AMEREN MISSOURI
CALLAWAY ENERGY CENTER
FULTON, MISSOURI

Docket Numbers 50-483 and 72-1045

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

to

THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Part I

January 1 to December 31, 2018

Prepared by

ENVIRONMENTAL, Inc.
Midwest Laboratory
and
Ameren Missouri
Callaway Energy Center

Submitted by

UNION ELECTRIC CO.
dba Ameren Missouri

Project No. 8036

PREFACE

This Annual Radiological Environmental Operating Report (AREOR) describes the Ameren Missouri Callaway Energy Center Radiological Environmental Monitoring Program (REMP), and the program results for the calendar year 2018. It is submitted in accordance with section 5.6.2 of the Callaway Energy Center Technical Specifications.

Staff members of the Environmental, Inc., Midwest Laboratory were responsible for the acquisition of data presented in this report. Environmental samples were collected by Ameren Missouri personnel or contractors to Ameren Missouri and shipped to Environmental, Inc. – Midwest Laboratory and Stanford Dosimetry, LLC, for analysis.

The report was prepared by Environmental, Inc., Midwest Laboratory and the Ameren Missouri Callaway Energy Center.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

PART II

LIST OF TABLES

In addition, the following tables are in the Appendices:

Appendix A

Appendix C

LIST OF FIGURES

1.0 INTRODUCTION

This report presents an analysis of the results of the Radiological Environmental Monitoring Program (REMP) conducted during 2018 for the Union Electric Company (dba Ameren Missouri) Callaway Energy Center.

The objectives of the REMP are to monitor potential critical pathways of radioactive effluent to man and determine the radiological impact on the environment caused by operation of the Callaway Energy Center. The Radiological Environmental Monitoring Program was initiated in April 1982.

The Callaway Energy Center consists of one 3565 MT pressurized water reactor, which achieved initial criticality on October 2, 1984. The plant is located on a plateau approximately ten miles southeast of the City of Fulton in Callaway County, Missouri and approximately eighty miles west of the St. Louis metropolitan area. The Missouri River flows by the site in an easterly direction approximately five miles south of the site at its closest point.

Tabulation of the individual analyses for the year 2018 is included in Part II of this report.

2.0 SUMMARY

The Radiological Environmental Monitoring Program, as required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Callaway Energy Center is described herein. Results for the year 2018 are summarized and discussed.

For the year, the Callaway Energy Center was operated in compliance with Offsite Dose Calculation Manual (ODCM) and Radiological Effluent Controls (REC) requirements. Results from the REMP indicate the Callaway Energy Center has had no significant radiological impact on the health and safety of the public or on the environment.

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

3.1 Program Design and Data Interpretation

The purpose of the Radiological Environmental Monitoring Program at the Callaway Energy Center is to assess the impact of the plant on its environment. For this purpose, samples are collected from waterborne, airborne, ingestion and terrestrial pathways and analyzed for radioactive content. Direct radiation levels are monitored by thermoluminescent dosimeters (TLDs).

Sources of environmental radiation can 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, planned or accidental; and
(4) Industrial and medical radioactive waste.

Effects due to operation of the Callaway Energy Center must be distinguished from those due to other sources in interpreting the data.

The indicator-control concept is a major interpretive aid; where feasible the design of the Callaway Energy Center program has both indicator and control stations. Most types of samples are collected 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.

The monitoring program includes analyses for iodine-131, a fission product, and tritium, which is produced by cosmic rays, atmospheric nuclear detonations, and also by nuclear power plants. Most samples are analyzed for gamma-emitting isotopes, with results for the following groups quantified: zirconium-95, cesium-137, and cerium-144. These three gamma-emitting isotopes are 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 days after reactor shutdown. On the other hand, ten 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 detonation.

Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occurring isotope, were chosen as analytical monitors and should not be considered radiological impact indicators.

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 pre-operational data. Results of the 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., a nuclear accident.

3.2 Program Description

The sampling and analysis schedules for the environmental radiological monitoring program at the Callaway Energy Center are summarized in Tables 5.1 and 5.2 and briefly reviewed below. Table 5.1 identifies sampling locations and specifies as to type (indicator or control) and its distance, and direction relative to the reactor site. The types of samples collected at each location, required analyses and the frequency of collections are presented in Table 5.2.

To monitor the air environment, airborne particulate and airborne iodine samples are collected by continuous pumping, at six locations. The airborne particulates are collected on glass fiber filters and the airborne iodine through activated charcoal cartridges. Both filters and cartridges are exchanged weekly. Airborne particulates are analyzed for gamma-emitting isotopes. Charcoal cartridges are analyzed for iodine-131.

The ingestion pathway is monitored by sampling of milk (if available), fish and green leafy vegetation.

Milk samples are collected monthly when animals are on pasture and monthly the rest of the year. There were no milk indicator stations identified by the Land Use Census for the subject year. The control station continued to be collected. Samples are analyzed for iodine-131 and gamma-emitting isotopes.

Monthly during the growing season, edible green leafy vegetation is collected from both indicator and control locations. Vegetation samples typically consist of mustard greens, turnip greens, cabbage, lettuce, collards, radish greens, swiss chard, broccoli and poke. Other edible broad leaf vegetation is collected if primary varieties are not available. The samples are analyzed for iodine-131 and other gamma-emitting isotopes.

Feed crops (soybeans, sorghum, corn) are collected from locations FC-1 through FC-4. FC-1, FC-2 and FC-3 are located on Ameren property traversed by the discharge pipeline. The samples are collected at harvest and analyzed for tritium and gamma emitting isotopes. FC-4 is a control location, beyond the influence of plant operations. Feed crops are grown for animal feed and not for human consumption. The soybean field for sample FC-1 is planted by the Missouri State Department of Conservation (MODOC) to provide feed to wildlife living in the Reform Wildlife Conservation Area. MODOC did not plant the field this year and there was no crop to sample.

The waterborne pathway is monitored by sampling surface water, groundwater and drinking water, and bottom and shoreline sediments. Water samples are analyzed for tritium and gamma-emitting isotopes, and sediments are analyzed for gamma-emitting isotopes.

The waterborne pathway is also monitored by upstream and downstream semiannual collections of fish. The five most abundant recreational or commercial fish species are collected. Samples are analyzed for gamma-emitting isotopes.

Monthly composite samples of surface water from the Missouri River are collected from one indicator location (S02) and from one control location (S01). The surface water samples are composites of daily collections by automatic river samplers.

Onsite surface water from nine ponds is analyzed for tritium and gamma-emitting isotopes. The collection frequencies are semiannually.

To monitor possible sources of ground water contamination due to plant operations, non-potable ground water samples were collected monthly or quarterly from well locations both onsite and along the discharge pipeline. The samples were analyzed for tritium and gamma-emitting isotopes.

3.2 Program Description (continued)

Potable well water samples are collected quarterly from the plant drinking water supply, neighboring property owners, and from the town of Portland, MO. The samples were analyzed for tritium and gamma-emitting isotopes.

River bottom sediment is collected semiannually at the plant's intake (A) and discharge (C). The samples are taken from water at least 2 meters deep to prevent influence of bank erosion. Shoreline sediments are collected semiannually in the same area as bottom sediment. These samples are collected within two feet of the edge of the water. The samples are analyzed for gamma-emitting isotopes.

The direct ambient gamma radiation pathway is also considered. This exposure is monitored by thermoluminescent dosimeters (TLDs) at forty-four locations in and around the Callaway site. The TLDs are placed in 16 sectors around the plant as specified in the ODCM-RECS. Five of the TLD stations have neutron monitoring capability and three locations are designated as controls. TLDs are exchanged and analyzed quarterly.

Soil is collected annually from seven indicator locations (F2, PR3, F6, PR7, W2, W3, and W4) and two control locations (M9, W1) to monitor the terrestrial environment. The samples are analyzed for gamma-emitting isotopes.

3.3 Program Execution

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

(1) Airborne Particulates and Iodine.

The Air sampler station A-11 found not operating 3/28/18, samples had lower volume (CR 201801634). Air station A8 was found not running 6/6/18 for about 16 hours (CR 201802861).

(2) Ground Water:

Water was frozen during the 1/16/18 collection event inside the old blowdown line. The well was dry for the 1/20/18 collection event at location U1MW-047 (CR 201801736).

(3) Broadleaf Vegetation:

Edible broadleaf vegetation, collected at the five area gardens was available for harvest May through October 2018 with the following exceptions: Samples were not available at locations V-9, V-12, V-16 in April due to the gardens not yet producing. Gardens at locations V-11 and V-16 were not producing in May. No sample was available at location V-9 for the 8/14/18 collection. No sample was available for location V-11 for the 7/9/18 or the 8/14/18 collection. No vegetables were available at location V-16 for the 8/14/18 or the 10/9/18 collections. Location V-18 (Ward residence) was dropped from the program in 2018 due to poor performance.

(4) Inedible crops:

Inedible crops were not collected at location FC-1 during the 2018 collection due to the field not being planted.

(5) Milk:

Milk sampling was discontinued at location M-9 after the 4/24/18 sampling event due to the lack of an indicator location. Vegetation sampling is sufficient to comply with the requirements of the ODCM.

3.3 Program Execution (continued)

(6) Direct Radiation

The fourth quarter TLD at location IDM-61 was found to have water intrusion. The results of the reading were evaluated by the vendor and found to be inconsistent with the previous 7 quarters (location was established in the first quarter of 2017). Therefore this TLD was treated as a missing sample (CR 201900133).

3.4 Laboratory Procedures

The iodine-131 analyses in milk were made using a sensitive radiochemical procedure involving separation of the iodine by ion-exchange, solvent extraction and subsequent beta counting.

Gamma-spectroscopic analyses were performed with HPGe detectors. Levels of iodine-131 in vegetation and concentrations of airborne iodine-131 in charcoal samples were also determined by gamma spectroscopy.

Tritium was measured by liquid scintillation.

Analytical Procedures used by Environmental, Inc. are on file at the laboratory 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, 2018). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained through Quality control samples and crosscheck program results are presented in Appendix A.

Environmental TLDs are processed by Stanford Dosimetry, LLC.

3.5 Program Modifications

Vegetation sample station location V18 was deleted 4/26/18 due to poor performance. There are still one more than the required number of sampling locations after the deletion of location V18.

Milk sampling at station M9 was deleted due to the lack of a corresponding indicator station. Broadleaf vegetation sampling fulfills the requirements of the ODCM.

3.6 Detection and Reporting Limits

Table 5.3 gives the minimum required detection limits for radiological environmental sample analysis. For each sample type, the table lists the detection level for each isotope. The lower limit of detection (LLD) used in this report is described in NRC Regulatory Guide 4.1 Rev. 1, "Program for Monitoring Radioactivity in the Environs of Nuclear Power Plants" and the NRC Radiological Assessment Branch Technical Position, Rev. 1, November 1979, "An Acceptable Radiological Environmental Monitoring Program".

3.7 Land Use Census

The Land Use Census is performed annually during the growing season. In 2018, the survey was conducted October 11, 2018 within a five mile canvassing radius of the Callaway Energy Center. The area around the plant was divided into 16 meteorological sectors. The locations of the nearest resident, nearest milk animal, and nearest garden of greater than 500 square feet producing broadleaf vegetation were identified.

The results of the census are presented in Table 5.4. The table includes radial direction and distance from the Callaway Energy Center for each location. The bearings listed in Table 5.4 were measured from the Callaway Plant to the sample location.

The following revisions are reflected in the 2018 report. In Sector A, James and Erica Wagoner are now the closest resident in this sector. In Sector F, Davis Wimmer is no longer planting a broadleaf garden, there is no replacement in this sector.

All residents included in the summary were verified by the Callaway County Assessor's GIS aerial photography.

During the survey a water well was identified at 9549 County Road 464, Portland, MO 65067. This well is owned by Amy Dillon. No irrigation uses of the Missouri River, within 10 miles downstream, were identified during the survey. The Missouri Department of Natural Resources confirmed that no new drinking water intakes have been located along the Missouri River within ten (10) river miles downstream from the plant.

4.0 RESULTS AND DISCUSSION

All collections and analyses were made as scheduled, except for the listing in Table 5.5.

Results are summarized in Table 5.6 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.

The tabulated results of all measurements are not included in this section, although references to these results will be made in the 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 Callaway Energy Center.

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

The Fukushima Daiichi nuclear accident occurred March 11, 2011. There were no reported accidents involving significant release to the environment at nuclear reactor facilities in 2018. The last reported atmospheric test was conducted on October 16, 1980 by the People's Republic of China. There were no reported atmospheric nuclear tests in 2018.

4.2 Program Findings

Airborne Particulates and Iodine

No gamma emitting isotopes were identified other than naturally occurring Be-7. There was no I-131 activity detected in any of the charcoal canister samples.

Air sampling for 2018 indicates no radiological effects of plant operation.

Direct Radiation (TLDs)

Forty-four gamma sensitive TLDs were placed in 16 sectors around the Callaway site. Measurements from forty-one indicator locations averaged 15.2 mrem/quarter and the three control locations averaged 14.4 mrem/quarter. Readings ranged from 10.9 to 17.4 mrem /quarter, with the highest from the control location CA-IDM-27, averaging 16.7 mrem/quarter. The differences are statistically insignificant. The TLD readings were consistent with the results for the years 2000 through 2017 as detailed in table 5.7.

Five neutron sensitive TLDs were placed in locations at the Site Boundary closest to the Independent Spent Fuel Storage Facility Installation (ISFSI) and at a control location approximately 14 miles from the site. There was no significant measureable neutron dose and there was no effect from the ISFSI in 2018.

Milk

There are no milk indicator stations. No iodine-131 was detected in samples from the control station during the duration of sampling. No gamma-emitting isotopes, with the exception of naturally occurring potassium-40, were detected in milk. Milk data for 2018 show no radiological effects of plant operation. Sampling was discontinued since there are not enough sampling locations to fulfill the milk sampling requirement. Leafy green (broadleaf) vegetation sampling was performed in lieu of milk sampling.

Broadleaf Vegetation

There was no I-131 activity detected in broadleaf vegetation samples. No gamma-emitting isotopes were detected in broadleaf vegetation samples except for naturally occurring potassium-40. Vegetation data for 2018 show no radiological effects of plant operation.

Non-Food Crops

Soybean samples were analyzed for tritium and gamma-emitting isotopes. Slight tritium activity was detected at three of the seven samples taken. No gamma-emitting isotopes, except for naturally occurring potassium-40, were detected in non-food crops.

Fish

Edible portions of fish were analyzed by gamma spectroscopy. No gamma-emitting isotopes, except for naturally occurring potassium-40, were detected in fish.

Soil

Cesium-137 activity was detected at thirteen of the eighteen sample locations at an average concentration of 284 pCi/kg dry. 337 pCi/kg dry was the average activity for the ten of fourteen positive indicator locations. Three of the four control samples were positive for Cesium-137 with an average activity of 109 pCi/kg dry. The cesium-137 activity is consistent with levels observed from 1999 through 2017; these levels are attributable to the deposition of fallout from previous decades.

Surface Water

Low level tritium was detected in two of the twelve samples collected at the downstream location S02 at an average concentration of 347 pCi/L. There was no tritium detected in the remaining ten samples from S02. No gamma-emitting isotopes were detected.

Surface Water, Ponds

Eighteen pond samples were analyzed for 2018. No tritium activity or gamma activity was detected.

Drinking Water Wells (potable water)

Sixty samples from fifteen different locations were analyzed for tritium and gamma-emitting isotopes. No tritium or gamma-emitting isotopes were detected.

Wells and Ponds (non-potable water)

Groundwater samples from deep wells F-05 and F-15 were analyzed for tritium and gamma-emitting isotopes. There were no tritium or gamma emitting isotopes detected. Wells MW-31, MW-34, MW-36, MW-39, MW-47, MW-58, and MW-59 were installed during the 2014 LSI (the 2014 LSI is described in detail in the Callaway Energy Center 2014 Annual Radioactive Effluents Release Report). These wells continue to monitor the natural attenuation of tritium which decreased significantly during 2015 and continued to decrease in 2016 and 2017 and decreased again in 2018. Tritium activity was detected in 19 of 27 samples from these wells. The highest concentration was measured in MW-58 which peaked at 911 pCi/L in January. By October, the concentration in

MW-58 had fallen to 516 pCi/L. The average concentration among positive results for these wells was 776 pCi/L. this decline has been steady since the December of 2016. The contamination is being remediated by monitored natural attenuation. There are no active leaks.

Wells GWS, 936, 937B, 937D, 939R, 940, 941 and IFSFI Sump are located in the Plant Protected Area, adjacent to the power block. Tritium activity in these wells is believed to be the result of washout from gaseous effluents. The low level tritium activity observed in wells MW-014 is likely due to residual low level contamination from moisture carryover during normal operation of air release valves (ARVs) in manholes 5 and 6B on the now-retired discharge pipeline. The pipeline was replaced in 2008 and there has been no new contamination of this area since then. The existing contamination is being remediated by monitored natural attenuation. There are no active leaks and the results are consistent with 2015 through 2018.

Sediments

Samples of shoreline and bottom sediments were collected in May and October 2018 at both an indicator and a control location and analyzed for gamma-emitting isotopes. Cesium-137 was detected in one of the two bottom sediment samples, in the May indicator sample, at a concentration of 44 pCi/kg dry weight, and was detected in one of the two shoreline sediments, in the May control sample, at concentration of 46 pCi/kg dry weight. These results are consistent with results from previous years. There were no other gamma-emitting isotopes detected excepting naturally occurring potassium-40 in any of the sediment samples.

5.0 TABLES

Table 5.1. Sampling Locations. (TLD's)

Location Code	Distance / Direction [1]	Description	Sample Types [2]
1a	10.8 mi. 310 ° NW	City of Fulton on Hwy Z, 0.65 mi. E of Bus. 54, W of Campus Apartments.	IDM
3	1.2 mi. 308 ° NW	0.1 mi. West of Hwy CC on Gravel Rd., 0.8 mi. South Hwy O, Pole No. 18559.	IDM
5	1.3 mi. 79 ° ENE	Primary Meteorological Tower.	IDM
6	2.0 mi. 274 ° W	Cty Rd. 428, 1.2 mi. West of Hwy CC	IDM
7	1.4 mi. 184 ° S	Cty Rd. 459, 2.6 mi. North of Hwy 94	IDM
9	3.8 mi. 183 ° S	NW Side of the Cty Rd. 459 and Hwy 94 Junction	IDM
10	3.9 mi. 159 ° SSE	Hwy 94, 1.8 mi. East of Cty Rd. 459	IDM
11a	4.7 mi. 139 ° SE	City of Portland	IDM
14	4.9 mi. 122 ° ESE	SE Side of Intersection D and 94	IDM
17	3.8 mi. 88 ° E	Cty Rd. 4053, 0.3 mi. E of Hwy 94	IDM
18a	3.7 mi. 67 ° ENE	East side of Hwy D, 0.5 mi. South of Hwy O	IDM
20	4.7 mi. 46 ° NE	City of Readsville	IDM
21	3.8 mi. 23 ° NNE	Cty Rd. 155, 1.9 mi. North of Hwy O	IDM
22a	0.9 mi. 10 ° NNE	0.9 mi south of HWY O, co-located with air station A8	IDM
23	6.6 mi. 15 ° NNE	City of Yucatan	IDM
26 [3]	11.7 mi. 82 ° E	Town of Americus	IDM
27 [3]	9.3 mi. 114 ° ESE	Town of Bluffton	IDM
30a	4.4 mi. 206 ° SSW	City of Steedman	IDM
31a	7.8 mi. 224 ° SW	City of Mokane, Hwy C and Cty Rd. 400, 0.9 mi. N. of Hwy 94	IDM
32	5.4 mi. 250 ° WSW	Hwy VV, 0.6 mi.West of Cty Rd. 447	IDM
32a	5.0 mi. 243 ° WSW	Cty Rd. 447	IDM
33	7.4 mi. 272 ° W	City of Hams Prairie, SE of Hwy C and AD Junction.	IDM
34	9.5 mi. 292 ° WNW	NE Side of Hwy C and Cty Rd. 408 Junction.	IDM
35	5.8 mi. 340 ° NNW	City of Toledo	IDM
36	4.9 mi. 7 ° N	Cty Rd. 155, 0.8 mi. South of Cty Rd. 132	IDM
37	0.5 mi. 195 ° SSW	Cty Rd. 459, 0.9 mi. South of Hwy CC	IDM
38	4.6 mi. 334 ° NNW	Cty Rd. 133, 1.5 mi. South of Hwy UU	IDM
39	5.4 mi. 312 ° NW	Cty Rd. 111	IDM
39a	5.0 mi. 308 ° NW	Cty Rd. 111	IDM
40	4.2 mi. 292 ° WNW	NE Side of Cty Rd. 112 and Hwy O	IDM
41	4.9 mi. 277 ° W	Hwy AD, 2.8 mi. East of Hwy C	IDM
42	4.4 mi. 231 ° SW	Cty Rd. 447, 2.6 mi. North of Cty Rd. 463	IDM
43	0.5 mi. 223 ° SW	Cty Rd. 459, 0.7 mi. South of Hwy CC	IDM
44	1.7 mi. 254 ° WSW	Hwy CC, 1.0 mi. South of Cty Rd. 459	IDM
45	1.0 mi. 285 ° WNW	Cty Rd. 428, 0.1 mi. West of Hwy CC	IDM
46	1.5 mi. 328 ° NNW	NE Side of Hwy CC and Cty Rd. 466 Intersection	IDM
47	1.0 mi. 10 ° N	Cty Rd. 448, 0.9 mi. South of Hwy O	IDM
48	0.4 mi. NE	Cty Rd. 448, 1.5 mi. South of Hwy O, Plant Security Sign Post.	IDM
49	1.6 mi. 94 ° E	Cty Rd. 448, Utility Pole No. 06959, Reform Wildlife Mgmt. Parking Area.	IDM
50	0.9 mi. 168 ° SSE	Cty Rd. 459, 3.3 mi. North of Hwy 94	IDM
51a	0.3 mi. 150° SE	Owner Control Fence, SE of the Water Treatment Plant.	IDM
52	0.4 mi. 111 ° ESE	Light Pole Near the East Plant Security Fence.	IDM
60 [3]	13.5 mi. 224 ° SW	Just past Tebbetts City sign.	IDM

Table 5.1. Sampling Locations. (TLD's, continued)

Location Code	Distance / Direction [1]	Description	Sample Types [2]
60N [3]	13.5 mi 224 ° SW	Co-located with location with IDM-60.	IDM
61	1.9 mi 334 ° NNW	Community of Reform, Corner of CC and O, co-located with location 61N	IDM
61N	1.9 mi 334 ° NNW	Community of Reform, Corner of CC and O, co-located with location 61.	IDM
62N	1.2 mi. 308 ° NW	Co-located with location 3	IDM
63N	0.9 mi. 10 ° NNE	Co-located with air station A8 and location 22a	IDM
64N	1.0 mi. 285 ° WNW	Co-located with location 45	IDM

Table 5.1. Sampling Locations (Airborne Radioiodine and Particulate samples, Surface Ponds, Potable Water)

A1	1.3 mi. 79 ° ENE	Primary Meteorological Tower.	APT, AIO
A7	9.5 mi. 312 ° NW	C. Bartley Farm, Fulton, MO.	APT, AIO
A8	0.9 mi. 10 ° NNE	Cty Rd. 448, 0.9 miles South of Hwy 0.	APT, AIO
A9	1.9 mi. 334 ° NNW	Community of Reform.	APT, AIO
A10	0.89 mi 276 ° W	EOF Parking lot.	APT, AIO
A11	0.71 mi 166 ° SSE	Sludge ponds lift pumps area	APT, AIO
3	2.9 mi. 168 °	Potable water, County Road 448 Ward Residence	DWA
4	2.6 mi. 158 °	Potable water, County Road 448 Miller Residence	DWA
5	2.5 mi. 153 °	Potable water, County Road 448 Brucker Brothers Farm	DWA
6	2.2 mi. 141 °	Potable water, County Road 448 Lindeman Residence	DWA
7	2.1 mi. 108 °	Potable water, County Road 448 Kriete Residence	DWA
8	3.4 mi. 193 °	Potable water, County Road 457 Brandt Residence	DWA
9	2.9 mi. 204 °	Potable water, County Road 457 Clardy Residence	DWA
10	2.7 mi. 208 °	Potable water, County Road 457 S. Dillon Residence	DWA
12	3.6 mi. 165 °	Potable water, County Road 464 J. Dillon Residnece	DWA
21	2.4 mi. 120 °	Potable water, County Road 469 Baumgarth Residence	DWA
22	2.4 mi. 140 °	Potable water, State Road 94 Plummer Residence	DWA
23	5.6 mi 142 °	Potable water, Curdt Residence	DWA
24	2.9 mi 203 °	Potable water, Farley Residence	DWA
V16	1.64 mi. 76 ° WSW	Wallendorf Farm, Steedman, MO	DWA
PW1	Callaway Cafeteria	Potable water, Unit 1 Construction well #3 open from 400'-1400'	DWA
Pond 01	0.6 mi. 264 °	Fishing Pond	SWA
Pond 02	0.7 mi. 232 °	Fishing Pond	SWA
Outfall 010	0.6 mi. 42 °	Stormwater Run-Off Pond	SWA
Outfall 011	1.0 mi. 60 °	Stormwater Run-Off Pond	SWA
Outfall 012	0.5 mi. 178 °	Stormwater Run-Off Pond	SWA
Outfall 013	0.5 mi. 189 °	Stormwater Run-Off Pond	SWA
Outfall 014	0.6 mi. 343 °	Stormwater Run-Off Pond	SWA
Outfall 015	0.7 mi. 4 °	Stormwater Run-Off Pond	SWA
Sludge Lagoon, # 4	0.8 mi. 153 °	On service Sewage Sludge Lagoon	SWA
S01 [3]	4.8 mi. 150 ° SSE	555 feet Upstream of Discharge North Bank	SWA
S02	4.9 mi. 138 ° SE	1.1 River Miles Downstream of Discharge North Bank	SWA

Table 5.1. Sampling Locations, Non-potable Groundwater Wells

Location Code	Distance / Direction [1]	Description	Sample Types [2]
U1MW-936	Plant Peninsula Area	Diesel Fuel Remediation Well, NW of SFSB	WWA
U1MW-937B	Plant Peninsula Area	Monitoring Well, West of the Turbine Bldg.	WWA
U1MW-937D	Plant Peninsula Area	Monitoring Well, North of Discharge Monitor Tanks.	WWA
U1MW-939R	Plant Peninsula Area	Monitoring Well, East of the Fuel Bldg.	WWA
U1MW-940	Plant Peninsula Area	Monitoring Well, West of the Radwaste Bldg.	WWA
U1MW-941	Plant Peninsula Area	Monitoring Well, West of the Radwaste Bldg.	WWA
U1MW-GWS	Plant Peninsula Area	Ground Water Sump, West of Reactor Bldg and SFSB	WWA
U1MW-ISFSI	ISFSI sump	ISFSI Sump	WWA
U1MW-001	0.3 mi. 334°	Just Outside OCA , Groundwater Monitoring Well	WWA
U1MW-002	0.4 mi. 206 °	Outside OCA , Groundwater Monitoring Well	WWA
U1MW-004	3.7 mi. 165 °	Dillon, Groundwater Monitoring Well	WWA
U1MW-005	3.8 mi. 160 °	Brownlee / Hudson, Groundwater Monitoring Well	WWA
U1MW-006	3.0 mi. 171 °	South of Ward Residence, Groundwater Monitoring Well	WWA
U1MW-010	3.1 mi. 173 °	Pipeline, Groundwater Monitoring Well	WWA
U1MW-012	3.0 mi. 172 °	S. of Ward Residence, Groundwater Monitoring Well	WWA
U1MW-013	0.8 mi. 159 °	Pipeline Corridor, south of sludge ponds	WWA
U1MW-014	3.7 mi. 171 °	Pipeline Corridor, near manhole 6B	WWA
U1MW-015	3.9 mi. 162 °	Pipeline Corridor, North of HWY 94.	WWA
U1MW-016	4.5 mi. 151 °	Pipeline Corridor, near heavy haul road at intake structure	WWA
U1MW-018	3.75 mi. 172 °	Pipeline Corridor, near manhole 6B	WWA
U1MW-019	3.71 mi.172 °	Pipeline Corridor, near manhole 5	WWA
U1MW-020	3.88 mi.164 °	Pipeline Corridor, near manhole 3B	WWA
U1MW-031	0.2 mi. ENE	~1m from manhole 86-2 & 1m from HDPE discharge	WWA
U1MW-034	0.2 mi. E	~130m from manhole 86-2, HDPE discharge line bedding.	WWA
U1MW-036	0.3 mi. ESE	~300m from MH 86-2, HDPE discharge @ cross conn. pipe	WWA
U1MW-039	0.6 mi. SSE	~1100m from manhole 86-2	WWA
U1MW-047	4.6 mi. SSE	Upstream side of HDPE Gate Valve Vault inside HDPE pipeline bedding	WWA
U1MW-058	0.3 mi. SE	~400m from manhole 86-2, discharge line bedding	WWA
U1MW-059	1.0 mi. SSE	~1700m from MH86-2, discharge line bedding	WWA
Inside Old BDL	1.4 mi. SSE	Sampled through hole in Techite blowdown line	WWA
U2 MW 2S	1.8 mi. 5 °	Groundwater Monitoring Well	WWA
U2 MW 5S	1.1 mi. 261 °	Groundwater Monitoring Well	WWA
U2 MW 8	0.4 mi. 12 °	Groundwater Monitoring Well	WWA
U2 MW 10	0.4 mi. 163 °	Groundwater Monitoring Well	WWA
U2 MW 16	2.9 mi. 203 °	Groundwater Monitoring Well	WWA
F05	0.9 mi. 169 °	Groundwater Monitoring Well	WWA
F15	0.4 mi. 29 °	Groundwater Monitoring Well	WWA

Table 5.1. Sampling Locations, Soil, Food Products, Milk, Fish, Bottom Sediments and Inedible Crops.

Location Code	Distance / Direction [1]	Description	Sample Types [2]
F2	1.0 mi. 235 ° SW	Callaway Plant Forest Ecology Plot F2.	SOL
F6	1.6 mi. 51 ° NE	Callaway Plant Forest Ecology Plot F6.	SOL
PR3	0.95 mi. 108 ° ESE	Callaway Plant Forest Ecology Plot PR3.	SOL
PR7	0.5 mi. 320 ° NNW	Callaway Plant Forest Ecology Plot PR7.	SOL
W1 [3]	0.52 mi. 150 ° SE	Callaway Plant Wetlands, High Ground.	SOL
W2	0.52 mi. 149 ° SSE	Callaway Plant Wetlands, Inlet Area.	SOL
W3	0.65 mi. 152 ° SSE	Callaway Plant Wetlands, Discharge Area.	SOL
W4	0.63 mi. 155 ° SSE	Callaway Plant Wetlands, SW Bank.	SOL
M9 [3]	13 mi. 228 ° SW	Ferguson Farm, Tebbetts, MO.	SOL
V9	1.9 mi. 294 ° WNW	Meehan Farm, Steedman, MO	FPL
V11	3.2 mi. 325 ° NW	Hickman Farm, Steedman, MO	FPL
V12 [3]	18.7 mi. 255 ° WSW	Kissock Farm, South of New Bloomfield, MO	FPL
V16	1.6 mi. 76 ° WSW	Wallendorf Farm, Steedman, MO	FPL
M9 [3]	13 mi. 228 ° SW	Ferguson Farm, Tebbetts, MO.	MLK
A [3,4]		Between 0.6 and 10.0 river miles upstream of the plant discharge.	AQF
A [3]		Upstream of the plant intake.	AQS
C [4]		Downstream,of the plant discharge, between the confluence of the Missouri River and Logan Creek(longitude -91.7365° and the Portland boat ramp)..	AQF
C		Vicinity of Portland – north bank	AQS
FC1	3.4 mi. S	Between discharge pipeline MH-8 and the Katy Trail	FC
FC2	3.8 mi. ESE	Between discharge pipeline MH-5 and MH-3B.	FC
FC3	4.1 mi. SSE	Between Hwy 94 and the barge loading dock access road.	FC
FC4 [3]	7.9 mi. SW	South Callaway High School, Unlikely to be influenced by plant operations.	FC

[1] Distances are measured from the midpoint of the two reactors as described in Final Safety Analysis Report (FSAR) Sec. 2.1.1.1.

