1.The Iowa Department of Agriculture and Land Stewardship provided a list of permitted commercial dairy farms located with Benton and Linn Counties. Large commercial dairies were included in the survey, but none were located within five miles of the DAEC facility. DAEC continues to collect milk samples from two permitted dairy farms located in WSW and SW sectors. In addition, a farm in the ENE sector, D-76 ODAM table 5-1, provided occasional goat milk samples.

The Cedar River was surveyed by State of Iowa Hygienic Laboratory boat crew on September 21, 2017 for water use downstream of the DAEC to Cedar Rapids. This survey identified no new usages of river water when compared to 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. The State of Iowa Hygienic Laboratory performed fish sampling on June 15, 2017 and August 18, 2017. Fish filets from Northern Pike, Smallmouth Bass, Largemouth Bass, and Channel Catfish were processed for off-site laboratory analysis and results indicate no impact to human consumable fish.

In addition to the Cedar River water use survey and fish sampling, the State of Iowa Hygienic Laboratory performed a terrestrial assessment on September 8, 2017. The assessment determined no salt damage to foliage. The State of Iowa Hygienic Laboratory performed Cedar River benthic insect sampling from September 9-October 9, 2017. No anomalies identified.



Soil sampling in August 2017 and river sediment sampling in November 2017 identified Cesium-137 (Cs-137). The river bed sediment sample with positive Cs-137 was collected at D-49, upstream of DAEC operations. The source of the Cs-137 was not from plant activities.

In cooperation with State of Iowa Public Health Department and State of Iowa Hygienic Laboratory, additional samples, on-site and off-site, were collected in December 2017. The source of Cs-137 in soil was determined to not be from DAEC operations. A review of scientific literature identified a Center of Disease Control (CDC) report documenting

fallout deposition from nuclear weapons testing at the Nevada Test Site and from other countries that performed atmospheric nuclear weapons testing in the 1950s-1960s as a probable source for global contamination: http://www.cdc.gov/nceh/radiation/.

Six precipitation collection stations on-site identified tritium in monthly samples. The probable source of tritium is atmospheric recapture from tritiated water vapor releases as documented in the DAEC Annual Radiological Material Release Report. The concentrations range from less than detectable, less than (<)144 pCi/L, to 4,435 pCi/L at sample location D-127.

Biweekly DAEC sewage plant effluent sampling and analysis did not identify any plant by-products. The results can be found in the Duane Arnold Energy Center 2017 Annual Radiological Material Release Report.

Vegetation samples from various locations within the owner controlled area, at the site boundary, and within the surrounding community including private gardens did not identify any DAEC plant by-products.

Periodic inspection and sampling from buried electrical vaults on occasion identified tritiated water seepage and pooling in the vault. The source of the tritium is from precipitation recapture and subsequent surface water runoff into the vault. No other isotopes other than tritium have been identified in an electrical vault.

Benton County Public Health Department and Linn County Public Health Department provided ground water well permit data. In 2017, two new drinking wells were installed within three miles of the facility, but these wells are not within the shallow aquifer that is contaminated by tritium and the new wells are up gradient of the facility. DAEC sampling changes in 2017 included additional drinking water sampling at DAEC liquid effluent release point in the Cedar River and at the City of Cedar Rapids municipal drinking water facility, ODAM, Table 5-1, D-53 and D-54.

As a result of the 2017 Land Use Census, adjustments were made to the Meteorological Information and Dose Assessment System (MIDAS-NU) projection software model for changes in receptor distances. No significant annual dose corrections were necessary. The 2017 annual radiation dose assessment can be found in Appendix E.

