May 6, 2022

NG-22-0053
FPL-3

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

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

Subject: 2021 Annual Radiological Environmental Operating Report

Please find as Enclosure 1 to this letter, a copy of NextEra Energy Duane Arnold, LLC's 2021 Annual Radiological Environmental Operating Report for the Duane Arnold Energy Center, pursuant to the requirements of DODAM Section 8.2.2 and FPL-3 Appendix G.

This letter contains no new commitments and does not revise any existing commitments.

Should you have any questions regarding this matter, please contact Michael Casey at (319) 851-7606.

Paul Hansen

Paul Hansen
Decommissioning Director
NextEra Energy Duane Arnold, LLC

Enclosure

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

Enclosure to
NG-22-0053

Duane Arnold Energy Center

2021 Annual Radiological Environmental Operating Report

118 pages follow

2021

Annual Radiological Environmental Operating Report

Duane Arnold Energy Center

Cedar Rapids, Iowa

Docket No. 50-331

January 1, 2021 through December 31, 2021

2020
Annual Radiological Environmental Operating Report

Duane Arnold Energy Center
DOCKET NUMBER. 50-331

Prepared By: John Dierickx Date: 4/28/2022
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DUANE ARNOLD ENERGY CENTER
CEDAR RAPIDS, IOWA
DOCKET NO. 50-331

REPORT

to the

UNITED STATES
NUCLEAR REGULATORY COMMISSION

Annual Radiological Environmental Operating Report

January 1 to December 31, 2021

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

Reviewed and
Approved

Ashok Banavali, Ph.D.
Laboratory Manager

PREFACE

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

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

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory at the Duane Arnold Energy Center, Palo, Iowa, during the period January - December 2021. This Program monitors the levels of radioactivity in the air, terrestrial, and aquatic environments in order to assess the impact of the plant on its surroundings.

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

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

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

In July of 2018, NextEra Energy Duane Arnold L.L.C. announced the cessation of power operations planned for the 4th quarter of 2020. However, a severe windstorm on August 10, 2020, damaged the plant's cooling towers. There were no abnormal releases as all safety systems functioned as designed. The reactor was permanently defueled on October 12, 2020. The decommissioning process has started with the layup plans for long-term dormancy period prior to returning the area to a greenfield. The plant is being placed in SAFSTOR.

2.0 SUMMARY

The Radiological Environmental Monitoring Program, as required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Duane Arnold Energy Center, is herein described. Results for the year 2021 are summarized and discussed. Information regarding DAEC effluents and the Offsite Dose Assessment Manual (ODAM) and Defueled Offsite Dose Assessment Manual (DODAM) can be found in the 2021 DAEC Annual Radiological Material Release Report (ARMRR).

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

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

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

3.1 Program Design and Data Interpretation

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

Sources of environmental radiation include the following:

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

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

A major interpretive aid in assessment of these effects is the design of the monitoring program at the DAEC which is based on the indicator-control concept. Most types of samples are collected both at indicator locations (nearby, downwind, or downstream) and at control locations (distant, upwind, or upstream). A station effect would be indicated if the radiation level at an indicator location was significantly larger than that at the control location. The difference would have to be greater than could be accounted for by typical fluctuations in radiation levels arising from other sources.

An additional interpretive technique involves analyses for specific radionuclides present in the environmental samples collected from the DAEC site. The DAEC's monitoring program includes analyses for strontium-90 and iodine-131, which are fission products, and tritium, which is produced by cosmic rays, atmospheric nuclear detonations, and also by nuclear power plants. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, and cerium-144. These three gamma-emitting isotopes were selected as radiological impact indicators because of the different characteristic proportions in which they appear in the fission product mix produced by a nuclear reactor and that produced by a nuclear detonation. Each of the three isotopes is produced in roughly equivalent amounts by a reactor: each constitutes about 10% of the total activity of fission products ten (10) days after reactor shutdown. Alternatively, ten (10) days after a nuclear explosion, the contributions of zirconium-95, cerium-144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud,1963). The other group quantified consists of niobium-95, ruthenium-103 and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the next group, manganese-54, cobalt-58 and-60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of nuclear power plant effluents, but are not produced in significant quantities by nuclear detonations. Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occurring isotope, were chosen as calibration monitors and provide a comparison between levels of naturally occurring radionuclides and radionuclides that could be attributed to the operation of the plant.

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

can be related to those obtained in other parts of the world. Finally, results can be related to events known to cause elevated levels of radiation in the environment, e.g., atmospheric nuclear detonations.

3.2 Program Description

3.2.1 Environmental Monitoring

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

To monitor the air environment, a continuous air sampler is employed. Airborne particulates and activated charcoal canisters are mounted on the intake of the air sampler to collect airborne particulates and airborne iodine respectively at ten sampling locations. Nine locations are indicators: D-3, D-4, D-5a, D-6, D-7, D-11, D-15, D-16, D-40, and control location D-13. Filters are changed and counted weekly. Particulate filters are analyzed for gross beta activity. If gross beta activity exceeds ten times the yearly mean of the control samples, gamma isotopic analysis is performed. Quarterly composites of airborne particulates from each location are analyzed for gamma-emitting isotopes. Charcoal canister samples are analyzed weekly for iodine-131.

Ambient gamma radiation is monitored at a total of 52 locations. A TLD is placed at each location and exchanged and analyzed quarterly. The TLD locations are distributed as follows:

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

Surface water is collected monthly from five total locations: D-49, D-50, D-51, D-61 and D-99. The monthly samples are analyzed for tritium and gamma-emitting isotopes. Additional analyses are performed on samples collected from the control and indicator locations, D-49 and D-61. Analyses for low-level iodine-131 are performed on monthly collections and quarterly composites are prepared and analyzed for strontium-89 and strontium-90.

The aquatic environment is also monitored at D-49 and D-61 with semiannual fish collection.

Cedar River bottom sediment is collected semiannually at the D-49, D-51, and D-107a. The samples are analyzed for gamma-emitting isotopes.

Drinking water is collected monthly from D-53, D-54, and D-52, and quarterly from D-55, D-57, D-58 and control location D-72. The samples are analyzed for tritium and gamma-emitting isotopes. Any positive identification of a reactor by-product material initiates analyses for hard to detect isotopes of Ni-63, Sr-89, Sr-90, Fe-55 and gross alpha. The samples are analyzed for tritium, I-131 by chemical separation to an MDC of 1 pCi/L, and gamma-emitting isotopes.

Milk sampling was discontinued in November of 2020.

Additional monitoring of the terrestrial environment, grain, hay, grass and broadleaf vegetation samples are collected annually, as available, from four locations: D-16, D-57, D-58 and D-59. Grain, hay and broadleaf (green leafy) vegetation samples are analyzed for gamma-emitting isotopes and at least two broad leaf vegetation samples are analyzed for iodine-131.

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

3.2.2 Groundwater Protection Program

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Groundwater Protection Program (GWPP). The GWPP is formally included within REMP and the standards are set forth in the ODAM-DODAM, Table 6.3-2. The Groundwater Protection Program encompasses activities to ensure the protection of groundwater within the owner-controlled area by sampling the groundwater, soil, precipitation, electrical vaults and sewage effluent. For sewage effluent results only, refer to the Duane Arnold Energy Center, 2021 Annual Radioactive Material Release Report and Table 22 of Part II of this report for groundwater, soil, electrical vault, and precipitation sample results.

3.3 Program Execution

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

(1) REMP Air Samplers for Airborne Particulates / Airborne Iodine:

Sampling was discontinued at locations D-03, D-06, D-07, D-11 and D-40 after completion of the 4/16/21 sampling as a result of the decommissioning process begun in the fourth quarter of 2020.

(2) Thermoluminescent Dosimetry (TLD):

TLD's at locations D-02 and D-83 for the 1st quarter were missing from the field, possibly vandalized.

The TLD at location D-08 was missing in the field for the 4th quarter.

(3) Well Water:

D-58, sample not collected 8/25/21 due to a power outage at the location.

D-58, sample not collected 11/18/21 due to a power outage at the location.

(4) Surface Water:

D-49, D-61 and D-99 surface water samples not available 1/13/21 due to frozen conditions.

D-49, D-50, D-51, D-61 and D-99 surface water samples not collected 2/11/21 due to frozen conditions.

3.4 Laboratory Procedures

The Iodine-131 analyses in milk and water are based on EPA recognized Standard Method 7500-I-C(2000), which involves separation of iodine using an ion-exchange method, solvent extraction, and subsequent beta counting. Levels of iodine-131 in vegetation and concentrations of airborne iodine-131 in charcoal samples were determined by gamma spectroscopy.

Gamma-spectroscopic analyses are performed using high-purity germanium (HPGe) detectors. The gamma isotopic analysis provides a spectrum with an energy range from 80 to 2048 KeV. Specific isotopes included in the gamma library are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95,

Nb-95, Ru-103, Ru-106, I-131, Ba-La-140, Cs-134, Cs-137, Ce-141, and Ce-144. Naturally occurring gamma-emitters, such as Be-7, K-40 and Ra daughters, are frequently detected but may not be listed.

Tritium was measured by liquid scintillation spectrometry.

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

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of the QA Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 2018). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

Sampling was discontinued at air station locations D-03, D-06, D-07, D-11 and D-40 after completion of the 4/16/21 sampling as a result of the decommissioning process begun in the fourth quarter of 2020.

4.0 RESULTS AND DISCUSSION

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

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

Tabulated results of measurements are not included in this section, although reference to these results will be made in discussion. A complete tabulation of results for 2021 is contained in Part II of the Annual Report on the Radiological Environmental Monitoring Program for the Duane Arnold Energy Center.

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported accidents involving significant release to the environment at nuclear reactor facilities in 2021. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2021. The last reported test was conducted on October 16, 1980 by the People's Republic of China.

4.2 Program Findings

Results obtained show background levels of radioactivity in the environmental samples collected outside of the Owner Controlled Area in 2021.

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were 0.031 pCi/m3 and 0.028 pCi/m3 at the control location. Sampling was discontinued at five of the ten sampling locations after the 4/16/21 collection period. These results are consistent with levels observed from 2000 through 2020. The results are tabulated below.

Year	Indicators	Controls		Year	Indicators	Controls
Concentration (pCi/m^3)				Concentration (pCi/m^3)		
2000	0.026	0.027		2011	0.030	0.029
2001	0.026	0.026		2012	0.030	0.029
2002	0.027	0.027		2013	0.028	0.025
2003	0.029	0.029		2014	0.026	0.025
2004	0.028	0.028		2015	0.027	0.024
2005	0.031	0.031		2016	0.027	0.023
2006	0.029	0.027		2017	0.028	0.025
2007	0.031	0.031		2018	0.028	0.026
2008	0.029	0.029		2019	0.026	0.025
2009	0.031	0.030		2020	0.026	0.026
2010	0.028	0.028		2021	0.031	0.028

Average annual gross beta concentrations in airborne particulates.

4.2 Program Findings, Airborne Particulates (continued)

Gamma-spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955), was detected in all samples, with an average activity of 0.087 pCi/m^3 for indicator locations and 0.073 pCi/m^3 for the control location. No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the ODAM.

Airborne Iodine

335 weekly air samples were collected in 2021 from ten air monitoring stations. Levels of airborne iodine-131 measured below the required limit of 0.030 pCi/m^3 in all of the samples tested. Sampling was discontinued at five of the ten locations after 4/16/21 collection period.

Ambient Radiation (TLDs)

205 TLDs were collected and analyzed in 2021. At twelve control locations, thermoluminescent dosimeter (TLD) readings averaged 14.7 mR/quarter. At locations within a half mile, one mile and three mile radius of the stack, the measurements averaged 15.6, 17.2 and 15.1 mR/quarter, respectively. The two on-site locations D-15 and D-16 averaged 14.2 and 14.1 mR/quarter respectively. These average measurements are similar to the estimated average natural background radiation for Middle America, 19.5 mR/quarter, which is based on data on Pages 71 and 108 of the report, "Natural Background Radiation in the United States" (National Council on Radiation Protection and Measurements, 1975). The terrestrial absorbed dose (uncorrected for structural and body shielding) ranges from 8.8 to 18.8 mrad/quarter and averages 11.5 mrad/quarter for Middle America. Cosmic radiation and cosmogenic radionuclides contribute 8.0 mrad/quarter for a total average of 19.5 mrad/quarter. No plant effect is indicated.

ISFSI Facility Operations Monitoring

Four TLDs, placed directionally along the ISFSI fence line, averaged 37.5 mR/quarter. The TLD site D-30, located between the nearest residence and the ISFSI site averaged 17.1 mR/quarter. Calculated dose rates indicate the site is in compliance with 10 CFR 72.104 and 40 CFR 190.

Groundwater (drinking water-potable)

50 drinking water samples from seven locations were collected in 2021. Tritium concentrations in ground water samples were less than the MDC of 167 pCi/L in all samples analyzed. I-131 and other gamma-emitting isotopes were below detection limits.

No reactor by-product radionuclides could be identified. All samples met required lower limits of detection as specified in the ODAM.

4.2 Program Findings (continued)

Vegetation

Two broadleaf and four grain and forage vegetation samples from four locations were collected in 2021. Iodine-131 concentrations in vegetation samples were less than the LLD level of 0.028 pCi/g wet weight in all samples analyzed.

With the exception of potassium-40, which was observed in all vegetation samples, all other gamma-emitting isotopes were below detection limits. No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the ODAM.

Surface Water

36 surface water samples were collected from five locations in 2021. One surface water tested positive for tritium at a concentration of 1335 pCi/L. This positive result is due to a release from the liquid radwaste system. No tritium was detected above an LLD of 167 pCi/L in the other 35 samples tested. No I-131 was measured above an LLD of 0.5 pCi/L and no gamma-emitting isotopes were measured above their respective LLD's in any of the 36 samples tested.

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

Fish

Eight fish samples from three sport fish species were collected in May and September, 2021, and analyzed for gamma-emitting isotopes. With the exception of naturally-occurring potassium-40, no gamma-emitting isotopes were identified in edible portions of fish. The potassium-40 level was similar at both the indicator and control locations (3.77 and 3.36 pCi/g wet, respectively).

No reactor by-product radionuclides were identified. All samples met required lower limits of detection as specified in the ODAM.

River Sediments

Five river sediment samples from three locations were collected in 2021 during the months of March and September, and analyzed for gamma-emitting isotopes. Potassium-40 activity ranged from 5.18 to 8.51 pCi/g dry weight at the indicator locations and between 7.35 and 8.21 pCi/g dry weight at the control location.

All samples met required lower limits of detection as specified in the ODAM-DODAM.

4.3 Ground Water Protection Program Findings

Environmental, Inc., Midwest Laboratory provides laboratory services for the Duane Arnold Energy Center Ground Water Protection Program except for sewage effluent results; refer to Appendix E. Sewage effluent sample results can be found in the Duane Arnold Energy Center 2021 Annual Radiological Material Release Report.

Groundwater

139 groundwater samples (non-potable water) were collected from 55 permitted monitoring wells 2021. Tritium was the only plant by-product identified. Concentrations of tritium ranged from less than 161 pCi/L to 28,095 pCi/L at D-67, monitoring well MW-23A. An explanation of tritium mitigation can be found in the Duane Arnold Energy Center 2021 Radioactive Material Release Report. Tritium was not identified in any drinking water well on-site or at

off-site wells or Cedar Rapids municipal drinking water samples. Lastly, the monitoring well farthest down gradient prior to the boundary of the owner-controlled area and the Cedar River, MW-33A, did not indicate tritium above the lower level of detection, less than 168 pCi/L.