[2] AIO = Air Iodine, APT = Air Particulate, AQF = Fish, AQS = Sediment, FPL = Leafy Green Vegetables, FC = Food Crops, IDM = TLD, MLK = Milk, SOL = Soil, SWA = Surface Water, DWA = Drinking Water, WWA = Ground Water.

[3] Control Location.

[4] The expanded collection areas provide sufficient habitat to collect the required number of species.

Table 5.2. Collection Frequencies and Required Analyses [1] (January 1 through December 31, 2016)

Sample Type	Media Code	Collection Frequency	Required Analyses
Direct radiation	IDM	Quarterly	Deep Dose Equivalent (DDE)
Airborne iodine	AIO	Weekly	^{131}I
Air particulate	APT	Weekly	PGE[4] each sample
Surface water (river)	SWA	Monthly composite	PGE and ^{3}H
Surface water (except UHS & Unit 2 ponds)	SWA	Semiannually	PGE and ^{3}H. If contaminated with gamma emitting nuclides of plant origin, analyze for HTD[5] nuclides.
Surface water (UHS and Unit 2 ponds)	SWA	Semiannually	PGE and ^{3}H
Groundwater (not potable)	WWA	Quarterly	PGE and ^{3}H. If contaminated with gamma emitting nuclides of plant origin, analyze for HTD nuclides.
Well water-potable	DWA	Monthly	PGE and ^{3}H. If contaminated with gamma emitting nuclides of plant origin, analyze for HTD nuclides.
Shoreline sediment	AQS	Semiannually	PGE
Bottom sediment [2]	AQS	Semiannually	PGE
Sludge pond sediment	SOL	Annually	PGE
Soil	SOL	Annually	PGE
Milk animal	MLK	Semimonthly when animals are on pasture, monthly other times	PGE and ^{131}I
Leafy green vegetables	FPL	Monthly when available [3]	PGE and ^{131}I
Inedible crops	FC	At time of harvest	PGE and ^{3}H
Fish	AQF	Semiannually	PGE on edible portion

[1] Samples required by ODCM unless specified otherwise.

[2] Required by NPDES permit.

[3] The growing season is defined as the months April 1- November 1, but will vary according to weather conditions.

[4] Principal Gamma Emitters (PGE) are defined as ^{54}Mn, ^{59}Fe, ^{58}Co, ^{60}Co, ^{65}Zn, $^{95}Zr/Nb$, ^{134}Cs, ^{137}Cs, $^{140}Ba/La$ and other gamma- emitting nuclides that may be identified during the gamma spectroscopy analysis.

[5] Hard to Detect (HTD) nuclides are defined as ^{89}Sr, ^{90}Sr, ^{55}Fe, ^{63}Ni, ^{237}Np, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, ^{241}Am, ^{242}Cm and $^{243/244}Cm$.

Table 5.3. Minimum Required Detection Capabilities for REMP Sample Analysis[1]

Analysis	Water (pCi/L)	Airborne (pCi/m^3)	Fish (pCi/kg wet)	Milk (pCi/L)	Food Products (pCi/kg wet)	Non-Food Products (pCi/kg wet)	Soil and Sediment (pCi/kg dry)
H-3	3000/2000[3]					3000	
Mn-54	15		130				
Fe-59	30		260				
Co-58/60	15		130				
Zn-65	30		260				
Zr-Nb-95 [2]	15						
I-131	1000/1[3]	0.07		1	60		
Cs-134	15	0.05	130	15	60	60	150
Cs-137	18	0.06	150	18	80	80	180
Ba-La-140 [2]	15			15			

[1] This list does not mean only these nuclides will be detected and reported. Other peaks which are measurable and identifiable will be reported.

[2] Total activity, parent plus daughter activity.

[3] LLDs for Surface and Drinking / Ground water are the same, with the exception of H-3 and I-131. The Drinking / Ground water LLDs for H-3 and I-131 are 2000 and 1 pCi/liter respectively.

Table 5.4 2018 Land Use Census Results

Closest Receptor in Miles

Sector	Residence	Garden [1, 2]	Milk [1]
N(A)	2.37	NI	NI
NNE(B)	2.16	NI	NI
NE(C)	2.26	NI	NI
ENE(D)	2.86	2.86	NI
E(E)	3.51	NI	NI
ESE(F)	2.11	NI	NI
SE(G)	3.93	NI	NI
SSE(H)	3.17	3.57	NI
S(J)	2.86	NI	NI
SSW(K)	2.38	2.78	NI
SW(L)	2.63	2.63	NI
WSW(M)	1.20	1.96	NI
W(N)	1.56	3.55	NI
WNW(P)	1.93	1.93	NI
NW(Q)	2.07	3.16	NI
NNW(R)	1.81	NI	NI

[1] NI = None Identified.
[2] Broadleaf Vegetation
* Declined to participate in the program.

Table 5.5. Missed collections and analyses, Callaway Energy Center

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
WWA	H-3	U1MW-047	01-20-18	Well dry.
WWA	H-3	Inside old BDL	01-16-18	Water frozen.
APT	Gamma	CA-A-011	03-28-18	Low volume. Pump found not running.
AIO	I-131	CA-A-011	03-28-18	Low volume. Pump found not running.
MLK	Gamma, I-131	M-9	05-08-18	Milk sampling discontinued. No indicator samples available.
FPL	Gamma	CA-FPL-V9	04-10-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V11	04-10-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V12	04-10-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V16	04-10-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V9	05-08-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V12	05-08-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V16	05-08-18	Garden not yet producing.
FPL	Gamma	CA-FPL-V11	07-09-18	No sample available.
FPL	Gamma	CA-FPL-V-9	08-14-18	No sample available.
FPL	Gamma	CA-FPL-V-11	08-14-18	No sample available.

Table 5.5. Missed collections and analyses, Callaway Energy Center (cont.)

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
FPL	Gamma	CA-FPL-V-16	08-14-18	No sample available.
FC	H-3, Gamma	CA-FC-1	09-17-18	No sample available.
FPL	Gamma	CA-FPL-V-16	10-09-18	No Sample available.
IDM	Gamma	CA-IDM-61	4th Qtr	Sample invalid due to water intrusion.

Table 5.6 Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type and Number of Analyses(a)		Req'd LLD(b)	Indicator Locations Mean, Fraction, Range (c)	Location with Highest Annual Mean		Control Locations Mean, Fraction, Range (c)	Number Non-Routine Results(e)
					Location (d)	Mean, Fraction, Range (c)		
Waterborne Pathway								
Surface Water (pCi/L)	H-3	24	3000	3147(2/12) (159-534)	CA-SWA-S02 4.9 mi SE	347 (4/12) (159-534)	ND	0
	GS	24	(b)	ND	-	-	ND	0
Surface Water, Ponds (pCi/L)	H-3	18	3000	ND			none	0
	GS	18	(b)	ND	-	-	ND	0
Potable Wells (pCi/L)	H-3	59	2000	ND	-	-	ND	0
	GS	59	(b)	ND	-	-	ND	0
Wells (non-potable) (pCi/L)	H-3	203	3000	302 (53/202) (157-911)	CA-U1MW-58	665 (4/4) (394-911)	None	0
	GS	140	(b)	ND	-	-	ND	0
Sediments (pCi/kg) dry	Cs-134	8	150	ND	-	-	ND	0
	Cs-137	8	180	44 (1/4)	CA-AQS-A	46 (1/4)	ND	0
Airborne Pathway								
Airborne Particulates (pCi/m^3)	GS	307	(b)	ND	-	-	None	0
Airborne Iodine (pCi/m^3)	I-131	307	0.07	ND	-	-	None	0
Soil								
Soil (pCi/kg) dry	Cs-134	18	150	ND	-	-	ND	0
	Cs-137	18	180	337 (10/14) (125-634)	F-006 1.6 mi. NE	612 (2/2) (589-634)	109(3/4) (45-143)	0

Table 5.6 Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type and Number of Analyses(a)	Req'd LLD(b)	Indicator Locations Mean, Fraction, Range (c)	Location with Highest Annual Mean		Control Locations Mean, Fraction, Range (c)	Number Non-Routine Results(e)
				Location (d)	Mean, Fraction, Range (c)		
Ingestion Pathway							
Food Products Leafy Green Vegetables (pCi/kg wet)	GS 41	(b)	ND	-	-	ND	0
Non- food Products Soybeans (pCi/kg) wet	H-3 (f) 7	3000	ND	-	-	ND	0
	GS 7	(b)	ND	-	-	ND	0
Fish Edible Flesh (pCi/kg) wet	GS 20	(b)	ND	-	-	ND	0
Milk (pCi/L)	I-131 20	1	none	-	-	ND	0
	GS 20	(b)	ND	-	-	ND	0
Direct Radiation							
(Quarterly TLDs) (mrem/Qtr)	Gamma 175		15.2(163/163) (10.8-17.3)	CA-IDM-27, 4.7 mi. SE	16.7 (4/4) (16.4-17.4)	14.4 (12/12) (10.9-17.4)	0
	Neutron 20		ND	-	-	ND	0

(a) GS = gamma spectroscopy.
(b) LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample. LLD's for gamma spectroscopy are in Table 5.3.
(c) Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F). ND= not detected.
(d) Locations are specified by station code (Table 5.2) and distance (miles) and direction relative to reactor site.
(e) Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.
(f) Units: pCi/L.

Table 5.7 Direct Radiation Dose (mrem/91 days) for the Period 2000-2017

Station Code	Mean	3σ	Mean + 3σ	Max
CA-IDM-1A	16.0	2.8	18.8	18.0
CA-IDM-3	16.9	2.9	19.9	20.0
CA-IDM-5	14.4	2.8	17.1	17.1
CA-IDM-6	16.5	3.3	19.8	19.0
CA-IDM-7	16.2	3.1	19.3	19.0
CA-IDM-9	15.0	2.5	17.6	17.0
CA-IDM-10	17.0	2.7	19.8	19.3
CA-IDM-11A	17.2	2.7	19.9	19.3
CA-IDM-14	15.9	2.8	18.7	18.7
CA-IDM-17	16.1	3.0	19.1	18.3
CA-IDM-18A	16.2	4.9	21.0	18.9
CA-IDM-20	16.6	2.9	19.5	19.3
CA-IDM-21	16.5	3.3	19.8	19.0
CA-IDM-22A	14.7	4.9	19.6	18.0
CA-IDM-23	16.6	2.8	19.3	19.0
CA-IDM-26(C)	11.5	2.3	13.7	13.1
CA-IDM-27(C)	17.2	2.8	20.1	20.0
CA-IDM-30A	15.7	2.8	18.6	18.2
CA-IDM-31A	17.0	2.7	19.7	19.0
CA-IDM-32	16.7	2.8	19.6	19.0
CA-IDM-32A	16.2	3.8	20.1	20.0
CA-IDM-33	16.0	2.7	18.8	18.0
CA-IDM-34	15.4	3.0	18.4	18.0
CA-IDM-35	14.9	2.6	17.4	17.3
CA-IDM-36	15.6	3.2	18.8	18.7
CA-IDM-37	15.8	2.8	18.6	18.0
CA-IDM-38	11.5	2.2	13.7	13.9
CA-IDM-39	15.9	3.0	18.9	19.0
CA-IDM-39A	16.5	2.9	19.5	19.0
CA-IDM-40	17.1	3.0	20.1	19.2
CA-IDM-41	15.8	3.1	18.9	19.0
CA-IDM-42	13.7	2.5	16.2	15.6
CA-IDM-43	16.0	2.9	18.9	18.7
CA-IDM-44	16.3	3.2	19.5	19.0
CA-IDM-45	14.9	3.2	18.1	20.0
CA-IDM-46	16.4	2.8	19.2	19.9
CA-IDM-47	15.7	2.7	18.4	18.0
CA-IDM-48	16.6	2.7	19.3	19.0
CA-IDM-49	15.6	2.6	18.2	18.0
CA-IDM-50	16.3	2.8	19.1	20.0
CA-IDM-51A	17.1	2.8	19.9	19.8
CA-IDM-52	16.8	2.5	19.3	19.1
CA-IDM-60(C)	16.2	2.4	18.6	18.0
CA-IDM-61[a]	15.0	1.4	16.5	15.7

[a] Only includes data from 2017 when this location was added to the program.

6.0 REFERENCES

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. 2001 - 2017. Environmental Radiological Monitoring Program for the Callaway Energy Center, Annual Report - Part II, Data Tabulations and Analyses, January - December, 2000 – 2017

_____ 2018. Quality Manual, Rev. 6, 20 July 2018.

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

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

_____ 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.

Hammer, Gregory R.,"Climate of Missouri", monograph available from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA). January, 2006.

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

Stanford Dosimetry, LLC, 2018. Environmental Dosimetry Company, Annual Quality Assurance Status Report, January-December, 2017.

Teledyne Brown Engineering Environmental Services, Midwest Laboratory. 1999 - 2000. Environmental Radiological Monitoring Program for the Callaway Plant, Annual Report - Part II, Data Tabulations and Analyses, January - December, 1998 - 1999.

U.S. Environmental Protection Agency, 2007. RadNet, formerly Environmental Radiation Ambient Monitoring System, Gross Beta in Air (MO) 1981 – 2006, Gross Beta in Drinking Water (MO) 1982– 2004.

Wilson, D. W., G. M. Ward and J. E. Johnson. 1969. 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

APPENDIX A

INTERLABORATORY 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, 2018 through December, 2018

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.

Table A-1 lists results that were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource 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. Acceptance criteria is detailed on Attachment A page A2. 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. The Precision Acceptance limit is ±25% of the mean for Sr-89,90, Gross Alpha and Gross Beta or the 2-sigma uncertainty overlaps the mean value. For all other analytes the precision acceptance limit is ±20% of the mean or the 2-sigma uncertainty overlaps the mean value.
Complete analytical data for duplicate analyses is available upon request.

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

Table A-7 lists results that were obtained through participation in the MRAD PT Study Proficiency Testing Progra administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

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

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

Analysis	Ratio of lab result to known value.
Gamma Emitters	0.8 to 1.2
Strontium-89, Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226, Radium-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-129, Iodine-131	0.8 to 1.2
Nickel-63, Technetium-99, Uranium-238	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

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-52	1/8/2018	Sr-89	61.6 ± 5.8	65.2	52.9 - 73.2	Pass
ERW-52	1/8/2018	Sr-90	39.7 ± 2.3	39.2	28.2 - 45.1	Pass
ERW-54	1/8/2018	Ba-133	89.7 ± 4.7	95.1	80.2 - 105	Pass
ERW-54	1/8/2018	Cs-134	62.1 ± 5.4	65.6	53.4 - 72.2	Pass
ERW-54	1/8/2018	Cs-137	111.2 ± 6.1	112	101 - 126	Pass
ERW-54	1/8/2018	Co-60	115.8 ± 4.7	114.0	103.0 - 128.0	Pass
ERW-54	1/8/2018	Zn-65	292.2 ± 14.0	277.0	249 - 324	Pass
ERW-52	1/8/2018	Gr. Alpha	70.1 ± 3.0	72.4	38.1 - 89.2	Pass
ERW-52	1/8/2018	Gr. Beta	47.4 ± 1.4	54.8	37.5 - 61.7	Pass
ERW-58	1/8/2018	I-131	25.3 ± 1.0	28.1	23.4 - 33.0	Pass
ERW-61	1/8/2018	Ra-226	12.4 ± 0.4	14.20	10.60 - 16.30	Pass
ERW-60	1/8/2018	Ra-228	4.9 ± 0.8	4.21	2.43 - 5.81	Pass
ERW-60	1/8/2018	Uranium	52.2 ± 0.9	58.6	47.8 - 64.5	Pass
ERW-62	1/8/2018	H-3	21,780 ± 437	21,200	18,600 - 23,300	Pass
ERW-2555	7/9/2018	Sr-89	62.8 ± 4.0	62.7	50.7 - 70.6	Pass
ERW-2555	7/9/2018	Sr-90	40.1 ± 1.3	40.1	29.5 - 46.1	Pass
ERW-2557	7/9/2018	Ba-133	23.1 ± 2.3	25.6	19.9 - 29	Pass
ERW-2557	7/9/2018	Cs-134	15.2 ± 1.7	15.7	11.4 - 18.2	Pass
ERW-2557	7/9/2018	Cs-137	22.3 ± 4.9	192	173 - 213	Fail[b]
ERW-2557	7/9/2018	Co-60	110.4 ± 3.7	119.0	107 - 133	Pass
ERW-2557	7/9/2018	Zn-65	189.5 ± 7.5	177.0	159 - 208	Pass
ERW-2559	7/9/2018	Gr. Alpha	13.5 ± 0.7	16.0	7.79 - 22.6	Pass
ERW-2559	7/9/2018	Gr. Beta	41.1 ± 0.9	49.0	33.2 - 56.1	Pass
ERW-2561	7/9/2018	I-131	24.9 ± 0.9	28.1	23.4 - 33.0	Pass
ERW-2563	7/9/2018	Ra-226	9.0 ± 0.3	9.08	6.81 - 10.6	Pass
ERW-2563	7/9/2018	Ra-228	3.2 ± 0.4	2.28	1.07 - 3.60	Pass
ERW-2563	7/9/2018	Uranium	38.2 ± 1.4	51.8	42.2 - 57.1	Fail[c]
ERW-2565	7/9/2018	H-3	21,039 ± 302	20,400	17,900 - 22,400	Pass
ERW-3832[b]	10/7/2016	Ba-133	57.0 ± 3.1	54.9	45 - 61	Pass
ERW-3832[b]	10/7/2016	Cs-134	79.2 ± 3.0	81.8	67 - 90	Pass
ERW-3832[b]	10/7/2016	Cs-137	222.4 ± 4.5	210	189 - 233	Pass
ERW-3832[b]	10/7/2016	Co-60	67.7 ± 3.5	64.5	58 - 73	Pass
ERW-3832[b]	10/7/2016	Zn-65	274.1 ± 3.0	245	220 - 287	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 Resource Associates (ERA).

[b] A transcription error caused the Cs-137 result submitted to be understated by a factor of 10.
The actual result obtained was slightly higher than the acceptance criteria for the study.
A "Quick Response" proficiency test was analyzed to help determine the cause of the high result. (See ERW-3832 above)
No definitive cause for the previous high Cs-137 result was determined.

[c] An investigation was conducted on the apparent cause of failure in the Uranium isotopic PT analysis. In order to get to the root cause of the failure a NIST U-natural 4321d-standard was purchased and a new U-232 diluted tracer was standardized. The analysis was rerun and the results were found to be within the acceptance criteria. It appears that the original U-232 tracer used in the analysis may have been compromised (concentrated) resulting in a very high negative bias.

TABLE A-2. Table has been intentionally omitted.

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	Ratio Lab/Known
SPW-1749	4/21/2016	Fe-55	1,576 ± 81	1,482	1,186 - 1,778	Pass	1.06
SPW-95	1/11/2018	H-3	16,457 ± 381	16,507	13,206 - 19,808	Pass	1.00
SPW-109	1/12/2018	Sr-90	18.9 ± 1.7	17.9	14.3 - 21.5	Pass	1.06
SPW-175	1/19/2018	H-3	16,261 ± 382	16,507	13,206 - 19,808	Pass	0.99
SPW-210	1/23/2018	H-3	16,461 ± 382	16,507	13,206 - 19,808	Pass	1.00
SPW-212	1/10/2018	Ra-226	12.9 ± 0.4	12.3	8.6 - 16.0	Pass	1.05
SPW-272	1/30/2018	H-3	16,607 ± 384	16,507	13,206 - 19,808	Pass	1.01
W-013118	4/29/2016	Cs-134	33.9 ± 7.4	36.2	29.0 - 43.4	Pass	0.94
W-013118	4/29/2016	Cs-137	80.0 ± 7.9	71.9	57.5 - 86.3	Pass	1.11
SPW-330	2/1/2018	Ni-63	168 ± 2	198	139 - 258	Pass	0.85
SPW-338	2/2/2018	H-3	16,512 ± 381	16,507	13,206 - 19,808	Pass	1.00
SPW-384	2/6/2018	H-3	16,429 ± 380	16,507	13,206 - 19,808	Pass	1.00
W-020618	4/29/2016	Cs-134	39.0 ± 12.0	36.2	29.0 - 43.4	Pass	1.08
W-020618	4/29/2016	Cs-137	81.0 ± 15.7	71.9	57.5 - 86.3	Pass	1.13
SPW-461	2/13/2018	H-3	16,799 ± 385	16,507	13,206 - 19,808	Pass	1.02
SPW-516	2/19/2018	H-3	16,323 ± 382	16,507	13,206 - 19,808	Pass	0.99
SPW-556	2/8/2018	Ra-226	12.2 ± 0.3	12.3	8.6 - 16.0	Pass	0.99
SPW-582	2/22/2018	H-3	16,200 ± 380	16,507	13,206 - 19,808	Pass	0.98
SPW-609	2/23/2018	H-3	16,467 ± 383	16,507	13,206 - 19,808	Pass	1.00
SPW-650	2/21/2018	Ra-226	11.8 ± 0.5	12.3	8.6 - 16.0	Pass	0.96
SPW-666	2/28/2018	Gr. Alpha	67.1 ± 2.8	72.4	36.2 - 108.6	Pass	0.93
SPW-666	2/28/2018	Gr. Beta	48.1 ± 1.4	54.8	43.8 - 65.8	Pass	0.88
W-022818	4/29/2016	Cs-134	32.7 ± 8.5	36.2	29.0 - 43.4	Pass	0.90
W-022818	4/29/2016	Cs-137	73.8 ± 9.3	71.9	57.5 - 86.3	Pass	1.03
SPW-748	3/6/2018	H-3	16,209 ± 381	16,507	13,206 - 19,808	Pass	0.98
SPW-787	3/8/2018	H-3	16,934 ± 388	16,507	13,206 - 19,808	Pass	1.03
W-030718	4/29/2016	Cs-134	33.4 ± 7.9	36.2	29.0 - 43.4	Pass	0.92
W-030718	4/29/2016	Cs-137	78.9 ± 9.6	71.9	57.5 - 86.3	Pass	1.10
SPW-885	3/15/2018	H-3	16,475 ± 384	16,507	13,206 - 19,808	Pass	1.00
SPW-931	3/20/2018	H-3	16,467 ± 384	16,507	13,206 - 19,808	Pass	1.00
SPW-957	3/12/2018	Ra-226	11.4 ± 0.4	12.3	8.6 - 16.0	Pass	0.93
SPW-969	3/23/2018	Ni-63	260 ± 12	329	230 - 428	Pass	0.79
W-031418	4/29/2016	Cs-134	36.9 ± 11.2	36.2	29.0 - 43.4	Pass	1.02
W-031418	4/29/2016	Cs-137	82.3 ± 15.5	71.9	57.5 - 86.3	Pass	1.14
SPW-985	3/27/2018	H-3	16,544 ± 386	16,507	13,206 - 19,808	Pass	1.00
SPW-1037	4/4/2018	H-3	16,298 ± 384	16,507	13,206 - 19,808	Pass	0.99
SPW-1149	4/12/2018	H-3	16,361 ± 383	16,507	13,206 - 19,808	Pass	0.99
SPW-1200	4/13/2018	U-238	44.2 ± 2.3	41.7	29.2 - 54.2	Pass	1.06
SPW-1426	4/20/2018	H-3	16,573 ± 390	16,507	13,206 - 19,808	Pass	1.00
SPW-1454	4/24/2018	H-3	16,495 ± 384	16,507	13,206 - 19,808	Pass	1.00
SPW-1493	4/26/2018	Ra-228	4.59 ± 1.10	4.21	2.95 - 5.47	Pass	1.09
SPW-1518	4/27/2018	H-3	16,483 ± 382	16,507	13,206 - 19,808	Pass	1.00
SPW-1522	4/27/2018	Tc-99	105 ± 2	108	75 - 140	Pass	0.98
W-050118	4/29/2016	Cs-134	35.2 ± 9.9	36.2	29.0 - 43.4	Pass	0.97
W-050118	4/29/2016	Cs-137	82.4 ± 7.7	71.9	57.5 - 86.3	Pass	1.15

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	Ratio Lab/Known
SPW-1573	5/2/2018	Gr. Alpha	25.2 ± 0.5	20.1	10.1 - 30.2	Pass	1.25
SPW-1573	5/2/2018	Gr. Beta	28.2 ± 0.3	27.5	22.0 - 33.0	Pass	1.03
SPW-1618	5/3/2018	H-3	14,834 ± 366	16,507	13,206 - 19,808	Pass	0.90
W-050318	4/29/2016	Cs-134	32.9 ± 7.6	36.2	29.0 - 43.4	Pass	0.91
W-050318	4/29/2016	Cs-137	83.1 ± 8.5	71.9	57.5 - 86.3	Pass	1.16
SPW-1644	5/4/2018	Sr-90	20.0 ± 1.3	17.9	14.3 - 21.5	Pass	1.12
W-050718	4/29/2018	Cs-134	42.4 ± 8.5	36.2	29.0 - 43.4	Pass	1.17
W-050718	4/29/2018	Cs-137	80.6 ± 13.6	71.9	57.5 - 86.3	Pass	1.12
SPW-1695	5/8/2018	H-3	16,450 ± 384	16,507	13,206 - 19,808	Pass	1.00
W-050818	4/29/2016	Cs-134	32.3 ± 6.9	36.2	29.0 - 43.4	Pass	0.89
W-050818	4/29/2016	Cs-137	73.0 ± 8.2	71.9	57.5 - 86.3	Pass	1.02
SPW-1780	5/11/2018	H-3	16,784 ± 388	16,507	13,206 - 19,808	Pass	1.02
W-051518	4/29/2016	Cs-134	33.0 ± 6.7	36.2	29.0 - 43.4	Pass	0.91
W-051518	4/29/2016	Cs-137	76.0 ± 7.4	71.9	57.5 - 86.3	Pass	1.06
W-051718	4/29/2016	Cs-134	35.1 ± 5.7	36.2	29.0 - 43.4	Pass	0.97
W-051718	4/29/2016	Cs-137	73.7 ± 6.7	71.9	57.5 - 86.3	Pass	1.03
SPW-1897	5/18/2018	H-3	16,650 ± 387	16,507	13,206 - 19,808	Pass	1.01
SPW-1899	5/18/2018	H-3	16,754 ± 365	16,507	13,206 - 19,808	Pass	1.01
W-052418	4/29/2016	Cs-134	33.9 ± 6.2	36.2	29.0 - 43.4	Pass	0.94
W-052418	4/29/2016	Cs-137	78.8 ± 7.4	71.9	57.5 - 86.3	Pass	1.10
SPW-1994	5/24/2018	H-3	16,488 ± 384	16,507	13,206 - 19,808	Pass	1.00
W-053118	4/29/2016	Cs-134	38.9 ± 9.5	36.2	29.0 - 43.4	Pass	1.07
W-053118	4/29/2016	Cs-137	74.0 ± 7.5	71.9	57.5 - 86.3	Pass	1.03
SPW-2042	5/31/2018	H-3	16,901 ± 390	16,507	13,206 - 19,808	Pass	1.02
W-060518	4/29/2016	Cs-134	33.0 ± 10.1	36.2	29.0 - 43.4	Pass	0.91
W-060518	4/29/2016	Cs-137	83.3 ± 8.7	71.9	57.5 - 86.3	Pass	1.16
SPW-2186	6/6/2018	H-3	16,551 ± 385	16,507	13,206 - 19,808	Pass	1.00
SPW-2914	6/19/2018	Ra-226	12.7 ± 0.4	12.3	8.6 - 16.0	Pass	1.03
SPW-2437	6/27/2018	Sr-90	18.0 ± 1.1	17.9	14.3 - 21.5	Pass	1.00
SPW-2447	6/29/2018	H-3	16,595 ± 387	16,507	13,206 - 19,808	Pass	1.01
W-070518	4/29/2016	Cs-134	38.9 ± 8.1	36.2	29.0 - 43.4	Pass	1.08
W-070518	4/29/2016	Cs-137	73.4 ± 9.4	71.9	57.5 - 86.3	Pass	1.02
SPW-2546	7/10/2018	H-3	15,949 ± 373	16,507	13,206 - 19,808	Pass	0.97
W-071218	4/29/2016	Cs-134	33.1 ± 7.7	36.2	29.0 - 43.4	Pass	0.91
W-071218	4/29/2016	Cs-137	74.5 ± 7.7	71.9	57.5 - 86.3	Pass	1.04
SPW-2706	7/16/2018	H-3	15,474.7 ± 366.6	16,507	13,206 - 19,808	Pass	0.94
SPW-2772	7/19/2018	H-3	15,994.0 ± 374.0	16,507	13,206 - 19,808	Pass	0.97
SPW-2811	7/20/2018	Gr. Alpha	21.1 ± 0.4	20.1	10.1 - 30.2	Pass	1.05
SPW-2811	7/20/2018	Gr. Beta	26.9 ± 0.3	27.5	22.0 - 33.0	Pass	0.98
W-072118	4/29/2016	Cs-134	33.6 ± 7.3	36.2	29.0 - 43.4	Pass	0.93
W-072118	4/29/2016	Cs-137	80.3 ± 7.9	71.9	57.5 - 86.3	Pass	1.12
SPW-3689	7/23/2018	Ra-226	12.7 ± 0.3	12.3	8.6 - 16.0	Pass	1.03
W-072718	2/1/2017	U-234	26.8 ± 3.4	31.4	22.0 - 40.8	Pass	0.85
W-072718	2/1/2017	U-238	24.1 ± 3.2	32.4	22.7 - 42.1	Pass	0.74
SPW-3018	7/31/2018	H-3	16,166 ± 376	16,507	13,206 - 19,808	Pass	0.98
SPW-3154	8/6/2018	H-3	15,686 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-081218	4/29/2016	Cs-134	38.6 ± 11.5	36.2	29.0 - 43.4	Pass	1.07
W-081218	4/29/2016	Cs-137	83.7 ± 13.4	71.9	57.5 - 86.3	Pass	1.16