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:

- Radioactive reactor-by-product material was identified in multiple groundwater samples collected by the DAEC's Ground Water Protection Program (GWPP). The following was included to the DAEC Offsite Dose Assessment Manual (ODAM):

  "In February 2016, the GWPP routine sampling identified a contaminate plume in the shallow aquifer (less than 25 feet deep). Release standards are set forth in Section 6.0, Radiological Liquid Effluent Release O.6.1.2, Table 7.1-2. In accordance with GWPP Administrative Control Procedure (ACP) 1411.35 and Environmental Protection Agency (EPA) drinking water standards for tritium, 20,000 pCi/L, groundwater batch and continuous releases are expected less than (<) 20,000 pCi/L. Groundwater samples are analyzed on-site and validated by off-site secondary laboratory. Off-site laboratory results are published Annual Radiological Environmental Report."

- Tritium concentrations from on-site monitoring wells range from non-detectable at less than (<) 146 pCi/L to 203,138 pCi/L from monitoring well MW-08A (D-128A). No on-site or neighboring drinking water wells are installed in this shallow aquifer. Tritium not has been identified in neighboring drinking water wells or on-site drinking water (deep aquifers). Tritiated groundwater remains within the owner controlled area. Gross alpha values in several samples are believed to be influenced by naturally occurring radioactive materials in the environment, i.e. radon.

- The United States Nuclear Regulatory Commission, NRC, provides an informative resource for tritium. The information can be found at:

  https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/tritium-radiation-fs.html

New additions to REMP and GWPP sampling include:

1. As of January 1, 2018, 56 groundwater wells are operational to support GWPP efforts.

2. In February 2017, two extraction wells were placed in operation to pump groundwater from a shallow aquifer less than 25 feet below the surface. Monitoring well, D-166, was converted to an extraction well, D-81, on August 1, 2017. As of January 1, 2018, three extraction wells are operational.

3. As of January 1, 2018, 18 groundwater transducers are operational to support GWPP and groundwater modeling efforts.

4. A goat farmer in the NW was added to the REMP program in January 2017. Due to goat herd size, goat milk production is routinely not available.

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 2017 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 as per Environmental Sampling Procedure, ESP 4.5.

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 the central United States.

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 ODAM. 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 81 releases of radioactive material to liquid effluents (groundwater mitigation) in 2017. The maximum dose from tritiated groundwater release was 0.00879 mrem.

2.) The maximum dose to air at the site boundary from noble gases released was 0.00204 mrad from gamma radiation at 535 meters towards the South-Southwest.

3.) The maximum dose to air at the site boundary from noble gases released was 0.00227 mrad beta radiation at 4,022 meters towards the West-Northwest.

4.) The whole body dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.00360 mrem, at 805 meters towards the West.

5.) The skin dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.00370 mrem, at 805 meters towards the 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 805 meters towards the West, with an estimated dose equivalent of 0.00571 mrem.

7.) The hypothetical maximally exposed organ due to airborne carbon-14 was the bone of a child located 2470 meters to the East-Northeast of the site. The dose was 0.09770 mrem.

Conclusion

No measurable dose due to the operation of the DAEC or the DAEC ISFSI was detected by environmental TLDs in 2017. 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 2017

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	D*	SE	0.00879 mrem	3 mrem
Organ Dose	Child - Liver	D*	SE	0.00879 mrem	10 mrem
Noble Gas					
Gamma Air Dose		936	NW	0.00204 mrad	10 mrad
Beta Air Dose		1176	N	0.00023 mrad	20 mrad
Whole Body	All	2120	NW	0.00360 mrem	5 mrem
Skin	Adult	2120	NW	0.00370 mrem	15 mrem
Particulates & Iodines					
Organ Dose	Child – Lungs	805	W	0.00571 mrem	15 mrem
Carbon 14					
Organ Dose	Child – Bone	2470	N	0.09770 mrem	15 mrem

* There is no Appendix I limit for direct radiation. Compliance with 40 CFR 190 limits of 25 mrem whole body and 75 mrem thyroid is demonstrated in the Duane Arnold Energy Center 2017 Annual Radiological Environmental Operating Report, subsections "Ambient Radiation (TLDs)" and "ISFSI Facility Operations Monitoring".

D* Receptor location is aquatic pathway at Cedar River, See Offsite Dose Assessment Manual, ODAM, figure 3-2.

The following graphs are TLD trends based on distance to the facility over time.