Precipitation

28 precipitation samples were collected in 2021 from seven locations. Tritium was consistently identified at location D-127. Tritium concentrations range from 202 pCi/L to 355 pCi/L (+/- 92 pCi/L) from D-127. The proximity of the plant gaseous effluent release points coupled with atmospheric conditions enables recapture of gaseous effluent, specifically tritiated water vapor, to be entrained in precipitation and deposited within the protected area. Occasionally, tritiated precipitation collects in a basin or pit. This water is then sampled and released in accordance with the ODAM-DODAM, Table 7.1-2.

Electrical Vaults

One electrical vault sample was collected in 2021. Electrical vaults are below grade structures designed for electrical cabling. Surface water and groundwater may seep into the vaults. The tritium concentration location D-121 measured less than 161 pCi/L.

Storm Drains, Sluice Pond, and Drainage Ditches

Other samples collected in 2021 included two sluice pond samples from location D-122, 1 drainage ditch sample from location D-124, and one storm drain sample from location D-125. The storm drain sample tritium concentration was (239 +/- 90 pCi/L). The drainage ditch sample and sluice pond samples measured below the lower level of detection.

5.0 TABLES AND FIGURES

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

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

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

[b] Includes fission-product daughters.

Table 5.2 Sample collection and analysis program.

Sampling Location [a]				
Exposure Pathway and/or Sample Type	Sample Point	Description	Sampling and Collection Frequency	Type and Frequency of Analysis [b]
Airborne Particulates	3 4 5A 6 7 11 13 15 16 40	Hiawatha Pleasant Creek SRA Palo Center Point Shellsburg Toddville Alburnett (C) On-site North On-site South Wickiup Hill	Continuous operation of sampler with sample collection at least once per week or as required by dust loading	Analyze for gross beta activity more than 72 hours after filter change. Perform gamma isotopic analysis on each sample having gross beta activity greater than ten times the yearly mean of the control samples. Composite weekly samples to form a quarterly composite (by location). Analyze quarterly composite for gamma isotopic.
Airborne Iodine	3 4 5A 6 7 11 13 15 16 40	Hiawatha Pleasant Creek SRA Palo Center Point Shellsburg Toddville Alburnett (C) On-site North On-site South Wickiup Hill	Continuous operation of sampler with sample collection at least once per week.	Analyze each cartridge for iodine-131.
Ambient Radiation	1-3, 5A, 6-8 10, 11, 13 15-23, 28-32, 4, 33-42 43-48 82-86, 91 161-164	(Controls) (Controls) (Indicators) Within 0.5 mile of Stack Within 3.0 miles of Stack Within 1.0 mile of Stack ISFSI Fence line	One dosimeter continuously at each location. Dosimeters are changed at least quarterly.	Read gamma radiation dose quarterly.
Surface Water	49 50 51 61 99	Lewis Access (C) Plant Intake Plant Discharge ~ ½ mi. downstream from Plant Discharge Pleasant Creek Lake	Once per month.	Gamma isotopic and tritium analysis for each sample (by location). Locations 49 and 61, analyses for low-level I-131. Quarterly composites for Sr-89, Sr-90.

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

Sampling Location [a]				
Exposure Pathway and/or Sample Type	Sample Point	Description	Sampling and Collection Frequency	Type and Frequency of Analysis [b]
Ground Water	52 53 54 55 57, 58 72 (C)	Plant potable water Treated Municipal Water Inlet to Municipal Water Treatment System On-site well Wells off-site and within 4 km of DAEC	Grab sample at least once per quarter	Analysis gamma-emitting isotopes, iodine-131 and tritium on quarterly samples. If reactor by-product gamma-emitters are identified, or if tritium concentrations measure > MDA, then analyze for Ni-63, Sr-89, Sr-90 and alpha emitters.
River Sediment	49 50 51 107a	Lewis Access Plant Intake (C) Plant Discharge North Drainage Ditch (on-site)	At least once every six months.	Gamma isotopic analysis of each sample
Vegetation	16,57 56, 57, 58,59,77, 96,108, 110,118 138 (C)	Farms raising food crops	Annually at harvest time. Two samples of each: grain, green leafy, and forage.	Gamma isotopic analysis, including iodine-131, on each sample.
Fish	49 56 61	Cedar River upstream of DAEC not influenced by effluent (C) Downstream of DAEC in influence of effluent	One sample per 6 months (once during January through June and once during July through December).	Gamma isotopic analysis on edible portions.
Milk	138 (C) 110 76	Farm near Newhall, IA Dairy Farm within 7.8 miles from Site Goat Farm ENE of site.	Monthly. Monthly. Monthly depending on availability.	Gamma isotopic and iodine-131 analyses of each sample.

[a] (C) denotes control location. All other locations are indicators.
[b] Gamma isotopic analysis and analysis for gamma-emitting nuclides refer to high resolution gamma ray spectrum analysis.

Table 5.3 Sampling locations, Duane Arnold Energy Center.

Sampling Location		
Code	Location Description	Distance and Direction from Site Stack
D-1	Cedar Rapids	20,800 meters SE
D-2	Marion	16,900 meters ESE
D-3	Hiawatha	10,800 meters SE
D-5	Palo	4,500 meters SSW
D-4	Pleasant Creek SRA	4,960 meters NW
D-5A	Palo	3,470 meters SSW
D-6	Center Point	9,660 meters N
D-7	Shellsburg	7,950 meters W
D-8	Urbana	15,000 meters NNW
D-10	Atkins	13,600 meters SSW
D-11	Toddville	4,980 meters E
D-13	Alburnett	14,500 meters ENE
D-15	On-site, North-Northwest	1,050 meters NNW
D-16	On-site, South-Southeast	520 meters SSE
D-17	On-site, N	1,050 meters N
D-18	On-site, NNE	630 meters NNE
D-19	On-site, NE	590 meters NE
D-20	On-site, ENE	550 meters ENE
D-21	On-site, ENE	515 meters ENE
D-22	On-site, ESE	535 meters ESE
D-23	On-site, SE	490 meters SE
D-28	On-site, WSW	730 meters WSW
D-29	On-site, W	630 meters W
D-30	On-site, WNW	640 meters WNW
D-31	On-site, NW	1,020 meters NW
D-32	On-site, NNW	1,110 meters NNW
D-33	3 mile ring	4,340 meters N
D-34	3 mile ring	3,930 meters NNE
D-35	3 mile ring	2,800 meters NE
D-36	3 mile ring	3,500 meters ENE
D-37	3 mile ring	2,960 meters E
D-38	3 mile ring	3,180 meters ESE
D-39	3 mile ring	2,510 meters SE
D-40	3 mile ring	2,430 meters SSE
D-41	3 mile ring	5,680 meters S
D-42	3 mile ring	4,380 meters SSE
D-43	1 mile ring	1,590 meters SSW
D-44	1 mile ring	1,580 meters WSW
D-45	1 mile ring	1,420 meters W
D-46	1 mile ring	1,580 meters WNW
D-47	1 mile ring	1,760 meters NW
D-48	1 mile ring	1,680 meters NNW

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

Sampling Location		
Code	Location Description	Distance and Direction from Site Stack
D-49	Lewis Access, upstream of DAEC	6,750 meters NNW
D-50	Plant Intake	560 meters SE
D-51	Plant Discharge	600 meters SE
D-52	Plant potable water	On-site
D-53	Treated Municipal Water	13,900 meters SE
D-54	Inlet, Municipal Water Treatment System	13,900 meters SE
D-55	Production Well	Production wells A-D
D-56	Control samples from various locations	Sample location varies
D-57	Farm (Off-site Well)	805 meters W
D-58	Farm (Off-site Well)	974 meters WSW-SW
D-61	Downstream of plant discharge	670 meters SSE
D-59	Hobby farm	2.615 meters SE
D-72	Farm	3,200 meters SSW
D-76	Farm	2,888 meters ENE
D-77	Farm	2,288 meters SW
D-82	On-site, SSE	660 meters SSE
D-83	On-site, SSE	620 meters SSE
D-84	On-site, S	610 meters S
D-85	On-site, SSW	660 meters SSW
D-86	On-site, SW	850 meters SW
D-91	On-site, NNW	1,090 meters NNW
D-96	Farm	11,400 meters SSW
D-99	Pleasant Creek Lake	3,880 meters WNW
D-107a	North Drainage Ditch	On-site
D-109	Farm	5,890 meters SW
D-110	Farm	12,700 meters SW
D-118	Farm	2,230 meters NW
D-138	Farm	21,600 meters WSW
D-161	ISFSI Fence East	On-site
D-162	ISFSI Fence South	On-site
D-163	ISFSI Fence West	On-site
D-164	ISFSI Fence North	On-site

Table 5.4 Type and Frequency of collections.

Location	Weekly	Monthly	Quarterly	Semiannually	Annually
D-1			TLD		
D-2			TLD		
D-3	AP, AI		TLD		
D-4	AP, AI		TLD		
D-5			TLD		
D-5A	AP, AI		TLD		
D-6	AP, AI		TLD		
D-7	AP, AI		TLD		
D-8			TLD		
D-10			TLD		
D-11	AP, AI		TLD		
D-13	AP, AI		TLD		
D-15	AP, AI		TLD		
D-15a					SO
D-16	AP, AI		TLD		G, SO
D-17 to D-23			TLD		
D-28 to D-39			TLD		
D-40	AP, AI		TLD		
D-41 to D-48			TLD		
D-49		SW		F	
D-50		SW		BS	
D-51		SW		BS	
D-52			WW		
D-53			WW		
D-54			WW		
D-55			WW		
D-56					
D-57			WW		G
D-58			WW		
D-59					G
D-61		SW		F	
D-72			WW		
D-76		MI*			
D-77					G
D-82 to D-86			TLD		
D-91			TLD		
D-99		SW			ME**
D-107A				BS	
D-108					G
D-110		MI			G
D-118					G
D-138		MI			G
D-161 to D-164			TLD		
On-site					

* Goat's milk sampled when available.

**Meat sampled when available.

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

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

Table 5.6. Program Deviations, Duane Arnold Energy Center.

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
SW		D-49	01-13-21	Unable to collect sample, water frozen.
SW		D-61	01-13-21	Unable to collect sample, water frozen.
SW		D-99	01-13-21	Unable to collect sample, water frozen.
SW		D-49	02-11-21	Unable to collect sample, water frozen.
SW		D-50	02-11-21	Unable to collect sample, water frozen.
SW		D-51	02-11-21	Unable to collect sample, water frozen.
SW		D-61	02-11-21	Unable to collect sample, water frozen.
SW		D-99	02-11-21	Unable to collect sample, water frozen.
TLD		D-2	1st Qtr '21	TLD missing in field.
TLD		D-83	1st Qtr '21	TLD missing in field.
WW		D-58	08-25-21	Unable to collect water due to a power outage at the location.
WW		D-58	11-18-21	Unable to collect water due to a power outage at the location.
TLD		D-8	4th Qtr '21	TLD missing in field.

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	Duane Arnold Energy Center	Docket No.	50-331
Location of Facility	Linn, Iowa	Reporting Period	January-December, 2021

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Airborne Pathway							
Airborne Particulates (pCi/m^3)	GB 335	0.003	0.031 (283/283) (0.006-0.064)	D-40	0.035 (15/15) (0.006-0.060)	0.028 (52/52) (0.007-0.065)	0
	GS 30						
	Be-7	0.210	0.087 (24/30) (0.064-0.117)	D-5A	0.092 (4/4) (0.076-0.110)	0.073 (4/4) (0.051-0.102)	0
	Mn-54	0.0062	< LLD	-	-	< LLD	0
	Fe-59	0.0398	< LLD	-	-	< LLD	0
	Co-58	0.0111	< LLD	-	-	< LLD	0
	Co-60	0.0046	< LLD	-	-	< LLD	0
	Zn-65	0.0131	< LLD	-	-	< LLD	0
	Nb-95	0.0327	< LLD	-	-	< LLD	0
	Zr-95	0.0240	< LLD	-	-	< LLD	0
	Ru-103	0.0304	< LLD	-	-	< LLD	0
	Ru-106	0.0518	< LLD	-	-	< LLD	0
	Cs-134	0.0060	< LLD	-	-	< LLD	0
	Cs-137	0.0064	< LLD	-	-	< LLD	0
	Ce-141	0.0682	< LLD	-	-	< LLD	0
	Ce-144	0.0425	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 335	0.030	< LLD	-	-	< LLD	0
Direct Radiation							
TLDs (mR/quarter) Control Locations	Gamma 46	1.0	None	D-5	17.4 (4/4) (15.7-18.4)	14.7 (47/47) (11.5-18.4)	0
Within 0.5 mi. of Stack	Gamma 79	1.0	15.6 (79/79) (9.8-20.9)	D-28	18.5 (4/4) (15.8-20.6)	None	0
Within 1.0 mi. of Stack	Gamma 24	1.0	17.2 (24/24) (13.0-20.6)	D-46	19.2 (4/4) (17.2-20.0)	None	0
Within 3.0 mi.of Stack	Gamma 40	1.0	15.1 (40/40) (11.0-19.2)	D-38	17.5 (4/4) (16.0-19.2)	None	0
ISFSI border	Gamma 16	1.0	37.5 (16/16) (16.6-63.1)	D-161	59.4 (4/4) (53.3-63.1)	None	0

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	Duane Arnold Energy Center	Docket No.	50-331
Location of Facility	Linn, Iowa	Reporting Period	January-December, 2021

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Waterborne Pathway							
Surface Water (pCi/L)	H-3 36	167	1335 (1/36)	D-51	1335 (1/11)	< LLD	0
	I-131chem 36	0.5	< LLD	-	-	< LLD	0
	Sr-89 8	0.77	< LLD	-	-	< LLD	0
	Sr-90 8	0.57	< LLD	-	-	< LLD	0
	GS 36						
	Mn-54	4.4	< LLD	-	-	< LLD	0
	Fe-59	9.5	< LLD	-	-	< LLD	0
	Co-58	4.2	< LLD	-	-	< LLD	0
	Co-60	4.0	< LLD	-	-	< LLD	0
	Zn-65	8.1	< LLD	-	-	< LLD	0
	Nb-95	6.9	< LLD	-	-	< LLD	0
	Zr-95	8.1	< LLD	-	-	< LLD	0
	I-131	9.7	< LLD	-	-	< LLD	0
	Cs-134	7.5	< LLD	-	-	< LLD	0
	Cs-137	6.1	< LLD	-	-	< LLD	0
	Ba-140	20.8	< LLD	-	-	< LLD	0
	La-140	16.6	< LLD	-	-	< LLD	0
Sediments Ci/g dry)	GS 5						
	K-40	1.0	7.36 (3/3) (5.18-8.51)	D-51	8.45 (2/2) (8.39-8.51)	7.78 (2/2) (7.35-8.21)	0
	Mn-54	0.023	< LLD	-	-	< LLD	0
	Fe-59	0.065	< LLD	-	-	< LLD	0
	Co-58	0.022	< LLD	-	-	< LLD	0
	Co-60	0.013	< LLD	-	-	< LLD	0
	Zn-65	0.054	< LLD	-	-	< LLD	0
	Nb-95	0.043	< LLD	-	-	< LLD	0
	Zr-95	0.052	< LLD	-	-	< LLD	0
	Ru-103	0.035	< LLD	-	-	< LLD	0
	Ru-106	0.128	< LLD	-	-	< LLD	0
	Cs-134	0.018	< LLD	-	-	< LLD	0
	Cs-137	0.016	< LLD	-	-	< LLD	0
	Ce-141	0.066	< LLD	-	-	< LLD	0
	Ce-144	0.137	< LLD	-	-	< LLD	0