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	Ratio Lab/Known
SPW-3278	8/16/2018	H-3	15,587 ± 370	16,507	13,206 - 19,808	Pass	0.94
SPW-3378	8/23/2018	Ni-63	378 ± 44	465	325 - 604	Pass	0.81
SPW-3420	8/23/2018	H-3	15,536 ± 368	16,507	13,206 - 19,808	Pass	0.94
SPW-3691	8/23/2018	Ra-226	15.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.26
SPW-3477	8/27/2018	Ra-228	11.3 ± 1.6	15.1	10.6 - 19.7	Pass	0.75
W-082818	4/29/2016	Cs-134	33.0 ± 2.7	36.2	29.0 - 43.4	Pass	0.91
W-082818	4/29/2016	Cs-137	80.7 ± 3.0	71.9	57.5 - 86.3	Pass	1.12
SPW-3648	9/7/2018	H-3	15,876 ± 371	16,507	13,206 - 19,808	Pass	0.96
SPW-4755	9/7/2018	Ra-226	11.2 ± 0.3	12.3	8.6 - 16.0	Pass	0.91
W-091118	4/29/2016	Cs-134	35.3 ± 2.7	36.2	29.0 - 43.4	Pass	0.98
W-091118	4/29/2016	Cs-137	80.7 ± 3.2	71.9	57.5 - 86.3	Pass	1.12
SPW-3843	9/19/2018	H-3	15,759 ± 372	16,507	13,206 - 19,808	Pass	0.95
W-092818	4/29/2016	Cs-134	36.1 ± 10.0	36.2	29.0 - 43.4	Pass	1.00
W-092818	4/29/2016	Cs-137	73.6 ± 9.9	71.9	57.5 - 86.3	Pass	1.02
SPW-3991	10/1/2018	H-3	15,614 ± 369	16,507	13,206 - 19,808	Pass	0.95
SPW-4105	10/5/2018	H-3	15,669 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-101118	4/29/2016	Cs-134	33.5 ± 3.1	36.2	29.0 - 43.4	Pass	0.92
W-101118	4/29/2016	Cs-137	79.7 ± 3.2	71.9	57.5 - 86.3	Pass	1.11
SPW-4205	10/12/2018	H-3	15,821 ± 372	16,507	13,206 - 19,808	Pass	0.96
SPW-4274	10/17/2018	H-3	15,575 ± 369	16,507	13,206 - 19,808	Pass	0.94
SPW-4596	10/31/2018	H-3	15,650 ± 369	16,507	13,206 - 19,808	Pass	0.95
SPW-4682	11/1/2018	H-3	15,742 ± 371	16,507	13,206 - 19,808	Pass	0.95
SPW-4684	11/1/2018	Sr-90	19.1 ± 1.2	17.9	14.3 - 21.5	Pass	1.07
SPW-4790	11/9/2018	H-3	15,887 ± 373	16,507	13,206 - 19,808	Pass	0.96
SPW-4839	11/13/2018	Ni-63	381 ± 43	465	326 - 605	Pass	0.82
SPW-4863	11/16/2018	H-3	15,610 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-111618	4/29/2016	Cs-134	38.0 ± 12.4	36.2	29.0 - 43.4	Pass	1.05
W-111618	4/29/2016	Cs-137	83.8 ± 13.8	71.9	57.5 - 86.3	Pass	1.17
SPW-5049	11/30/2018	H-3	15,370 ± 366	16,507	13,206 - 19,808	Pass	0.93
SPW-5148	12/7/2018	H-3	15,522 ± 368	16,507	13,206 - 19,808	Pass	0.94
W-121118	4/29/2016	Cs-134	39.4 ± 7.9	36.2	29.0 - 43.4	Pass	1.09
W-121118	4/29/2016	Cs-137	78.5 ± 7.7	71.9	57.5 - 86.3	Pass	1.09
W-121218	4/29/2016	Cs-134	42.0 ± 13.8	36.2	29.0 - 43.4	Pass	1.16
W-121218	4/29/2016	Cs-137	79.2 ± 13.1	71.9	57.5 - 86.3	Pass	1.10
W-121318	4/29/2016	Cs-134	35.1 ± 7.8	36.2	29.0 - 43.4	Pass	0.97
W-121318	4/29/2016	Cs-137	77.5 ± 8.4	71.9	57.5 - 86.3	Pass	1.08
SPW-5279	12/14/2018	H-3	15,686 ± 370	16,507	13,206 - 19,808	Pass	0.95
W-121418	4/29/2016	Cs-134	34.5 ± 8.2	36.2	29.0 - 43.4	Pass	0.95
W-121418	4/29/2016	Cs-137	82.7 ± 8.0	71.9	57.5 - 86.3	Pass	1.15
W-121718	4/29/2016	Cs-134	34.9 ± 10.5	36.2	29.0 - 43.4	Pass	0.96
W-121718	4/29/2016	Cs-137	80.3 ± 8.1	71.9	57.5 - 86.3	Pass	1.12
SPW-5351	12/19/2018	H-3	15,855 ± 375	16,507	13,206 - 19,808	Pass	0.96
SPW-5404	12/31/2018	H-3	15,179 ± 365	16,507	13,206 - 19,808	Pass	0.92

[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 listed in Attachment A of this report.
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-94	Water	1/11/2018	H-3	154	1 ± 74	200
SPW-108	Water	1/12/2018	Sr-89	0.63	0.41 ± 0.53	5
SPW-108	Water	1/12/2018	Sr-90	0.55	0.05 ± 0.26	1
SPW-174	Water	1/19/2018	H-3	152	23 ± 73	200
SPW-209	Water	1/23/2018	H-3	154	78 ± 78	200
SPW-211	Water	1/10/2018	Ra-226	0.03	0.19 ± 0.03	2
SPW-213	Water	1/23/2018	I-131	0.23	-0.05 ± 0.13	1
SPW-271	Water	1/30/2018	H-3	156	- 36 ± 77	200
SPW-329	Water	2/1/2018	Ni-63	74	-13 ± 45	200
SPW-337	Water	2/2/2018	H-3	154	-16 ± 71	200
SPW-385	Water	2/6/2018	H-3	150	-19 ± 71	200
SPW-461	Water	2/13/2018	H-3	156	56 ± 80	200
SPW-515	Water	2/19/2018	H-3	153	-1 ± 80	200
SPW-555	Water	2/8/2018	Ra-226	0.04	0.14 ± 0.03	2
SPW-581	Water	2/22/2018	H-3	156	43 ± 77	200
SPW-608	Water	2/23/2018	H-3	151	58 ± 75	200
SPW-649	Water	2/21/2018	Ra-226	0.04	0.17 ± 0.03	2
SPW-665	Water	2/28/2018	Gr. Alpha	0.43	0.70 ± 0.36	2
SPW-665	Water	2/28/2018	Gr. Beta	0.68	0.86 ± 0.51	4
SPW-747	Water	3/6/2018	H-3	154	11 ± 82	200
SPW-786	Water	3/8/2018	H-3	156	62 ± 76	200
SPW-865	Water	3/14/2018	I-131	0.18	0.07 ± 0.10	1
SPW-930	Water	3/20/2018	H-3	155	44 ± 84	200
SPW-956	Water	3/12/2018	Ra-226	0.03	0.18 ± 0.03	2
SPW-984	Water	3/27/2018	H-3	153	32 ± 82	200
SPW-1036	Water	4/4/2018	H-3	162	14 ± 77	200
SPW-1148	Water	4/12/2018	H-3	159	-15 ± 73	200
SPW-1202	Water	4/13/2018	U-234	0.15	0.00 ± 0.09	1
SPW-1202	Water	4/13/2018	U-238	0.15	0.06 ± 0.13	1
SPW-1425	Water	4/20/2018	H-3	159	45 ± 98	200
SPW-1453	Water	4/24/2018	H-3	155	43 ± 77	200
SPW-1492	Water	4/26/2018	Ra-228	0.68	0.25 ± 0.35	2
SPW-1517	Water	4/27/2018	H-3	150	54 ± 75	200
SPW-1521	Water	4/27/2018	Tc-99	5.38	2.64 ± 3.31	10
SPW-1572	Water	5/2/2018	Gr. Alpha	0.41	-0.23 ± 0.26	2
SPW-1572	Water	5/2/2018	Gr. Beta	0.69	-0.28 ± 0.47	4
SPW-1617	Water	5/3/2018	H-3	155	-113 ± 68	200
SPW-1643	Water	5/4/2018	Sr-89	0.66	0.36 ± 0.50	5
SPW-1643	Water	5/4/2018	Sr-90	0.57	-0.07 ± 0.25	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-1694	Water	5/8/2018	H-3	157	86 ± 80	200
SPW-1779	Water	5/11/2018	H-3	156	11 ± 74	200
SPW-1895	Water	5/17/2018	I-131	0.12	0.00 ± 0.08	1
SPW-1896	Water	5/18/2018	H-3	155	46 ± 75	200
SPW-1898	Water	5/18/2018	H-3	186	2 ± 92	200
SPW-1993	Water	5/24/2018	H-3	158	103 ± 79	200
SPW-2041	Water	5/31/2018	H-3	156	115 ± 81	200
SPW-2185	Water	6/6/2018	H-3	150	29 ± 74	200
SPW-2383	Water	6/6/2018	Ra-226	0.03	0.20 ± 0.02	2
SPW-2264	Water	6/11/2018	Gr. Alpha	0.39	-0.02 ± 0.27	2
SPW-2264	Water	6/11/2018	Gr. Beta	0.73	-0.35 ± 0.50	4
SPW-2913	Water	6/19/2018	Ra-226	0.02	0.18 ± 0.02	2
SPW-2436	Water	6/27/2018	Sr-89	0.66	0.00 ± 0.46	5
SPW-2436	Water	6/27/2018	Sr-90	0.61	-0.10 ± 0.27	1
SPW-2447	Water	6/29/2018	H-3	160	-6 ± 79	200
SPW-2545	Water	7/10/2018	H-3	154	20 ± 74	200
SPW-2705	Water	7/16/2018	H-3	153	15 ± 73	200
SPW-2771	Water	7/19/2018	H-3	156	-27 ± 71	200
SPW-2810	Water	7/20/2018	Gr. Alpha	0.42	-0.09 ± 0.29	2
SPW-2810	Water	7/20/2018	Gr. Beta	0.70	0.31 ± 0.50	4
SPW-3688	Water	7/23/2018	Ra-226	0.02	0.21 ± 0.02	2
SPW-3017	Water	7/31/2018	H-3	157	-5 ± 74	200
SPW-3153	Water	8/6/2018	H-3	152	13 ± 72	200
SPW-3377	Water	8/23/2018	Ni-63	66	18 ± 40	200
SPW-3446	Water	8/27/2018	H-3	151	-15 ± 69	200
SPW-3476	Water	8/27/2018	Ra-228	0.77	0.05 ± 0.36	2
SPW-3648	Water	9/7/2018	H-3	148	89 ± 75	200
SPW-4754	Water	9/7/2018	Ra-226	0.03	0.13 ± 0.08	2
SPW-3842	Water	9/19/2018	H-3	156	29 ± 74	200
SPW-3990	Water	10/1/2018	H-3	153	-6 ± 71	200
SPW-4105	Water	10/5/2018	H-3	150	7 ± 71	200
SPW-4565	Water	10/11/2018	Ra-228	0.86	-0.26 ± 0.36	2
SPW-4205	Water	10/12/2018	H-3	154	-9 ± 71	200
SPW-4273	Water	10/17/2018	H-3	153	67 ± 76	200
SPW-4595	Water	10/30/2018	H-3	150	75 ± 74	200
SPW-4681	Water	11/1/2018	H-3	152	19 ± 72	200
SPW-4789	Water	11/9/2018	H-3	148	27 ± 73	200
SPW-4862	Water	11/16/2018	H-3	154	15 ± 77	200
SPW-5048	Water	11/30/2018	H-3	151	-6 ± 69	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-4681	Water	11/1/2018	H-3	152	19 ± 72	200
SPW-4683	Water	11/1/2018	Sr-89	0.64	0.25 ± 0.45	5
SPW-4683	Water	11/1/2018	Sr-90	0.51	-0.10 ± 0.22	1
SPW-4799	Water	11/9/2018	I-131	0.43	-0.01 ± 0.20	1
SPW-4838	Water	11/13/2018	Ni-63	62	34 ± 38	200
SPW-5028	Water	11/19/2018	Ra-226	0.04	-0.14 ± 0.03	2
SPW-5028	Water	11/19/2018	Ra-228	0.96	-0.11 ± 0.43	2
SPW-5147	Water	12/7/2018	H-3	151	14 ± 71	200
SPW-5278	Water	12/14/2018	H-3	153	83 ± 76	200
SPW-5350	Water	12/19/2018	H-3	153	71 ± 75	200
SPW-5403	Water	12/31/2018	H-3	156	51 ± 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-010218	1/2/2018	Gr. Beta	0.048 ± 0.004	0.057 ± 0.004	0.052 ± 0.003	Pass
AP-010218	1/2/2018	Be-7	0.073 ± 0.008	0.073 ± 0.007	0.073 ± 0.005	Pass
AP-010318	1/3/2018	Gr. Beta	0.039 ± 0.005	0.034 ± 0.005	0.037 ± 0.003	Pass
AP-6846,6847	1/3/2018	Be-7	0.058 ± 0.010	0.062 ± 0.010	0.060 ± 0.007	Pass
AP-010318	1/3/2018	Be-7	0.059 ± 0.009	0.059 ± 0.007	0.059 ± 0.006	Pass
AP-010818	1/8/2018	Gr. Beta	0.053 ± 0.007	0.055 ± 0.007	0.054 ± 0.005	Pass
WW-164,165	1/11/2018	Gr. Beta	21.9 ± 2.2	20.4 ± 2.1	21.1 ± 1.5	Pass
WW-189,190	1/11/2018	H-3	501 ± 100	498 ± 100	499 ± 71	Pass
AP-011518	1/15/2018	Gr. Beta	0.032 ± 0.005	0.033 ± 0.005	0.032 ± 0.003	Pass
AP-012318	1/23/2018	Gr. Beta	0.031 ± 0.005	0.032 ± 0.005	0.031 ± 0.003	Pass
LW-280,281	1/25/2018	Gr. Beta	1.10 ± 0.52	1.19 ± 0.55	1.15 ± 0.38	Pass
AP-013018	1/30/2018	Gr. Beta	0.024 ± 0.005	0.023 ± 0.005	0.024 ± 0.003	Pass
SG-301,302	1/30/2018	Ac-228	3.01 ± 0.49	3.11 ± 0.71	3.06 ± 0.43	Pass
SG-301,302	1/30/2018	Pb-214	2.47 ± 0.31	2.22 ± 0.35	2.34 ± 0.23	Pass
SG-301,302	1/30/2018	K-40	7.44 ± 1.93	6.52 ± 2.25	6.98 ± 1.48	Pass
SWU-322,323	1/30/2018	Gr. Beta	1.48 ± 1.10	3.06 ± 1.31	2.27 ± 0.85	Pass
P-391,392	2/2/2018	H-3	428 ± 94	332 ± 89	380 ± 65	Pass
S-433,434	2/7/2018	Pb-214	0.16 ± 0.04	0.13 ± 0.05	0.15 ± 0.03	Pass
S-433,434	2/7/2018	Ac-228	0.24 ± 0.06	0.26 ± 0.07	0.25 ± 0.05	Pass
S-433,434	2/7/2018	K-40	6.45 ± 0.58	6.50 ± 0.59	6.48 ± 0.41	Pass
AP-454,455	2/8/2018	Be-7	0.233 ± 0.102	0.271 ± 0.111	0.252 ± 0.075	Pass
AP-021218	2/12/2018	Gr. Beta	0.037 ± 0.005	0.035 ± 0.005	0.036 ± 0.004	Pass
CF-477,478	2/12/2018	Be-7	0.31 ± 0.17	0.21 ± 0.08	0.26 ± 0.09	Pass
AP-021918	2/19/2018	Gr. Beta	0.036 ± 0.005	0.033 ± 0.008	0.035 ± 0.005	Pass
AP-022118	2/21/2018	Gr. Beta	0.030 ± 0.003	0.025 ± 0.003	0.028 ± 0.002	Pass
SWU-704,705	2/27/2018	Gr. Beta	2.50 ± 0.65	1.72 ± 0.58	2.11 ± 0.44	Pass
W-849,850	2/28/2018	H-3	567 ± 105	730 ± 112	649 ± 77	Pass
AP-030518	3/5/2018	Gr. Beta	0.024 ± 0.005	0.025 ± 0.005	0.024 ± 0.004	Pass
DW-90026,90027	3/7/2018	Gr. Alpha	55.4 ± 2.5	60.3 ± 2.6	57.8 ± 1.8	Pass
DW-90026,90027	3/7/2018	Gr. Beta	28.0 ± 1.2	27.4 ± 1.2	27.7 ± 0.8	Pass
S-800,801	3/8/2018	Ra-226	1.06 ± 0.15	1.17 ± 0.17	1.12 ± 0.11	Pass
S-800,801	3/8/2018	Ra-228	1.08 ± 0.19	1.05 ± 0.20	1.07 ± 0.14	Pass
S-800,801	3/8/2018	K-40	15.5 ± 1.3	15.7 ± 1.4	15.6 ± 0.9	Pass
SG-863,864	3/8/2018	Ra-226	5.56 ± 0.28	5.92 ± 0.27	5.74 ± 0.19	Pass
SG-863,864	3/8/2018	Ra-228	7.77 ± 0.44	8.19 ± 0.53	7.98 ± 0.34	Pass
SG-863,864	3/8/2018	K-40	10.75 ± 1.29	12.28 ± 1.39	11.52 ± 0.95	Pass
WW-842,843	3/9/2018	H-3	415 ± 99	423 ± 99	419 ± 70	Pass
AP-030918	3/9/2018	Gr. Beta	0.027 ± 0.004	0.021 ± 0.004	0.024 ± 0.003	Pass
AP-031318	3/13/2018	Gr. Beta	0.030 ± 0.004	0.031 ± 0.004	0.031 ± 0.003	Pass
AP-031318	3/13/2018	Gr. Beta	0.026 ± 0.005	0.024 ± 0.005	0.025 ± 0.003	Pass
WW-934,935	3/13/2018	H-3	266 ± 95	294 ± 96	280 ± 68	Pass
S-972,973	3/20/2018	K-40	23.1 ± 3.3	19.8 ± 2.5	21.4 ± 2.1	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
AP-032018	3/20/2018	Gr. Beta	0.021 ± 0.005	0.023 ± 0.005	0.022 ± 0.004	Pass
WW-1016,1017	3/22/2018	H-3	716 ± 110	790 ± 113	753 ± 79	Pass
SW-995,996	3/26/2018	H-3	14,538 ± 364	14,647 ± 365	14,593 ± 258	Pass
WW-1900,1901	3/30/2018	H-3	863 ± 123	865 ± 123	864 ± 87	Pass
AP-1299,1300	4/3/2018	Be-7	0.075 ± 0.017	0.073 ± 0.014	0.074 ± 0.011	Pass
SG-1470,1471	4/3/2018	Pb-214	1.45 ± 0.14	1.39 ± 0.12	1.42 ± 0.09	Pass
SG-1470,1471	4/3/2018	Ac-228	2.39 ± 0.31	2.55 ± 0.31	2.47 ± 0.22	Pass
WW-1123,1124	4/5/2018	H-3	11,266 ± 319	11,175 ± 320	11,220 ± 226	Pass
DW-90035,90036	4/6/2018	Ra-226	1.04 ± 0.13	0.88 ± 0.14	0.96 ± 0.10	Pass
DW-90035,90036	4/6/2018	Ra-228	0.84 ± 0.13	1.08 ± 0.42	0.96 ± 0.22	Pass
AP-041018	4/10/2018	Gr. Beta	0.023 ± 0.004	0.019 ± 0.004	0.021 ± 0.003	Pass
SS-1611,1612	4/18/2018	K-40	10.01 ± 0.54	8.93 ± 0.56	9.47 ± 0.39	Pass
SW-1427,1428	4/18/2018	H-3	180 ± 84	114 ± 81	147 ± 58	Pass
WW-1494,1495	4/20/2018	H-3	326 ± 84	270 ± 89	298 ± 61	Pass
AP-042518	4/25/2018	Gr. Beta	0.028 ± 0.004	0.023 ± 0.004	0.026 ± 0.003	Pass
SO-1634,1635	4/25/2018	K-40	5.72 ± 0.51	6.36 ± 0.56	6.04 ± 0.38	Pass
BS-1546,1547	4/26/2018	K-40	8.35 ± 0.53	8.54 ± 0.57	8.44 ± 0.39	Pass
AP-042618	4/26/2018	Gr. Beta	0.023 ± 0.004	0.021 ± 0.004	0.022 ± 0.003	Pass
DW-90043,90044	4/27/2018	Gr. Alpha	11.9 ± 1.1	11.3 ± 1.1	11.6 ± 0.8	Pass
AP-050118	5/1/2018	Gr. Beta	0.020 ± 0.006	0.022 ± 0.006	0.021 ± 0.004	Pass
AP-050218	5/2/2018	Gr. Beta	0.020 ± 0.002	0.019 ± 0.002	0.020 ± 0.002	Pass
F-2333,2334	5/2/2018	Cs-137	2.53 ± 0.34	2.51 ± 0.32	2.52 ± 0.24	Pass
DW-90048,90049	5/2/2018	Ra-226	0.18 ± 0.11	0.14 ± 0.08	0.16 ± 0.07	Pass
DW-90048,90049	5/2/2018	Ra-228	0.86 ± 0.60	0.78 ± 0.60	0.82 ± 0.42	Pass
WW-1833,1834	5/8/2018	H-3	182 ± 83	304 ± 98	243 ± 64	Pass
SG-1747,1748	5/8/2018	Pb-214	13.0 ± 0.6	13.0 ± 0.6	13.0 ± 0.4	Pass
SG-1747,1748	5/8/2018	Ac-228	21.0 ± 1.2	21.1 ± 1.4	21.0 ± 0.9	Pass
AP-050818	5/8/2018	Gr. Beta	0.027 ± 0.005	0.025 ± 0.004	0.026 ± 0.003	Pass
F-1812,1813	5/9/2018	K-40	4.30 ± 0.47	3.40 ± 0.47	3.85 ± 0.33	Pass
SG-1767,1768	5/9/2018	Pb-214	0.96 ± 0.24	0.72 ± 0.24	0.84 ± 0.17	Pass
SG-1767,1768	5/9/2018	Ac-228	1.28 ± 0.34	1.15 ± 0.37	1.22 ± 0.25	Pass
AP-051418	5/14/2018	Gr. Beta	0.038 ± 0.006	0.033 ± 0.005	0.036 ± 0.004	Pass
DW-90061,90062	5/17/2018	Ra-226	1.53 ± 0.13	1.78 ± 0.15	1.66 ± 0.10	Pass
DW-90061,90062	5/17/2018	Ra-228	0.82 ± 0.45	0.87 ± 0.44	0.85 ± 0.31	Pass
F-2201,2202	5/18/2018	K-40	2.73 ± 0.40	2.68 ± 0.45	2.71 ± 0.30	Pass
AP-051818	5/18/2018	Gr. Beta	0.020 ± 0.004	0.026 ± 0.004	0.023 ± 0.003	Pass
WW-2050,2051	5/22/2018	H-3	28,404 ± 502	28,666 ± 504	28,535 ± 356	Pass
AP-052218	5/22/2018	Gr. Beta	0.024 ± 0.004	0.021 ± 0.004	0.023 ± 0.003	Pass
AP-052918	5/29/2018	Gr. Beta	0.028 ± 0.004	0.024 ± 0.004	0.026 ± 0.003	Pass
AP-052918	5/29/2018	Gr. Beta	0.023 ± 0.005	0.025 ± 0.005	0.024 ± 0.003	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
G-2133,2134	6/4/2018	Be-7	0.55 ± 0.64	0.32 ± 0.16	0.43 ± 0.33	Pass
G-2133,2134	6/4/2018	K-40	7.12 ± 0.64	6.53 ± 0.58	6.82 ± 0.43	Pass
WW-2270,2271	6/8/2018	H-3	90 ± 84	71 ± 83	80 ± 59	Pass
VE-2312,2313	6/11/2018	K-40	6.06 ± 0.17	5.50 ± 0.46	5.78 ± 0.24	Pass
AP-2375,2376	6/14/2018	Be-7	0.310 ± 0.134	0.240 ± 0.100	0.275 ± 0.084	Pass
AP-2893,2894	6/27/2018	Be-7	0.111 ± 0.016	0.111 ± 0.016	0.111 ± 0.011	Pass
SG-24511,2512	7/2/2018	Gr. Alpha	19.60 ± 3.08	19.55 ± 3.06	19.58 ± 2.17	Pass
SG-2469,2470	7/2/2018	Pb-214	9.16 ± 0.48	9.46 ± 0.37	9.31 ± 0.30	Pass
SG-2469,2470	7/2/2018	Ac-228	9.94 ± 0.87	10.00 ± 0.64	9.97 ± 0.54	Pass
SG-2511,2512	7/2/2018	Pb-214	4.46 ± 0.31	4.57 ± 0.34	4.52 ± 0.23	Pass
SG-2511,2512	7/2/2018	Ac-228	6.15 ± 0.57	5.83 ± 0.66	5.99 ± 0.44	Pass
VE-2610,2611	7/9/2018	K-40	6.52 ± 0.75	5.92 ± 0.75	6.22 ± 0.53	Pass
F-2851,2852	7/11/2018	K-40	2.93 ± 0.38	2.83 ± 0.32	2.88 ± 0.25	Pass
AP-071218	7/12/2018	Gr. Beta	0.021 ± 0.003	0.024 ± 0.004	0.023 ± 0.002	Pass
AP-2721,2722	7/12/2018	Be-7	0.204 ± 0.100	0.275 ± 0.127	0.240 ± 0.081	Pass
WW-2742,2743	7/12/2018	H-3	253 ± 86	278 ± 97	265 ± 65	Pass
DW-90123,90124	7/24/2018	Ra-226	0.97 ± 0.18	1.06 ± 0.12	1.02 ± 0.11	Pass
DW-90123,90124	7/24/2018	Ra-228	3.61 ± 0.74	4.05 ± 0.80	3.83 ± 0.54	Pass
G-3000,3001	7/24/2018	Be-7	3.29 ± 0.25	3.24 ± 0.26	3.26 ± 0.18	Pass
G-3000,3001	7/24/2018	K-40	4.98 ± 0.40	5.06 ± 0.41	5.02 ± 0.29	Pass
S-2916,2917	7/24/2018	Pb-214	1.00 ± 0.51	0.94 ± 0.53	0.97 ± 0.37	Pass
S-2916,2917	7/24/2018	Ac-228	0.98 ± 0.11	0.98 ± 0.09	0.98 ± 0.07	Pass
AP-073018	7/30/2018	Gr. Beta	0.029 ± 0.004	0.022 ± 0.004	0.026 ± 0.003	Pass
DW-90133,90134	8/7/2018	Ra-228	2.34 ± 0.68	3.28 ± 0.73	2.81 ± 0.50	Pass
DW-90138,90139	8/10/2018	Gr. Alpha	4.02 ± 0.68	3.87 ± 0.66	3.95 ± 0.51	Pass
VE-3281,3282	8/14/2018	K-40	11.40 ± 0.831	11.39 ± 0.524	11.39 ± 0.491	Pass
VE-3323,3324	8/14/2018	K-40	3.41 ± 0.227	3.67 ± 0.262	3.54 ± 0.173	Pass
VE-3323,3324	8/14/2018	Be-7	0.25 ± 0.069	0.33 ± 0.092	0.29 ± 0.058	Pass
AP-081518	8/15/2018	Gr. Beta	0.022 ± 0.003	0.028 ± 0.003	0.025 ± 0.002	Pass
PM-3365,3366	8/16/2018	K-40	14.77 ± 0.76	14.19 ± 0.69	14.48 ± 0.51	Pass
S-3478,3479	8/27/2018	Pb-214	0.70 ± 0.05	0.70 ± 0.05	0.70 ± 0.04	Pass
S-3478,3479	8/27/2018	Ac-228	0.84 ± 0.11	0.89 ± 0.08	0.87 ± 0.07	Pass
SWT-3501,3502	8/27/2018	Gr. Beta	0.64 ± 0.48	1.42 ± 0.56	1.03 ± 0.37	Pass
VE-3522,3523	8/28/2018	K-40	2.51 ± 0.20	2.63 ± 0.20	2.57 ± 0.14	Pass
WW-3745,3746	8/31/2018	H-3	1035 ± 119	1056 ± 99	1045 ± 77	Pass
S-3542,3543	8/30/2018	K-40	6.10 ± 0.72	5.69 ± 0.63	5.90 ± 0.48	Pass
W-3703,3704	9/11/2018	Gr. Alpha	0.71 ± 0.80	1.03 ± 0.81	0.87 ± 0.57	Pass
W-3703,3704	9/11/2018	Gr. Beta	1.67 ± 1.08	0.53 ± 1.00	1.10 ± 0.74	Pass
SG-3796,3797	9/14/2018	Gr. Alpha	42.3 ± 3.6	50.9 ± 3.8	46.6 ± 2.6	Pass

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

			Concentration[a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SG-3796,3797	9/14/2018	Gr. Beta	43.9 ± 1.9	44.1 ± 1.8	44.0 ± 1.3	Pass
SG-3796,3797	9/14/2018	Pb-214	10.4 ± 0.6	14.2 ± 0.5	12.3 ± 0.4	Pass
SG-3796,3797	9/14/2018	Ac-228	15.8 ± 1.2	15.7 ± 1.2	15.8 ± 0.8	Pass
DW-90173,90174	10/24/2018	Ra-226	1.13 ± 0.15	1.38 ± 0.17	1.26 ± 0.11	Pass
DW-90173,90174	10/24/2018	Ra-228	5.09 ± 0.84	6.59 ± 0.89	5.84 ± 0.61	Pass
SW-4782,4783	11/7/2018	H-3	192 ± 82	238 ± 84	215 ± 59	Pass
WW-4959,4960	11/13/2018	H-3	330 ± 88	286 ± 86	308 ± 61	Pass
SG-4850,4851	11/14/2018	Pb-214	15.0 ± 0.4	14.7 ± 0.4	14.9 ± 0.3	Pass
SG-4850,4851	11/14/2018	Ac-228	17.5 ± 0.7	16.7 ± 0.6	17.1 ± 0.5	Pass
VE-4917,4918	11/20/2018	K-40	4.54 ± 0.45	4.05 ± 0.46	4.30 ± 0.32	Pass
VE-4917,4918	11/20/2018	Be-7	9.42 ± 0.45	9.42 ± 0.46	9.42 ± 0.32	Pass
SG-5046,5047	11/21/2018	K-40	8.65 ± 1.18	9.12 ± 1.02	8.88 ± 0.78	Pass
SG-5046,5047	11/21/2018	Cs-137	0.18 ± 0.06	0.10 ± 0.05	0.14 ± 0.04	Pass
SG-5046,5047	11/21/2018	Gr. Alpha	22.8 ± 5.6	17.5 ± 4.8	20.2 ± 3.7	Pass
SG-5046,5047	11/21/2018	Gr. Beta	31.8 ± 3.5	26.8 ± 3.1	29.3 ± 2.4	Pass
SG-6286,6287	12/1/2018	Pb-214	11.3 ± 0.4	10.7 ± 0.5	11.0 ± 0.3	Pass
SG-6286,6287	12/1/2018	Ac-228	13.5 ± 0.9	13.2 ± 1.0	13.4 ± 0.7	Pass
SWU-5132,5133	12/4/2018	H-3	159 ± 82	204 ± 80	181 ± 57	Pass
SWU-5132,5133	12/4/2018	Gr. Beta	1.32 ± 0.56	1.33 ± 0.57	1.32 ± 0.40	Pass
XAP-5499,5500	1/2/2019	Fe-55	941 ± 220	1027 ± 226	984 ± 158	Pass
XAP-5499,5500	1/2/2019	Sr-89	20.2 ± 7.3	14.9 ± 5.7	17.5 ± 4.7	Pass
XAP-5499,5500	1/2/2019	Ni-63	12.1 ± 8.5	15.6 ± 8.5	13.8 ± 6.0	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-765	2/1/2018	Am-241	1.57 ± 4.46	0	NA [c]	Pass
MASO-765	2/1/2018	Cs-137	4.69 ± 2.59	4.6	NA [d]	Pass
MASO-765	2/1/2018	Co-57	886 ± 7	826	578 - 1074	Pass
MASO-765	2/1/2018	Co-60	579 ± 7	560	392 - 728	Pass
MASO-765	2/1/2018	Mn-54	1135 ± 15	1010	707 - 1313	Pass
MASO-765	2/1/2018	K-40	653 ± 47	577	404 - 750	Pass
MASO-765	2/1/2018	Zn-65	1096 ± 19	960	672 - 1248	Pass
MASO-765	2/1/2018	Pu-238	54.4 ± 5.6	45.2	31.6 - 58.8	Pass
MASO-765	2/1/2018	Pu-239/240	58.9 ± 5.6	50.8	35.6 - 66.0	Pass
MASO-765	2/1/2018	Sr-90	1.07 ± 1.15	0	NA [c]	Pass
MAAP-769	2/1/2018	Am-241	0.070 ± 0.021	0.067	0.047 - 0.087	Pass
MAAP-769	2/1/2018	Cs-134	0.55 ± 0.04	0.675	0.473 - 0.878	Pass
MAAP-769	2/1/2018	Cs-137	0.01 ± 0.01	0	NA [c]	Pass
MAAP-769	2/1/2018	Co-57	1.06 ± 0.04	1.18	0.83 - 1.53	Pass
MAAP-769	2/1/2018	Co-60	0.01 ± 0.01	0	NA [c]	Pass
MAAP-769	2/1/2018	Mn-54	1.01 ± 0.05	1.03	0.72 - 1.34	Pass
MAAP-769	2/1/2018	Zn-65	1.37 ± 0.11	1.33	0.93 - 1.73	Pass
MAAP-769	2/1/2018	Pu-238	0.042 ± 0.017	0.0445	0.0312 - 0.0579	Pass
MAAP-769	2/1/2018	Pu-239/240	-0.001 ± 0.006	0	NA [c]	Pass
MAAP-769	2/1/2018	Sr-90	1.12 ± 0.13	1.01	0.71 - 1.31	Pass
MAAP-769	2/1/2018	U-234/233	0.117 ± 0.023	0.124	0.087 - 0.161	Pass
MAAP-769	2/1/2018	U-238	0.126 ± 0.023	0.128	0.090 - 0.166	Pass
MAVE-767	2/1/2018	Cs-134	3.03 ± 0.10	3.23	2.26 - 4.20	Pass
MAVE-767	2/1/2018	Cs-137	3.86 ± 0.05	3.67	2.57 - 4.77	Pass
MAVE-767	2/1/2018	Co-57	4.86 ± 0.09	4.42	3.09 - 5.75	Pass
MAVE-767	2/1/2018	Co-60	2.24 ± 0.06	2.29	1.60 - 2.98	Pass
MAVE-767	2/1/2018	Mn-54	2.75 ± 0.08	2.66	1.86 - 3.46	Pass
MAVE-767	2/1/2018	Zn-65	0.02 ± 0.05	0	NA [c]	Pass
MAW-656	2/1/2018	I-129	1.66 ± 0.07	1.93	1.35 - 2.51	Pass
MAW-662	2/1/2018	Am-241	0.581 ± 0.050	0.709	0.496 - 0.922	Pass
MAW-662	2/1/2018	Cs-134	9.35 ± 0.38	10.2	7.1 - 13.3	Pass
MAW-662	2/1/2018	Cs-137	13.0 ± 0.2	12.2	8.5 - 15.9	Pass
MAW-662	2/1/2018	Co-57	0.003 ± 0.039	0	NA [c]	Pass
MAW-662	2/1/2018	Co-60	11.73 ± 0.19	11.5	8.1 - 15.0	Pass
MAW-662	2/1/2018	Mn-54	0.060 ± 0.019	0	NA [c]	Pass
MAW-662	2/1/2018	Zn-65	15.85 ± 0.27	14.3	10.0 - 18.6	Pass
MAW-662	2/1/2018	Fe-55	10.7 ± 11.7	11.1	7.80 - 14.40	Pass
MAW-662	2/1/2018	Ni-63[e]	11.0 ± 1.4	14.0	9.8 - 18.2	Warning
MAW-662	2/1/2018	Ni-63[e]	12.9 ± 1.7	14.0	9.8 - 18.2	Pass
MAW-662	2/1/2018	H-3	-0.3 ± 3.0	0	NA [c]	Pass
MAW-662	2/1/2018	Pu-238	0.02 ± 0.01	0.023	NA [d]	Pass
MAW-662	2/1/2018	Pu-239/240	0.585 ± 0.056	0.600	0.420 - 0.780	Pass
MAW-662	2/1/2018	Ra-226[f]	0.340 ± 0.040	0.257	0.180 - 0.334	Fail
MAW-662	2/1/2018	Ra-226[f]	0.297 ± 0.048	0.257	0.180 - 0.334	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-662	2/1/2018	Sr-90	9.92 ± 0.75	11.4	8.0 - 14.8	Pass
MAW-662	2/1/2018	Tc-99	4.9 ± 0.4	4.37	3.06 - 5.68	Pass
MAW-662	2/1/2018	U-233/234	0.404 ± 0.041	0.430	0.301 - 0.559	Pass
MAW-662	2/1/2018	U-238	0.396 ± 0.041	0.437	0.306 - 0.568	Pass
MASO-3638	8/1/2018	Cs-134	688.7 ± 26.2	781	547 - 1015	Pass
MASO-3638	8/1/2018	Cs-137	605.9 ± 22.7	572	400 - 744	Pass
MASO-3638	8/1/2018	Co-57	976.7 ± 37.6	958	671 - 1245	Pass
MASO-3638	8/1/2018	Co-60	604.5 ± 24.9	608	426 - 790	Pass
MASO-3638	8/1/2018	Mn-54	5.2 ± 5.2	0	NA [c]	Pass
MASO-3638	8/1/2018	K-40	630 ± 31	566	396 - 736	Pass
MASO-3638	8/1/2018	Zn-65	556.4 ± 26.8	500	350 - 650	Pass
MAAP-3636	8/1/2018	Cs-134	0.37 ± 0.04	0.444	0.311 - 0.577	Pass
MAAP-3636	8/1/2018	Cs-137	0.34 ± 0.05	0.345	0.242 - 0.449	Pass
MAAP-3636	8/1/2018	Co-57	0.56 ± 0.04	0.592	0.414 - 0.770	Pass
MAAP-3636	8/1/2018	Co-60	0.28 ± 0.03	0.294	0.206 - 0.382	Pass
MAAP-3636	8/1/2018	Mn-54	0.26 ± 0.05	0.266	0.186 - 0.346	Pass
MAAP-3636	8/1/2018	Zn-65	0.22 ± 0.07	0.201	NA [d]	Pass
MAVE-3640	8/1/2018	Cs-134	1.87 ± 0.10	1.94	1.36 - 2.52	Pass
MAVE-3640	8/1/2018	Cs-137	2.69 ± 0.15	2.36	1.65 - 3.07	Pass
MAVE-3640	8/1/2018	Co-57	3.90 ± 0.12	3.31	2.32 - 4.30	Pass
MAVE-3640	8/1/2018	Co-60	1.76 ± 0.09	1.68	1.18 - 2.18	Pass
MAVE-3640	8/1/2018	Mn-54	2.91 ± 0.16	2.53	1.77 - 3.29	Pass
MAVE-3640	8/1/2018	Zn-65	1.53 ± 0.21	1.37	0.96 - 1.78	Pass
MAW-3480	8/1/2018	H-3	336.0 ± 10.7	338	237 - 439	Pass
MAW-3480	8/1/2018	Cs-134	7.86 ± 0.31	8.7	6.1 - 11.3	Pass
MAW-3480	8/1/2018	Cs-137	7.55 ± 0.33	6.9	4.8 - 9.0	Pass
MAW-3480	8/1/2018	Co-57	15.67 ± 0.36	14.9	10.4 - 19.4	Pass
MAW-3480	8/1/2018	Co-60	0.12 ± 0.12	0	NA [c]	Pass
MAW-3480	8/1/2018	Mn-54	13.38 ± 0.44	12.5	8.8 - 16.3	Pass
MAW-3480	8/1/2018	Zn-65	7.80 ± 0.53	7.53	5.27 - 9.79	Pass
MAW-3634	8/1/2018	I-129	1.32 ± 0.08	1.62	1.13 - 2.11	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) and 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] Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

[e] The lab was in the "warning zone" on this study(biased low). The sample was rerun applying an aggressive oxidation technique to remove a complexing agent that is utilized in the early steps of the procedure. Reanalysis was acceptable with this enhanced technique.

[f] An investigation was performed to determine reason for the failure of the Ra-226 result. A backup solution was reanalyzed with acceptable results. The current study as well as a past study were reanalyzed with acceptable results. No conclusion has been currently drawn from the results of this investigation.

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

MRAD-28 Study

Lab Code [b]	Date	Analysis	Concentration [a] Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERAP-942	3/19/2018	Am-241[d]	24.6	7.86	5.61 - 10.5	Fail
ERAP-942	3/19/2018	Am-241[d]	7.30	7.86	5.61 - 10.5	Pass
ERAP-942	3/19/2018	Cs-134	174	204	132 - 250	Pass
ERAP-942	3/19/2018	Cs-137	969	865	710 - 1130	Pass
ERAP-942	3/19/2018	Co-60	672	665	565 - 845	Pass
ERAP-942	3/19/2018	Fe-55	701	771	281 - 1230	Pass
ERAP-942	3/19/2018	Mn-54	< 50	< 50.0	0.00 - 50.0	Pass
ERAP-942	3/19/2018	Zn-65	594	668	548 - 1020	Pass
ERAP-942	3/19/2018	Pu-238	56.8	55.6	42.0 - 68.3	Pass
ERAP-942	3/19/2018	Pu-239	54.4	52.3	39.1 - 63.1	Pass
ERAP-942	3/19/2018	Sr-90	113	124	78.4 - 169	Pass
ERAP-942	3/19/2018	U-234	22.8	24.6	18.2 - 28.8	Pass
ERAP-942	3/19/2019	U-238	22.7	24.4	18.4 - 29.1	Pass
ERAP-944	3/19/2018	Gross Alpha	49.1	43.4	22.7 - 71.5	Pass
ERAP-944	3/19/2018	Gross Beta	44.8	52.0	31.5 - 78.6	Pass
ERSO-946	3/19/2018	Ac-228	1,480	1,240	818 - 1560	Pass
ERSO-946	3/19/2018	Am-241	48	74.7	40.3 - 106	Pass
ERSO-946	3/19/2018	Bi-212[e]	1,980	1,240	355 - 1,850	Fail
ERSO-946	3/19/2018	Bi-212[e]	1,285	1,240	355 - 1,850	Pass
ERSO-946	3/19/2018	Bi-214	2,180	1,760	845 - 2,620	Pass
ERSO-946	3/19/2018	Cs-134	5,230	5,330	3,640 - 6,370	Pass
ERSO-946	3/19/2018	Cs-137	4,820	4,210	3,180 - 5,320	Pass
ERSO-946	3/19/2018	Co-60	8,390	8,060	6,350 - 9,950	Pass
ERSO-946	3/19/2018	K-40[e]	14,100	10,600	7,300 - 12,700	Fail
ERSO-946	3/19/2018	K-40[e]	12,160	10,600	7,300 - 12,700	Pass
ERSO-946	3/19/2018	Mn-54	< 1000	< 1000	0 - 1,000	Pass
ERSO-946	3/19/2018	Pb-212	1,140	1,240	865 - 1,570	Pass
ERSO-946	3/19/2018	Pb-214	2,330	1,850	777 - 2910	Pass
ERSO-946	3/19/2018	Pu-238	1,830	1,470	733 - 2230	Pass
ERSO-946	3/19/2018	Pu-239	1,520	1,330	725 - 1910	Pass
ERSO-946	3/19/2018	Sr-90	3,500	4,500	1,400 - 7,010	Pass
ERSO-946	3/19/2018	Th-234	1,800	1,800	680 - 3,080	Pass
ERSO-946	3/19/2018	U-234	1,610	1,820	853 - 2,380	Pass
ERSO-946	3/19/2018	U-238	1,800	1,800	988 - 2,420	Pass
ERSO-946	3/19/2018	Zn-65	2,440	1,990	1,590 - 2,710	Pass
ERW-952	3/19/2018	Gr. Alpha	25.3	29.0	10.6 - 40.0	Pass
ERW-952	3/19/2018	Gr. Beta	61.3	73.1	36.6 - 101	Pass
ERW-954	3/19/2018	H-3	22,300	21,700	16,400 - 26,400	Pass

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

MRAD-28 Study

Lab Code [b]	Date	Analysis	Concentration [a] Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERVE-948	3/19/2018	Am-241	3,800	3,880	2,400 - 5,480	Pass
ERVE-948	3/19/2018	Cm-244	2,490	2,630	1,480 - 3,270	Pass
ERVE-948	3/19/2018	Co-60	579	491	385 - 642	Pass
ERVE-948	3/19/2018	Cs-134	2,090	1,950	1,290 - 2,600	Pass
ERVE-948	3/19/2018	Cs-137	2,640	2,160	1,660 - 2,910	Pass
ERVE-948	3/19/2018	K-40	34,000	30,900	23,200 - 39,100	Pass
ERVE-948	3/19/2018	Mn-54	< 300	< 300	0.00 - 300	Pass
ERVE-948	3/19/2018	Zn-65	3,080	2,400	1,790 - 3,560	Pass
ERVE-948	3/19/2018	Pu-238	2,400	2,020	1,400 - 2,600	Pass
ERVE-948	3/19/2018	Pu-239	5,140	4,160	2,880 - 5,270	Pass
ERVE-948	3/19/2018	Sr-90	3,570	3,330	1,880 - 4340	Pass
ERVE-948	3/19/2018	U-233/234	4,130	4,050	2,850 - 5,170	Pass
ERVE-948	3/19/2018	U-238	4,190	4,010	2,830 - 5,020	Pass
ERW-950	3/19/2018	Am-241	72.5	103	70.7 - 132	Pass
ERW-950	3/19/2018	Co-60	1,550	1,480	1,280 - 1,700	Pass
ERW-950	3/19/2018	Cs-134	1,280	1,330	1,000 - 1,460	Pass
ERW-950	3/19/2018	Cs-137	343	328	281 - 373	Pass
ERW-950	3/19/2018	Mn-54	< 100	< 100	0.00 - 100	Pass
ERW-950	3/19/2018	Pu-238	59.8	66.1	39.7 - 85.6	Pass
ERW-950	3/19/2018	Pu-239	84.8	91.8	56.8 - 113	Pass
ERW-950	3/19/2018	U-234	111	132	100 - 151	Pass
ERW-950	3/19/2018	U-238	113	131	102 - 154	Pass
ERW-950	3/19/2018	Zn-65	1,450	1,300	1160 - 1640	Pass
ERW-950	3/19/2018	Fe-55	533	445	261 - 647	Pass
ERW-950	3/19/2018	Sr-90	754	781	562 - 965	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory (EIML) as a participant in the crosscheck program for proficiency testing administered by Environmental Resource 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] Reported result was higher than ERA's upper acceptance limit. An investigation was initiated. The sample was run with a pre-treatment technique. Rerunning the analysis with this pre-treatment gave a result of 7.30 pCi/total. Going forward all samples for Am-241 will be analyzed utilizing this pre-treatment.

[e] The ERA results for Bi-212 and K-40 were outside the acceptable limits. The sample analysis was rerun utilizing a different library with acceptable results. The library used in the original analysis contained many more energies than the second library used, rendering a less reliable result for Bi-212. The K-40 value was overstated due to the use of a background spectrum analysis that had not fully quantified the K-40 present. Going forward a table has been created to track the historical results for the background subtraction for each HPGe detector so that any changes in background can be more easily identified.

APPENDIX B. DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All results, 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 result is less than the Minimum Detectable Concentration (MDC), L, it is reported as: < L, where L = the Minimum Detectable Concentration 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 MDC are not included in the average.

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

4.4 If all but one of the values are less than the highest MDC, the single value x and its 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. NON-RADIOLOGICAL MONITORING PROGRAM

1.0. Introduction

Union Electric Company Callaway Plant, d.b.a. Ameren Missouri Callaway Energy Center, in accordance with federal regulations and a desire to maintain the quality of the local environment around Callaway Plant has implemented an Environmental Protection Plan, (EPP) contained in Appendix B of the Callaway Plant Operating License.

The objective of the EPP is to provide for protection of non-radiological environmental values during operation of the Callaway Plant.

This report describes the conduct of the EPP for the Callaway Plant during 2018.

2.0. Unusual or Important Events

No unusual or important events reportable under the EPP Section 4.1 were identified during 2018.

3.0. EPP Non-compliances

During 2018, there were no non-compliances with the EPP.

4.0. Nonroutine Reports

There were no nonroutine reports submitted in accordance with the EPP, Section 5.4.2 in 2018.

5.0. Plant Design and Operation Environmental Evaluations.

This section lists all changes in the plant design, operation, tests or experiments installed during 2018, which could have involved a potentially significant unreviewed environmental question in accordance with section 3.1 of Appendix B.

During 2018, no major plant changes were completed that could have involved a potentially significant unreviewed environmental question.

APPENDIX D

Sampling Location Maps

Figure D-1. Radiological Environmental Sampling Locations 1, 2, 3, mile radius from site location.

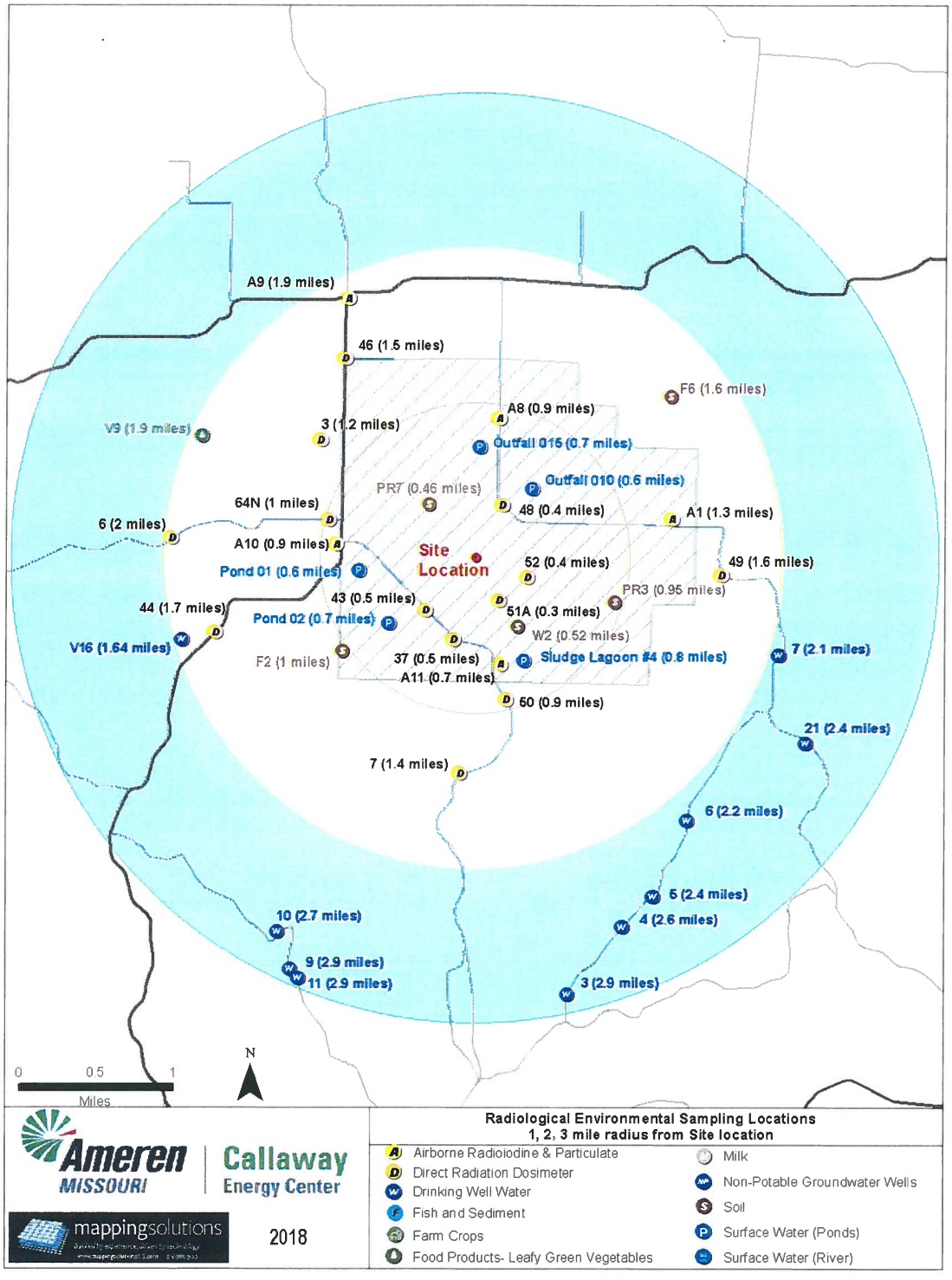


Figure D-2. Radiological Environmental Sampling Locations 3, 4, 5, 6 mile radius from site location.

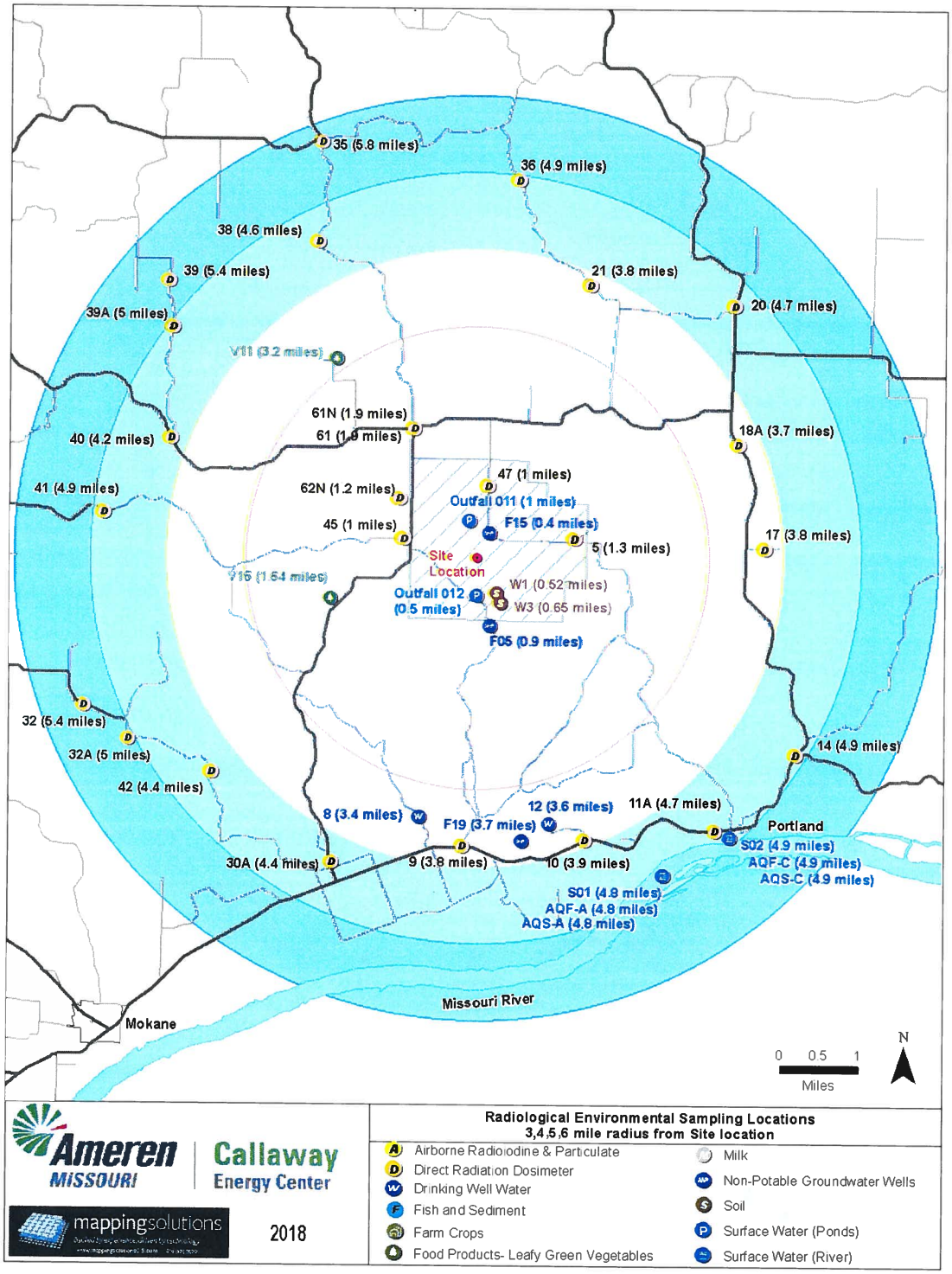


Figure D-3. Radiological Environmental Sampling Locations 5, 10, 15 mile radius from site location.

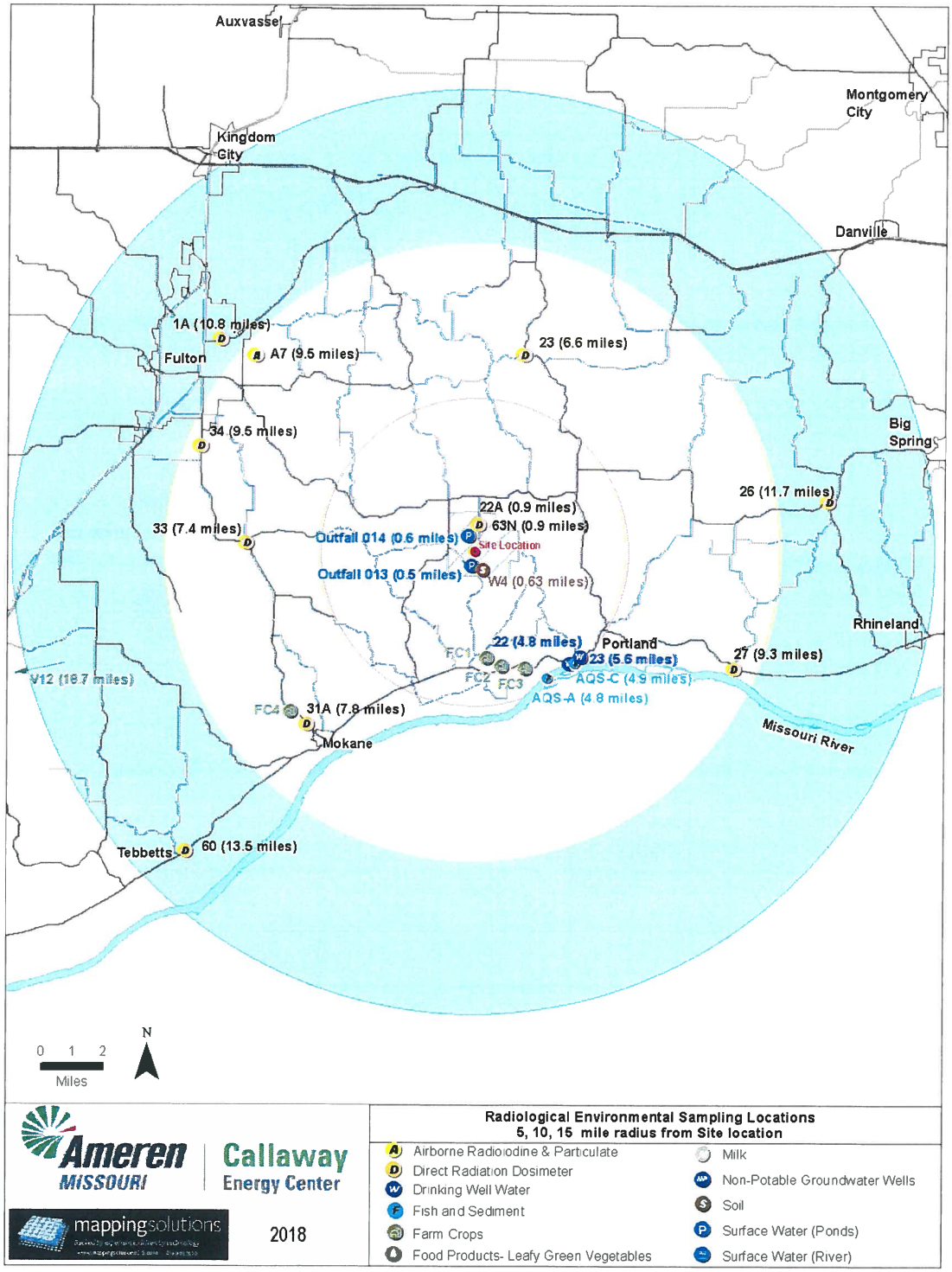


Figure D-4. Non-Potable Groundwater Monitoring Wells, 600 ft radius from Site.

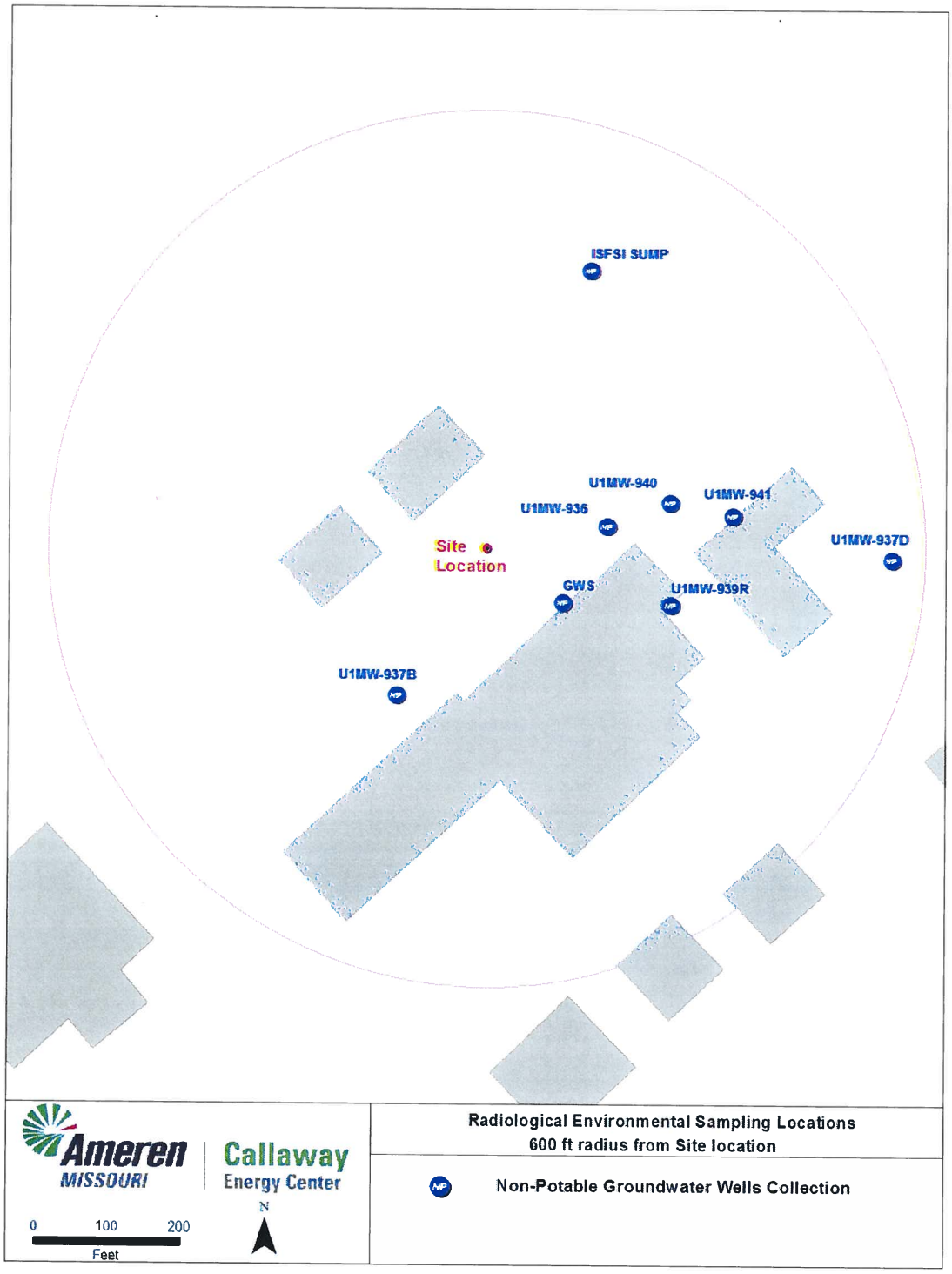
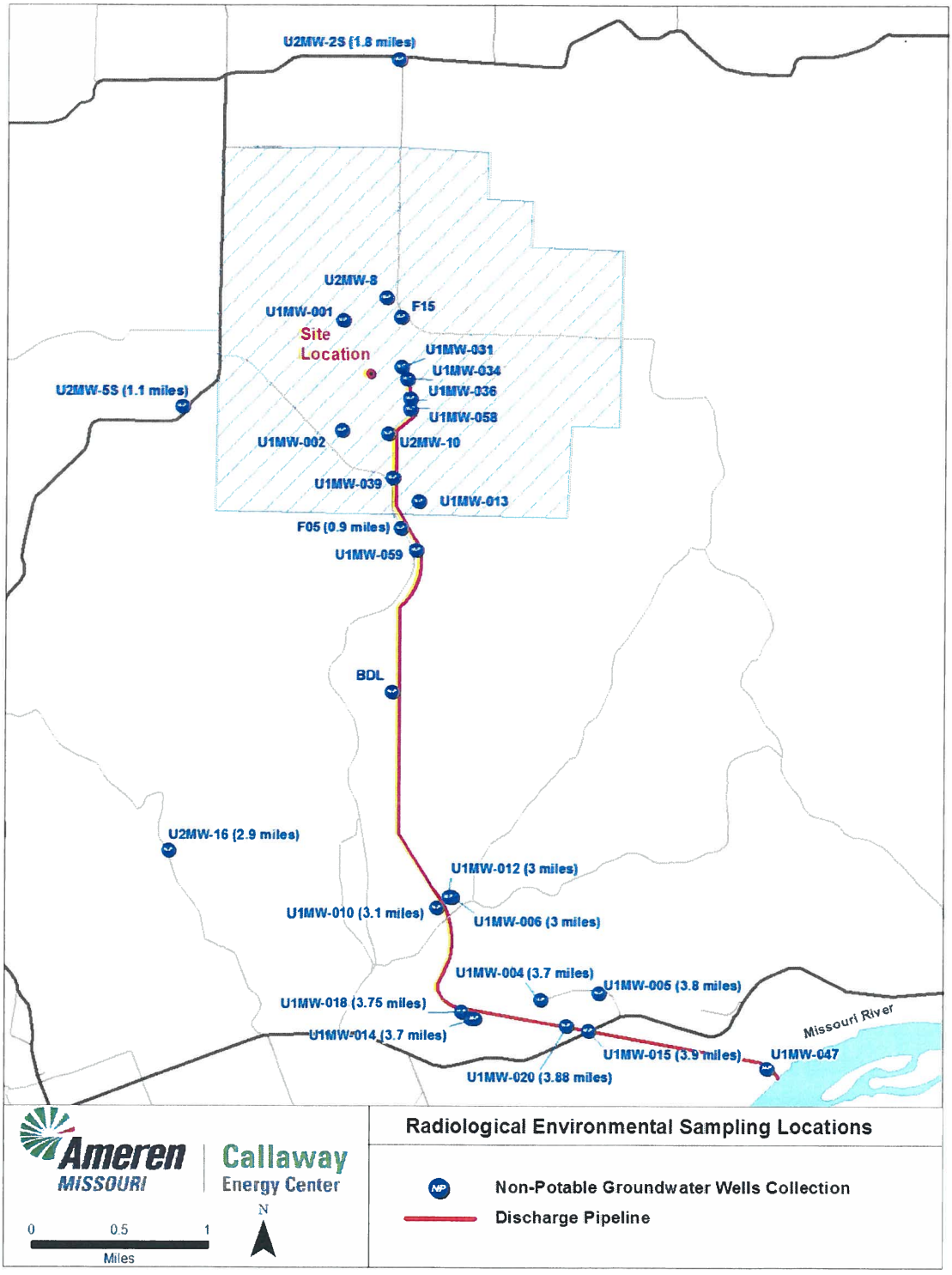


Figure D-5. Non-Potable Groundwater Monitoring Wells Collection.