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	Duane Arnold Energy Center	Docket No.	50-331
Location of Facility	Linn, Iowa	Reporting Period	January-December, 2021

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Waterborne Pathway							
Ground Water, potable (pCi/L)	I-131 50	0.5	< LLD	-	-	< LLD	0
	H-3 50	167	< LLD	-	-	< LLD	0
	GS 50						
	Mn-54	6.1	< LLD	-	-	< LLD	0
	Fe-59	14.1	< LLD	-	-	< LLD	0
	Co-58	5.4	< LLD	-	-	< LLD	0
	Co-60	5.9	< LLD	-	-	< LLD	0
	Zn-65	10.3	< LLD	-	-	< LLD	0
	Nb-95	6.1	< LLD	-	-	< LLD	0
	Zr-95	11.1	< LLD	-	-	< LLD	0
	I-131	13.1	< LLD	-	-	< LLD	0
	Cs-134	9.3	< LLD	-	-	< LLD	0
	Cs-137	7.7	< LLD	-	-	< LLD	0
	Ba-140	31.5	< LLD	-	-	< LLD	0
	La-140	6.7	< LLD	-	-	< LLD	0
Ingestion Pathway							
Broadleaf Vegetation (pCi/g wet)	GS 4						
	K-40	0.05	5.42 (4/4) (4.47-6.58)	D-58	6.58 (1/1)	None	0
	Mn-54	0.022	< LLD	-	-	-	0
	Fe-59	0.051	< LLD	-	-	-	0
	Co-58	0.019	< LLD	-	-	-	0
	Co-60	0.019	< LLD	-	-	-	0
	Zn-65	0.043	< LLD	-	-	-	0
	Nb-95	0.020	< LLD	-	-	-	0
	Zr-95	0.037	< LLD	-	-	-	0
	Ru-103	0.023	< LLD	-	-	-	0
	Ru-106	0.233	< LLD	-	-	-	0
	I-131	0.028	< LLD	-	-	-	0
	Cs-134	0.026	< LLD	-	-	-	0
	Cs-137	0.022	< LLD	-	-	-	0
	Ce-141	0.056	< LLD	-	-	-	0
	Ce-144	0.179	< LLD	-	-	-	0

Table 5.7 Radiological Environmental Monitoring Program Summary.

Name of Facility	Duane Arnold Energy Center	Docket No.	50-331
Location of Facility	Linn, Iowa (County, State)	Reporting Period	January-December, 2021

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean Location [d]	Location with Highest Annual Mean Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
Ingestion Pathway (cont.)							
Vegetation (Grain and Forage) (pCi/g wet)	GS 2						
	K-40	0.05	8.31 (2/2) (3.07-13.56)	D-16	13.56 (1/1)	None	0
	Mn-54	0.014	< LLD	-	-		0
	Fe-59	0.025	< LLD	-	-		0
	Co-58	0.013	< LLD	-	-		0
	Co-60	0.015	< LLD	-	-		0
	Zn-65	0.026	< LLD	-	-		0
	Nb-95	0.013	< LLD	-	-		0
	Zr-95	0.027	< LLD	-	-		0
	Ru-103	0.010	< LLD	-	-		0
	Ru-106	0.121	< LLD	-	-		0
	I-131	0.019	< LLD	-	-		0
	Cs-134	0.013	< LLD	-	-		0
	Cs-137	0.013	< LLD	-	-		0
	Ce-141	0.021	< LLD	-	-		0
	Ce-144	0.085	< LLD	-	-		0
Fish (pCi/g wet)	GS	8					
	K-40	1.0	3.77 (4/4) (3.53-3.96)	D-61	3.63 (5/5) (2.97-4.22)	3.36 (4/4) (3.09-3.66)	0
	Mn-54	0.023	< LLD	-	-	< LLD	0
	Fe-59	0.063	< LLD	-	-	< LLD	0
	Co-58	0.022	< LLD	-	-	< LLD	0
	Co-60	0.023	< LLD	-	-	< LLD	0
	Zn-65	0.056	< LLD	-	-	< LLD	0
	Nb-95	0.028	< LLD	-	-	< LLD	0
	Zr-95	0.060	< LLD	-	-	< LLD	0
	Ru-103	0.047	< LLD	-	-	< LLD	0
	Ru-106	0.227	< LLD	-	-	< LLD	0
	Cs-134	0.029	< LLD	-	-	< LLD	0
	Cs-137	0.021	< LLD	-	-	< LLD	0
	Ce-141	0.056	< LLD	-	-	< LLD	0
	Ce-144	0.190	< LLD	-	-	< LLD	0

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

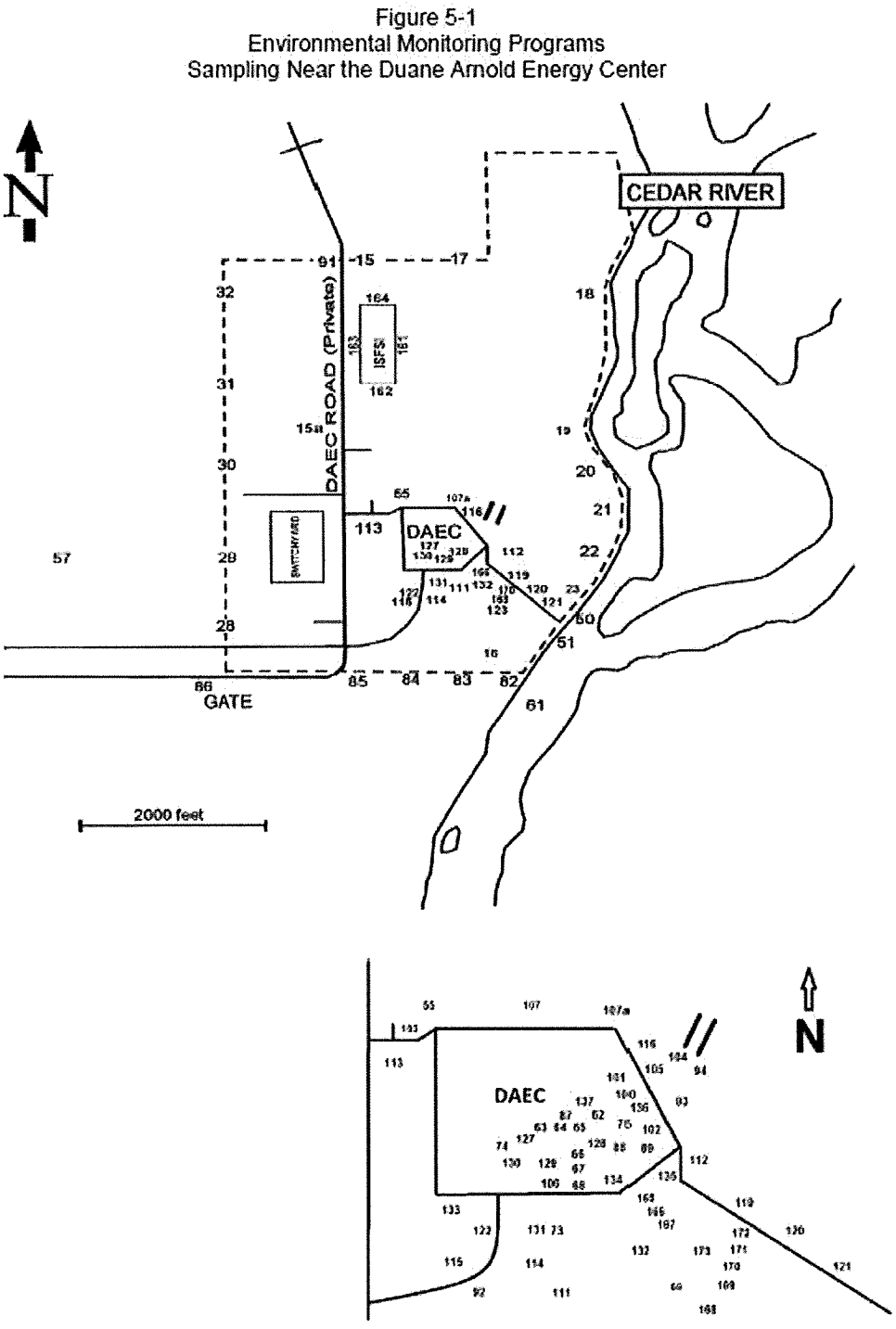
[b] LLD = Nominal lower limit of detection based on 4.66 sigma counting error for the background sample.

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

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

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

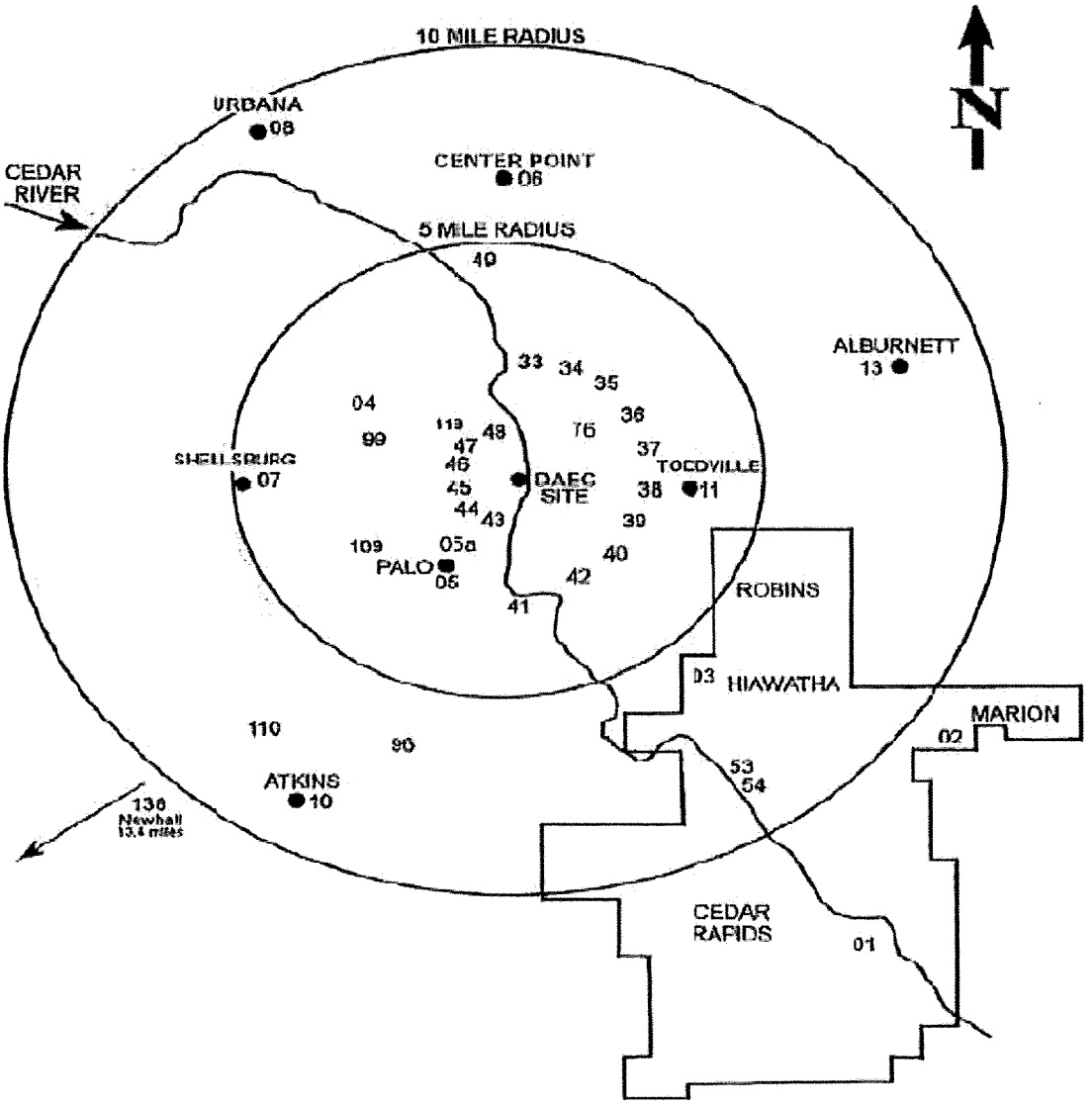
Figure 5.1 Radiological Environmental Monitoring Program Sampling Stations near the Duane Arnold Energy Center.



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

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

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



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

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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, 2021 through December, 2021

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

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

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

Results in Table A-1 were obtained through participation in the 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 intralaboratory "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

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

Table A-5 lists analytical results from the intralaboratory "duplicate" program for the past twelve months. Acceptance is based on each result being within 25% of the mean of the two results or the two sigma uncertainties of each result overlap.

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

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

Attachment A lists the laboratory acceptance criteria for various analyses.

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

Attachment A

ACCEPTANCE CRITERIA FOR INTRALABORATORY "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
RAD-124 Study						
ERW-94	1/11/2021	Ba-133	24.1 ± 3.5	23.8	18.4 - 27.4	Pass
ERW-94	1/11/2021	Cs-134	46.1 ± 3.1	42.8	34.2 - 47.1	Pass
ERW-94	1/11/2021	Cs-137	154 ± 6.0	148	133 - 165	Pass
ERW-94	1/11/2021	Co-60	39.4 ± 3.2	34.6	30.8 - 40.8	Pass
ERW-94	1/11/2021	Zn-65	66.2 ± 6.3	61.6	54.6 - 75.0	Pass
ERDW-96	1/11/2021	Gr. Alpha	58.4 ± 2.6	63.3	33.2 - 78.5	Pass
ERDW-96	1/11/2021	Gr. Beta	38.1 ± 1.3	39.8	26.4 - 47.3	Pass
ERDW-98	1/11/2021	Ra-226	16.3 ± 0.5	15.5	11.5 - 17.8	Pass
ERDW-98	1/11/2021	Ra-228	12.3 ± 1.2	12.9	8.54 - 15.8	Pass
ERDW-98	1/11/2021	Uranium	33.2 ± 1.8	30.1	24.4 - 33.4	Pass
ERW-100	1/11/2021	H-3	2,100 ± 160	2,120	1,750 - 2,350	Pass
RAD-126 Study						
ERDW-2194	7/12/2021	Ba-133	44.1 ± 4.0	45.5	37.2 - 50.6	Pass
ERDW-2194	7/12/2021	Cs-134	85.2 ± 3.9	87.5	71.8 - 96.2	Pass
ERDW-2194	7/12/2021	Cs-137	218 ± 8	208	187 - 230	Pass
ERDW-2194	7/12/2021	Co-60	91.7 ± 4.0	87.1	78.4 - 98.1	Pass
ERDW-2194	7/12/2021	Zn-65	114 ± 9	102	91.8 - 122.0	Pass
ERDW-2196	7/12/2021	Gr. Alpha	61.5 ± 2.9	49.1	25.6 - 61.7	Pass
ERDW-2196	7/12/2021	Gr. Beta	31.7 ± 1.3	31.5	20.3 - 39.2	Pass
ERDW-2200	7/12/2021	Ra-226	16.5 ± 0.5	13.4	10.0 - 15.4	Fail[b]
ERDW-2200	7/12/2021	Ra-228	8.7 ± 1.0	7.6	4.81 - 9.7	Pass
ERDW-2200	7/12/2021	Uranium	71.7 ± 2.3	62.3	50.9 - 68.5	Fail[c]
ERDW-2202	7/12/2021	H-3	11,300 ± 300	10,400	9,050 - 11,400	Pass
ERDW-2198	7/12/2021	I-131	22.3 ± 1.1	20.8	17.2 - 25.0	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] The radium-226 result did not meet ERA acceptance criteria.