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

AMEREN MISSOURI,
CALLAWAY ENERGY CENTER
FULTON, MISSOURI

Docket Numbers 50-483 and 72-1045

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

to

THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Part II

DATA TABULATIONS AND ANALYSES

January 1 to December 31, 2018

Prepared by

ENVIRONMENTAL, Inc.
Midwest Laboratory

Submitted by

Union Electric Co.
dba Ameren Missouri

Project No. 8036

Approved : _____

Ashok Banavali,Ph.D.
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 Ameren Missouri, Callaway Energy Center, Fulton, Missouri in 2018. Results of completed analyses are presented in the attached tables.

For information regarding sampling locations, type and frequency of collection, and sample codes, refer to Part I, Tables 5.1 - 5.2 and Figures 5.1 through 5.8.

Analyses results from additional sampling may be found in Appendix A.

2.0 DATA TABLES

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-001							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	311	< 0.09	< 0.007	< 0.007	< 0.010	< 0.008	< 0.009	< 0.006	< 0.046
01-11-18	301	< 0.11	< 0.005	< 0.006	< 0.014	< 0.009	< 0.007	< 0.017	< 0.052
01-18-18	307	< 0.10	< 0.009	< 0.008	< 0.010	< 0.008	< 0.008	< 0.015	< 0.039
01-26-18	341	0.14 ± 0.08	< 0.006	< 0.006	< 0.014	< 0.007	< 0.005	< 0.010	< 0.035
02-01-18	257	0.15 ± 0.09	< 0.007	< 0.007	< 0.014	< 0.009	< 0.006	< 0.010	< 0.042
02-08-18	302	0.23 ± 0.09	< 0.006	< 0.007	< 0.015	< 0.008	< 0.008	< 0.012	< 0.040
02-15-18	299	< 0.11	< 0.009	< 0.008	< 0.014	< 0.009	< 0.010	< 0.013	< 0.048
02-22-18	298	< 0.08	< 0.009	< 0.007	< 0.015	< 0.010	< 0.006	< 0.008	< 0.045
03-01-18	272	< 0.10	< 0.005	< 0.008	< 0.008	< 0.011	< 0.009	< 0.010	< 0.051
03-07-18	235	0.16 ± 0.08	< 0.011	< 0.010	< 0.015	< 0.011	< 0.011	< 0.020	< 0.042
03-15-18	312	0.12 ± 0.07	< 0.007	< 0.006	< 0.013	< 0.006	< 0.007	< 0.014	< 0.036
03-21-18	237	0.18 ± 0.09	< 0.008	< 0.009	< 0.019	< 0.010	< 0.010	< 0.021	< 0.037
03-28-18	279	0.17 ± 0.09	< 0.007	< 0.007	< 0.013	< 0.010	< 0.011	< 0.016	< 0.046
04-05-18	320	0.20 ± 0.10	< 0.011	< 0.007	< 0.019	< 0.012	< 0.010	< 0.019	< 0.040
04-12-18	277	< 0.13	< 0.009	< 0.006	< 0.018	< 0.010	< 0.008	< 0.022	< 0.033
04-18-18	236	< 0.15	< 0.014	< 0.012	< 0.018	< 0.011	< 0.011	< 0.029	< 0.060
04-26-18	316	< 0.12	< 0.005	< 0.009	< 0.020	< 0.008	< 0.007	< 0.027	< 0.045
05-03-18	272	0.28 ± 0.15	< 0.011	< 0.006	< 0.014	< 0.012	< 0.012	< 0.029	< 0.055
05-10-18	275	< 0.13	< 0.007	< 0.004	< 0.018	< 0.011	< 0.011	< 0.041	< 0.047
05-17-18	269	0.19 ± 0.11	< 0.010	< 0.013	< 0.015	< 0.008	< 0.008	< 0.014	< 0.055
05-23-18	231	< 0.11	< 0.011	< 0.011	< 0.024	< 0.011	< 0.008	< 0.030	< 0.057
05-31-18	301	0.25 ± 0.11	< 0.007	< 0.009	< 0.019	< 0.008	< 0.006	< 0.015	< 0.045
06-06-18	227	< 0.12	< 0.010	< 0.007	< 0.012	< 0.011	< 0.011	< 0.016	< 0.050
06-14-18	309	0.30 ± 0.08	< 0.008	< 0.005	< 0.011	< 0.008	< 0.008	< 0.014	< 0.027
06-21-18	262	0.16 ± 0.09	< 0.006	< 0.007	< 0.009	< 0.010	< 0.011	< 0.006	< 0.053
06-28-18	256	< 0.12	< 0.006	< 0.006	< 0.018	< 0.010	< 0.011	< 0.007	< 0.053
07-05-18	264	< 0.13	< 0.011	< 0.008	< 0.023	< 0.013	< 0.006	< 0.026	< 0.071
07-12-18	262	0.28 ± 0.13	< 0.010	< 0.013	< 0.021	< 0.011	< 0.006	< 0.014	< 0.057
07-19-18	263	0.26 ± 0.12	< 0.005	< 0.004	< 0.020	< 0.010	< 0.008	< 0.025	< 0.032
07-26-18	258	< 0.14	< 0.010	< 0.009	< 0.027	< 0.014	< 0.009	< 0.035	< 0.036
08-02-18	263	0.16 ± 0.09	< 0.011	< 0.012	< 0.017	< 0.010	< 0.008	< 0.009	< 0.041
08-09-18	260	< 0.14	< 0.012	< 0.010	< 0.017	< 0.012	< 0.009	< 0.020	< 0.061
08-16-18	259	< 0.14	< 0.010	< 0.008	< 0.018	< 0.010	< 0.010	< 0.011	< 0.033
08-23-18	259	< 0.14	< 0.008	< 0.009	< 0.018	< 0.009	< 0.007	< 0.032	< 0.053
08-30-18	264	0.27 ± 0.16	< 0.010	< 0.007	< 0.025	< 0.013	< 0.013	< 0.025	< 0.053
09-06-18	256	< 0.11	< 0.008	< 0.008	< 0.015	< 0.011	< 0.014	< 0.018	< 0.054
09-13-18	261	< 0.15	< 0.011	< 0.013	< 0.023	< 0.012	< 0.010	< 0.017	< 0.055
09-20-18	255	< 0.11	< 0.014	< 0.008	< 0.025	< 0.012	< 0.012	< 0.017	< 0.035
09-27-18	259	< 0.15	< 0.007	< 0.009	< 0.023	< 0.013	< 0.014	< 0.028	< 0.063
10-04-18	258	< 0.12	< 0.009	< 0.009	< 0.015	< 0.011	< 0.008	< 0.023	< 0.038
10-11-18	266	< 0.11	< 0.009	< 0.006	< 0.017	< 0.011	< 0.007	< 0.014	< 0.057

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-001 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	259	< 0.12	< 0.007	< 0.009	< 0.015	< 0.014	< 0.013	< 0.016	< 0.053
10-25-18	258	< 0.13	< 0.009	< 0.007	< 0.016	< 0.011	< 0.011	< 0.011	< 0.058
11-01-18	255	0.17 ± 0.10	< 0.009	< 0.005	< 0.019	< 0.009	< 0.007	< 0.008	< 0.048
11-08-18	254	< 0.11	< 0.007	< 0.012	< 0.015	< 0.011	< 0.011	< 0.016	< 0.053
11-16-18	288	< 0.11	< 0.007	< 0.004	< 0.010	< 0.012	< 0.008	< 0.008	< 0.033
11-21-18	180	< 0.14	< 0.017	< 0.006	< 0.021	< 0.016	< 0.012	< 0.025	< 0.080
11-29-18	271	< 0.12	< 0.007	< 0.006	< 0.013	< 0.011	< 0.007	< 0.007	< 0.032
12-06-18	274	< 0.09	< 0.014	< 0.009	< 0.021	< 0.014	< 0.012	< 0.021	< 0.059
12-12-18	234	< 0.13	< 0.011	< 0.010	< 0.018	< 0.013	< 0.009	< 0.011	< 0.069
12-20-18	315	< 0.10	< 0.007	< 0.004	< 0.015	< 0.010	< 0.005	< 0.011	< 0.046
12-27-18	271	< 0.12	< 0.007	< 0.006	< 0.012	< 0.014	< 0.010	< 0.034	< 0.061
01-03-19	271	< 0.11	< 0.013	< 0.008	< 0.018	< 0.011	< 0.006	< 0.027	< 0.052

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-007							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	266	< 0.11	< 0.014	< 0.014	< 0.011	< 0.012	< 0.011	< 0.010	< 0.066
01-11-18	256	< 0.12	< 0.008	< 0.006	< 0.013	< 0.009	< 0.008	< 0.025	< 0.047
01-18-18	265	< 0.10	< 0.008	< 0.007	< 0.013	< 0.011	< 0.005	< 0.009	< 0.050
01-26-18	292	< 0.10	< 0.004	< 0.008	< 0.014	< 0.009	< 0.009	< 0.007	< 0.036
02-01-18	220	0.20 ± 0.09	< 0.009	< 0.011	< 0.012	< 0.011	< 0.009	< 0.020	< 0.050
02-08-18	260	0.27 ± 0.11	< 0.007	< 0.010	< 0.016	< 0.009	< 0.006	< 0.012	< 0.052
02-15-18	255	< 0.10	< 0.008	< 0.006	< 0.013	< 0.009	< 0.005	< 0.006	< 0.039
02-22-18	255	< 0.15	< 0.012	< 0.012	< 0.028	< 0.014	< 0.017	< 0.030	< 0.061
03-01-18	292	< 0.13	< 0.005	< 0.010	< 0.021	< 0.010	< 0.006	< 0.009	< 0.051
03-07-18	253	0.17 ± 0.10	< 0.010	< 0.013	< 0.010	< 0.012	< 0.008	< 0.010	< 0.042
03-15-18	333	0.18 ± 0.07	< 0.005	< 0.004	< 0.012	< 0.005	< 0.005	< 0.008	< 0.036
03-21-18	254	0.21 ± 0.08	< 0.007	< 0.006	< 0.012	< 0.007	< 0.006	< 0.010	< 0.036
03-28-18	301	0.19 ± 0.11	< 0.008	< 0.008	< 0.016	< 0.008	< 0.010	< 0.023	< 0.030
04-05-18	334	< 0.11	< 0.008	< 0.009	< 0.016	< 0.010	< 0.006	< 0.018	< 0.028
04-12-18	297	< 0.11	< 0.006	< 0.006	< 0.013	< 0.011	< 0.009	< 0.028	< 0.046
04-18-18	315	0.21 ± 0.11	< 0.010	< 0.006	< 0.015	< 0.009	< 0.008	< 0.024	< 0.041
04-26-18	334	0.19 ± 0.09	< 0.006	< 0.007	< 0.012	< 0.007	< 0.005	< 0.024	< 0.040
05-03-18	295	0.24 ± 0.13	< 0.013	< 0.010	< 0.015	< 0.011	< 0.007	< 0.018	< 0.055
05-10-18	297	0.20 ± 0.09	< 0.007	< 0.008	< 0.021	< 0.009	< 0.006	< 0.023	< 0.031
05-17-18	301	0.26 ± 0.11	< 0.006	< 0.007	< 0.014	< 0.008	< 0.008	< 0.013	< 0.052
05-23-18	257	< 0.10	< 0.008	< 0.005	< 0.013	< 0.011	< 0.010	< 0.020	< 0.066
05-31-18	342	0.17 ± 0.07	< 0.008	< 0.007	< 0.014	< 0.007	< 0.007	< 0.007	< 0.024
06-06-18	257	0.21 ± 0.11	< 0.009	< 0.007	< 0.011	< 0.009	< 0.008	< 0.017	< 0.047
06-14-18	347	0.26 ± 0.10	< 0.006	< 0.005	< 0.011	< 0.007	< 0.007	< 0.010	< 0.031
06-21-18	301	0.16 ± 0.07	< 0.008	< 0.008	< 0.016	< 0.011	< 0.009	< 0.006	< 0.052
06-28-18	300	< 0.10	< 0.008	< 0.005	< 0.018	< 0.009	< 0.009	< 0.008	< 0.026
07-05-18	275	< 0.13	< 0.009	< 0.007	< 0.022	< 0.011	< 0.009	< 0.016	< 0.051
07-12-18	274	0.22 ± 0.09	< 0.014	< 0.009	< 0.017	< 0.012	< 0.010	< 0.015	< 0.031
07-19-18	276	0.24 ± 0.10	< 0.004	< 0.009	< 0.017	< 0.009	< 0.008	< 0.026	< 0.043
07-26-18	270	< 0.12	< 0.006	< 0.009	< 0.018	< 0.010	< 0.009	< 0.019	< 0.031
08-02-18	265	< 0.11	< 0.011	< 0.008	< 0.022	< 0.013	< 0.006	< 0.023	< 0.047
08-09-18	260	0.29 ± 0.16	< 0.010	< 0.010	< 0.020	< 0.009	< 0.008	< 0.020	< 0.036
08-16-18	281	< 0.13	< 0.008	< 0.006	< 0.016	< 0.010	< 0.009	< 0.010	< 0.040
08-23-18	283	0.14 ± 0.08	< 0.007	< 0.007	< 0.017	< 0.009	< 0.006	< 0.010	< 0.047
08-30-18	277	< 0.12	< 0.010	< 0.004	< 0.018	< 0.011	< 0.008	< 0.053	< 0.052
09-06-18	281	0.21 ± 0.11	< 0.008	< 0.007	< 0.021	< 0.010	< 0.010	< 0.017	< 0.045
09-13-18	278	< 0.14	< 0.007	< 0.004	< 0.024	< 0.010	< 0.011	< 0.044	< 0.035
09-20-18	278	< 0.12	< 0.008	< 0.006	< 0.013	< 0.011	< 0.005	< 0.014	< 0.050
09-27-18	276	< 0.12	< 0.010	< 0.007	< 0.015	< 0.010	< 0.009	< 0.013	< 0.058
10-04-18	274	< 0.16	< 0.010	< 0.005	< 0.029	< 0.013	< 0.012	< 0.025	< 0.060
10-11-18	271	< 0.11	< 0.012	< 0.009	< 0.020	< 0.010	< 0.006	< 0.015	< 0.062

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-007 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	267	< 0.11	< 0.008	< 0.011	< 0.021	< 0.011	< 0.009	< 0.017	< 0.037
10-25-18	265	< 0.11	< 0.014	< 0.006	< 0.016	< 0.012	< 0.010	< 0.017	< 0.052
11-01-18	265	< 0.12	< 0.009	< 0.007	< 0.022	< 0.014	< 0.011	< 0.008	< 0.068
11-08-18	260	< 0.10	< 0.010	< 0.005	< 0.022	< 0.011	< 0.007	< 0.010	< 0.049
11-16-18	288	< 0.12	< 0.012	< 0.006	< 0.014	< 0.015	< 0.012	< 0.020	< 0.056
11-21-18	181	< 0.20	< 0.020	< 0.021	< 0.038	< 0.019	< 0.018	< 0.044	< 0.061
11-29-18	288	< 0.10	< 0.007	< 0.007	< 0.012	< 0.009	< 0.005	< 0.007	< 0.049
12-06-18	250	< 0.15	< 0.012	< 0.008	< 0.027	< 0.014	< 0.007	< 0.029	< 0.050
12-12-18	214	< 0.14	< 0.010	< 0.005	< 0.016	< 0.012	< 0.010	< 0.015	< 0.038
12-20-18	296	< 0.18	< 0.021	< 0.011	< 0.035	< 0.016	< 0.017	< 0.047	< 0.067
12-27-18	250	< 0.15	< 0.014	< 0.012	< 0.015	< 0.013	< 0.006	< 0.022	< 0.068
01-03-19	245	< 0.14	< 0.011	< 0.011	< 0.022	< 0.013	< 0.007	< 0.026	< 0.044

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-008							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	284	0.13 ± 0.08	< 0.006	< 0.005	< 0.007	< 0.009	< 0.008	< 0.007	< 0.041
01-11-18	279	< 0.11	< 0.006	< 0.005	< 0.012	< 0.008	< 0.006	< 0.016	< 0.032
01-18-18	279	< 0.11	< 0.005	< 0.010	< 0.017	< 0.009	< 0.007	< 0.015	< 0.043
01-26-18	320	< 0.08	< 0.007	< 0.010	< 0.010	< 0.008	< 0.008	< 0.014	< 0.030
02-01-18	242	0.22 ± 0.12	< 0.011	< 0.013	< 0.013	< 0.010	< 0.009	< 0.013	< 0.056
02-08-18	275	0.17 ± 0.07	< 0.006	< 0.009	< 0.009	< 0.007	< 0.009	< 0.009	< 0.045
02-15-18	276	0.20 ± 0.10	< 0.005	< 0.007	< 0.011	< 0.007	< 0.008	< 0.011	< 0.027
02-22-18	276	< 0.09	< 0.006	< 0.007	< 0.010	< 0.008	< 0.009	< 0.011	< 0.037
03-01-18	277	< 0.10	< 0.009	< 0.007	< 0.018	< 0.010	< 0.005	< 0.007	< 0.047
03-07-18	236	< 0.11	< 0.007	< 0.010	< 0.014	< 0.010	< 0.009	< 0.014	< 0.048
03-15-18	309	0.13 ± 0.06	< 0.005	< 0.006	< 0.010	< 0.008	< 0.008	< 0.008	< 0.045
03-21-18	234	0.23 ± 0.10	< 0.005	< 0.006	< 0.013	< 0.007	< 0.005	< 0.011	< 0.035
03-28-18	275	< 0.11	< 0.007	< 0.007	< 0.014	< 0.010	< 0.006	< 0.018	< 0.046
04-05-18	309	0.17 ± 0.09	< 0.010	< 0.009	< 0.019	< 0.010	< 0.008	< 0.017	< 0.032
04-12-18	274	0.32 ± 0.17	< 0.013	< 0.013	< 0.015	< 0.011	< 0.006	< 0.032	< 0.065
04-18-18	230	0.26 ± 0.12	< 0.011	< 0.010	< 0.023	< 0.014	< 0.012	< 0.059	< 0.039
04-26-18	310	0.23 ± 0.12	< 0.009	< 0.008	< 0.019	< 0.008	< 0.010	< 0.013	< 0.046
05-03-18	273	0.27 ± 0.13	< 0.009	< 0.006	< 0.017	< 0.011	< 0.006	< 0.015	< 0.051
05-10-18	276	< 0.14	< 0.015	< 0.007	< 0.018	< 0.012	< 0.012	< 0.023	< 0.051
05-17-18	280	< 0.14	< 0.009	< 0.006	< 0.018	< 0.011	< 0.012	< 0.014	< 0.033
05-23-18	240	< 0.13	< 0.010	< 0.007	< 0.016	< 0.012	< 0.010	< 0.018	< 0.065
05-31-18	299	< 0.12	< 0.006	< 0.007	< 0.014	< 0.010	< 0.010	< 0.013	< 0.047
06-06-18	203	< 0.15	< 0.011	< 0.010	< 0.024	< 0.018	< 0.012	< 0.024	< 0.062
06-14-18	303	0.32 ± 0.10	< 0.008	< 0.004	< 0.012	< 0.008	< 0.006	< 0.006	< 0.032
06-21-18	264	< 0.12	< 0.010	< 0.005	< 0.013	< 0.008	< 0.009	< 0.041	< 0.041
06-28-18	269	< 0.10	< 0.006	< 0.005	< 0.015	< 0.009	< 0.006	< 0.008	< 0.028
07-05-18	268	< 0.17	< 0.010	< 0.010	< 0.020	< 0.011	< 0.008	< 0.059	< 0.072
07-12-18	278	< 0.16	< 0.011	< 0.005	< 0.022	< 0.011	< 0.005	< 0.029	< 0.051
07-19-18	279	0.24 ± 0.12	< 0.010	< 0.006	< 0.023	< 0.013	< 0.008	< 0.029	< 0.044
07-26-18	290	< 0.14	< 0.007	< 0.005	< 0.025	< 0.009	< 0.006	< 0.018	< 0.055
08-02-18	310	< 0.13	< 0.006	< 0.003	< 0.011	< 0.008	< 0.005	< 0.016	< 0.050
08-09-18	335	0.27 ± 0.12	< 0.006	< 0.004	< 0.013	< 0.008	< 0.008	< 0.011	< 0.035
08-16-18	347	0.18 ± 0.09	< 0.005	< 0.005	< 0.014	< 0.008	< 0.006	< 0.017	< 0.045
08-23-18	347	0.13 ± 0.08	< 0.006	< 0.004	< 0.016	< 0.007	< 0.007	< 0.009	< 0.045
08-30-18	281	0.17 ± 0.10	< 0.008	< 0.006	< 0.019	< 0.009	< 0.007	< 0.012	< 0.049
09-06-18	276	< 0.11	< 0.006	< 0.004	< 0.016	< 0.010	< 0.008	< 0.017	< 0.050
09-13-18	292	0.22 ± 0.11	< 0.007	< 0.009	< 0.012	< 0.010	< 0.010	< 0.018	< 0.044
09-20-18	294	< 0.12	< 0.010	< 0.010	< 0.021	< 0.010	< 0.010	< 0.024	< 0.030
09-27-18	309	< 0.12	< 0.011	< 0.009	< 0.014	< 0.011	< 0.013	< 0.024	< 0.056
10-04-18	315	< 0.09	< 0.011	< 0.011	< 0.019	< 0.013	< 0.010	< 0.013	< 0.064
10-11-18	325	< 0.12	< 0.008	< 0.009	< 0.009	< 0.008	< 0.008	< 0.013	< 0.030

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-008 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	338	< 0.11	< 0.009	< 0.005	< 0.016	< 0.007	< 0.006	< 0.018	< 0.048
10-25-18	280	< 0.12	< 0.008	< 0.006	< 0.018	< 0.011	< 0.013	< 0.014	< 0.054
11-01-18	279	< 0.11	< 0.006	< 0.005	< 0.016	< 0.011	< 0.009	< 0.015	< 0.034
11-08-18	286	< 0.12	< 0.007	< 0.006	< 0.014	< 0.010	< 0.008	< 0.016	< 0.036
11-16-18	332	< 0.10	< 0.012	< 0.011	< 0.016	< 0.011	< 0.010	< 0.015	< 0.036
11-21-18	214	< 0.12	< 0.011	< 0.008	< 0.028	< 0.015	< 0.012	< 0.013	< 0.060
11-29-18	358	< 0.11	< 0.006	< 0.005	< 0.015	< 0.009	< 0.009	< 0.016	< 0.043
12-06-18	330	0.15 ± 0.08	< 0.007	< 0.005	< 0.016	< 0.008	< 0.008	< 0.006	< 0.025
12-12-18	294	< 0.11	< 0.011	< 0.007	< 0.015	< 0.012	< 0.007	< 0.010	< 0.045
12-20-18	382	< 0.10	< 0.007	< 0.004	< 0.011	< 0.009	< 0.008	< 0.010	< 0.034
12-27-18	346	0.19 ± 0.10	< 0.007	< 0.006	< 0.010	< 0.009	< 0.005	< 0.019	< 0.024
01-03-19	341	< 0.07	< 0.005	< 0.004	< 0.007	< 0.008	< 0.004	< 0.008	< 0.032

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-009							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	291	< 0.11	< 0.008	< 0.008	< 0.012	< 0.011	< 0.008	< 0.019	< 0.033
01-11-18	282	< 0.12	< 0.011	< 0.010	< 0.013	< 0.011	< 0.010	< 0.018	< 0.038
01-18-18	289	< 0.09	< 0.008	< 0.008	< 0.007	< 0.009	< 0.008	< 0.011	< 0.044
01-26-18	321	< 0.07	< 0.008	< 0.006	< 0.005	< 0.007	< 0.008	< 0.009	< 0.026
02-01-18	225	< 0.12	< 0.011	< 0.009	< 0.011	< 0.010	< 0.008	< 0.007	< 0.060
02-08-18	264	< 0.12	< 0.009	< 0.008	< 0.009	< 0.010	< 0.011	< 0.011	< 0.048
02-15-18	268	< 0.13	< 0.008	< 0.011	< 0.016	< 0.010	< 0.009	< 0.016	< 0.055
02-22-18	268	< 0.10	< 0.009	< 0.006	< 0.014	< 0.008	< 0.005	< 0.007	< 0.046
03-01-18	269	< 0.11	< 0.008	< 0.007	< 0.011	< 0.010	< 0.007	< 0.014	< 0.049
03-07-18	230	< 0.11	< 0.013	< 0.009	< 0.012	< 0.013	< 0.007	< 0.029	< 0.045
03-15-18	304	0.16 ± 0.08	< 0.005	< 0.005	< 0.007	< 0.006	< 0.006	< 0.006	< 0.026
03-21-18	229	< 0.12	< 0.006	< 0.008	< 0.017	< 0.012	< 0.010	< 0.010	< 0.055
03-28-18	268	< 0.12	< 0.006	< 0.010	< 0.012	< 0.011	< 0.009	< 0.024	< 0.044
04-05-18	305	< 0.08	< 0.006	< 0.010	< 0.014	< 0.009	< 0.008	< 0.005	< 0.028
04-12-18	269	< 0.16	< 0.013	< 0.012	< 0.021	< 0.012	< 0.007	< 0.052	< 0.040
04-18-18	227	0.35 ± 0.18	< 0.013	< 0.011	< 0.028	< 0.016	< 0.015	< 0.032	< 0.067
04-26-18	306	0.26 ± 0.09	< 0.009	< 0.005	< 0.015	< 0.007	< 0.006	< 0.023	< 0.037
05-03-18	266	0.29 ± 0.15	< 0.006	< 0.006	< 0.020	< 0.009	< 0.010	< 0.046	< 0.050
05-10-18	265	< 0.12	< 0.011	< 0.007	< 0.011	< 0.011	< 0.008	< 0.036	< 0.039
05-17-18	265	< 0.12	< 0.010	< 0.006	< 0.015	< 0.009	< 0.010	< 0.017	< 0.032
05-23-18	227	< 0.15	< 0.010	< 0.011	< 0.017	< 0.012	< 0.009	< 0.030	< 0.068
05-31-18	297	0.33 ± 0.12	< 0.008	< 0.004	< 0.013	< 0.008	< 0.009	< 0.009	< 0.027
06-06-18	225	0.27 ± 0.13	< 0.009	< 0.006	< 0.010	< 0.011	< 0.010	< 0.014	< 0.050
06-14-18	301	0.24 ± 0.10	< 0.006	< 0.005	< 0.015	< 0.009	< 0.007	< 0.010	< 0.048
06-21-18	260	< 0.11	< 0.005	< 0.005	< 0.013	< 0.011	< 0.008	< 0.008	< 0.056
06-28-18	265	< 0.11	< 0.011	< 0.004	< 0.018	< 0.010	< 0.006	< 0.015	< 0.055
07-05-18	262	< 0.12	< 0.004	< 0.008	< 0.022	< 0.011	< 0.008	< 0.010	< 0.053
07-12-18	263	< 0.16	< 0.008	< 0.006	< 0.022	< 0.013	< 0.006	< 0.032	< 0.066
07-19-18	264	0.30 ± 0.17	< 0.010	< 0.005	< 0.017	< 0.011	< 0.006	< 0.024	< 0.055
07-26-18	261	< 0.15	< 0.008	< 0.013	< 0.028	< 0.012	< 0.006	< 0.044	< 0.034
08-02-18	277	0.17 ± 0.08	< 0.008	< 0.007	< 0.020	< 0.009	< 0.009	< 0.016	< 0.047
08-09-18	281	0.29 ± 0.11	< 0.008	< 0.010	< 0.011	< 0.009	< 0.007	< 0.014	< 0.063
08-16-18	274	< 0.12	< 0.005	< 0.004	< 0.014	< 0.009	< 0.006	< 0.011	< 0.047
08-23-18	285	0.30 ± 0.14	< 0.006	< 0.008	< 0.017	< 0.010	< 0.006	< 0.014	< 0.051
08-30-18	293	0.24 ± 0.12	< 0.009	< 0.003	< 0.014	< 0.007	< 0.007	< 0.015	< 0.047
09-06-18	289	< 0.10	< 0.012	< 0.005	< 0.015	< 0.010	< 0.006	< 0.016	< 0.052
09-13-18	294	< 0.12	< 0.007	< 0.011	< 0.011	< 0.010	< 0.010	< 0.023	< 0.047
09-20-18	286	< 0.11	< 0.009	< 0.004	< 0.016	< 0.010	< 0.006	< 0.018	< 0.059
09-27-18	294	< 0.12	< 0.006	< 0.005	< 0.018	< 0.011	< 0.006	< 0.014	< 0.052
10-04-18	292	< 0.11	< 0.008	< 0.007	< 0.012	< 0.010	< 0.007	< 0.013	< 0.048
10-11-18	293	< 0.11	< 0.011	< 0.007	< 0.017	< 0.010	< 0.010	< 0.019	< 0.059