[c] The uranium result did not meet ERA acceptance criteria.

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

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported[b] Dose (mrem)	Performance[c] Quotient (P)	
Environmental, Inc.		Group 1				
2021-1	11/8/2021	Spike 1	167.0	171.4	0.03	
2021-1	11/8/2021	Spike 2	167.0	159.4	-0.05	
2021-1	11/8/2021	Spike 3	167.0	160.8	-0.04	
2021-1	11/8/2021	Spike 4	167.0	164.5	-0.01	
2021-1	11/8/2021	Spike 5	167.0	156.7	-0.06	
2021-1	11/8/2021	Spike 6	167.0	152.3	-0.09	
2021-1	11/8/2021	Spike 7	167.0	158.7	-0.05	
2021-1	11/8/2021	Spike 8	167.0	161.6	-0.03	
2021-1	11/8/2021	Spike 9	167.0	152.4	-0.09	
2021-1	11/8/2021	Spike 10	167.0	155.7	-0.07	
2021-1	11/8/2021	Spike 11	167.0	158.8	-0.05	
2021-1	11/8/2021	Spike 12	167.0	163.1	-0.02	
2021-1	11/8/2021	Spike 13	167.0	162.2	-0.03	
2021-1	11/8/2021	Spike 14	167.0	158.8	-0.05	
2021-1	11/8/2021	Spike 15	167.0	173.5	0.04	
2021-1	11/8/2021	Spike 16	167.0	158.7	-0.05	
2021-1	11/8/2021	Spike 17	167.0	162.9	-0.02	
2021-1	11/8/2021	Spike 18	167.0	159.3	-0.05	
2021-1	11/8/2021	Spike 19	167.0	158.2	-0.05	
2021-1	11/8/2021	Spike 20	167.0	161.7	-0.03	
Mean (Spike 1-20)				160.5	-0.04	Pass[d]
Standard Deviation (Spike 1-20)				5.2	0.03	Pass[d]

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

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

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

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

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

			mrem		
Lab Code	Irradiation Date	Description	Delivered Dose	Reported[b] Dose	Performance[c] Quotient (P)	
Environmental, Inc.		Group 2				
2021-2	11/8/2021	Spike 21	102.0	98.3	-0.04	
2021-2	11/8/2021	Spike 22	102.0	88.4	-0.13	
2021-2	11/8/2021	Spike 23	102.0	96.7	-0.05	
2021-2	11/8/2021	Spike 24	102.0	101.4	-0.01	
2021-2	11/8/2021	Spike 25	102.0	98.5	-0.03	
2021-2	11/8/2021	Spike 26	102.0	96.3	-0.06	
2021-2	11/8/2021	Spike 27	102.0	95.8	-0.06	
2021-2	11/8/2021	Spike 28	102.0	94.3	-0.08	
2021-2	11/8/2021	Spike 29	102.0	93.5	-0.08	
2021-2	11/8/2021	Spike 30	102.0	95.7	-0.06	
2021-2	11/8/2021	Spike 31	102.0	101.7	0.00	
2021-2	11/8/2021	Spike 32	102.0	98.5	-0.03	
2021-2	11/8/2021	Spike 33	102.0	96.7	-0.05	
2021-2	11/8/2021	Spike 34	102.0	87.2	-0.15	
2021-2	11/8/2021	Spike 35	102.0	89.7	-0.12	
2021-2	11/8/2021	Spike 36	102.0	88.5	-0.13	
2021-2	11/8/2021	Spike 37	102.0	85.4	-0.16	
2021-2	11/8/2021	Spike 38	102.0	90.0	-0.12	
2021-2	11/8/2021	Spike 39	102.0	90.9	-0.11	
2021-2	11/8/2021	Spike 40	102.0	92.6	-0.09	
Mean (Spike 21-40)				94.0	-0.08	Pass[d]
Standard Deviation (Spike 21-40)				4.7	0.05	Pass[d]

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

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

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

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

TABLE A-3. Intralaboratory "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-55	1/8/2021	H-3	1,889 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPDW-62	1/11/2021	Gr. Alpha	34.3 ± 1.7	64.9	34.0 - 80.4	Pass	0.53
SPDW-62	1/11/2021	Gr. Beta	9.2 ± 0.8	8.9	3.6 - 17.4	Pass	1.04
SPW-131	1/19/2021	Sr-90	18.0 ± 1.1	17.9	14.3 - 21.5	Pass	1.00
SPW-133	1/19/2021	H-3	1,842 ± 150	2,110	1,688 - 2,532	Pass	0.87
SPW-188	1/18/2021	Ra-228	14.2 ± 1.7	14.9	10.4 - 19.3	Pass	0.96
SPW-236	1/26/2021	Ra-228	12.2 ± 1.9	15.3	10.7 - 19.9	Pass	0.80
SPW-305	2/5/2021	H-3	1,785 ± 147	2,110	1,688 - 2,532	Pass	0.85
SPW-372	2/12/2021	H-3	1,742 ± 145	2,110	1,688 - 2,532	Pass	0.83
SPW-526	3/5/2021	H-3	1,899 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPW-692	3/19/2021	H-3	1,953 ± 151	2,110	1,688 - 2,532	Pass	0.93
SPW-694	1/4/2021	Ra-226	9.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.79
SPW-800	3/30/2021	Ra-228	15.8 ± 2.0	15.3	10.7 - 19.9	Pass	1.03
SPW-802	3/31/2021	H-3	1,878 ± 150	2,110	1,688 - 2,532	Pass	0.89
SPW-810	3/19/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30103	3/31/2021	Ra-226	13.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.10
SPW-812	4/1/2021	H-3	2,005 ± 155	2,110	1,688 - 2,532	Pass	0.95
SPW-919	4/7/2021	H-3	1,877 ± 149	2,110	1,688 - 2,532	Pass	0.89
SPW-944	4/9/2021	Gr. Alpha	56.7 ± 2.5	58.4	29.2 - 87.6	Pass	0.97
SPW-944	4/9/2021	Gr. Beta	35.1 ± 1.3	38.1	30.5 - 45.7	Pass	0.92
SPW-1048	4/15/2021	H-3	1,915 ± 152	2,110	1,688 - 2,532	Pass	0.91
SPW-1250	4/30/2021	H-3	2,015 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-1373	5/11/2021	Gr. Alpha	63.5 ± 2.9	58.4	29.2 - 87.6	Pass	1.09
SPW-1373	5/11/2021	Gr. Beta	38.5 ± 1.3	38.1	30.5 - 45.7	Pass	1.01
SPW-1377	5/11/2021	Sr-90	17.4 ± 1.2	17.9	14.3 - 21.5	Pass	0.97
SPDW-30108	5/28/2021	H-3	2,222 ± 161	2,110	1,688 - 2,532	Pass	1.05
SPDW-30125	5/13/2021	Ra-226	10.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.89
SPDW-30118	6/4/2021	H-3	2,230 ± 163	2,110	1,688 - 2,532	Pass	1.06
SPMI-1672	6/8/2021	Sr-90	14.2 ± 0.9	13.6	10.9 - 16.3	Pass	1.04
SPDW-30160	6/11/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30129	6/15/2021	H-3	2,238 ± 162	2,110	1,688 - 2,532	Pass	1.06
SPDW-30134	6/18/2021	Gr. Alpha	17.9 ± 1.4	23.5	11.8 - 35.3	Pass	0.76
SPDW-30134	6/18/2021	Gr. Beta	60.9 ± 1.6	67.6	54.1 - 81.1	Pass	0.90
SPDW-30148	6/25/2021	Ra-228	15.1 ± 2.9	15.3	10.7 - 19.9	Pass	0.98
SPDW-30206	7/8/2021	Ra-226	12.7 ± 0.4	12.3	8.6 - 16.0	Pass	1.03
SPDW-3001	7/29/2021	Ra-226	11.6 ± 0.3	12.3	8.6 - 16.0	Pass	0.95

[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 & SPW (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] Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code[b]	Date	Concentration[a] Analysis	Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
SPDW-30224	8/2/2021	Gr. Alpha	38.6 ± 2.1	49.1	24.6 - 73.7	Pass	0.79
SPDW-30224	8/2/2021	Gr. Beta	27.8 ± 1.2	31.5	25.2 - 37.8	Pass	0.88
SPDW-30226	8/13/2021	H-3	2,074 ± 157	2,110	1,688 - 2,532	Pass	0.98
SPDW-30231	8/18/2021	Ra-228	14.5 ± 2.2	15.3	10.7 - 19.9	Pass	0.95
SPW-2783	9/3/2021	Sr-90	18.9 ± 1.2	17.1	13.7 - 20.5	Pass	1.10
SPDW-2785	9/3/2021	H-3	2,135 ± 158	2,110	1,688 - 2,532	Pass	1.01
SPDW-2891	9/10/2021	H-3	2,159 ± 160	2,110	1,688 - 2,532	Pass	1.02
SPDW-3115	9/17/2021	Ra-226	11.3 ± 0.3	12.3	8.6 - 16.0	Pass	0.92
SPDW-3036	9/23/2021	Ra-228	18.0 ± 2.6	15.3	10.7 - 19.9	Pass	1.17
SPDW-3223	9/28/2021	Ra-228	16.6 ± 2.5	15.3	10.7 - 19.9	Pass	1.08
SPDW-3288	9/29/2021	U-234	29.2 ± 1.6	23.0	16.1 - 29.9	Pass	1.27
SPDW-3288	9/29/2021	U-238	28.2 ± 1.6	23.2	16.3 - 30.2	Pass	1.21
SPDW-30276	9/29/2021	Ra-226	9.4 ± 0.4	12.3	8.6 - 16.0	Pass	0.76
SPDW-3157	10/1/2021	H-3	2,111 ± 158	2,110	1,688 - 2,532	Pass	1.00
SPDW-3393	10/15/2021	H-3	2,184 ± 161	2,110	1,688 - 2,532	Pass	1.04
SPDW-3604	10/28/2021	H-3	2,104 ± 15	2,110	1,688 - 2,532	Pass	1.00
SPDW-30283	11/4/2021	Ra-226	11.7 ± 0.3	12.3	8.6 - 16.0	Pass	0.95
SPDW-3769	11/10/2021	H-3	2,026 ± 156	2,110	1,688 - 2,532	Pass	0.96
SPDW-3860	11/18/2021	H-3	2,161 ± 161	2,110	1,688 - 2,532	Pass	1.02
SPDW-30290	11/22/2021	Ra-226	12.0 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
SPDW-3958	12/3/2021	H-3	2,126 ± 160	2,110	1,688 - 2,532	Pass	1.01
SPW-3971	12/7/2021	Sr-90	19.0 ± 1.2	17.1	13.7 - 20.5	Pass	1.11
SPDW-30287	12/9/2021	Ra-228	12.3 ± 1.7	15.3	10.7 - 19.9	Pass	0.80
SPDW-30295	12/16/2021	H-3	2,265 ± 163	2,110	1,688 - 2,532	Pass	1.07
SPDW-30301	12/30/2021	H-3	2,055 ± 163	2,110	1,688 - 2,532	Pass	0.97
SPDW-30307	12/13/2021	Ra-226	11.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.95

[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 & SPW (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] Acceptance criteria are listed in Attachment A of this report.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Date	Analysis[c]	Concentration[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[d]	Criteria (4.66 σ)
SPW-54	Water	1/8/2021	H-3	153	24 ± 77	200
SPDW-61	Water	1/11/2021	Gr. Alpha	0.56	-0.32 ± 0.37	2
SPDW-61	Water	1/11/2021	Gr. Beta	0.73	-0.11 ± 0.49	4
SPW-130	Water	1/19/2021	Sr-89	0.66	-0.12 ± 0.49	5
SPW-130	Water	1/19/2021	Sr-90	0.68	-0.02 ± 0.31	1
SPW-132	Water	1/19/2021	H-3	165	38 ± 79	200
SPW-4923	Water	1/26/2021	I-131	0.28	0.26 ± 0.16	1
SPW-187	Water	1/18/2021	Ra-228	1.44	0.81 ± 0.76	2
SPW-235	Water	1/26/2021	Ra-228	1.54	0.94 ± 0.82	2
SPW-254	Water	2/2/2021	I-131	0.29	-0.06 ± 0.13	1
SPW-304	Water	2/5/2021	H-3	159	6 ± 74	200
SPW-371	Water	2/12/2021	H-3	154	-37 ± 70	200
SPW-525	Water	3/5/2021	H-3	160	97 ± 80	200
SPW-691	Water	3/19/2021	H-3	158	-38 ± 71	200
SPW-693	Water	1/4/2021	Ra-226	0.03	-0.01 ± 0.01	2
SPW-799	Water	3/30/2021	Ra-228	1.03	0.06 ± 0.48	2
SPW-809	Water	3/19/2021	Ra-226	0.04	0.01 ± 0.03	2
SPDW-30102	Water	3/31/2021	Ra-226	0.03	0.00 ± 0.03	2
SPW-811	Water	4/1/2021	H-3	158	-29 ± 77	200
SPW-918	Water	4/7/2021	H-3	156	93 ± 79	200
SPW-943	Water	4/9/2021	Gr. Alpha	0.39	-0.08 ± 0.27	2
SPW-943	Water	4/9/2021	Gr. Beta	0.73	0.04 ± 0.51	4
SPW-1047	Water	4/15/2021	H-3	160	-51 ± 74	200
SPW-1249	Water	4/30/2021	H-3	158	109 ± 81	200
SPW-1372	Water	5/11/2021	Gr. Alpha	0.35	0.27 ± 0.27	2
SPW-1372	Water	5/11/2021	Gr. Beta	0.68	0.27 ± 0.49	4
SPW-1376	Water	5/11/2021	Sr-89	0.52	0.23 ± 0.39	5
SPW-1376	Water	5/11/2021	Sr-90	0.51	-0.06 ± 0.23	1
SPDW-30124	Water	5/13/2021	Ra-226	0.03	-0.02 ± 0.03	2
SPDW-30104	Water	5/26/2021	Ra-228	1.30	-0.04 ± 0.60	2
SPDW-30107	Water	5/28/2021	H-3	157	33 ± 76	200
SPDW-30117	Water	6/4/2021	H-3	165	67 ± 81	200
SPMI-1671	Milk	6/8/2021	Sr-89	0.46	0.23 ± 0.42	5
SPMI-1671	Milk	6/8/2021	Sr-90	0.45	0.23 ± 0.24	1
SPDW-30159	Water	6/11/2021	Ra-226	0.04	-0.02 ± 0.04	2
SPDW-30128	Water	6/15/2021	H-3	161	17 ± 76	200
SPDW-30133	Water	6/17/2021	I-131	0.20	0.06 ± 0.12	1
SPDW-30134	Water	6/18/2021	Gr. Alpha	0.46	-0.11 ± 0.32	2
SPDW-30134	Water	6/18/2021	Gr. Beta	0.70	-0.10 ± 0.49	4
SPDW-30147	Water	6/25/2021	Ra-228	1.76	-0.15 ± 0.80	2