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-009 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	303	< 0.11	< 0.010	< 0.007	< 0.016	< 0.009	< 0.007	< 0.010	< 0.034
10-25-18	300	< 0.10	< 0.008	< 0.004	< 0.011	< 0.009	< 0.010	< 0.017	< 0.057
11-01-18	296	< 0.11	< 0.009	< 0.008	< 0.019	< 0.011	< 0.009	< 0.015	< 0.040
11-08-18	301	< 0.11	< 0.007	< 0.005	< 0.014	< 0.009	< 0.005	< 0.019	< 0.035
11-16-18	347	0.24 ± 0.11	< 0.008	< 0.006	< 0.010	< 0.008	< 0.007	< 0.007	< 0.040
11-21-18	212	< 0.12	< 0.007	< 0.007	< 0.020	< 0.014	< 0.010	< 0.014	< 0.074
11-29-18	323	< 0.09	< 0.008	< 0.007	< 0.012	< 0.008	< 0.007	< 0.008	< 0.042
12-06-18	270	< 0.10	< 0.010	< 0.007	< 0.023	< 0.013	< 0.010	< 0.009	< 0.033
12-12-18	231	< 0.15	< 0.009	< 0.012	< 0.013	< 0.013	< 0.007	< 0.009	< 0.059
12-20-18	313	0.21 ± 0.12	< 0.008	< 0.004	< 0.022	< 0.009	< 0.012	< 0.011	< 0.057
12-27-18	290	< 0.13	< 0.010	< 0.011	< 0.018	< 0.014	< 0.010	< 0.030	< 0.051
01-03-19	295	< 0.08	< 0.008	< 0.005	< 0.014	< 0.007	< 0.007	< 0.011	< 0.032

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-010							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	263	< 0.12	< 0.010	< 0.010	< 0.011	< 0.011	< 0.008	< 0.014	< 0.056
01-11-18	259	< 0.11	< 0.009	< 0.008	< 0.009	< 0.011	< 0.011	< 0.022	< 0.045
01-18-18	256	< 0.12	< 0.008	< 0.011	< 0.016	< 0.010	< 0.010	< 0.020	< 0.058
01-26-18	296	< 0.09	< 0.004	< 0.009	< 0.008	< 0.009	< 0.005	< 0.007	< 0.026
02-01-18	220	< 0.13	< 0.012	< 0.013	< 0.016	< 0.012	< 0.008	< 0.020	< 0.067
02-08-18	472	< 0.06	< 0.002	< 0.003	< 0.005	< 0.006	< 0.005	< 0.007	< 0.022
02-15-18	257	< 0.10	< 0.008	< 0.008	< 0.021	< 0.011	< 0.007	< 0.010	< 0.037
02-22-18	257	< 0.14	< 0.008	< 0.008	< 0.014	< 0.014	< 0.007	< 0.017	< 0.036
03-01-18	258	< 0.11	< 0.006	< 0.008	< 0.013	< 0.011	< 0.005	< 0.009	< 0.032
03-07-18	213	< 0.14	< 0.012	< 0.014	< 0.022	< 0.011	< 0.010	< 0.014	< 0.070
03-15-18	273	0.18 ± 0.08	< 0.008	< 0.008	< 0.012	< 0.008	< 0.008	< 0.019	< 0.047
03-21-18	212	0.23 ± 0.14	< 0.011	< 0.012	< 0.025	< 0.013	< 0.010	< 0.031	< 0.063
03-28-18	244	0.29 ± 0.15	< 0.008	< 0.016	< 0.017	< 0.015	< 0.012	< 0.026	< 0.041
04-05-18	284	< 0.14	< 0.008	< 0.011	< 0.024	< 0.012	< 0.010	< 0.042	< 0.052
04-12-18	243	< 0.12	< 0.009	< 0.007	< 0.021	< 0.011	< 0.013	< 0.036	< 0.058
04-18-18	216	< 0.16	< 0.014	< 0.008	< 0.015	< 0.014	< 0.011	< 0.040	< 0.050
04-26-18	282	0.29 ± 0.12	< 0.006	< 0.006	< 0.012	< 0.010	< 0.008	< 0.022	< 0.057
05-03-18	248	0.34 ± 0.16	< 0.013	< 0.011	< 0.024	< 0.013	< 0.010	< 0.032	< 0.070
05-10-18	254	0.28 ± 0.10	< 0.009	< 0.007	< 0.013	< 0.011	< 0.009	< 0.029	< 0.060
05-17-18	253	0.31 ± 0.14	< 0.010	< 0.006	< 0.018	< 0.009	< 0.011	< 0.022	< 0.052
05-23-18	214	< 0.13	< 0.009	< 0.007	< 0.017	< 0.011	< 0.008	< 0.022	< 0.060
05-31-18	292	0.23 ± 0.11	< 0.012	< 0.005	< 0.013	< 0.011	< 0.007	< 0.018	< 0.052
06-06-18	219	< 0.14	< 0.008	< 0.006	< 0.028	< 0.012	< 0.010	< 0.061	< 0.051
06-14-18	294	0.31 ± 0.10	< 0.006	< 0.007	< 0.008	< 0.009	< 0.008	< 0.011	< 0.054
06-21-18	252	< 0.11	< 0.008	< 0.005	< 0.017	< 0.010	< 0.011	< 0.010	< 0.041
06-28-18	249	0.29 ± 0.16	< 0.009	< 0.007	< 0.020	< 0.012	< 0.007	< 0.021	< 0.051
07-05-18	255	< 0.12	< 0.009	< 0.009	< 0.016	< 0.011	< 0.009	< 0.009	< 0.052
07-12-18	256	< 0.16	< 0.014	< 0.009	< 0.028	< 0.012	< 0.008	< 0.034	< 0.053
07-19-18	253	0.27 ± 0.15	< 0.010	< 0.008	< 0.017	< 0.012	< 0.009	< 0.045	< 0.044
07-26-18	249	< 0.15	< 0.010	< 0.007	< 0.019	< 0.012	< 0.008	< 0.018	< 0.056
08-02-18	279	< 0.11	< 0.007	< 0.008	< 0.017	< 0.010	< 0.010	< 0.015	< 0.054
08-09-18	287	0.26 ± 0.12	< 0.006	< 0.005	< 0.017	< 0.011	< 0.008	< 0.020	< 0.060
08-16-18	283	< 0.12	< 0.007	< 0.009	< 0.020	< 0.011	< 0.007	< 0.020	< 0.050
08-23-18	286	0.20 ± 0.11	< 0.005	< 0.006	< 0.016	< 0.007	< 0.005	< 0.012	< 0.047
08-30-18	294	0.26 ± 0.14	< 0.008	< 0.006	< 0.017	< 0.009	< 0.008	< 0.029	< 0.050
09-06-18	286	< 0.12	< 0.008	< 0.006	< 0.017	< 0.010	< 0.007	< 0.014	< 0.040
09-13-18	290	0.25 ± 0.11	< 0.005	< 0.007	< 0.021	< 0.009	< 0.007	< 0.019	< 0.051
09-20-18	292	< 0.13	< 0.010	< 0.005	< 0.024	< 0.010	< 0.009	< 0.022	< 0.047
09-27-18	290	< 0.12	< 0.010	< 0.008	< 0.012	< 0.010	< 0.012	< 0.025	< 0.043
10-04-18	293	< 0.14	< 0.008	< 0.010	< 0.020	< 0.012	< 0.007	< 0.023	< 0.037
10-11-18	287	< 0.11	< 0.004	< 0.008	< 0.020	< 0.011	< 0.008	< 0.019	< 0.036

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-010 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	282	< 0.13	< 0.005	< 0.009	< 0.018	< 0.010	< 0.012	< 0.025	< 0.059
10-25-18	283	< 0.14	< 0.007	< 0.006	< 0.019	< 0.016	< 0.008	< 0.011	< 0.061
11-01-18	278	< 0.15	< 0.013	< 0.008	< 0.020	< 0.014	< 0.014	< 0.022	< 0.062
11-08-18	277	< 0.09	< 0.013	< 0.006	< 0.020	< 0.013	< 0.010	< 0.021	< 0.062
11-16-18	314	< 0.13	< 0.007	< 0.010	< 0.021	< 0.012	< 0.008	< 0.011	< 0.066
11-21-18	193	< 0.16	< 0.016	< 0.010	< 0.026	< 0.016	< 0.017	< 0.037	< 0.071
11-29-18	279	< 0.11	< 0.011	< 0.005	< 0.015	< 0.011	< 0.006	< 0.013	< 0.040
12-06-18	244	< 0.11	< 0.013	< 0.004	< 0.025	< 0.012	< 0.006	< 0.010	< 0.047
12-12-18	205	< 0.14	< 0.008	< 0.009	< 0.023	< 0.013	< 0.010	< 0.011	< 0.078
12-20-18	290	< 0.15	< 0.015	< 0.008	< 0.023	< 0.015	< 0.008	< 0.025	< 0.044
12-27-18	247	0.18 ± 0.11	< 0.007	< 0.014	< 0.016	< 0.015	< 0.006	< 0.031	< 0.066
01-03-19	238	< 0.12	< 0.010	< 0.008	< 0.013	< 0.011	< 0.005	< 0.040	< 0.055

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-011							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
01-04-18	249	0.26 ± 0.13	< 0.008	< 0.008	< 0.012	< 0.012	< 0.009	< 0.017	< 0.066
01-11-18	249	< 0.15	< 0.010	< 0.009	< 0.021	< 0.009	< 0.009	< 0.064	< 0.051
01-18-18	240	< 0.13	< 0.005	< 0.009	< 0.009	< 0.011	< 0.012	< 0.011	< 0.049
01-26-18	286	0.18 ± 0.07	< 0.008	< 0.007	< 0.013	< 0.009	< 0.007	< 0.021	< 0.043
02-01-18	215	< 0.11	< 0.009	< 0.013	< 0.011	< 0.012	< 0.008	< 0.011	< 0.053
02-08-18	244	< 0.12	< 0.008	< 0.011	< 0.013	< 0.011	< 0.006	< 0.009	< 0.058
02-15-18	297	0.18 ± 0.08	< 0.011	< 0.010	< 0.021	< 0.011	< 0.008	< 0.012	< 0.045
02-22-18	297	< 0.11	< 0.004	< 0.005	< 0.011	< 0.009	< 0.008	< 0.009	< 0.052
03-01-18	300	< 0.11	< 0.011	< 0.010	< 0.019	< 0.013	< 0.011	< 0.017	< 0.038
03-07-18	203	< 0.15	< 0.016	< 0.008	< 0.018	< 0.014	< 0.010	< 0.032	< 0.042
03-15-18	272	< 0.14	< 0.011	< 0.009	< 0.016	< 0.011	< 0.009	< 0.014	< 0.044
03-21-18	209	0.23 ± 0.13	< 0.018	< 0.010	< 0.017	< 0.016	< 0.010	< 0.036	< 0.058
03-28-18	2	< 4.86	< 0.539	< 0.410	< 0.630	< 0.456	< 0.379	< 0.742	< 2.563 [b]
04-05-18	335	0.20 ± 0.10	< 0.006	< 0.005	< 0.016	< 0.008	< 0.006	< 0.040	< 0.032
04-12-18	292	0.21 ± 0.11	< 0.013	< 0.006	< 0.011	< 0.011	< 0.011	< 0.077	< 0.059
04-18-18	248	< 0.18	< 0.012	< 0.008	< 0.018	< 0.011	< 0.011	< 0.037	< 0.061
04-26-18	324	0.24 ± 0.10	< 0.007	< 0.005	< 0.015	< 0.009	< 0.006	< 0.017	< 0.052
05-03-18	284	0.31 ± 0.10	< 0.006	< 0.008	< 0.014	< 0.009	< 0.009	< 0.024	< 0.049
05-10-18	285	0.35 ± 0.12	< 0.013	< 0.008	< 0.017	< 0.009	< 0.009	< 0.022	< 0.041
05-17-18	283	0.32 ± 0.11	< 0.010	< 0.006	< 0.015	< 0.011	< 0.009	< 0.024	< 0.036
05-23-18	244	< 0.14	< 0.006	< 0.007	< 0.019	< 0.011	< 0.009	< 0.022	< 0.054
05-31-18	319	0.25 ± 0.12	< 0.009	< 0.004	< 0.017	< 0.009	< 0.006	< 0.010	< 0.036
06-06-18	239	0.24 ± 0.13	< 0.009	< 0.009	< 0.017	< 0.010	< 0.009	< 0.014	< 0.035
06-14-18	321	0.21 ± 0.08	< 0.011	< 0.006	< 0.008	< 0.009	< 0.009	< 0.012	< 0.051
06-21-18	284	0.17 ± 0.09	< 0.006	< 0.005	< 0.013	< 0.009	< 0.006	< 0.011	< 0.041
06-28-18	274	< 0.11	< 0.006	< 0.004	< 0.014	< 0.010	< 0.006	< 0.008	< 0.035
07-05-18	280	0.21 ± 0.09	< 0.008	< 0.006	< 0.018	< 0.011	< 0.006	< 0.012	< 0.050
07-12-18	281	0.26 ± 0.13	< 0.009	< 0.005	< 0.023	< 0.010	< 0.008	< 0.034	< 0.054
07-19-18	280	0.22 ± 0.12	< 0.005	< 0.005	< 0.017	< 0.010	< 0.008	< 0.028	< 0.043
07-26-18	276	0.31 ± 0.12	< 0.012	< 0.005	< 0.023	< 0.010	< 0.009	< 0.023	< 0.049
08-02-18	277	< 0.14	< 0.013	< 0.006	< 0.016	< 0.011	< 0.010	< 0.015	< 0.044
08-09-18	277	0.22 ± 0.13	< 0.011	< 0.010	< 0.020	< 0.011	< 0.013	< 0.030	< 0.054
08-16-18	272	< 0.12	< 0.010	< 0.007	< 0.020	< 0.009	< 0.008	< 0.011	< 0.045
08-23-18	276	0.22 ± 0.13	< 0.006	< 0.005	< 0.018	< 0.010	< 0.010	< 0.013	< 0.054
08-30-18	282	0.26 ± 0.14	< 0.013	< 0.009	< 0.015	< 0.011	< 0.007	< 0.036	< 0.040
09-06-18	268	< 0.15	< 0.010	< 0.008	< 0.013	< 0.011	< 0.009	< 0.030	< 0.032
09-13-18	275	< 0.16	< 0.014	< 0.011	< 0.026	< 0.012	< 0.013	< 0.033	< 0.055
09-20-18	271	< 0.14	< 0.008	< 0.011	< 0.024	< 0.014	< 0.008	< 0.026	< 0.061
09-27-18	273	< 0.11	< 0.011	< 0.006	< 0.018	< 0.009	< 0.006	< 0.017	< 0.061
10-04-18	275	0.24 ± 0.13	< 0.008	< 0.005	< 0.014	< 0.011	< 0.009	< 0.023	< 0.042
10-11-18	272	< 0.16	< 0.008	< 0.007	< 0.025	< 0.013	< 0.014	< 0.024	< 0.037

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

[b] Low volume; pump found not running; filter very light.

Table 1. Air particulates and charcoal cartridges, analyses for gamma-emitting isotopes and I-131[a].

Collection: Continuous, weekly exchange.

Units: pCi/m^3

Location		CA-A-011 (cont.)							
		^{7}Be	^{58}Co	^{60}Co	^{95}Zr	^{134}Cs	^{137}Cs	$^{140}BaLa$	^{144}Ce
Required LLDs		-	-	-	-	0.050	0.060	-	-
Date Collected	Vol.								
10-18-18	270	< 0.12	< 0.004	< 0.005	< 0.019	< 0.011	< 0.008	< 0.032	< 0.051
10-25-18	272	< 0.11	< 0.006	< 0.009	< 0.022	< 0.010	< 0.009	< 0.008	< 0.041
11-01-18	267	0.24 ± 0.11	< 0.012	< 0.008	< 0.020	< 0.011	< 0.006	< 0.019	< 0.058
11-08-18	269	< 0.13	< 0.011	< 0.006	< 0.015	< 0.013	< 0.012	< 0.015	< 0.048
11-16-18	296	< 0.11	< 0.004	< 0.005	< 0.016	< 0.010	< 0.007	< 0.011	< 0.054
11-21-18	190	< 0.15	< 0.008	< 0.012	< 0.029	< 0.015	< 0.010	< 0.023	< 0.073
11-29-18	296	< 0.11	< 0.005	< 0.008	< 0.016	< 0.011	< 0.010	< 0.014	< 0.055
12-06-18	259	< 0.16	< 0.013	< 0.007	< 0.021	< 0.015	< 0.011	< 0.026	< 0.047
12-12-18	223	< 0.17	< 0.011	< 0.007	< 0.031	< 0.016	< 0.008	< 0.020	< 0.082
12-20-18	314	0.26 ± 0.11	< 0.005	< 0.008	< 0.018	< 0.009	< 0.007	< 0.014	< 0.032
12-27-18	267	< 0.13	< 0.010	< 0.007	< 0.024	< 0.014	< 0.012	< 0.022	< 0.072
01-03-19	257	< 0.11	< 0.007	< 0.007	< 0.011	< 0.012	< 0.006	< 0.030	< 0.041

[a] Iodine-131 concentrations are < 0.07 pCi/m^3 unless noted otherwise.

Table 2. Milk, analyses for iodine-131 and gamma-emitting isotopes.

Collection: Semimonthly during grazing season, monthly otherwise.

Units: pCi/L

Location		CA-MLK-M9					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Zn-65	Cs-134	Cs-137	Ba-La-140
Required LLDs		1	-	-	15	18	15
01-08-18	CAMI -87	< 0.3	979 ± 107	< 11.5	< 4.8	< 5.3	< 3.6
02-12-18	CAMI -484	< 0.4	906 ± 84	< 4.2	< 3.1	< 1.9	< 2.4
03-12-18	CAMI -878	< 0.3	1176 ± 114	< 8.4	< 3.6	< 2.4	< 3.1
04-09-18	CAMI -1150	< 0.4	1205 ± 123	< 11.5	< 4.5	< 4.3	< 1.8
04-24-18	CAMI -1486	< 0.3	943 ± 110	< 6.9	< 4.5	< 4.3	< 1.5
05-08-18			NS[a]				

[a] "NS" = No sample; see Part I Table 5.5, Listing of Missed Samples.

Table 3. Vegetation, analyses for iodine-131 and gamma-emitting isotopes.

Collection: Monthly, during growing season

Units: pCi/kg wet

Lab Code	Collection Date	Sample Type	Concentration (pCi/kg wet) ^{40}K	^{54}Mn	^{58}Co	^{60}Co	^{131}I	^{134}Cs	^{137}Cs
			Location: CA-FPL-V9						
	4/10/2018			NS[a]					
	5/8/2018			NS[a]					
CAVE- 2300	6/11/2018	Lettuce	5466 ± 384	< 11.0	< 13.8	< 8.4	< 38.1	< 12.5	< 11.5
CAVE- 2301	6/12/2018	Spinach	6436 ± 381	< 10.0	< 8.5	< 10.1	< 30.2	< 8.4	< 8.7
CAVE- 2302	6/12/2018	Turnip greens	4895 ± 342	< 8.4	< 8.0	< 11.3	< 27.8	< 11.2	< 6.7
CAVE- 2303	6/12/2018	Mustard greens	4890 ± 363	< 13.2	< 10.6	< 6.9	< 32.9	< 11.3	< 11.9
CAVE- 2304	6/12/2018	Cabbage	3655 ± 289	< 12.0	< 10.4	< 7.7	< 35.3	< 11.4	< 11.0
CAVE- 2604	7/10/2018	Cabbage	4270 ± 339	< 9.3	< 8.4	< 4.5	< 17.8	< 9.7	< 10.0
	8/14/2018			NS[a]					
CAVE- 3765	9/11/2018	Mustard greens	4274 ± 272	< 7.9	< 8.5	< 4.8	< 28.0	< 8.2	< 7.2
CAVE- 3766	9/11/2018	Turnip greens	3566 ± 280	< 7.1	< 7.9	< 4.3	< 27.2	< 7.5	< 6.4
CAVE- 4171	10/9/2018	Collard greens	2507 ± 270	< 5.2	< 8.7	< 8.6	< 14.7	< 10.3	< 6.9
CAVE- 4172	10/9/2018	Turnip greens	3912 ± 335	< 7.9	< 6.5	< 6.7	< 9.0	< 10.6	< 11.4
CAVE- 4173	10/9/2018	Mustard Greens	3567 ± 287	< 5.4	< 3.6	< 7.9	< 14.6	< 10.5	< 6.2
CAVE- 4174	10/9/2018	Lettuce	3131 ± 266	< 7.2	< 8.2	< 6.0	< 10.0	< 11.0	< 11.0
			Location: CA-FPL-V11						
	4/10/2018			NS[a]					
CAVE- 1737	5/7/2018	Lettuce	4047 ± 373	< 13.8	< 12.2	< 9.7	< 21.2	< 13.0	< 7.4
CAVE- 2305	6/11/2018	Swiss Chard	7846 ± 535	< 11.8	< 18.1	< 9.6	< 38.5	< 14.2	< 16.4
CAVE- 2306	6/11/2018	Lettuce	5248 ± 395	< 8.5	< 8.1	< 7.2	< 28.1	< 10.2	< 11.7
	7/9/2018			NS[a]					
	8/14/2018			NS[a]					
CAVE- 3768	9/10/2018	Cabbage	4793 ± 250	< 5.1	< 6.4	< 3.2	< 15.6	< 6.8	< 5.6
CAVE- 3769	9/10/2018	Collard greens	6542 ± 367	< 6.9	< 13.1	< 10.9	< 38.2	< 9.9	< 9.3
CAVE- 4175	10/8/2018	Cabbage	5484 ± 424	< 14.4	< 11.7	< 11.4	< 26.1	< 15.7	< 11.2
CAVE- 4177	10/8/2018	Lettuce	4017 ± 143	< 5.6	< 3.3	< 3.3	< 7.8	< 5.4	< 5.5

[a] "NS" = No sample; see Part I Table 5.5, Listing of Missed Samples.

Table 3. Vegetation, analyses for iodine-131 and gamma-emitting isotopes.

Collection: Monthly, during growing season

Units: pCi/kg wet

Lab Code	Collection Date	Sample Type	Concentration (pCi/kg wet) ^{40}K	^{54}Mn	^{58}Co	^{60}Co	^{131}I	^{134}Cs	^{137}Cs
			Location: CA-FPL-V12						
	4/10/2018			NS[a]					
	5/8/2018			NS[a]					
CAVE- 2307	6/11/2018	Swiss Chard	4969 ± 374	< 13.2	< 5.6	< 6.0	< 24.7	< 11.5	< 11.5
CAVE- 2308	6/11/2018	Lettuce	6569 ± 493	< 17.1	< 19.5	< 15.8	< 54.9	< 19.4	< 15.2
CAVE- 2309	6/11/2018	Cabbage	2849 ± 298	< 8.5	< 6.5	< 7.0	< 28.8	< 8.9	< 8.7
CAVE- 2310	6/11/2018	Poke Weed	7792 ± 496	< 12.8	< 14.9	< 15.4	< 26.0	< 13.9	< 10.8
CAVE- 2605	7/9/2018	Swiss Chard	8610 ± 442	< 12.1	< 11.4	< 10.4	< 28.7	< 12.1	< 12.9
CAVE- 2606	7/9/2018	Lettuce	8054 ± 475	< 12.6	< 9.5	< 7.6	< 23.3	< 11.6	< 11.5
CAVE- 2607	7/9/2018	Cabbage	2351 ± 242	< 8.8	< 6.0	< 4.9	< 16.8	< 8.5	< 8.2
CAVE- 3279	8/14/2018	Swiss Chard	6590 ± 428	< 12.1	< 6.7	< 10.3	< 12.7	< 9.7	< 11.1
CAVE- 3280	8/14/2018	Spinach Mustard	4120 ± 343	< 8.2	< 10.0	< 8.2	< 13.6	< 10.2	< 15.2
CAVE- 3281	8/14/2018	Poke Greens	11389 ± 524	< 14.5	< 14.5	< 17.4	< 23.9	< 15.3	< 9.9
CAVE- 3770	9/10/2018	Swiss Chard	6830 ± 216	< 4.6	< 6.4	< 5.0	< 22.8	< 5.3	< 7.4
CAVE- 4178	10/9/2018	Cabbage	3734 ± 357	< 10.8	< 11.8	< 7.4	< 15.2	< 14.3	< 15.5
CAVE- 4179	10/9/2018	Swiss Chard	3733 ± 336	< 9.9	< 7.4	< 8.0	< 15.3	< 10.1	< 8.0
			Location: CA-FPL-V16						
	4/10/2018			NS[a]					
	5/8/2018			NS[a]					
CAVE- 2311	6/11/2018	Collard Greens	7337 ± 606	< 19.0	< 14.5	< 17.3	< 41.1	< 16.8	< 21.0
CAVE- 2312	6/11/2018	Kale	5499 ± 458	< 17.3	< 16.6	< 10.0	< 35.6	< 16.3	< 9.5
CAVE- 2314	6/11/2018	Turnip greens	7230 ± 427	< 10.9	< 5.7	< 14.5	< 43.4	< 12.6	< 7.4
CAVE- 2608	7/9/2018	Lettuce	3674 ± 288	< 15.1	< 14.1	< 12.9	< 21.6	< 13.1	< 11.9
CAVE- 2609	7/9/2018	Kale	7045 ± 472	< 11.8	< 8.3	< 13.6	< 22.0	< 13.4	< 12.7
CAVE- 2610	7/9/2018	Beet greens	5922 ± 752	< 39.8	< 30.8	< 34.2	< 45.8	< 33.9	< 37.4
CAVE- 2612	7/9/2018	Turnip greens	5340 ± 398	< 19.8	< 19.4	< 11.3	< 28.0	< 17.4	< 20.5
CAVE- 2613	7/9/2018	Radish greens	6207 ± 493	< 13.5	< 13.0	< 9.0	< 16.0	< 12.5	< 8.1
	8/14/2018			NS[a]					
CAVE- 3771	9/10/2018	Lettuce	2851 ± 239	< 13.7	< 13.2	< 10.7	< 52.3	< 11.2	< 12.0
	10/9/2018			NS[a]					

[a] "NS" = No sample; see Part I Table 5.5, Listing of Missed Samples.

Table 4. Non-food Crops, analyses for tritium and gamma-emitting isotopes.

Collection: Annually, at harvest

Units: pCi/kg wet

Lab Code	Sample Type	Collection Date	(pCi/L) ^{3}H	Concentration (pCi/kg wet) ^{40}K	^{54}Mn	^{58}Co	^{60}Co	^{134}Cs	^{137}Cs
				Location: CA-FC-1					
		9/17/2018			NS[a]				
		9/17/2018			NS[a]				
		9/17/2018			NS[a]				
				Location: CA-FC-2					
CAVE- 3851	1-Soybeans	9/17/2018	316 ± 87[b]	7339 ± 165	< 5.6	< 5.7	< 4.2	< 4.5	< 4.2
CAVE- 3852	2-Soybeans	9/17/2018	<185	6215 ± 152	< 4.8	< 5.0	< 5.3	< 4.6	< 5.4
CAVE- 3853	3-Soybeans	9/17/2018	<185	6207 ± 156	< 2.5	< 5.1	< 4.0	< 4.0	< 2.9
				Location: CA-FC-3					
CAVE- 3854	1-Soybeans	9/17/2018	371 ± 90[c]	6483 ± 457	< 8.0	< 10.7	< 7.2	< 13.3	< 9.6
CAVE- 3856	2-Soybeans	9/17/2018	< 151	7845 ± 168	< 4.5	< 4.7	< 4.3	< 5.1	< 4.4
CAVE- 3857	3-Soybeans	9/17/2018	346 ± 88[d]	5800 ± 155	< 4.1	< 4.3	< 5.5	< 5.0	< 5.6
				Location: CA-FC-4(C)					
CAVE- 3858	Soybeans	9/14/2018	< 185	6873 ± 353	< 5.0	< 10.2	< 8.9	< 9.0	< 9.0

[a] "NS" = No sample; see Part I Table 5.5, Listing of Missed Samples.

[b] Recount result = 553 ± 129

[c] Duplicate result = 367 ± 89

[d] Recount result = 288 ± 121

Table 5. Soil, analyses for gamma-emitting isotopes.
Collection: Annually

Lab Code	Collection Date	Concentration (pCi/kg dry) ^{40}K	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
Location: SOL-F-002										
CASO- 5007	11/14/2018	11546 ± 787	< 25.3	< 58.6	< 31.5	< 27.0	< 39.4	< 24.7	467 ± 46	< 121.7
CASO- 5008	11/14/2018	11980 ± 1016	< 40.4	< 61.3	< 34.2	< 17.4	< 36.8	< 36.9	582 ± 63	< 114.7
Location: SOL-F-006										
CASO- 5009	11/20/2018	11036 ± 784	< 24.9	< 50.3	< 25.6	< 20.0	< 32.9	< 26.3	634 ± 49	< 41.3
CASO- 5010	11/20/2018	10459 ± 750	< 31.7	< 63.3	< 29.4	< 22.9	< 41.3	< 26.3	589 ± 50	< 43.4
Location: SOL-PR-003										
CASO- 5013	11/20/2018	9263 ± 630	< 23.5	< 76.4	< 37.5	< 20.8	< 58.7	< 13.3	144 ± 30	< 216.5
CASO- 5014	11/20/2018	10633 ± 722	< 20.6	< 58.0	< 28.3	< 15.6	< 34.4	< 19.3	275 ± 43	< 78.3
Location: SOL-PR-007										
CASO- 5015	11/14/2018	9860 ± 751	< 23.9	< 58.3	< 34.0	< 23.4	< 44.8	< 25.0	209 ± 34	< 116.8
CASO- 5016	11/14/2018	11303 ± 685	< 26.2	< 98.0	< 29.0	< 15.9	< 93.1	< 24.1	205 ± 34	< 237.8
Location: SOL-M-009										
CASO- 5011	11/20/2018	16462 ± 923	< 32.2	< 55.1	< 38.9	< 17.4	< 68.1	< 26.3	139 ± 38	< 221.5
CASO- 5012	11/20/2018	15659 ± 589	< 19.5	< 51.8	< 25.7	< 15.6	< 47.5	< 12.4	143 ± 27	< 100.5
Location: SOL-W-001										
CASO- 5017	11/14/2018	4391 ± 454	< 22.5	< 54.8	< 23.6	< 7.0	< 41.4	< 15.3	< 21	< 191.0
CASO- 5018	11/14/2018	13181 ± 772	< 32.9	< 45.3	< 23.1	< 15.4	< 32.1	< 18.4	45 ± 24	< 115.8
Location: SOL-W-002										
CASO- 5019	11/14/2018	9670 ± 631	< 19.4	< 44.2	< 23.9	< 13.1	< 31.3	< 17.7	< 15	< 74.6
CASO- 5020	11/14/2018	13254 ± 610	< 19.3	< 47.7	< 19.0	< 15.8	< 35.3	< 17.4	< 17	< 39.7
Location: SOL-W-003										
CASO- 5021	11/14/2018	14448 ± 772	< 26.0	< 127.4	< 39.9	< 18.2	< 55.8	< 17.7	125 ± 31	< 161.1
CASO- 5022	11/14/2018	14772 ± 824	< 24.0	< 60.4	< 36.0	< 20.7	< 42.2	< 24.2	141 ± 28	< 118.3
Location: SOL-W-004										
CASO- 5023	11/14/2018	8442 ± 534	< 25.3	< 60.1	< 30.4	< 19.5	< 47.9	< 14.8	< 16	< 301.6
CASO- 5024	11/14/2018	6260 ± 581	< 27.8	< 36.6	< 29.9	< 12.1	< 35.2	< 21.2	< 15	< 92.1

Table 6. Surface water, analyses for tritium and gamma-emitting isotopes.

Collection: Monthly
Location: CA-SWA-S01 Units: pCi/L

Lab Code Date Collected	Required LLD	CASW- 382 01-30-18	CASW- 717 02-27-18	CASW- 1022 03-27-18	CASW- 1541 04-24-18
H-3	3000	< 150	< 156	< 163	< 156
Mn-54	15	< 2.3	< 2.0	< 3.4	< 2.7
Fe-59	30	< 3.5	< 4.0	< 5.4	< 2.7
Co-58	15	< 2.2	< 3.1	< 1.6	< 2.6
Co-60	15	< 1.7	< 2.5	< 2.1	< 1.5
Zn-65	30	< 1.9	< 4.4	< 2.7	< 2.4
Zr-Nb-95	15	< 2.8	< 2.7	< 3.1	< 2.2
I-131	1000	< 5.1	< 6.4	< 6.6	< 19.9
Cs-134	15	< 2.6	< 2.9	< 3.6	< 2.8
Cs-137	18	< 3.1	< 2.8	< 3.2	< 3.2
Ba-La-140	15	< 2.2	< 2.6	< 2.2	< 6.6

Lab Code Date Collected	Required LLD	CASW- 2145 05-30-18	CASW- 2449 06-26-18	CASW- 3146 07-31-18	CASW- 3564 08-28-18
H-3	3000	< 151	< 154	< 152	< 148
Mn-54	15	< 1.4	< 2.7	< 2.1	< 3.8
Fe-59	30	< 5.2	< 4.7	< 4.7	< 14.4
Co-58	15	< 2.9	< 2.7	< 1.6	< 4.9
Co-60	15	< 1.7	< 2.6	< 1.1	< 5.4
Zn-65	30	< 4.6	< 4.0	< 3.2	< 15.6
Zr-Nb-95	15	< 3.9	< 2.3	< 2.8	< 9.7
I-131	1000	< 20.0	< 5.2	< 10.3	< 23.3
Cs-134	15	< 4.0	< 2.9	< 3.5	< 7.9
Cs-137	18	< 3.6	< 3.0	< 3.3	< 5.0
Ba-La-140	15	< 6.5	< 3.7	< 5.4	< 13.8

Lab Code Date Collected	Required LLD	CASW- 3971 09-24-18	CASW- 4716 10-30-18	CASW- 5065 11-28-18	CASW- 5413 12-26-18
H-3	3000	< 150	< 152	< 153	< 148
Mn-54	15	< 6.0	< 2.5	< 2.3	< 3.0
Fe-59	30	< 7.7	< 5.3	< 7.6	< 5.4
Co-58	15	< 4.7	< 2.8	< 3.9	< 2.0
Co-60	15	< 3.6	< 1.4	< 1.9	< 2.3
Zn-65	30	< 8.4	< 3.4	< 5.0	< 5.2
Zr-Nb-95	15	< 3.9	< 2.6	< 5.6	< 3.0
I-131	1000	< 25.3	< 5.9	< 19.4	< 7.8
Cs-134	15	< 4.9	< 3.0	< 3.8	< 3.5
Cs-137	18	< 4.1	< 3.2	< 2.9	< 2.1
Ba-La-140	15	< 4.2	< 4.8	< 6.1	< 4.1

Table 6. Surface water, analyses for tritium and gamma-emitting isotopes.

Collection: Monthly
Location: CA-SWA-S02 Units: pCi/L

Lab Code Date Collected	Required LLD	CASW- 383 01-30-18	CASW- 718 02-27-18	CASW- 1023 03-27-18	CASW- 1542 04-24-18
H-3	3000	< 150	< 156	< 163	534 ± 101
Mn-54	15	< 2.0	< 3.1	< 2.8	< 3.4
Fe-59	30	< 3.1	< 3.1	< 3.0	< 6.0
Co-58	15	< 1.8	< 1.5	< 3.4	< 1.9
Co-60	15	< 1.9	< 2.3	< 1.9	< 2.2
Zn-65	30	< 4.6	< 3.8	< 4.6	< 4.9
Zr-Nb-95	15	< 2.2	< 2.5	< 2.0	< 3.7
I-131	1000	< 4.7	< 6.2	< 3.9	< 16.7
Cs-134	15	< 2.8	< 2.6	< 3.0	< 2.8
Cs-137	18	< 2.8	< 3.2	< 3.1	< 2.4
Ba-La-140	15	< 4.1	< 2.7	< 1.8	< 7.4

Lab Code Date Collected	Required LLD	CASW- 2146 05-30-18	CASW- 2451 06-26-18	CASW- 3147 07-31-18	CASW- 3566 08-28-18
H-3	3000	< 151	< 154	< 152	< 148
Mn-54	15	< 2.2	< 1.9	< 3.3	< 3.8
Fe-59	30	< 5.4	< 3.2	< 4.8	< 7.9
Co-58	15	< 2.5	< 2.9	< 1.4	< 3.7
Co-60	15	< 1.8	< 2.3	< 2.0	< 3.2
Zn-65	30	< 2.5	< 2.9	< 4.1	< 4.9
Zr-Nb-95	15	< 2.6	< 4.3	< 3.4	< 3.2
I-131	1000	< 15.8	< 7.4	< 9.0	< 12.8
Cs-134	15	< 2.8	< 3.2	< 3.7	< 4.0
Cs-137	18	< 3.8	< 2.9	< 3.2	< 4.3
Ba-La-140	15	< 5.3	< 1.7	< 2.8	< 4.5

Lab Code Date Collected	Required LLD	CASW- 3972 09-24-18	CASW- 4718 10-30-18	CASW- 5066 11-28-18	CASW- 5415 12-26-18
H-3	3000	< 150	< 152	< 153	159 ± 78
Mn-54	15	< 2.7	< 3.1	< 2.2	< 2.5
Fe-59	30	< 4.1	< 6.3	< 7.3	< 5.6
Co-58	15	< 1.8	< 3.6	< 2.7	< 1.6
Co-60	15	< 1.9	< 2.9	< 2.4	< 1.7
Zn-65	30	< 4.5	< 2.3	< 3.4	< 4.7
Zr-Nb-95	15	< 5.0	< 4.8	< 3.1	< 3.4
I-131	1000	< 13.5	< 6.9	< 18.0	< 9.0
Cs-134	15	< 4.2	< 3.4	< 2.8	< 3.4
Cs-137	18	< 3.3	< 2.2	< 2.4	< 3.4
Ba-La-140	15	< 2.7	< 4.5	< 7.9	< 6.8

7. Surface Water (Ponds), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-SWA-POND 01						
CASW- 900	03/09/18	< 155	< 3.6	< 4.3	< 1.6	< 2.7	< 4.3	< 3.8	< 3.7	< 3.2	< 4.4
CASW- 3666	09/04/18	< 156	< 2.5	< 4.3	< 3.6	< 2.7	< 4.9	< 4.5	< 4.0	< 3.8	< 8.7
					Location: CA-SWA-POND 02						
CASW- 901	03/09/18	< 155	< 2.4	< 6.2	< 3.0	< 2.8	< 4.2	< 2.9	< 2.9	< 3.1	< 3.9
CASW- 3667	09/04/18	< 156	< 0.8	< 2.2	< 1.2	< 1.2	< 2.5	< 2.9	< 1.4	< 1.6	< 2.8
					Location: CA-SWA-SLUDGE LAGOON #4						
CASW- 893	03/07/18	< 155	< 4.0	< 5.4	< 3.5	< 4.2	< 9.0	< 4.8	< 4.4	< 4.9	< 2.3
CASW- 3668	09/04/18	< 156	< 1.2	< 2.0	< 0.9	< 1.0	< 1.9	< 1.4	< 1.1	< 1.1	< 5.5

7. Surface Water (Ponds), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-SWA-OUTFALL 010						
CASW- 894	03/07/18	< 155	< 2.0	< 4.8	< 3.0	< 2.2	< 5.6	< 2.8	< 2.9	< 2.0	< 3.1
CASW- 3660	09/04/18	< 156	< 2.9	< 8.1	< 2.4	< 2.9	< 2.2	< 4.9	< 4.0	< 2.6	< 3.5
					Location: CA-SWA-OUTFALL 011						
CASW- 895	03/07/18	< 155	< 1.8	< 3.5	< 1.8	< 1.8	< 2.9	< 2.5	< 2.3	< 2.4	< 2.4
CASW- 3661	09/04/18	< 156	< 2.4	< 3.2	< 3.0	< 1.9	< 4.5	< 5.0	< 3.5	< 3.8	< 4.2
					Location: CA-SWA-OUTFALL 012						
CASW- 896	03/07/18	< 155	< 2.4	< 4.3	< 2.7	< 2.4	< 4.8	< 3.9	< 2.0	< 3.4	< 5.2
CASW- 3662	09/04/18	< 156	< 2.7	< 5.1	< 2.7	< 1.8	< 4.9	< 4.6	< 3.0	< 3.2	< 8.5
					Location: CA-SWA-OUTFALL 013						
CASW- 897	03/07/18	< 155	< 2.7	< 5.9	< 1.5	< 2.1	< 4.4	< 2.0	< 3.0	< 2.7	< 1.8
CASW- 3663	09/04/18	< 156	< 2.9	< 7.7	< 3.3	< 2.3	< 5.0	< 4.9	< 3.9	< 3.6	< 6.4
					Location: CA-SWA-OUTFALL 014						
CASW- 898	03/09/18	< 155	< 1.6	< 3.9	< 2.2	< 1.8	< 2.7	< 3.1	< 2.8	< 1.7	< 5.5
CASW- 3664	09/04/18	< 156	< 3.4	< 6.6	< 1.6	< 1.8	< 2.2	< 3.9	< 3.3	< 2.2	< 3.5
					Location: CA-SWA-OUTFALL 015						
CASW- 899	03/09/18	< 155	< 2.3	< 5.5	< 2.6	< 2.7	< 2.7	< 2.3	< 2.8	< 2.0	< 4.4
CASW- 3665	09/04/18	< 156	< 1.9	< 3.8	< 2.1	< 3.0	< 4.0	< 2.8	< 3.1	< 2.8	< 4.4

Table 8. Drinking Water Wells, analysis for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					CA-DWA-003 (Ward)						
CADW- 366	1/30/2018	< 150	< 3.5	< 7.2	< 2.4	< 2.6	< 3.9	< 2.4	< 4.1	< 3.8	< 1.6
CADW- 1580	4/25/2018	< 157	< 4.2	< 6.5	< 4.2	< 3.6	< 8.0	< 6.9	< 3.9	< 3.2	< 12.7
CADW- 3205	8/1/2018	< 154	< 4.6	< 4.2	< 2.2	< 1.7	< 4.7	< 3.4	< 3.9	< 4.1	< 5.4
CADW- 4880	10/31/2018	< 151	< 1.7	< 5.8	< 2.9	< 1.0	< 3.2	< 3.1	< 3.1	< 2.9	< 4.5
					CA-DWA-004 (Miller)						
CADW- 367	1/30/2018	< 150	< 2.6	< 7.7	< 2.6	< 2.4	< 2.8	< 2.3	< 3.0	< 2.5	< 3.2
CADW- 1581	4/26/2018	< 157	< 2.4	< 6.0	< 3.7	< 2.1	< 3.5	< 3.7	< 3.7	< 1.3	< 5.3
CADW- 3206	7/31/2018	< 154	< 3.4	< 7.1	< 3.0	< 2.1	< 3.5	< 2.9	< 3.9	< 2.9	< 3.1
CADW- 4881	10/31/2018	< 151	< 2.1	< 4.6	< 3.3	< 2.5	< 6.4	< 4.7	< 4.1	< 3.7	< 6.6
					CA-DWA-005 (Brucker Bros.)						
CADW- 368	1/30/2018	< 150	< 5.9	< 10.9	< 2.6	< 3.5	< 7.6	< 6.4	< 6.3	< 5.0	< 3.0
CADW- 1582	4/25/2018	< 157	< 2.2	< 4.5	< 2.6	< 1.5	< 2.0	< 3.0	< 2.2	< 3.5	< 3.9
CADW- 3207	8/6/2018	< 154	< 1.8	< 5.6	< 1.8	< 1.3	< 4.0	< 2.8	< 2.8	< 3.2	< 5.3
CADW- 4882	11/13/2018	< 151	< 2.7	< 4.1	< 1.6	< 0.9	< 3.7	< 2.7	< 3.2	< 3.6	< 4.9
					CA-DWA-006 (Lindeman)						
CADW- 370	1/30/2018	< 150	< 2.6	< 4.0	< 1.4	< 2.3	< 6.3	< 3.1	< 3.2	< 2.8	< 2.3
CADW- 1583	4/25/2018	< 157	< 3.6	< 5.2	< 2.3	< 1.0	< 5.1	< 2.9	< 4.1	< 3.0	< 6.0
CADW- 3208	8/1/2018	< 154	< 2.7	< 3.0	< 3.4	< 2.4	< 2.7	< 4.8	< 3.0	< 2.9	< 4.7
CADW- 4883	10/31/2018	< 151	< 3.9	< 5.9	< 2.9	< 2.7	< 7.2	< 5.7	< 3.3	< 2.8	< 7.8
					CA-DWA-007 (Kriete)						
CADW- 371	1/30/2018	< 150	< 2.7	< 3.9	< 3.5	< 2.2	< 5.3	< 4.6	< 3.6	< 3.6	< 1.8
CADW- 1584	4/25/2018	< 157	< 2.4	< 5.2	< 1.9	< 2.2	< 2.6	< 3.1	< 3.0	< 3.0	< 5.0
CADW- 3209	8/1/2018	< 154	< 3.2	< 4.9	< 3.7	< 1.8	< 4.8	< 3.3	< 3.5	< 2.2	< 4.9
CADW- 4884	10/31/2018	< 151	< 1.9	< 4.5	< 3.9	< 1.8	< 5.2	< 5.2	< 3.7	< 2.9	< 7.0
					CA-DWA-008 (Brandt)						
CADW- 372	1/31/2018	< 150	< 2.0	< 4.2	< 2.4	< 2.2	< 5.0	< 3.9	< 2.6	< 2.3	< 3.1
CADW- 1585	4/25/2018	< 157	< 2.9	< 4.7	< 1.8	< 2.1	< 4.2	< 3.5	< 3.0	< 2.8	< 9.0
CADW- 3210	8/1/2018	< 154	< 2.2	< 7.8	< 3.5	< 2.5	< 5.3	< 4.4	< 3.1	< 2.5	< 5.2
CADW- 4885	10/31/2018	< 151	< 2.5	< 3.4	< 3.9	< 2.7	< 5.8	< 3.0	< 2.9	< 2.2	< 2.7

Table 8. Drinking Water Wells, analysis for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L)									
		^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
						CA-DWA-009 (Clardy)					
CADW- 373	1/31/2018	< 150	< 2.8	< 3.6	< 3.6	< 2.2	< 4.3	< 1.5	< 3.1	< 2.1	< 1.8
CADW- 1586	4/25/2018	< 157	< 2.3	< 5.4	< 2.5	< 1.7	< 4.2	< 2.9	< 3.1	< 2.5	< 7.3
CADW- 3211	8/1/2018	< 154	< 2.4	< 7.9	< 2.9	< 1.8	< 1.3	< 2.9	< 2.7	< 2.5	< 5.5
CADW- 4886	10/31/2018	< 151	< 3.2	< 5.3	< 2.7	< 2.8	< 3.2	< 4.3	< 3.6	< 2.3	< 9.3
						CA-DWA-010 (Dillon, Susan)					
CADW- 374	1/31/2018	< 150	< 2.7	< 2.7	< 2.3	< 3.2	< 5.5	< 2.6	< 3.2	< 3.2	< 2.9
CADW- 1587	4/25/2018	< 157	< 3.5	< 4.4	< 3.1	< 2.9	< 3.2	< 5.0	< 3.5	< 3.2	< 6.2
CADW- 3212	8/1/2018	< 154	< 3.0	< 5.8	< 1.7	< 1.3	< 3.4	< 2.8	< 2.9	< 3.3	< 4.9
CADW- 4887	11/2/2018	< 151	< 3.6	< 5.7	< 2.0	< 2.6	< 4.1	< 3.4	< 3.7	< 3.5	< 8.8
						CA-DWA-012 (Dillon, Joe)					
CADW- 375	1/31/2018	< 150	< 3.6	< 5.8	< 1.0	< 2.5	< 6.3	< 3.8	< 3.7	< 4.5	< 4.9
CADW- 1588	4/25/2018	< 157	< 2.9	< 7.2	< 2.7	< 1.5	< 2.8	< 3.4	< 3.1	< 2.2	< 5.7
CADW- 3213	8/1/2018	< 154	< 2.7	< 5.8	< 2.2	< 1.8	< 3.2	< 3.4	< 3.1	< 2.7	< 9.6
CADW- 4888	11/2/2018	< 151	< 2.4	< 5.3	< 2.5	< 2.0	< 4.9	< 4.3	< 2.7	< 3.0	< 8.6
						CA-DWA-21					
CADW- 376	1/31/2018	< 150	< 2.5	< 4.0	< 2.1	< 2.7	< 5.6	< 1.9	< 3.2	< 3.8	< 3.7
CADW- 1589	4/25/2018	< 157	< 2.3	< 3.8	< 2.1	< 1.4	< 2.6	< 4.7	< 2.5	< 2.0	< 8.9
CADW- 3214	8/1/2018	< 154	< 3.1	< 6.0	< 2.8	< 1.2	< 2.9	< 3.3	< 3.5	< 2.9	< 3.4
CADW- 4889	10/31/2018	< 151	< 3.8	< 7.0	< 2.5	< 2.1	< 4.1	< 3.9	< 3.7	< 3.3	< 6.9
						CA-DWA-022 (Plummer)					
CADW- 377	1/31/2018	< 150	< 3.6	< 5.4	< 2.0	< 2.5	< 3.1	< 2.4	< 3.6	< 2.4	< 3.6
CADW- 1590	4/25/2018	< 157	< 5.1	< 10.0	< 6.2	< 2.4	< 9.1	< 4.3	< 3.9	< 4.7	< 4.1
CADW- 3216	8/1/2018	< 154	< 2.8	< 5.5	< 2.4	< 2.0	< 4.0	< 3.6	< 3.6	< 3.3	< 5.8
CADW- 4890	11/2/2018	< 151	< 2.4	< 4.6	< 2.9	< 2.6	< 6.3	< 4.6	< 3.8	< 4.0	< 5.5

Table 8. Drinking Water Wells, analysis for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					CA-DWA-PW1 (Plant Cafeteria)						
CADW- 381	1/31/2018	< 150	< 2.9	< 4.2	< 2.0	< 2.5	< 3.5	< 2.3	< 3.1	< 1.9	< 4.2
CADW- 1595	4/26/2018	< 157	< 2.3	< 3.7	< 2.0	< 2.4	< 4.5	< 3.9	< 2.5	< 2.2	< 6.6
CADW- 3220	8/1/2018	< 154	< 3.4	< 5.5	< 2.8	< 1.3	< 3.2	< 5.2	< 3.6	< 2.9	< 8.4
CADW- 4894	10/31/2018	< 151	< 2.6	< 5.9	< 1.6	< 1.9	< 3.2	< 3.2	< 2.6	< 2.6	< 9.4
					CA-DWA-V16						
CADW- 380	1/31/2018	< 150	< 3.2	< 2.2	< 2.4	< 3.2	< 3.7	< 3.4	< 3.5	< 2.9	< 3.0
CADW- 1594	4/25/2018	< 157	< 1.9	< 4.8	< 2.0	< 1.6	< 3.4	< 4.6	< 2.8	< 3.6	< 4.8
CADW- 3219	8/1/2018	< 154	< 2.3	< 5.6	< 2.2	< 2.0	< 3.4	< 3.2	< 2.5	< 2.6	< 7.7
CADW- 4893	11/2/2018	< 151	< 2.5	< 5.3	< 3.1	< 2.0	< 2.4	< 5.0	< 3.0	< 3.2	< 11.5
					CA-DWA-D23						
CADW- 378	1/31/2018	< 150	< 1.8	< 5.0	< 1.7	< 2.0	< 5.2	< 2.6	< 2.8	< 3.4	< 3.7
CADW- 1592	4/25/2018	< 157	< 2.8	< 3.8	< 2.6	< 1.9	< 5.0	< 3.9	< 2.7	< 1.7	< 13.3
CADW- 3217	8/1/2018	< 154	< 2.2	< 5.7	< 2.7	< 1.3	< 2.7	< 2.4	< 2.6	< 2.6	< 7.8
CADW- 4891	11/2/2018	< 151	< 2.7	< 5.3	< 3.0	< 3.1	< 4.3	< 4.8	< 3.8	< 2.2	< 12.5
					CA-DWA-024						
CADW- 379	1/31/2018	< 150	< 1.9	< 5.9	< 1.6	< 2.3	< 5.9	< 2.6	< 3.0	< 2.4	< 1.5
CADW- 1593	4/25/2018	< 157	< 2.0	< 6.3	< 3.6	< 2.7	< 4.4	< 2.7	< 3.5	< 2.7	< 7.7
CADW- 3218	8/1/2018	< 154	< 1.7	< 5.6	< 1.8	< 1.3	< 2.4	< 2.6	< 2.3	< 2.3	< 4.2
CADW- 4892	10/31/2018	< 151	< 2.9	< 8.0	< 3.0	< 2.3	< 3.3	< 2.9	< 3.2	< 3.4	< 7.7

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-WWA-936						
CAWW- 150	1/10/2018	253 ± 87	< 2.4	< 3.9	< 1.5	< 2.1	< 6.2	< 3.1	< 2.6	< 1.7	< 2.1
CAWW- 527	2/16/2018	222 ± 87	< 2.3	< 5.2	< 2.4	< 2.1	< 4.1	< 3.6	< 3.0	< 2.1	< 3.4
CAWW- 851	3/9/2018	248 ± 91	< 3.9	< 3.9	< 2.6	< 3.6	< 2.8	< 4.4	< 3.7	< 3.5	< 3.8
CAWW- 1173	4/11/2018	237 ± 86	< 2.8	< 3.3	< 1.5	< 1.8	< 3.8	< 2.1	< 2.9	< 1.6	< 2.8
CAWW- 1819	5/10/2018	220 ± 86	< 1.8	< 5.9	< 4.4	< 2.6	< 8.7	< 2.3	< 4.7	< 2.9	< 7.3
CAWW- 2266	6/8/2018	< 160	< 3.8	< 9.2	< 3.3	< 4.5	< 4.9	< 3.4	< 5.1	< 3.3	< 2.9
CAWW- 2750	7/12/2018	227 ± 85	< 2.5	< 3.4	< 1.6	< 1.2	< 6.1	< 4.7	< 2.9	< 4.4	< 3.1
CAWW- 3245	8/7/2018	< 154	< 4.2	< 5.2	< 3.8	< 1.6	< 6.2	< 5.6	< 4.8	< 5.1	< 7.1
CAWW- 3735	9/11/2018	< 156	< 2.9	< 4.5	< 4.6	< 2.2	< 4.8	< 5.8	< 3.8	< 4.0	< 4.7
CAWW- 4251	10/10/2018	219 ± 84	< 4.1	< 7.0	< 3.1	< 3.0	< 4.4	< 4.8	< 5.3	< 3.7	< 5.5
CAWW- 4855	11/13/2018	224 ± 82	< 3.3	< 8.7	< 5.6	< 2.2	< 6.7	< 5.3	< 5.2	< 4.3	< 5.8
CAWW- 5237	12/10/2018	250 ± 86	< 5.5	< 4.5	< 3.1	< 2.3	< 4.7	< 4.0	< 5.4	< 3.2	< 5.1
					Location: CA-WWA-937B						
CAWW- 151	1/10/2018	< 154	< 4.2	< 5.6	< 2.5	< 3.4	< 2.8	< 5.9	< 4.0	< 4.0	< 6.3
CAWW- 528	2/16/2018	< 156	< 3.4	< 7.0	< 2.8	< 2.4	< 3.1	< 2.2	< 3.4	< 3.4	< 1.7
CAWW- 852	3/9/2018	< 158	< 3.5	< 5.7	< 2.1	< 4.6	< 4.6	< 4.0	< 4.1	< 2.1	< 3.9
CAWW- 1174	4/11/2018	203 ± 85	< 2.5	< 2.5	< 3.8	< 2.4	< 5.3	< 4.3	< 3.3	< 4.1	< 2.5
CAWW- 1820	5/10/2018	227 < 86	< 2.8	< 7.2	< 4.2	< 3.4	< 3.3	< 6.3	< 4.0	< 3.3	< 12.6
CAWW- 2267	6/8/2018	166 ± 88	< 2.9	< 3.3	< 2.4	< 2.7	< 2.6	< 3.8	< 3.1	< 4.5	< 9.3
CAWW- 2751	7/12/2018	206 < 84	< 4.0	< 7.8	< 2.4	< 1.9	< 6.3	< 3.2	< 3.9	< 4.4	< 10.3
CAWW- 3246	8/10/2018	< 154	< 4.2	< 10.4	< 4.8	< 4.0	< 5.9	< 4.3	< 5.1	< 3.5	< 8.3
CAWW- 3736	9/11/2018	< 156	< 3.2	< 7.2	< 2.6	< 2.0	< 2.0	< 3.6	< 3.3	< 3.6	< 11.0
CAWW- 4252	10/10/2018	< 154	< 3.3	< 10.5	< 2.9	< 2.2	< 4.9	< 5.4	< 3.8	< 3.8	< 9.9
CAWW- 4856	11/13/2018	< 151	< 2.5	< 4.3	< 2.7	< 2.5	< 3.0	< 3.2	< 2.6	< 2.8	< 4.1
CAWW- 5238	12/10/2018	< 157	< 3.0	< 5.3	< 4.0	< 3.8	< 3.7	< 4.0	< 4.9	< 5.6	< 6.2
					Location: CA-WWA-937D						
CAWW- 152	1/10/2018	< 154	< 2.9	< 4.5	< 1.9	< 2.7	< 2.8	< 3.5	< 3.4	< 4.5	< 6.9
CAWW- 529	2/16/2018	< 156	< 6.5	< 12.1	< 6.5	< 7.0	< 20.3	< 9.6	< 8.3	< 8.4	< 4.7
CAWW- 853	3/9/2018	< 158	< 2.3	< 4.3	< 1.8	< 2.7	< 2.7	< 3.4	< 3.1	< 3.1	< 2.0
CAWW- 1175	4/11/2018	< 159	< 2.7	< 4.3	< 2.4	< 2.0	< 4.5	< 2.8	< 3.3	< 3.7	< 2.9
CAWW- 1821	5/10/2018	< 159	< 3.7	< 4.3	< 2.3	< 1.6	< 2.4	< 3.3	< 3.3	< 3.5	< 6.5
CAWW- 2268	6/8/2018	< 160	< 3.2	< 13.3	< 5.4	< 4.8	< 6.7	< 4.8	< 4.8	< 4.4	< 6.1
CAWW- 2752	7/12/2018	< 156	< 2.7	< 9.2	< 3.2	< 2.9	< 5.7	< 4.7	< 3.5	< 3.7	< 8.1
CAWW- 3247	8/7/2018	< 154	< 2.1	< 6.7	< 2.7	< 2.6	< 5.7	< 3.7	< 2.6	< 3.2	< 11.4
CAWW- 3737	9/11/2018	< 156	< 2.2	< 4.2	< 2.0	< 1.3	< 3.4	< 3.9	< 2.3	< 2.7	< 7.6
CAWW- 4253	10/10/2018	< 154	< 3.7	< 5.6	< 1.8	< 3.4	< 3.2	< 3.3	< 3.9	< 4.5	< 5.8
CAWW- 4857	11/13/2018	< 151	< 2.0	< 6.4	< 2.3	< 3.9	< 7.0	< 5.6	< 3.2	< 3.6	< 14.3
CAWW- 5239	12/10/2018	< 157	< 4.4	< 4.9	< 4.1	< 4.0	< 4.7	< 2.6	< 4.9	< 5.0	< 3.6

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-WWA-939R						
CAWW- 153	1/10/2018	157 ± 82	< 2.8	< 6.9	< 2.7	< 2.4	< 5.6	< 3.7	< 3.5	< 2.6	< 3.2
CAWW- 530	2/16/2018	< 156	< 2.6	< 6.3	< 1.9	< 2.3	< 5.5	< 2.0	< 3.5	< 3.3	< 4.1
CAWW- 854	3/9/2018	248 ± 91	< 2.4	< 6.9	< 3.4	< 3.4	< 5.1	< 5.3	< 4.2	< 4.2	< 4.3
CAWW- 1176	4/11/2018	298 ± 89	< 2.6	< 7.7	< 1.9	< 2.2	< 2.4	< 2.9	< 3.3	< 2.7	< 3.6
CAWW- 1822	5/10/2018	< 159	< 3.9	< 9.9	< 5.4	< 4.8	< 9.7	< 7.8	< 5.8	< 2.6	< 3.9
CAWW- 2269	6/8/2018	341 ± 96	< 2.2	< 4.8	< 1.9	< 2.1	< 4.6	< 4.3	< 3.3	< 1.8	< 3.5
CAWW- 2753	7/12/2018	168 ± 82	< 4.2	< 5.1	< 2.1	< 1.6	< 4.1	< 6.9	< 4.5	< 3.7	< 7.9
CAWW- 3248	8/7/2018	174 ± 85	< 3.0	< 5.7	< 2.4	< 2.0	< 2.3	< 5.7	< 3.1	< 3.0	< 5.2
CAWW- 3738	9/11/2018	364 ± 91	< 2.2	< 4.0	< 2.3	< 2.1	< 6.2	< 4.3	< 3.3	< 3.2	< 9.5
CAWW- 4254	10/10/2018	< 154	< 4.2	< 7.5	< 4.5	< 6.1	< 11.6	< 10.3	< 6.0	< 5.6	< 10.7
CAWW- 4858	11/13/2018	325 ± 87	< 4.6	< 4.1	< 4.8	< 1.3	< 6.2	< 5.4	< 4.3	< 3.2	< 11.0
CAWW- 5241	12/10/2018	309 ± 89	< 4.0	< 3.0	< 2.4	< 2.9	< 4.8	< 5.3	< 4.0	< 3.5	< 4.4
					Location: CA-WWA-940						
CAWW- 154	1/10/2018	< 154	< 3.9	< 7.2	< 2.4	< 2.4	< 7.6	< 3.3	< 4.0	< 4.1	< 9.1
CAWW- 531	2/16/2018	< 156	< 2.7	< 4.3	< 3.1	< 3.1	< 3.0	< 3.9	< 3.7	< 5.1	< 3.3
CAWW- 855	3/9/2018	< 158	< 2.5	< 8.5	< 2.5	< 4.2	< 4.9	< 2.9	< 4.8	< 3.6	< 3.3
CAWW- 1177	4/11/2018	< 159	< 2.5	< 5.3	< 2.8	< 2.6	< 2.7	< 3.3	< 3.6	< 2.6	< 2.6
CAWW- 1823	5/10/2018	< 159	< 2.4	< 5.6	< 4.0	< 2.0	< 6.3	< 4.8	< 4.3	< 3.8	< 12.1
CAWW- 2270	6/8/2018	< 160	< 2.8	< 6.8	< 4.6	< 1.2	< 5.1	< 3.8	< 3.1	< 3.0	< 5.4
CAWW- 2754	7/12/2018	< 156	< 2.3	< 7.7	< 2.9	< 2.3	< 7.3	< 2.4	< 4.6	< 2.9	< 4.5
CAWW- 3249	8/10/2018	< 154	< 2.9	< 8.0	< 2.7	< 2.1	< 4.3	< 4.0	< 4.6	< 2.5	< 5.3
CAWW- 3739	9/11/2018	< 156	< 1.6	< 4.0	< 1.3	< 1.3	< 3.2	< 2.7	< 1.7	< 1.5	< 4.2
CAWW- 4255	10/10/2018	< 154	< 3.7	< 5.8	< 2.3	< 2.7	< 3.9	< 2.8	< 3.9	< 3.0	< 5.3
CAWW- 4859	11/13/2018	< 151	< 4.0	< 10.5	< 3.1	< 3.4	< 6.6	< 5.1	< 5.0	< 4.6	< 6.1
CAWW- 5242	12/10/2018	< 157	< 2.7	< 4.8	< 3.2	< 2.5	< 6.3	< 4.2	< 3.9	< 4.5	< 2.6
					Location: CA-WWA-941						
CAWW- 155	1/10/2018	167 ± 83	< 2.4	< 5.1	< 2.5	< 3.0	< 5.8	< 5.1	< 3.6	< 2.3	< 3.8
CAWW- 532	2/16/2018	< 156	< 2.7	< 6.2	< 3.1	< 1.8	< 6.4	< 3.5	< 3.2	< 2.6	< 2.6
CAWW- 856	3/9/2018	< 158	< 2.7	< 5.7	< 2.0	< 2.6	< 8.2	< 3.3	< 3.5	< 3.3	< 4.1
CAWW- 1178	4/11/2018	< 159	< 2.9	< 2.3	< 2.3	< 1.1	< 4.0	< 3.6	< 4.0	< 3.4	< 8.3
CAWW- 1824	5/10/2018	< 159	< 1.9	< 4.0	< 3.4	< 2.9	< 3.7	< 4.3	< 3.0	< 3.2	< 8.0
CAWW- 2272	6/8/2018	< 160	< 3.9	< 9.5	< 4.5	< 3.8	< 4.2	< 4.9	< 4.8	< 3.6	< 7.7
CAWW- 2755	7/12/2018	< 156	< 4.2	< 4.8	< 4.0	< 1.9	< 3.3	< 6.0	< 3.7	< 4.1	< 9.4
CAWW- 3250	8/10/2018	< 154	< 3.8	< 6.0	< 2.2	< 2.6	< 4.9	< 4.1	< 3.3	< 3.8	< 11.6
CAWW- 3740	9/11/2018	< 156	< 3.4	< 11.5	< 5.3	< 1.8	< 5.0	< 4.3	< 3.3	< 3.3	< 4.6
CAWW- 4256	10/10/2018	< 154	< 3.2	< 3.2	< 4.5	< 3.0	< 4.0	< 4.1	< 3.8	< 3.6	< 9.2
CAWW- 4860	11/13/2018	< 151	< 4.6	< 7.5	< 4.1	< 2.4	< 5.3	< 4.8	< 3.9	< 4.1	< 6.1
CAWW- 5243	12/10/2018	< 157	< 3.5	< 6.8	< 5.2	< 2.0	< 3.6	< 4.5	< 5.7	< 4.5	< 4.8