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

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

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

[d] Activity reported is a net activity result.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Date	Analysis[c]	Concentration[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[d]	Criteria (4.66 σ)
SPDW-30205	Water	7/8/2021	Ra-226	0.03	0.02 ± 0.03	2
SPDW-3000	Water	7/29/2021	Ra-226	0.03	0.03 ± 0.03	2
SPDW-30223	Water	8/2/2021	Gr. Alpha	0.46	-0.13 ± 0.31	2
SPDW-30223	Water	8/2/2021	Gr. Beta	0.70	0.16 ± 0.49	4
SPDW-30225	Water	8/13/2021	H-3	161	-2 ± 75	200
SPDW-30230	Water	8/18/2021	Ra-228	1.02	0.47 ± 0.53	2
SPW-2782	Water	9/3/2021	Sr-89	0.60	-0.16 ± 0.48	5
SPW-2782	Water	9/3/2021	Sr-90	0.63	0.20 ± 0.32	1
SPDW-2784	Water	9/3/2021	H-3	157	-50 ± 69	200
SPDW-2890	Water	9/10/2021	H-3	163	-59 ± 72	200
SPDW-2981	Water	9/17/2021	H-3	162	11 ± 78	200
SPDW-3114	Water	9/17/2021	Ra-226	0.03	0.04 ± 0.03	2
SPDW-3035	Water	9/23/2021	Ra-228	1.15	0.10 ± 0.55	2
SPDW-3222	Water	9/28/2021	Ra-228	1.37	-0.30 ± 0.60	2
SPDW-3287	Water	9/29/2021	U-234	0.22	0.19 ± 0.23	1
SPDW-3287	Water	9/29/2021	U-238	0.38	-0.05 ± 0.21	1
SPDW-30275	Water	9/29/2021	Ra-226	0.05	0.03 ± 0.04	2
SPDW-3156	Water	10/1/2021	H-3	161	-11 ± 75	200
SPDW-3289	Water	10/12/2021	Gr. Alpha	0.40	0.21 ± 0.30	2
SPDW-3289	Water	10/12/2021	Gr. Beta	0.72	0.31 ± 0.52	4
SPDW-3392	Water	10/15/2021	H-3	158	58 ± 79	200
SPDW-3603	Water	10/28/2021	H-3	163	26 ± 77	200
SPDW-30282	Water	11/4/2021	Ra-226	0.04	0.04 ± 0.03	2
SPDW-3768	Water	11/10/2021	H-3	162	31 ± 77	200
SPDW-3859	Water	11/18/2021	H-3	162	45 ± 78	200
SPDW-30289	Water	11/22/2021	Ra-226	0.03	0.19 ± 0.03	2
SPDW-3957	Water	12/3/2021	H-3	161	118 ± 84	200
SPW-3970	Water	12/7/2021	Sr-89	0.54	-0.12 ± 0.43	5
SPW-3970	Water	12/7/2021	Sr-90	0.54	0.08 ± 0.26	1
SPDW-30286	Water	12/9/2021	Ra-228	0.91	-0.26 ± 0.39	2
SPDW-30288	Water	12/10/2021	I-131	0.22	0.00 ± 0.12	1
SPDW-30306	Water	12/13/2021	Ra-226	0.05	-0.05 ± 0.04	2
SPDW-30294	Water	12/16/2021	H-3	162	-33 ± 73	200
SPDW-30300	Water	12/30/2021	H-3	166	68 ± 91	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] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

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

[d] Activity reported is a net activity result.

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
S-20,21	1/5/2021	K-40	23.3 ± 0.6	22.6 ± 1.6	23.0 ± 0.9	Pass
XW-295,296	1/13/2021	H-3	245 ± 87	288 ± 89	267 ± 62	Pass
S-143,144	1/14/2021	K-40	7.47 ± 0.76	8.38 ± 0.22	7.93 ± 0.40	Pass
S-360,361	2/10/2021	K-40	9.23 ± 0.54	9.00 ± 0.68	9.12 ± 0.43	Pass
S-406,407	2/15/2021	K-40	2.92 ± 0.28	2.94 ± 0.94	2.93 ± 0.49	Pass
W-469,470	2/22/2021	Ra-226	0.75 ± 0.21	0.87 ± 0.22	0.81 ± 0.15	Pass
W-448,449	2/25/2021	Gr. Alpha	3.52 ± 1.84	3.72 ± 1.87	3.62 ± 1.31	Pass
W-448,449	2/25/2021	Gr. Beta	8.71 ± 1.36	8.91 ± 1.40	8.81 ± 0.98	Pass
W-448,449	2/25/2021	Ra-226	1.87 ± 0.25	1.82 ± 0.28	1.85 ± 0.19	Pass
W-448,449	2/25/2021	Ra-228	2.65 ± 1.26	2.53 ± 1.35	2.59 ± 0.92	Pass
P-511,512	3/2/2021	H-3	198 ± 85	202 ± 86	200 ± 60	Pass
WW-630,631	3/10/2021	H-3	144 ± 82	148 ± 82	146 ± 58	Pass
WW-743,744	3/16/2021	H-3	183 ± 85	167 ± 84	175 ± 60	Pass
S-785,786	3/25/2021	Pb-214	0.59 ± 0.08	0.34 ± 0.05	0.47 ± 0.05	Pass
S-785,786	3/25/2021	Ac-228	0.61 ± 0.12	0.58 ± 0.13	0.60 ± 0.09	Pass
AP-1052,1053	3/30/2021	Be-7	0.081 ± 0.010	0.075 ± 0.011	0.078 ± 0.007	Pass
AP-966,967	3/30/2021	Be-7	0.080 ± 0.010	0.085 ± 0.009	0.083 ± 0.007	Pass
SWU-835,836	3/30/2021	Gr. Beta	1.22 ± 0.56	1.27 ± 0.55	1.24 ± 0.39	Pass
AP-1204,1205	3/30/2021	Be-7	0.187 ± 0.102	0.160 ± 0.088	0.173 ± 0.067	Pass
AP-1029,1030	4/2/2021	Be-7	0.067 ± 0.012	0.079 ± 0.012	0.073 ± 0.009	Pass
SW-922,923	4/7/2021	H-3	440 ± 99	307 ± 93	373 ± 68	Pass
WW-987,988	4/12/2021	H-3	190 ± 87	284 ± 92	237 ± 63	Pass
F-1246,1247	4/22/2021	K-40	3.26 ± 0.66	2.83 ± 0.46	3.04 ± 0.40	Pass
SWT-1311,1312	4/27/2021	Gr. Beta	1.05 ± 0.52	1.16 ± 0.55	1.10 ± 0.38	Pass
WW-1401,1402	5/5/2021	Gr. Alpha	1.10 ± 1.00	2.50 ± 1.20	1.80 ± 0.78	Pass
WW-1401,1402	5/5/2021	K-40	126 ± 15	105 ± 30	115 ± 17	Pass
DW-30071.,30072	5/6/2021	Ra-226	0.98 ± 0.15	0.67 ± 0.13	0.83 ± 0.10	Pass
DW-30071.,30072	5/6/2021	Ra-228	0.83 ± 0.51	1.21 ± 0.54	1.02 ± 0.37	Pass
DW-30078,30079	5/10/2021	Gr. Alpha	4.90 ± 0.92	5.92 ± 0.99	5.41 ± 0.68	Pass
AP-051120A,B	5/11/2021	Gr. Beta	0.006 ± 0.002	0.005 ± 0.002	0.005 ± 0.002	Pass
DW-30083,30084	5/11/2021	Ra-226	0.34 ± 0.13	0.19 ± 0.20	0.27 ± 0.12	Pass
DW-30083,30084	5/11/2021	Ra-228	0.98 ± 0.60	0.15 ± 0.56	0.57 ± 0.41	Pass
S-1506,1507	5/18/2021	K-40	10.1 ± 0.8	14.9 ± 1.2	12.5 ± 0.7	Pass
DW-30092,30093	5/20/2021	Gr. Alpha	2.86 ± 0.85	2.40 ± 0.90	2.63 ± 0.62	Pass
DW-30095,30096	5/21/2021	Ra-226	1.18 ± 0.16	0.73 ± 0.15	0.96 ± 0.11	Pass
DW-30095,30096	5/21/2021	Ra-228	1.44 ± 0.63	0.61 ± 0.59	1.03 ± 0.43	Pass
AP-052521A,B	5/25/2021	Gr. Beta	0.021 ± 0.003	0.022 ± 0.003	0.021 ± 0.002	Pass
S-1589,1590	5/28/2021	Pb-214	1.16 ± 0.08	1.06 ± 0.09	1.11 ± 0.06	Pass
S-1589,1590	5/28/2021	Ac-228	1.17 ± 0.18	1.08 ± 0.14	1.13 ± 0.11	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
AP-060121A,B	6/1/2021	Gr. Beta	0.015 ± 0.003	0.013 ± 0.003	0.014 ± 0.002	Pass
DW-30113,30114	6/1/2021	Ra-226	2.00 ± 0.34	2.64 ± 0.26	2.32 ± 0.21	Pass
DW-30113,30114	6/1/2021	Ra-228	2.50 ± 0.78	3.13 ± 0.82	2.82 ± 0.57	Pass
PS-1631,1632	6/2/2021	K-40	21.1 ± 0.8	20.4 ± 0.8	20.7 ± 0.6	Pass
DW-30119,30120	6/3/2021	Gr. Alpha	1.18 ± 0.75	0.66 ± 0.64	0.92 ± 0.49	Pass
WW-1908,1909	6/4/2021	H-3	150 ± 85	176 ± 87	163 ± 61	Pass
VE-1717,1718	6/7/2021	Be-7	0.50 ± 0.19	0.38 ± 0.14	0.44 ± 0.12	Pass
VE-1717,1718	6/7/2021	K-40	5.26 ± 0.47	5.45 ± 0.44	5.35 ± 0.32	Pass
AP-060821A,B	6/8/2021	Gr. Beta	0.030 ± 0.004	0.028 ± 0.004	0.029 ± 0.003	Pass
AP-1822,1823	6/10/2021	Be-7	0.23 ± 0.12	0.22 ± 0.12	0.22 ± 0.08	Pass
CF-1844,1845	6/14/2021	K-40	8.37 ± 0.44	8.33 ± 0.35	8.35 ± 0.28	Pass
AP-061521A,B	6/15/2021	Gr. Beta	0.020 ± 0.004	0.017 ± 0.003	0.019 ± 0.002	Pass
DW-30131,30132	6/17/2021	Ra-226	0.41 ± 0.21	0.34 ± 0.23	0.38 ± 0.16	Pass
DW-30131,30132	6/17/2021	Ra-228	0.42 ± 0.85	0.52 ± 0.74	0.47 ± 0.56	Pass
DW-30138,30139	6/17/2021	Gr. Alpha	1.59 ± 0.84	2.21 ± 0.95	1.90 ± 0.63	Pass
S-1929,1930	6/22/2021	K-40	19.4 ± 1.0	19.2 ± 1.1	19.3 ± 0.7	Pass
AP-062221A,B	6/22/2021	Gr. Beta	0.014 ± 0.003	0.012 ± 0.028	0.013 ± 0.014	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2160,2161	6/28/2021	Be-7	0.11 ± 0.01	0.11 ± 0.01	0.11 ± 0.01	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2218,2119	6/29/2021	Be-7	0.11 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	Pass
AP-2235,2236	6/30/2021	Be-7	0.10 ± 0.01	0.11 ± 0.01	0.10 ± 0.01	Pass
CF-2139,2140	7/12/2021	Be-7	0.49 ± 0.12	0.65 ± 0.20	0.57 ± 0.12	Pass
CF-2139,2140	7/12/2021	K-40	8.25 ± 0.41	7.94 ± 0.46	8.10 ± 0.31	Pass
VE-2214,2215	7/12/2021	K-40	3.26 ± 0.11	3.41 ± 0.25	3.34 ± 0.14	Pass
DW-30169,30170	7/12/2021	Gr. Alpha	2.61 ± 0.87	2.09 ± 0.84	2.35 ± 0.60	Pass
DW-30169,30170	7/12/2021	Gr. Beta	2.09 ± 0.67	2.52 ± 0.60	2.31 ± 0.45	Pass
DW-30169,30170	7/12/2021	Ra-226	0.84 ± 0.24	0.82 ± 0.20	0.83 ± 0.16	Pass
DW-30169,30170	7/12/2021	Ra-228	0.80 ± 0.54	0.84 ± 0.50	0.82 ± 0.37	Pass
AP-71320,71321	7/13/2021	Gr. Beta	0.015 ± 0.003	0.010 ± 0.003	0.013 ± 0.002	Pass
XW-2424,2425	7/16/2021	H-3	193 ± 86	104 ± 81	149 ± 59	Pass
DW-30183,30184	7/19/2021	Ra-226	1.37 ± 0.18	1.21 ± 0.27	1.29 ± 0.16	Pass
DW-30183,30185	7/19/2021	Ra-228	1.51 ± 0.69	1.52 ± 0.68	1.52 ± 0.48	Pass
AP-71920,71921	7/19/2021	Gr. Beta	0.021 ± 0.004	0.020 ± 0.003	0.021 ± 0.002	Pass
S-2277,2278	7/20/2021	K-40	13.6 ± 0.9	12.3 ± 0.9	12.9 ± 0.6	Pass
DW-30191,30192	7/20/2021	Gr. Alpha	3.88 ± 0.94	3.66 ± 94.00	3.77 ± 47.00	Pass
SG-2382,2383	7/23/2021	Pb-214	1.88 ± 0.21	1.94 ± 0.21	1.91 ± 0.15	Pass
SG-2382,2383	7/23/2021	Ac-228	1.69 ± 0.28	1.96 ± 0.33	1.83 ± 0.22	Pass
DW-30207,30208	7/26/2021	Gr. Alpha	5.47 ± 1.29	5.20 ± 1.24	5.34 ± 0.89	Pass
DW-30207,30208	7/26/2021	Gr. Beta	5.89 ± 0.77	6.11 ± 0.73	6.00 ± 0.53	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
DW-30210,30211	7/28/2021	Ra-226	0.48 ± 0.13	0.62 ± 0.11	0.55 ± 0.09	Pass
DW-30210,30211	7/28/2021	Ra-228	0.45 ± 0.53	0.73 ± 0.65	0.59 ± 0.42	Pass
S-2509,2510	8/1/2021	K-40	14.2 ± 0.5	13.7 ± 1.0	14.0 ± 0.6	Pass
S-2509,2510	8/1/2021	Be-7	7.27 ± 0.29	7.97 ± 0.69	7.62 ± 0.37	Pass
DW-30221,30222	8/6/2021	Gr. Alpha	2.19 ± 1.55	2.08 ± 1.54	2.14 ± 1.09	Pass
DW-30221,30222	8/6/2021	Gr. Beta	1.19 ± 1.04	2.76 ± 1.08	1.98 ± 0.75	Pass
DW-30221,30222	8/6/2021	Ra-226	2.00 ± 0.22	1.58 ± 0.26	1.79 ± 0.17	Pass
DW-30221,30222	8/6/2021	Ra-228	1.69 ± 0.56	1.75 ± 0.54	1.72 ± 0.39	Pass
VE-2551,2552	8/11/2021	K-40	2.68 ± 0.20	2.61 ± 0.27	2.64 ± 0.17	Pass
VE-2551,2552	8/11/2021	Be-7	0.16 ± 0.08	0.18 ± 0.08	0.17 ± 0.05	Pass
AP-2578,2579	8/12/2021	Be-7	0.18 ± 0.09	0.20 ± 0.11	0.19 ± 0.07	Pass
AP-082421A,B	8/24/2021	Gr. Beta	0.032 ± 0.004	0.028 ± 0.004	0.030 ± 0.003	Pass
AP-083121A,B	8/24/2021	Gr. Beta	0.027 ± 0.004	0.029 ± 0.004	0.028 ± 0.003	Pass
VE-2684,2685	8/25/2021	K-40	2.15 ± 0.26	1.92 ± 0.27	2.03 ± 0.19	Pass
VE-2684,2685	8/25/2021	Be-7	0.20 ± 0.10	0.26 ± 0.11	0.23 ± 0.07	Pass
VE-2728,2729	8/25/2021	K-40	2.34 ± 0.41	2.27 ± 0.40	2.31 ± 0.29	Pass
DW-30238,30239	8/25/2021	Gr. Alpha	3.94 ± 0.91	2.43 ± 0.86	3.185 ± 0.63	Pass
DW-30238,30239	8/25/2021	Ra-226	2.57 ± 0.24	1.83 ± 0.24	2.20 ± 0.17	Pass
DW-30238,30239	8/25/2021	Ra-228	2.86 ± 0.83	2.52 ± 0.66	2.69 ± 0.53	Pass
SW-2641,2642	8/31/2021	H-3	289 ± 92	310 ± 93	300 ± 65	Pass
VE-2858,2859	9/2/2021	K-40	8.36 ± 0.41	8.02 ± 0.47	8.19 ± 0.31	Pass
SG-2934,2935	9/13/2021	Pb-214	2.72 ± 0.22	2.54 ± 0.27	2.63 ± 0.17	Pass
SG-2934,2935	9/13/2021	Ac-228	3.16 ± 0.39	3.22 ± 0.58	3.19 ± 0.35	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass
DW-30256,30257	10/8/2021	Gr. Alpha	2.35 ± 0.79	2.71 ± 0.92	2.53 ± 0.61	Pass
S-3279,3280	10/11/2021	K-40	10.08 ± 0.58	9.18 ± 0.53	9.63 ± 0.39	Pass
DW-30262,30263	10/14/2021	Ra-226	1.49 ± 0.30	1.51 ± 0.17	1.50 ± 0.17	Pass
DW-30262,30263	10/14/2021	Ra-228	1.16 ± 0.79	2.08 ± 0.82	1.62 ± 0.57	Pass
AP-102521A,B	10/25/2021	Gr. Beta	0.026 ± 0.005	0.030 ± 0.010	0.028 ± 0.010	Pass
XWW-3707,3708	10/27/2021	H-3	206 ± 87	268 ± 90	237 ± 63	Pass
AP-110121A,B	11/1/2021	Gr. Beta	0.017 ± 0.004	0.016 ± 0.00	0.016 ± 0.003	Pass
DW-30277,30278	11/5/2021	Gr. Alpha	10.11 ± 1.19	9.72 ± 1.11	9.92 ± 0.81	Pass
DW-30277,30278	11/5/2021	Gr .Beta	5.53 ± 0.72	4.22 ± 0.69	4.88 ± 0.50	Pass
DW-30277,30278	11/5/2021	Ra-226	6.27 ± 0.32	6.34 ± 0.37	6.31 ± 0.25	Pass
DW-30277,30278	11/5/2021	Ra-228	3.10 ± 0.86	3.76 ± 0.90	3.43 ± 0.62	Pass
AP-111521A,B	11/15/2021	Gr. Beta	0.022 ± 0.004	0.026 ± 0.005	0.024 ± 0.003	Pass
AP-112221A,B	11/22/2021	Gr. Beta	0.023 ± 0.004	0.025 ± 0.005	0.024 ± 0.003	Pass
AP-112921A,B	11/29/2021	Gr. Beta	0.038 ± 0.005	0.035 ± 0.005	0.037 ± 0.004	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
DW-30297,8	12/15/2021	Ra-226	1.71 ± 0.15	1.21 ± 0.13	1.46 ± 0.10	Pass
DW-30297,8	12/15/2021	Ra-228	2.44 ± 0.98	1.96 ± 0.97	2.20 ± 0.69	Pass
S-4182,4183	12/19/2021	Pb-214	1.19 ± 0.06	1.07 ± 0.08	1.13 ± 0.05	Pass
S-4182,4183	12/19/2021	Ac-228	1.08 ± 0.11	1.15 ± 0.14	1.12 ± 0.09	Pass
S-4182,4183	12/19/2021	K-40	1.75 ± 0.74	1.80 ± 0.84	1.78 ± 0.56	Pass
AP-122721A,B	12/27/2021	Gr. Beta	0.063 ± 0.006	0.060 ± 0.006	0.062 ± 0.004	Pass
AP-4350,4351	12/28/2021	Be-7	0.06 ± 0.02	0.06 ± 0.02	0.06 ± 0.01	Pass
AP-4845,4846	12/31/2021	Be-7	0.07 ± 0.01	0.06 ± 0.02	0.06 ± 0.01	Pass

Note: Duplicate analyses are performed on every twentieth sample received. 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).

[b] AP (Air Particulate), AV (Aquatic Vegetation), BS (Bottom Sediment), CF (Cattle Feed), CH (Charcoal Canister), DW (Drinking Water), E (Egg), F (Fish), G (Grass), LW (Lake Water), MI (Milk), P (Precipitation), PM (Powdered Milk), S (Solid), SG (Sludge), SO (Soil), SS (Shoreline Sediment), SW (Surface Water), SWT (Surface Water Treated), SWU (Surface Water Untreated), VE (Vegetation), W (Water), WW (Well Water).

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
MAAP-594	2/1/2021	Gross Alpha	1.30 ± 0.08	1.77	0.53 - 3.01	Pass
MAAP-594	2/1/2021	Gross Beta	0.81 ± 0.04	0.649	0.325 - 0.974	Pass
MADW-571	2/1/2021	Gross Alpha	0.73 ± 0.06	0.87	0.26 - 1.48	Pass
MADW-572	2/1/2021	Gross Beta	2.38 ± 0.06	2.50	1.25 - 3.75	Pass
MASO-591	2/1/2021	Cs-134	-2.57 ± 2.21	0	NA [c]	Pass
MASO-591	2/1/2021	Cs-137	1700 ± 20	1550	1085 - 2015	Pass
MASO-591	2/1/2021	Co-57	977 ± 7	920	644 - 1196	Pass
MASO-591	2/1/2021	Co-60	1360 ± 10	1370	959 - 1781	Pass
MASO-591	2/1/2021	Mn-54	0.91 ± 2.85	0	NA [c]	Pass
MASO-591	2/1/2021	Zn-65	687 - 17	604	423 - 785	Pass
MASO-591	2/1/2021	K-40	682 ± 53	618	433 - 803	Pass
MAW-569	2/1/2021	Cs-134	10.5 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-569	2/1/2021	Cs-137	8.53 ± 0.32	7.9	5.5 - 10.3	Pass
MAW-569	2/1/2021	Co-57	12.2 ± 0.3	11.4	8.0 - 14.8	Pass
MAW-569	2/1/2021	Co-60	0.03 ± 0.05	0	NA [c]	Pass
MAW-569	2/1/2021	Mn-54	16.5 ± 0.4	15.5	10.9 - 20.2	Pass
MAW-569	2/1/2021	Zn-65	11.5 ± 0.5	10.5	7.40 - 13.7	Pass
MAW-569	2/1/2021	K-40	9.93 ± 1.42	0	NA [c]	Fail [d]
MAAP-592	2/1/2021	Cs-134	1.54 ± 0.06	2.14	1.50 - 2.78	Pass
MAAP-592	2/1/2021	Cs-137	-0.011 ± 0.020	0	NA [c]	Pass
MAAP-592	2/1/2021	Co-57	0.636 ± 0.042	0.69	0.480 - 0.892	Pass
MAAP-592	2/1/2021	Co-60	-0.64 ± 0.02	0	NA [c]	Fail [e]
MAAP-592	2/1/2021	Mn-54	0.312 ± 0.058	0.312	0.218 - 0.406	Pass
MAAP-592	2/1/2021	Zn-65	0.41 ± 0.07	0.352	0.246 - 0.458	Pass
MAVE-588	2/1/2021	Cs-134	3.73 ± 0.09	3.60	2.50 - 4.70	Pass
MAVE-588	2/1/2021	Cs-137	5.69 ± 0.10	4.69	3.28 - 6.10	Pass
MAVE-588	2/1/2021	Co-57	6.23 ± 0.07	5.05	3.54 - 6.57	Pass
MAVE-588	2/1/2021	Co-60	3.29 ± 0.06	2.99	2.09 - 3.89	Pass
MAVE-588	2/1/2021	Mn-54	6.17 ± 0.16	5.25	3.68 - 6.83	Pass
MAVE-588	2/1/2021	Zn-65	-0.04 ± 0.08	0	NA [c]	Pass
MAAP-3007	8/1/2021	Gross Alpha	0.45 ± 0.04	0.960	0.288 - 1.632	Pass
MAAP-3007	8/1/2021	Gross Beta	0.71 ± 0.04	0.553	0.277 - 0.830	Pass
MADW-2688	8/1/2021	Gross Alpha	0.19 ± 0.03	0.232	0.070 - 0.394	Pass
MADW-2688	8/1/2021	Gross Beta	2.60 ± 0.06	2.807	1.404 - 4.211	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
MASO-3004	8/1/2021	Cs-134	1035 ± 10	1170	819 - 1521	Pass
MASO-3004	8/1/2021	Cs-137	628 ± 11	572	400 - 744	Pass
MASO-3004	8/1/2021	Co-57	-0.11 ± 1.26	0	NA [c]	Pass
MASO-3004	8/1/2021	Co-60	720 ± 7	722	714 - 1326	Pass
MASO-3004	8/1/2021	Mn-54	456 ± 11	410	287 - 533	Pass
MASO-3004	8/1/2021	Zn-65	1002 ± 22	907	635 - 1179	Pass
MASO-3004	8/1/2021	K-40	663 ± 50	607	425 - 789	Pass
MADW-3003	8/1/2021	Ra-226	0.32 ± 0.06	0.226	0.158 - 0.294	Fail[f]
MADW-3003	8/1/2021	Sr-90	3.63 ± 0.16	3.9	2.70 - 5.02	Pass
MADW-3003	8/1/2021	U-234	0.02 - 0.01	0.02	NA [g]	Pass
MADW-3003	8/1/2021	U-238	0.02 - 0.01	0.01	NA [g]	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), MADW (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] The sample spectrum was reanalyzed utilizing the minimum data point background width method. The result was 1.59 ± 1.77 Bq/L which satisfies MAPEP criteria for a false positive test.

[e] A decimal was misplaced in one of two cobalt-60 results while calculating a mean result causing MAPEP to fail the result as a statistically significant negative value at 3 standard deviations. The correct mean result (-0.0004 ± 0.0186) is not a statistically significant negative value and would not have failed.

f Radium result did not meet MAPEP acceptance criteria.

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

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

MRAD-30 Study

Lab Code [b]	Date	Analysis	Concentration [a] Laboratory Result	ERA Value [c]	Control Limits [d]	Acceptance
ERAP-722	3/22/2021	Cs-134	898	1030	668 - 1260	Pass
ERAP-722	3/22/2021	Cs-137	181	163	134 - 214	Pass
ERAP-722	3/22/2021	Co-60	1270	1220	1040 - 1550	Pass
ERAP-722	3/22/2021	Mn-54	< 4.3	< 50.0	0.00 - 50.0	Pass
ERAP-722	3/22/2021	Zn-65	908	771	632 - 1180	Pass
ERAP-722	3/22/2021	Sr-90	184	189	120 - 257	Pass
ERAP-724	3/22/2021	Gross Alpha	88.4	96.1	50.2 - 158	Pass
ERAP-724	3/22/2021	Gross Beta	74.1	62.6	38.0 - 94.6	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 code ERAP (air filter). Results are reported in units of (pCi/Filter).

[c] The ERA Assigned values for the air filter standards are equal to 100% of the parameter present in the standard as determined by the gravimetric and/or volumetric measurements made during standard preparation as applicable.

[d] The acceptance limits are established per the guidelines contained in the Department of Energy (DOE) report EML-564, Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes or ERA's SOP for the generation of Performance Acceptance Limits.

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Appendix B

Data Reporting Conventions

APPENDIX B. DATA REPORTING CONVENTIONS

Data Reporting Conventions

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

2.0. Single Measurements

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

where: x = value of the measurement;

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

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

3.0. Duplicate analyses

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

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

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

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

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

4.0. Computation of Averages and Standard Deviations

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

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

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

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

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

4.5 In rounding off, the following rules are followed:

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

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

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Appendix C

Maximum permissible concentrations of radioactivity
in air and water above natural background in unrestricted areas

APPENDIX C

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

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

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

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

[c] A natural radionuclide.

APPENDIX D

SUMMARY OF THE LAND USE CENSUS

AND REMP-GWPP DATA

Appendix D

Summary of the 2021 Land Use Census and REMP-GWPP Data

Executive Summary

The 2021 Radiological Environmental Monitoring Program (REMP) and Groundwater Protection Program (GWPP) sample locations and results were reviewed. There were no indications of any DAEC plant by-product in any REMP air, soil, river bed sediment, vegetation, meat, surface-water, and drinking water sample. GWPP sampling and results indicate tritiated groundwater remains within the owner controlled area and tritium concentrations in the SE sector continue to decline due to the combination of temporary and permanent groundwater mitigation. Post shutdown, the DAEC REMP-GWPP will remain necessary for 2021 and beyond. Defueled Offsite Dose Assessment Manual (DODAM) was revised to reduce environmental sampling consistent with the plant's operational condition.

Evaluation

The Duane Arnold Energy Center Land Use Census was completed during December 2021. Residences, cattle, and gardens greater than 500 square feet were identified within three miles for each of the 16 meteorological sectors. If none were identified within three mile range, additional surveys were performed out to a distance of five miles. Meteorological sectors were identified using Google Earth and digital compass rose overlay for accuracy and precision. The 2021 Land Use Census details can be found in Attachment 1.

Milk sampling was discontinued in 2021. The 2020 Land Use Census did not identify dairies within ten miles of the plant and removed the requirement from the DODAM. The Land Use Census will discontinue assessing dairies and goats as radioactive iodine has decayed and is no longer a concern.

A list of nearest livestock can be found on Attachment 2.

There were two nearest resident changes in the SSW sector and WSW sector. A list of the nearest residential property can be found in Attachment 3.