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-WWA-GWS						
CAWW- 156	1/10/2018	180 ± 84	< 2.1	< 2.8	< 1.7	< 2.5	< 2.3	< 3.2	< 3.0	< 3.9	< 3.0
CAWW- 533	2/16/2018	< 156	< 3.7	< 7.5	< 3.3	< 2.7	< 6.3	< 4.1	< 4.2	< 3.1	< 7.4
CAWW- 857	3/9/2018	< 158	< 3.5	< 3.8	< 3.6	< 3.1	< 4.3	< 2.6	< 4.0	< 3.6	< 2.8
CAWW- 1179	4/11/2018	198 ± 84	< 3.7	< 4.9	< 3.7	< 2.0	< 4.5	< 3.4	< 2.7	< 3.5	< 7.2
CAWW- 1825	5/10/2018	233 ± 86	< 3.1	< 7.1	< 4.4	< 2.4	< 3.9	< 5.3	< 3.9	< 3.6	< 11.6
CAWW- 2273	6/8/2018	< 160	< 3.3	< 4.8	< 3.1	< 1.7	< 5.7	< 4.7	< 3.2	< 3.2	< 9.0
CAWW- 2749	7/12/2018	202 ± 83	< 3.5	< 6.1	< 2.9	< 1.7	< 4.9	< 2.9	< 3.2	< 4.2	< 7.5
CAWW- 3251	8/7/2018	241 ± 88	< 2.1	< 4.9	< 4.1	< 1.8	< 6.4	< 4.5	< 4.1	< 4.1	< 3.8
CAWW- 3741	9/11/2018	206 ± 83	< 1.2	< 3.1	< 1.1	< 1.4	< 2.6	< 2.9	< 1.5	< 1.8	< 4.0
CAWW- 4257	10/10/2018	621 ± 102	< 3.1	< 5.4	< 2.9	< 1.9	< 4.9	< 3.5	< 4.1	< 3.8	< 6.5
CAWW- 4861	11/13/2018	< 151	< 3.5	< 8.7	< 4.0	< 4.3	< 6.5	< 5.9	< 5.4	< 5.6	< 11.4
CAWW- 5244	12/10/2018	< 157	< 2.5	< 7.1	< 4.5	< 3.4	< 6.1	< 7.0	< 4.3	< 4.0	< 3.9
					ISFSI Sump						
CAWW- 149	1/14/2016	< 154									
CAWW- 1182	4/11/2018	< 159									
CAWW- 2756	7/12/2018	< 156									
CAWW- 4265	10/10/2018	< 154									
					Location: CA-WWA-U1MW-001						
CAWW- 225	1/20/2018	< 156	< 3.9	< 9.3	< 3.2	< 3.2	< 6.4	< 3.3	< 2.7	< 4.7	< 5.7
CAWW- 1438	4/18/2018	< 150	< 3.6	< 7.9	< 3.9	< 2.0	< 6.7	< 6.9	< 5.0	< 3.9	< 7.1
CAWW- 2828	7/16/2018	< 158	< 2.5	< 5.7	< 3.0	< 2.0	< 3.8	< 3.2	< 3.3	< 2.1	< 6.9
CAWW- 4260	10/12/2018	< 154	< 4.3	< 6.2	< 4.7	< 3.3	< 3.9	< 4.5	< 5.1	< 5.7	< 6.5
					Location: CA-WWA-U1MW-002						
CAWW- 220	1/17/2018	< 156	< 2.1	< 8.6	< 3.3	< 2.9	< 5.6	< 4.5	< 3.3	< 3.3	< 7.4
CAWW- 1435	4/13/2018	< 151	< 2.6	< 5.3	< 1.7	< 1.5	< 4.1	< 3.6	< 2.7	< 3.1	< 7.7
CAWW- 2632	7/10/2018	< 153	< 2.5	< 5.8	< 3.5	< 2.7	< 4.9	< 4.2	< 3.8	< 2.5	< 9.7
CAWW- 4118	10/2/2018	< 154	< 3.8	< 8.9	< 2.7	< 2.5	< 3.9	< 5.7	< 4.7	< 4.9	< 8.7
					Location: CA-WWA-U1MW-004						
CAWW- 41	1/8/2018	< 152	< 5.2	< 10.9	< 6.9	< 4.9	< 8.8	< 7.9	< 6.4	< 6.3	< 9.1
CAWW- 1128	4/4/2018	< 159	< 2.5	< 4.4	< 4.2	< 2.5	< 4.5	< 4.4	< 3.6	< 3.7	< 3.9
CAWW- 2630	7/10/2018	< 153	< 4.2	< 9.5	< 2.5	< 2.7	< 6.2	< 6.8	< 4.6	< 4.8	< 9.9
CAWW- 4263	10/11/2018	< 154	< 3.3	< 7.1	< 3.0	< 3.0	< 3.3	< 4.0	< 3.7	< 2.9	< 8.5

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
					Location: CA-WWA-U1MW-005						
CAWW- 43	1/8/2018	< 154	< 4.2	< 7.4	< 5.0	< 4.2	< 12.0	< 7.4	< 5.1	< 2.9	< 4.0
CAWW- 1129	4/4/2018	< 159	< 2.5	< 4.2	< 2.5	< 3.0	< 3.1	< 3.2	< 3.7	< 3.1	< 8.2
CAWW- 2633	7/10/2018	< 153	< 3.6	< 4.7	< 1.6	< 3.2	< 5.9	< 5.0	< 3.1	< 2.9	< 4.8
CAWW- 4264	10/11/2018	< 154	< 2.0	< 4.1	< 1.2	< 1.6	< 3.7	< 2.8	< 2.5	< 2.5	< 7.3
					Location: CA-WWA-U1MW-006						
CAWW- 219	1/17/2018	< 156	< 3.5	< 7.0	< 2.6	< 2.4	< 6.9	< 3.9	< 4.6	< 4.2	< 7.0
CAWW- 1443	4/18/2018	< 150	< 3.8	< 8.1	< 2.6	< 2.1	< 5.2	< 5.5	< 4.7	< 4.8	< 10.5
CAWW- 2835	7/17/2018	< 158	< 2.5	< 6.1	< 2.9	< 2.2	< 4.2	< 3.5	< 3.8	< 2.5	< 12.4
CAWW- 4259	10/11/2018	< 154	< 3.0	< 4.1	< 2.8	< 1.6	< 6.2	< 3.4	< 3.4	< 2.5	< 6.9
					Location: CA-WWA-U1MW-010						
CAWW- 146	1/9/2018	< 154	< 2.9	< 5.3	< 2.7	< 2.0	< 5.4	< 4.0	< 3.6	< 3.1	< 3.9
CAWW- 1431	4/12/2018	< 151	< 3.2	< 3.1	< 2.3	< 1.7	< 4.8	< 4.4	< 3.3	< 3.6	< 7.0
CAWW- 2838	7/17/2018	< 158	< 2.3	< 9.8	< 3.5	< 1.6	< 5.3	< 5.9	< 4.2	< 3.2	< 4.5
CAWW- 4261	10/11/2018	< 154	< 1.6	< 6.4	< 1.9	< 1.5	< 3.7	< 2.7	< 2.5	< 2.7	< 2.6
					Location: CA-WWA-U1MW-012						
CAWW- 218	1/17/2018	< 156	< 4.1	< 7.4	< 3.8	< 3.7	< 6.3	< 2.9	< 3.6	< 4.3	< 2.6
CAWW- 1442	4/18/2018	< 150	< 3.1	< 7.1	< 3.0	< 2.2	< 4.4	< 3.5	< 2.9	< 3.4	< 7.0
CAWW- 2834	7/17/2018	< 158	< 3.2	< 9.8	< 4.4	< 2.2	< 4.9	< 7.0	< 4.0	< 4.0	< 8.5
CAWW- 4258	10/11/2018	< 154	< 3.2	< 6.5	< 1.9	< 1.8	< 1.7	< 2.9	< 3.5	< 3.3	< 9.5
					Location: CA-WWA-U1MW-013						
CAWW- 226	1/20/2018	< 156	< 4.0	< 5.3	< 4.9	< 3.4	< 4.3	< 5.5	< 4.0	< 3.6	< 3.7
CAWW- 1439	4/18/2018	< 150	< 2.7	< 7.0	< 2.6	< 2.5	< 6.7	< 3.9	< 3.7	< 4.3	< 12.2
CAWW- 2837	7/17/2018	< 158	< 4.2	< 7.7	< 3.4	< 2.0	< 4.8	< 4.2	< 3.2	< 2.1	< 6.0
CAWW- 4525	10/17/2018	< 150	< 3.9	< 6.5	< 3.1	< 1.9	< 5.7	< 3.9	< 4.3	< 4.2	< 6.8
					Location: CA-WWA-U1MW-014						
CAWW- 46	1/4/2018	< 154	< 5.1	< 6.8	< 4.5	< 3.4	< 10.2	< 4.1	< 5.9	< 3.8	< 7.5
CAWW- 1432	4/12/2018	< 151	< 2.1	< 6.0	< 3.9	< 1.7	< 3.4	< 3.8	< 3.3	< 1.7	< 7.8
CAWW- 2637	7/9/2018	232 ± 84	< 3.4	< 6.6	< 2.9	< 2.9	< 5.1	< 4.8	< 4.1	< 4.3	< 8.2
CAWW- 4115	10/2/2018	< 154	< 2.6	< 5.2	< 3.0	< 1.7	< 4.4	< 3.0	< 3.4	< 3.5	< 10.6
					Location: CA-WWA-U1MW-015						
CAWW- 44	1/5/2018	< 154	< 3.1	< 6.0	< 2.1	< 2.4	< 4.4	< 3.1	< 3.4	< 3.4	< 3.4
CAWW- 1180	4/10/2018	< 159	< 3.7	< 5.3	< 3.6	< 3.0	< 6.7	< 2.8	< 4.0	< 4.5	< 3.9
CAWW- 2636	7/9/2018	< 153	< 2.9	< 9.1	< 3.2	< 2.2	< 2.9	< 4.6	< 3.9	< 4.3	< 6.5
CAWW- 4529	10/17/2018	< 150	< 3.0	< 7.1	< 1.5	< 2.5	< 5.7	< 3.6	< 3.6	< 3.5	< 6.5

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
		Location: CA-WWA-U1MW-016									
CAWW- 145	1/9/2018	< 154	< 4.1	< 5.5	< 3.2	< 2.5	< 4.1	< 5.5	< 4.1	< 2.9	< 5.8
CAWW- 1130	4/6/2018	< 159	< 2.9	< 6.4	< 2.6	< 2.6	< 6.6	< 3.3	< 3.4	< 2.1	< 2.8
CAWW- 2631	7/10/2018	< 153	< 3.3	< 7.8	< 2.7	< 2.4	< 3.2	< 3.6	< 3.1	< 3.7	< 6.3
CAWW- 4521	10/16/2018	< 150	< 1.7	< 6.1	< 2.5	< 1.6	< 4.3	< 3.3	< 2.3	< 3.3	< 2.9
		Location: CA-WWA-U1MW-18									
CAWW- 45	1/4/2018	< 154									
CAWW- 1429	4/12/2018	238 ± 85									
CAWW- 2640	7/9/2018	< 153									
CAWW- 4114	10/2/2018	< 154									
		Location: CA-WWA-U1MW-19									
CAWW- 215	1/16/2018	< 156									
CAWW- 1433	4/12/2018	< 151									
CAWW- 2638	7/9/2018	< 153									
CAWW- 4116	10/2/2018	< 154									
		Location: CA-WWA-U1MW-20									
CAWW- 217	1/16/2018	< 156									
CAWW- 1430	4/12/2018	< 151									
CAWW- 2639	7/9/2018	< 153									
CAWW- 4117	10/2/2018	< 154									
		Location: CA-WWA-U1MW-31									
CAWW- 221	1/18/2018	299 ± 90									
CAWW- 1440	4/16/2018	345 ± 90									
CAWW- 2843	7/18/2018	711 ± 107									
CAWW- 4524	10/16/2018	268 ± 84									

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
		Location: CA-WWA-U1MW-34									
CAWW- 222	1/18/2018	406 ± 95									
CAWW- 1437	4/16/2018	285 ± 88									
CAWW- 2842	7/18/2018	240 ± 87									
CAWW- 4526	10/17/2018	310 ± 86									
		Location: CA-WWA-U1MW-36									
CAWW- 223	1/18/2018	483 ± 99									
CAWW- 1441	4/18/2018	304 ± 88									
CAWW- 2839	7/18/2018	398 ± 94									
CAWW- 4527	10/17/2018	307 ± 87									
		Location: CA-WWA-U1MW-39									
CAWW- 147	1/9/2018	< 154									
CAWW- 1184	4/10/2018	< 159									
CAWW- 2829	7/16/2018	< 158									
CAWW- 4523	10/16/2018	< 150									

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
		Location: CA-WWA-U1MW-47									
	1/20/2018					ND[a]					
CAWW- 1434	4/13/2018	172 ± 82									
CAWW- 2635	7/10/2018	230 ± 84									
CAWW- 4522	10/16/2018	369 ± 89									
		Location: CA-WWA-U1MW-58									
CAWW- 224	1/18/2018	911 ± 116									
CAWW- 1436	4/16/2018	840 ± 111									
CAWW- 2840	7/18/2018	394 ± 94									
CAWW- 4528	10/17/2018	516 ± 96									
		Location: CA-WWA-U1MW-59									
CAWW- 227	1/20/2018	< 156									
CAWW- 1131	4/6/2018	< 159									
CAWW- 2841	7/18/2018	< 158									
CAWW- 4119	10/3/2018	< 154									
		Inside Old Blowdown Pipeline									
	1/16/2018					ND[a]					
CAWW- 1444	4/18/2018	171 ± 82									
CAWW- 2836	7/17/2018	< 158									
CAWW- 4532	10/18/2018	220 ± 82									

[a] "ND" = No data, see Part I Table 5.5, Listing of Missed Samples.

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
		Location: CA-WWA-U1MW-47									
	1/20/2018					ND[a]					
CAWW- 1434	4/13/2018	172 ± 82									
CAWW- 2635	7/10/2018	230 ± 84									
CAWW- 4522	10/16/2018	369 ± 89									
		Location: CA-WWA-U1MW-58									
CAWW- 224	1/18/2018	911 ± 116									
CAWW- 1436	4/16/2018	840 ± 111									
CAWW- 2840	7/18/2018	394 ± 94									
CAWW- 4528	10/17/2018	516 ± 96									
		Location: CA-WWA-U1MW-59									
CAWW- 227	1/20/2018	< 156									
CAWW- 1131	4/6/2018	< 159									
CAWW- 2841	7/18/2018	< 158									
CAWW- 4119	10/3/2018	< 154									
		Inside Old Blowdown Pipeline									
	1/16/2018					ND[a]					
CAWW- 1444	4/18/2018	171 ± 82									
CAWW- 2836	7/17/2018	< 158									
CAWW- 4532	10/18/2018	220 ± 82									

[a] "ND" = No data, see Part I Table 5.5, Listing of Missed Samples.

Table 9. Wells and Ponds (non-potable), analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L) ^{3}H	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	$^{95}ZrNb$	^{134}Cs	^{137}Cs	$^{140}BaLa$
		Location: CA-WWA-U2MW-2S									
CAWW- 229	1/20/2018	< 156									
CAWW- 1183	4/10/2018	< 159									
CAWW- 2641	7/10/2018	< 153									
CAWW- 4122	10/3/2018	< 154									
		Location: CA-WWA-U2MW-5S									
CAWW- 143	1/9/2018	< 154									
CAWW- 1132	4/4/2018	< 159									
CAWW- 2833	7/16/2018	< 158									
CAWW- 4121	10/3/2018	< 154									
		Location: CA-WWA-U2MW-8									
CAWW- 148	1/9/2018	< 154									
CAWW- 1134	4/6/2018	< 159									
CAWW- 2832	7/16/2018	< 158									
CAWW- 4531	10/16/2018	< 150									
		Location: CA-WWA-U2MW-10									
CAWW- 228	1/18/2018	< 156	< 2.8	< 6.9	< 2.5	< 2.5	< 3.6	< 3.8	< 3.0	< 1.8	< 3.7
CAWW- 1181	4/10/2018	< 159	< 3.6	< 7.0	< 3.6	< 1.5	< 5.7	< 2.3	< 3.7	< 3.6	< 4.8
CAWW- 2830	7/16/2018	< 158	< 1.7	< 3.8	< 1.8	< 1.8	< 4.1	< 2.4	< 2.2	< 2.2	< 6.2
CAWW- 4530	10/16/2018	< 150	< 3.1	< 6.1	< 2.4	< 1.8	< 6.0	< 3.0	< 3.7	< 3.3	< 6.3
		Location: CA-WWA-U2MW-16									
CAWW- 47	1/5/2018	< 154									
CAWW- 1133	4/6/2018	< 159									
CAWW- 2642	7/9/2018	< 153									
CAWW- 4120	10/3/2018	< 154									
		Location: CA-WWA-F-005									
CAWW- 122	1/10/2018	< 152	< 2.3	< 3.6	< 2.3	< 2.4	< 6.6	< 2.2	< 3.3	< 4.1	< 5.5
CAWW- 1253	4/11/2018	< 154	< 5.2	< 9.1	< 2.6	< 4.1	< 4.2	< 4.0	< 4.9	< 4.6	< 12.8
CAWW- 2574	7/6/2018	< 153	< 2.9	< 2.8	< 2.9	< 2.9	< 4.9	< 3.1	< 2.9	< 1.9	< 3.9
CAWW- 4301	10/12/2018	< 154	< 2.0	< 3.5	< 3.1	< 1.8	< 2.2	< 3.1	< 3.4	< 3.6	< 8.0
		Location: CA-WWA-F-015									
CAWW- 124	1/10/2018	< 152	< 2.7	< 3.4	< 3.2	< 2.5	< 3.1	< 2.5	< 2.7	< 3.6	< 1.6
CAWW- 1254	4/11/2018	< 154	< 2.7	< 6.5	< 2.2	< 2.2	< 2.3	< 3.9	< 3.3	< 3.0	< 4.3
CAWW- 2573	7/6/2018	< 153	< 2.0	< 5.1	< 1.7	< 1.7	< 2.4	< 3.1	< 3.1	< 1.9	< 3.2
CAWW- 4300	10/12/2018	< 154	< 3.3	< 5.6	< 3.4	< 1.6	< 4.3	< 3.0	< 3.2	< 3.0	< 5.4

Table 10a. Bottom sediments, analyses for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/kg dry

Location		CA-AQS-A	
Lab Code	Req. LLD	CABS- 1806	CABS- 4609
Date Collected	-	05-09-18	10-24-18
K-40	-	14016 ± 723	12101 ± 641
Mn-54	-	< 31.5	< 25.6
Fe-59	-	< 63.4	< 57.2
Co-58	-	< 20.8	< 16.8
Co-60	-	< 22.7	< 18.0
Zr-Nb-95	-	< 67.3	< 42.2
Cs-134	150	< 22.8	< 16.9
Cs-137	180	< 17.4	< 26.1
Ba-La-140	-	< 200.1	< 90.7

Location		CA-AQS-C	
Lab Code	Req. LLD	CABS- 1807	CABS- 4610
Date Collected	-	05-09-18	10-24-18
K-40	-	15995 ± 834	13870 ± 694
Mn-54	-	< 21.7	< 25.6
Fe-59	-	< 87.2	< 66.0
Co-58	-	< 26.0	< 24.9
Co-60	-	< 20.5	< 10.3
Zr-Nb-95	-	< 46.7	< 32.7
Cs-134	150	< 27.0	< 17.4
Cs-137	180	44 ± 23.9	< 25.9
Ba-La-140	-	< 232.0	< 97.6

Table 10b. Shoreline sediments, analyses for gamma-emitting isotopes.

Collection: Semiannually

Units: pCi/kg dry

Location		CA-AQS-A	
Lab Code	Req. LLD	CASS- 1804	CASS- 4606
Date Collected	-	05-09-18	10-24-18
K-40	-	14632 ± 763	13274 ± 568
Mn-54	-	< 24.1	< 22.9
Fe-59	-	< 72.7	< 44.2
Co-58	-	< 27.4	< 18.6
Co-60	-	< 21.3	< 15.3
Zr-Nb-95	-	< 40.6	< 47.9
Cs-134	150	< 19.8	< 12.2
Cs-137	180	46 ± 22.0	< 17.6
Ba-La-140	-	< 293.4	< 145.0

Location		CA-AQS-C	
Lab Code	Req. LLD	CASS- 1805	CASS- 4607
Date Collected	-	05-09-18	10-24-18
K-40	-	14262 ± 759	14021 ± 690
Mn-54	-	< 21.2	< 21.7
Fe-59	-	< 85.2	< 65.6
Co-58	-	< 23.5	< 26.4
Co-60	-	< 26.7	< 13.6
Zr-Nb-95	-	< 48.8	< 41.9
Cs-134	150	< 23.4	< 16.9
Cs-137	180	< 18.7	< 19.3
Ba-La-140	-	< 213.8	< 128.3

Table 11. Fish, analyses for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/kg wet

Location		CA-AQF-A				
Lab Code	Req. LLD	CAF- 1808	CAF- 1809	CAF- 1810	CAF- 1811	CAF- 1812
Date Collected		05-09-18	05-09-18	05-09-18	05-09-18	05-09-18
Sample Type		River Carpsucker	Silver Carp	Freshwater Drum	Common Carp	Smallmouth Buffalo
K-40	-	2135 ± 389	3463 ± 477	2431 ± 381	2661 ± 435	3413 ± 470
Mn-54	130	< 18.6	< 9.1	< 20.0	< 13.0	< 14.1
Fe-59	260	< 73.9	< 55.4	< 72.9	< 45.7	< 41.3
Co-58	130	< 18.0	< 26.5	< 17.8	< 24.8	< 17.5
Co-60	130	< 16.0	< 13.4	< 15.0	< 14.1	< 10.0
Zn-65	260	< 31.1	< 23.7	< 39.7	< 41.7	< 39.3
Cs-134	130	< 22.0	< 18.2	< 18.7	< 17.1	< 19.3
Cs-137	150	< 13.0	< 15.5	< 18.5	< 7.3	< 20.0

Lab Code	Req. LLD	CAF- 4611	CAF- 4612	CAF- 4613	CAF- 4614	CAF- 4615
Date Collected		10-24-18	10-24-18	10-24-18	10-24-18	10-24-18
Sample Type		Bigmouth Buffalo	Common Carp	Freshwater Drum	Silver Carp	River Carpsucker
K-40	-	3036 ± 418	3253 ± 340	2929 ± 348	2459 ± 342	3171 ± 455
Mn-54	130	< 17.6	< 14.0	< 13.9	< 15.2	< 16.8
Fe-59	260	< 46.0	< 50.4	< 48.8	< 15.8	< 40.4
Co-58	130	< 14.2	< 24.9	< 13.4	< 16.1	< 28.3
Co-60	130	< 11.9	< 15.8	< 14.6	< 11.6	< 11.2
Zn-65	260	< 16.0	< 14.7	< 22.7	< 7.5	< 29.8
Cs-134	130	< 18.9	< 18.3	< 12.7	< 16.1	< 18.6
Cs-137	150	< 10.2	< 18.0	< 16.1	< 13.9	< 15.4

Table 11. Fish, analyses for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/kg wet

Location		CA-AQF-C				
Lab Code	Req. LLD	CAF- 1814	CAF- 1815	CAF- 1816	CAF- 1817	CAF- 1818
Date Collected		05-09-18	05-09-18	05-09-18	05-09-18	06-02-17
Sample Type		River Carpsucker	Silver Carp	Freshwater Drum	Common Carp	Smallmouth Buffalo
K-40	-	2549 ± 473	3252 ± 473	3122 ± 493	3075 ± 387	4201 ± 461
Mn-54	130	< 20.1	< 14.2	< 22.7	< 18.9	< 13.3
Fe-59	260	< 91.1	< 58.6	< 59.0	< 58.5	< 57.1
Co-58	130	< 26.8	< 22.8	< 18.4	< 16.2	< 18.5
Co-60	130	< 27.4	< 9.2	< 25.4	< 11.4	< 18.0
Zn-65	260	< 35.2	< 33.0	< 50.8	< 31.2	< 41.2
Cs-134	130	< 22.5	< 21.8	< 22.8	< 16.9	< 22.1
Cs-137	150	< 24.1	< 13.6	< 14.3	< 15.7	< 13.8

Lab Code	Req. LLD	CAF- 4616	CAF- 4617	CAF- 4618	CAF- 4619	CAF- 4620
Date Collected		10-24-18	10-24-18	10-24-18	10-24-18	10-24-18
Sample Type		Bigmouth Buffalo	Common Carp	Freshwater Drum	Silver Carp	River Carpsucker
K-40	-	2995 ± 342	3033 ± 447	2832 ± 325	3086 ± 341	2916 ± 322
Mn-54	130	< 19.7	< 17.9	< 14.3	< 15.0	< 13.1
Fe-59	260	< 45.5	< 48.3	< 54.4	< 15.7	< 23.0
Co-58	130	< 18.6	< 17.5	< 21.0	< 16.4	< 17.4
Co-60	130	< 10.1	< 6.5	< 13.1	< 7.8	< 7.3
Zn-65	260	< 27.7	< 21.2	< 22.9	< 28.9	< 31.9
Cs-134	130	< 18.2	< 19.6	< 15.8	< 10.9	< 13.0
Cs-137	150	< 16.2	< 8.4	< 13.9	< 10.0	< 15.6

Table 12a. Direct Radiation (quarterly exposure)

Location	Gamma Dose (mrem/90 days)			
	QTR 1	QTR 2	QTR 3	QTR 4
CA-IDM-1A	15.83	15.47	14.68	15.44
CA-IDM-3	16.34	17.29	15.59	16.59
CA-IDM-5	13.98	13.80	13.64	13.25
CA-IDM-6	14.60	15.52	15.07	15.25
CA-IDM-7	15.51	15.45	15.12	15.46
CA-IDM-9	14.06	14.43	14.59	14.29
CA-IDM-10	16.80	16.63	16.67	16.41
CA-IDM-11A	16.26	16.62	16.37	17.19
CA-IDM-14	15.07	16.05	15.81	15.79
CA-IDM-17	14.97	16.38	15.25	15.36
CA-IDM-18A	15.35	15.93	16.30	15.86
CA-IDM-20	15.32	16.31	16.36	17.13
CA-IDM-21	15.08	15.65	15.65	15.24
CA-IDM-22A	12.98	12.58	12.57	12.55
CA-IDM-23	15.85	16.71	16.32	16.70
CA-IDM-26 (C)	11.25	11.36	11.01	10.94
CA-IDM-27 (C)	16.79	17.44	16.40	16.42
CA-IDM-30A	15.49	15.52	15.29	15.67
CA-IDM-31A	16.32	17.21	16.98	16.33
CA-IDM-32	15.92	16.96	17.08	16.39
CA-IDM-32A	14.61	15.35	14.43	15.29
CA-IDM-33	15.06	16.12	15.37	15.34
CA-IDM-34	14.97	15.23	15.15	14.66
CA-IDM-35	14.38	14.37	14.08	14.32
CA-IDM-36	14.42	14.30	14.31	14.48
CA-IDM-37	14.89	15.63	15.34	15.73
CA-IDM-38	11.10	11.56	10.84	11.15
CA-IDM-39	15.02	15.48	15.06	14.97
CA-IDM-39A	15.22	15.55	15.69	15.36
CA-IDM-40	16.00	16.08	15.84	16.65
CA-IDM-41	15.34	15.29	15.40	15.35
CA-IDM-42	13.30	14.04	13.39	13.39
CA-IDM-43	14.62	16.02	15.21	15.35
CA-IDM-44	15.05	15.69	14.82	15.36
CA-IDM-45	13.87	14.44	13.36	14.43
CA-IDM-46	15.52	16.88	15.49	16.43
CA-IDM-47	14.41	15.51	14.31	15.54
CA-IDM-48	15.86	17.00	15.90	15.60
CA-IDM-49	14.58	13.87	14.06	13.49
CA-IDM-50	15.32	15.35	15.03	15.66
CA-IDM-51A	16.94	17.01	15.31	16.70
CA-IDM-52	16.14	15.95	15.32	16.28
CA-IDM-60 (C)	15.09	14.90	15.56	15.46
CA-IDM-61	13.87	14.68	14.54	NS[a]

[a] "NS" = No sample; see Part I Table 5.5, Listing of Missed Samples.

Table 12b. Direct Radiation Neutron (quarterly exposure)

Location	Neutron Dose (mrem/91 days)			
	QTR 1	QTR 2	QTR 3	QTR 4
CA-IDM-60N (C)	0.0 ± 1.1	0.0 ± 1.5	0.0 ± 0.8	0.0 ± 1.6
CA-IDM-61N	0.0 ± 1.3	0.0 ± 1.3	0.0 ± 1.3	0.0 ± 1.1
CA-IDM-62N	0.0 ± 0.9	0.0 ± 1.4	0.0 ± 1.2	0.0 ± 1.1
CA-IDM-63N	0.0 ± 1.3	0.0 ± 1.4	0.0 ± 1.1	0.0 ± 1.1
CA-IDM-64N	0.0 ± 1.0	0.0 ± 1.0	0.0 ± 1.4	0.0 ± 1.7