There are nine new residences added to the 2021 Land Use Survey. A list of new residences can be found in Attachment 4. (complete attachment 4)

One meteorological sector, WSW, had a garden change and a list of the nearest gardens can be found in Attachment 5. Seven farmers/residents provided vegetation samples including the two closets neighbors to DAEC, D-58 and D-57. Vegetation providers are found in ODAM, Table 5-1. Subsequent vegetation analysis did not identify any DAEC plant by-product. Gardens were identified using Google Earth, and field observations.

Soil sampling on July 06, 2020, from D-15a and D-16., both of which identified Cesium-137 below reporting level of 180 pCi/g. A 2017-2018 soil sampling and evaluation at multiple locations near Waterloo, Ames, and Coralville, Iowa confirm the Cesium-137 is not from DAEC operations and Cs-137 can be attributed to weapons testing in the 1950-1960's.

Six Cedar River bed sediment samples were collected at D-49, D-51, and D-107a. No reactor by-product material was identified. Cs-137 was identified in past samples. The likely source of the Cs-137 is weapons testing in the 1950's-1960's and not from DAEC plant operations or plant by-product.

No meat samples were collected in 2020. However, a review of particulate and iodine sample results, indicates no deposition of radioactive material was likely.

Precipitation sampling has been discontinued. Given tritium trends in precipitation sample and regulatory guidance, sampling was discontinued.

310 groundwater samples were collected in 2020 and tritium wase the only plant by-product nuclide identified in the samples. The highest concentration identified in a monitoring well was 51,271 pCi/L on 10/13/2020 from monitoring well MW-08A, which is upstream of the temporary and permanent mitigation systems. Subsequent sampling and analysis confirm the tritium concentration in MW-08A decreased by 94% after continued mitigation operations. Since 10/13/2020, tritium in MW-08A has been consistently below 20,000 pCi/L. Monitoring wells MW-22A and MW-23A continue to have elevated tritium concentrations. Tritium was not identified in monitoring well MW-33A, which is the closet shallow monitoring well nearest the Cedar River. Therefore, the tritiated groundwater in the shallow appears to remain within DAEC owner-controlled area and mitigation efforts continue to successfully intercept the tritiated plume field.

The Cedar River was surveyed by University of Iowa Hygienic Laboratory boat on October 2, 2021 for water use downstream of the DAEC to Cedar Rapids. The survey identified no new usages of river water when compared to previous surveys.

The University of Iowa Hygienic Laboratory performed fish sampling on June 03, 2020 and August 14, 2020. Sportfish were targeted and edible fish filets include smallmouth bass, white crappie, northern pike, and channel catfish. Fish filets were processed for

off-site laboratory analysis and results indicate no impact to human consumable fish from DAEC operations or plant by-products. Recreational fishing is the only identified food pathway use of Cedar River water between DAEC and the City of Cedar Rapids eight miles down-river.

State of Iowa website, https://www.iihr.uiowa.edu/igs/geosam/well/search?m=471 was used to identify new private, municipal, or commercial wells within five miles of the plant. No new wells were identified in neighboring townships T83, T84 and T85 Ranges R7W, R8W and R9W.

In accordance with the DAEC's Environmental Sampling Procedure ESP 4.4, "Land Use Census", no changes in land use were identified that would adversely affect the Defueled Safety Analysis Report (DSAR). Examples of land use that would warrant an UFSAR update include new hazards near the DAEC such as new gas pipelines or new installations utilizing toxic gases. In 2020, there were no new hazards identified that would impact DAEC operations.

As a result of the 2021 Land Use Census, adjustments were made to the MIDAS dose projection software model for changes in receptor distances. Changes to MIDAS are noted in Attachment 6 and include quality assurance test problems from 2018 and 2019. There were no abnormalities noted between quality assurance tests and results.

The 2020 hypothetical maximally exposed organ due to airborne iodines and particulates with half-lives greater than eight days (excluding carbon-14) was the GI tract of a child at 805 meters towards the west of the facility, with an estimated dose equivalent of 0.00446 mRem. The 2020 hypothetical maximally expose organ due to a liquid effluent release from tritium is to a child's liver 0.0328 mRem at D-51, which is the liquid effluent release point into the Cedar River.

Effluents During Decommissioning

DAEC ceased power production permanently August 10, 2020 following the derecho. The derecho destroyed the cooling towers. After evaluating the condition, FPL chose not to restart the plant.

With the plant shutdown, gaseous effluents have significantly decreased. The offgas stack is no longer a release point. No credible sources of noble gas, iodine or tritium remain in the Turbine Building. Only particulate material will be monitored from the Turbine Building. No credible sources of noble gas or iodine remain in Low Level Radwaste (LLRW). Only particulate and tritium will be monitored in LLRW. While fuel remains in the fuel pool, all reactor building gaseous effluents will continue to be monitored.

To reduce plant water inventory, liquid effluent releases started in December 2020 and continued into 2021 and will continue in 2022. The liquid effluents are discharged in accordance with the DODAM sampling and analysis requirements and regulatory requirements. Three liquid radwaste discharges occurred in 2020, and ninety-four liquid discharges have occurred to date in 2021. The goal is to keep the radioactive liquid effluent less than 10% of the regulatory annual dose limit of 3 mrem Total Body and 10 mrem Organ. To date in 2021 the dose is at 6.5% Total Body and 3.0% Organ.

Groundwater mitigation will continue as tritium is removed from the shallow aquifer.

REMP Revision During Decommisioning

DODAM REMP sampling and analysis requirements were evaluated and the following DODAM changes were made.

1. As I-131 and I-133 have decayed since shutdown, iodine will no longer be analyzed in air samples. An evaluation was performed and REMP particulate sampling is reduced to location D-15 and D-16.

2. The number of REMP TLDs has been reduced by approximately half. No restrictions were made to increase TLDs as needed to support IFISI activities.

3. Weekly sewage sampling remains alternating between tritium and gamma analysis each week.

4. Surface-water, soil, vegetation, fish, Cedar River bed sediment, water use survey, meat sampling, and groundwater sampling remain though number of required samples have been reduced.

5. Gaseous effluent from carbon fourteen, C-14, will cease with power production and will not need to be included in the annual effluent report.

6. The Land Use Survey remains, though because of the reduced effluents, the frequency is extended to a biennial activity.

7. The Annual Radiological Material Release Report will remain an annual regulatory reporting requirement, which is due to the NRC by May 1st of each year for the previous calendar year.

8. The Annual Radiological Environmental Operating Report will remain an annual regulatory reporting requirement, which is due to the NRC by May 15th of each year for the previous calendar year.

Conclusion

The 2020 Radiological Environmental Monitoring Program (REMP) and Groundwater Protection Program (GWPP) sample locations and results were reviewed. There were no indications of any DAEC plant by-product in any REMP air, soil, riverbed sediment, vegetation, meat, surface-water, and drinking water sample.

GWPP sampling and results indicate tritiated groundwater remains within the owner-controlled area and tritium concentrations in the SE sector continue to decline due to the combination of temporary and permanent groundwater mitigation. Post shutdown, the DAEC REMP-GWPP remain. REMP-GWPP sampling and scheduling will be adjusted as needed, based on analysis review.

APPENDIX E

ANNUAL RADIATION DOSE ASSESSMENT

Appendix E

Annual Radiation Dose Assessment

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

Section A Dose Contribution from Direct Radiation

Direct radiation dose from the operation of the DAEC was captured by TLDs placed at locations in the surrounding environment as described in the ODAM-DODAM. Pre-operational and 2021 TLD results were evaluated with a paired difference statistical test. The evaluation concluded that there were no significant differences in the TLD populations for the 0.5-mile, 1 mile and Control TLD populations. No measurable dose due to the operation of the DAEC was detected by environmental TLDs in 2021. In addition, compliance with 40 CFR 190 limits of 25 mrem whole body and 75 mrem thyroid is demonstrated in the Duane Arnold Energy Center 2021 Annual Radiological Environmental Operating Report, subsections "Ambient Radiation (TLDs)" and "ISFSI Facility Operations Monitoring".

Section B Estimated Offsite Dose from Effluent Releases

The contribution of dose to a member of the public most likely to be exposed from liquid and gaseous effluent releases was calculated using the MIDAS computer program in accordance with the DODAM. Calculation methods follow those prescribed by Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".

Results of the MIDAS dose calculations are below:

1.) There were ninety-nine batch and continuous releases of radioactive material to liquid effluents in 2021. The maximum dose from liquid releases to an adult total body was 0.202 mrem and maximum organ dose to a teen liver was 0.315 mrem.

2.) As no noble gases were detected in 2021, the maximum gamma air dose from noble gases released was 0.0 mrad located at 481 meters towards the South-Southeast from plant centerline.

3.) As no noble gases were detected in 2021, the maximum beta air dose from noble gases released was 0.0 mrad at 481 meters towards the South-Southeast from the plant centerline.

4.) The whole-body dose equivalent to the hypothetical maximally exposed individual from

noble gases was 0.0010 mrem at 805 meters towards the West from the plant centerline.

5.) The skin dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.0 mrem at 805 meters towards the West from the plant centerline.

6.) The hypothetical maximally exposed organ due to airborne iodines and particulates with half-lives greater than eight days (excluding carbon-14) was 0.00103 mrem to the Lung of a child at 805 meters towards the West from the centerline of the plant.

CONCLUSION

The contribution of dose to a member of the public most likely to be exposed from liquid and gaseous effluent releases was calculated using the MIDAS computer program in accordance with the ODAM-DODAM and site procedures. The calculated doses for gaseous and liquid effluent releases are below the regulatory limits stated in 10 CFR 50, Appendix I and in 40 CFR 190.

Estimated Maximum Offsite Individual Doses for 2021

Type	Age Group	Distance (meters)	Direction	Dose or Dose Equivalent (mrem)	Annual 10 CFR 50, Appendix I "Limit"
Direct Radiation (as measured by TLDs)				None	*
Liquid Releases					
Whole Body Dose	Adult	D[1]	SE	0.202 mrem	3 mrem
Organ Dose	Child - Liver	D[1]	SE	0.315 mrem	10 mrem
Noble Gas					
Gamma Air Dose		481	SSE	0.0 mrad	10 mrad
Beta Air Dose		481	SSE	0.0 mrad	20 mrad
Whole Body	All	805	W	0.0 mrem	5 mrem
Skin	Child	805	W	0.0 mrem	15 mrem
Particulates & Iodines					
Organ Dose	Child – Lung	805	W	0.00103 mrem	15 mrem
Carbon 14					
Organ Dose	Child – Bone	1,760	N	0.0 mrem	15 mrem

* There is no Appendix I limit for direct radiation. Compliance with 40 CFR 190 limits of 25 mrem whole body and 75 mrem thyroid is demonstrated in the Duane Arnold Energy Center 2021 Annual Radiological Environmental Operating Report, subsections "Ambient Radiation (TLDs)" and "ISFSI Facility Operations Monitoring".

D[1] Receptor location is aquatic pathway at Cedar River. See ODAM-DODAM, Figure 3-2.

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

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

ANNUAL REPORT - PART II
DATA TABULATIONS AND ANALYSES

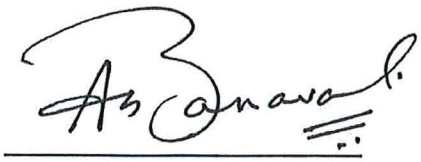
January 1 to December 31, 2021

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

Reviewed and Approved



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1.0 INTRODUCTION

The following constitutes a supplement to the Annual Report for the Radiological Environmental Monitoring Program conducted at the Duane Arnold Energy Center, Palo, Iowa in 2021. Results of completed analyses are presented in the attached tables.

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

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

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

2.0 PROGRAM DEVIATIONS

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
SW		D-49	01-13-21	No sample; river frozen.
SW		D-61	01-13-21	No sample; river frozen.
SW		D-99	01-13-21	No sample; river frozen.
SW		D-49	02-11-21	No sample; river frozen.
SW		D-50	02-11-21	No sample; river frozen.
SW		D-51	02-11-21	No sample; river frozen.
SW		D-61	02-11-21	No sample; river frozen.
SW		D-99	02-11-21	No sample; river frozen.
TLD		D-02	1st Qtr '21	TLD lost in field.
TLD		D-83	1st Qtr '21	TLD lost in field.
WW		D-58	08-25-21	Sample not collected due to power outage at location.
WW		D-58	11-18-21	Sample not collected due to power outage at location.
TLD		D-8	4th Qtr '21	TLD lost in field.

3.0 DATA TABLES

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

Location: D-3 (Hiawatha)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	310	0.044 ± 0.004			
01-14-21	232	0.052 ± 0.006			
01-22-21	323	0.026 ± 0.003			
01-29-21	283	0.026 ± 0.004			
02-03-21	202	0.029 ± 0.005			
02-10-21	283	0.047 ± 0.005			
02-18-21	322	0.039 ± 0.004			
02-25-21	283	0.052 ± 0.005			
03-05-21	322	0.035 ± 0.004			
03-12-21	283	0.026 ± 0.004			
03-18-21	240	0.025 ± 0.004			
03-26-21	324	0.015 ± 0.003			
04-02-21	283	0.023 ± 0.003			
1st Quarter Mean ± s.d.		0.034 ± 0.012			
04-09-21	282	0.027 ± 0.004			
04-16-21	283	0.006 ± 0.002			

Collection discontinued at the location

2nd Quarter Mean ± s.d.		0.016 ± 0.015			
			Cumulative Average		0.031

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

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

Location: D-4 (NW Sector)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	320	0.045 ± 0.004	07-09-21	300	0.025 ± 0.004
01-14-21	240	0.052 ± 0.005	07-16-21	300	0.021 ± 0.003
01-22-21	320	0.022 ± 0.003	07-23-21	300	0.031 ± 0.004
01-29-21	280	0.031 ± 0.004	07-31-21	343	0.034 ± 0.004
02-03-21	200	0.033 ± 0.005			
			08-06-21	258	0.024 ± 0.004
02-10-21	280	0.048 ± 0.005	08-12-21	257	0.030 ± 0.004
02-18-21	319	0.045 ± 0.004	08-20-21	341	0.031 ± 0.004
02-25-21	280	0.059 ± 0.005	08-27-21	299	0.020 ± 0.004
03-05-21	319	0.017 ± 0.003	09-02-21	257	0.031 ± 0.004
03-12-21	280	0.029 ± 0.004	09-10-21	342	0.027 ± 0.003
03-18-21	237	0.022 ± 0.004	09-17-21	275	0.046 ± 0.005
03-26-21	321	0.020 ± 0.003	09-24-21	274	0.025 ± 0.004
04-02-21	280	0.023 ± 0.003	10-01-21	274	0.044 ± 0.005
1st Quarter Mean ± s.d.		0.034 ± 0.014	3rd Quarter Mean ± s.d.		0.030 ± 0.008
04-09-21	279	0.023 ± 0.003	10-08-21	277	0.034 ± 0.004
04-16-21	280	0.006 ± 0.003	10-15-21	272	0.033 ± 0.004
04-23-21	280	0.018 ± 0.003	10-22-21	274	0.031 ± 0.004
04-29-21	240	0.024 ± 0.004	10-29-21	275	0.018 ± 0.003
05-07-21	320	0.017 ± 0.003	11-05-21	275	0.026 ± 0.004
05-14-21	299	0.013 ± 0.003	11-11-21	236	0.042 ± 0.005
05-21-21	300	0.020 ± 0.003	11-18-21	274	0.017 ± 0.003
05-28-21	300	0.016 ± 0.003	11-24-21	236	0.036 ± 0.005
			12-02-21	313	0.036 ± 0.004
06-04-21	299	0.024 ± 0.004			
06-10-21	258	0.025 ± 0.004	12-09-21	274	0.027 ± 0.004
06-18-21	342	0.024 ± 0.003	12-16-21	275	0.038 ± 0.004
06-25-21	300	0.019 ± 0.003	12-22-21	234	0.043 ± 0.005
07-02-21	299	0.022 ± 0.003	12-30-21	314	0.060 ± 0.005
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.034 ± 0.011
			Cumulative Average		0.029

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

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

Location: D-5A (Palo)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	316	0.043 ± 0.004	07-09-21	272	0.024 ± 0.004
01-14-21	237	0.052 ± 0.005	07-16-21	272	0.024 ± 0.004
01-22-21	316	0.025 ± 0.003	07-23-21	271	0.019 ± 0.003
01-29-21	277	0.031 ± 0.004	07-31-21	311	0.033 ± 0.004
02-03-21	198	0.034 ± 0.005			
			08-06-21	233	0.027 ± 0.004
02-10-21	278	0.047 ± 0.005	08-12-21	232	0.031 ± 0.005
02-18-21	315	0.042 ± 0.004	08-20-21	309	0.036 ± 0.004
02-25-21	278	0.050 ± 0.005	08-27-21	276	0.027 ± 0.004
03-05-21	308	0.035 ± 0.004	09-02-21	237	0.041 ± 0.005
03-12-21	271	0.035 ± 0.004	09-10-21	316	0.032 ± 0.004
03-18-21	231	0.023 ± 0.004	09-17-21	278	0.042 ± 0.004
03-26-21	310	0.016 ± 0.003	09-24-21	276	0.028 ± 0.004
04-02-21	270	0.027 ± 0.004	10-01-21	277	0.047 ± 0.005
1st Quarter Mean ± s.d.		0.036 ± 0.011	3rd Quarter Mean ± s.d.		0.032 ± 0.008
04-09-21	271	0.031 ± 0.004	10-08-21	280	0.028 ± 0.004
04-16-21	272	0.007 ± 0.003	10-15-21	275	0.032 ± 0.004
04-23-21	270	0.025 ± 0.004	10-22-21	276	0.033 ± 0.004
04-29-21	232	0.030 ± 0.004	10-29-21	277	0.020 ± 0.004
05-07-21	310	0.024 ± 0.003	11-05-21	277	0.029 ± 0.004
05-14-21	268	0.018 ± 0.003	11-11-21	238	0.046 ± 0.005
05-21-21	271	0.028 ± 0.004	11-18-21	277	0.016 ± 0.003
05-28-21	272	0.022 ± 0.004	11-24-21	239	0.038 ± 0.005
			12-02-21	316	0.038 ± 0.004
06-04-21	270	0.029 ± 0.004			
06-10-21	233	0.022 ± 0.004	12-09-21	277	0.024 ± 0.004
06-18-21	309	0.025 ± 0.003	12-16-21	278	0.037 ± 0.004
06-25-21	272	0.028 ± 0.004	12-22-21	236	0.048 ± 0.005
07-02-21	270	0.023 ± 0.004	12-30-21	317	0.061 ± 0.005
2nd Quarter Mean ± s.d.		0.024 ± 0.006	4th Quarter Mean ± s.d.		0.035 ± 0.012
			Cumulative Average		0.032

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

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

Location: D-6 (Center Point)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	333	0.046 ± 0.004			
01-14-21	249	0.050 ± 0.005			
01-22-21	333	0.028 ± 0.003			
01-29-21	291	0.032 ± 0.004			
02-03-21	208	0.035 ± 0.005			
02-10-21	294	0.049 ± 0.005			
02-18-21	332	0.044 ± 0.004			
02-25-21	292	0.051 ± 0.005			
03-05-21	332	0.027 ± 0.003			
03-12-21	291	0.032 ± 0.004			
03-18-21	247	0.023 ± 0.004			
03-26-21	333	0.018 ± 0.003			
04-02-21	274	0.022 ± 0.003			
1st Quarter Mean ± s.d.		0.035 ± 0.012			
04-09-21	274	0.027 ± 0.004			
04-16-21	274	0.006 ± 0.003			
Collection discontinued at the location					
2nd Quarter Mean ± s.d.		0.016 ± 0.015			
			Cumulative Average		0.033

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

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

Location: D-7 (Shellsburg)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	320	0.048 ± 0.004			
01-14-21	240	0.052 ± 0.005			
01-22-21	320	0.027 ± 0.003			
01-29-21	280	0.033 ± 0.004			
02-03-21	200	0.030 ± 0.005			
02-10-21	281	0.048 ± 0.005			
02-18-21	319	0.046 ± 0.004			
02-25-21	281	0.058 ± 0.005			
03-05-21	318	0.031 ± 0.004			
03-12-21	280	0.025 ± 0.004			
03-18-21	238	0.024 ± 0.004			
03-26-21	320	0.016 ± 0.003			
04-02-21	280	0.021 ± 0.003			
1st Quarter Mean ± s.d.		0.035 ± 0.014			
04-09-21	280	0.024 ± 0.003			
04-16-21	280	0.008 ± 0.003			
Collection discontinued at the location					
2nd Quarter Mean ± s.d.		0.016 ± 0.011			
			Cumulative Average		0.033

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

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

Location: D-11 (Toddville)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	330	0.047 ± 0.004			
01-14-21	247	0.055 ± 0.005			
01-22-21	330	0.024 ± 0.003			
01-29-21	289	0.025 ± 0.004			
02-03-21	206	0.034 ± 0.005			
02-10-21	289	0.049 ± 0.005			
02-18-21	328	0.041 ± 0.004			
02-25-21	289	0.053 ± 0.005			
03-05-21	329	0.031 ± 0.004			
03-12-21	289	0.031 ± 0.004			
03-18-21	245	0.025 ± 0.004			
03-26-21	343	0.020 ± 0.003			
04-02-21	300	0.019 ± 0.003			
1st Quarter Mean ± s.d.		0.035 ± 0.013			
04-09-21	299	0.026 ± 0.003			
04-16-21	300	0.007 ± 0.002			
Collection discontinued at the location					
2nd Quarter Mean ± s.d.		0.016 ± 0.013			
			Cumulative Average		0.032

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

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

Location: D-13 (Alburnett)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	310	0.059 ± 0.005	07-09-21	266	0.023 ± 0.004
01-14-21	232	0.065 ± 0.006	07-16-21	274	0.020 ± 0.003
01-22-21	303	0.026 ± 0.004	07-23-21	274	0.028 ± 0.004
01-29-21	266	0.030 ± 0.004	07-31-21	314	0.026 ± 0.003
02-03-21	190	0.036 ± 0.006			
			08-06-21	236	0.026 ± 0.004
02-10-21	266	0.050 ± 0.005	08-12-21	235	0.027 ± 0.004
02-18-21	302	0.042 ± 0.004	08-20-21	312	0.028 ± 0.004
02-25-21	266	0.056 ± 0.005	08-27-21	273	0.020 ± 0.004
03-05-21	303	0.027 ± 0.004	09-02-21	235	0.033 ± 0.005
03-12-21	266	0.032 ± 0.004	09-10-21	313	0.025 ± 0.003
03-18-21	225	0.025 ± 0.004	09-17-21	275	0.015 ± 0.003
03-26-21	304	0.020 ± 0.003	09-24-21	274	0.026 ± 0.004
04-02-21	266	0.019 ± 0.003	10-01-21	274	0.024 ± 0.004
1st Quarter Mean ± s.d.		0.038 ± 0.015	3rd Quarter Mean ± s.d.		0.025 ± 0.004
04-09-21	265	0.025 ± 0.004	10-08-21	277	0.028 ± 0.004
04-16-21	266	0.007 ± 0.003	10-15-21	275	0.029 ± 0.004
04-23-21	266	0.019 ± 0.003	10-22-21	276	0.023 ± 0.004
04-29-21	228	0.027 ± 0.004	10-29-21	277	0.018 ± 0.003
05-07-21	304	0.017 ± 0.003	11-05-21	277	0.024 ± 0.004
05-14-21	265	0.010 ± 0.003	11-11-21	238	0.039 ± 0.005
05-21-21	266	0.021 ± 0.004	11-18-21	277	0.016 ± 0.003
05-28-21	266	0.016 ± 0.003	11-24-21	239	0.026 ± 0.004
			12-02-21	316	0.031 ± 0.004
06-04-21	265	0.029 ± 0.004			
06-10-21	228	0.016 ± 0.004	12-09-21	277	0.019 ± 0.004
06-18-21	303	0.022 ± 0.003	12-16-21	278	0.030 ± 0.004
06-25-21	266	0.021 ± 0.004	12-22-21	237	0.046 ± 0.005
07-02-21	265	0.021 ± 0.004	12-30-21	317	0.046 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.029 ± 0.010
			Cumulative Average		0.028

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

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

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

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	326	0.047 ± 0.004	07-09-21	277	0.028 ± 0.004
01-14-21	244	0.050 ± 0.005	07-16-21	277	0.026 ± 0.004
01-22-21	326	0.029 ± 0.004	07-23-21	277	0.038 ± 0.004
01-29-21	286	0.032 ± 0.004	07-31-21	321	0.037 ± 0.004
02-03-21	204	0.035 ± 0.005			
			08-06-21	240	0.028 ± 0.004
02-10-21	286	0.045 ± 0.005	08-12-21	240	0.035 ± 0.005
02-18-21	325	0.046 ± 0.004	08-20-21	319	0.037 ± 0.004
02-25-21	286	0.054 ± 0.005	08-27-21	279	0.024 ± 0.004
03-05-21	316	0.035 ± 0.004	09-02-21	240	0.035 ± 0.005
03-12-21	277	0.033 ± 0.004	09-10-21	320	0.035 ± 0.004
03-18-21	235	0.029 ± 0.004	09-17-21	281	0.040 ± 0.004
03-26-21	317	0.020 ± 0.003	09-24-21	279	0.029 ± 0.004
04-02-21	277	0.016 ± 0.003	10-01-21	280	0.044 ± 0.005
1st Quarter Mean ± s.d.		0.036 ± 0.011	3rd Quarter Mean ± s.d.		0.034 ± 0.006
04-09-21	277	0.020 ± 0.003	10-08-21	283	0.029 ± 0.004
04-16-21	277	0.009 ± 0.003	10-15-21	263	0.034 ± 0.004
04-23-21	277	0.022 ± 0.003	10-22-21	265	0.032 ± 0.004
04-29-21	237	0.023 ± 0.004	10-29-21	266	0.018 ± 0.004
05-07-21	317	0.014 ± 0.003	11-05-21	266	0.030 ± 0.004
05-14-21	276	0.014 ± 0.003	11-11-21	229	0.046 ± 0.005
05-21-21	277	0.023 ± 0.004	11-18-21	265	0.016 ± 0.003
05-28-21	277	0.019 ± 0.003	11-24-21	229	0.035 ± 0.005
			12-02-21	303	0.034 ± 0.004
06-04-21	277	0.030 ± 0.004			
06-10-21	239	0.022 ± 0.004	12-09-21	266	0.026 ± 0.004
06-18-21	316	0.028 ± 0.004	12-16-21	266	0.035 ± 0.004
06-25-21	277	0.024 ± 0.004	12-22-21	227	0.046 ± 0.005
07-02-21	276	0.023 ± 0.004	12-30-21	304	0.058 ± 0.005
2nd Quarter Mean ± s.d.		0.021 ± 0.006	4th Quarter Mean ± s.d.		0.034 ± 0.011
			Cumulative Average		0.031

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

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

Location: D-16 (On-site)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	346	0.049 ± 0.004	07-09-21	286	0.026 ± 0.004
01-14-21	259	0.053 ± 0.005	07-16-21	286	0.022 ± 0.003
01-22-21	346	0.029 ± 0.003	07-23-21	285	0.036 ± 0.004
01-29-21	303	0.034 ± 0.004	07-31-21	327	0.042 ± 0.004
02-03-21	217	0.037 ± 0.005			
			08-06-21	245	0.025 ± 0.004
02-10-21	303	0.051 ± 0.005	08-12-21	245	0.035 ± 0.005
02-18-21	345	0.042 ± 0.004	08-20-21	325	0.037 ± 0.004
02-25-21	303	0.057 ± 0.005	08-27-21	285	0.019 ± 0.004
03-05-21	345	0.031 ± 0.004	09-02-21	245	0.038 ± 0.005
03-12-21	303	0.034 ± 0.004	09-10-21	326	0.031 ± 0.004
03-18-21	256	0.027 ± 0.004	09-17-21	269	0.048 ± 0.005
03-26-21	347	0.019 ± 0.003	09-24-21	268	0.027 ± 0.004
04-02-21	303	0.020 ± 0.003	10-01-21	269	0.052 ± 0.005
1st Quarter Mean ± s.d.		0.037 ± 0.012	3rd Quarter Mean ± s.d.		0.034 ± 0.010
04-09-21	302	0.027 ± 0.003	10-08-21	271	0.033 ± 0.004
04-16-21	303	0.007 ± 0.002	10-15-21	266	0.031 ± 0.004
04-23-21	303	0.018 ± 0.003	10-22-21	268	0.031 ± 0.004
04-29-21	260	0.028 ± 0.004	10-29-21	269	0.021 ± 0.004
05-07-21	317	0.022 ± 0.003	11-05-21	269	0.029 ± 0.004
05-14-21	285	0.013 ± 0.003	11-11-21	231	0.048 ± 0.005
05-21-21	286	0.021 ± 0.004	11-18-21	268	0.014 ± 0.003
05-28-21	286	0.021 ± 0.003	11-24-21	231	0.028 ± 0.005
			12-02-21	306	0.036 ± 0.004
06-04-21	285	0.027 ± 0.004			
06-10-21	246	0.023 ± 0.004	12-09-21	269	0.032 ± 0.004
06-18-21	325	0.025 ± 0.003	12-16-21	269	0.040 ± 0.004
06-25-21	286	0.022 ± 0.003	12-22-21	229	0.046 ± 0.005
07-02-21	285	0.020 ± 0.003	12-30-21	307	0.064 ± 0.005
2nd Quarter Mean ± s.d.		0.021 ± 0.006	4th Quarter Mean ± s.d.		0.035 ± 0.013
			Cumulative Average		0.032

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

Table 10. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131[a].
Location: D-40 (Wickiup Hill)
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-08-21	336	0.049 ± 0.004			
01-14-21	252	0.053 ± 0.005			
01-22-21	336	0.027 ± 0.003			
01-29-21	294	0.035 ± 0.004			
02-03-21	210	0.038 ± 0.005			
02-10-21	295	0.052 ± 0.005			
02-18-21	335	0.055 ± 0.005			
02-25-21	295	0.060 ± 0.005			
03-05-21	334	0.032 ± 0.004			
03-12-21	294	0.029 ± 0.004			
03-18-21	250	0.027 ± 0.004			
03-26-21	327	0.015 ± 0.003			
04-02-21	286	0.020 ± 0.003			
1st Quarter Mean ± s.d.		0.038 ± 0.014			
04-09-21	285	0.024 ± 0.003			
04-16-21	286	0.006 ± 0.002			
Collection discontinued at the location					
2nd Quarter Mean ± s.d.		0.015 ± 0.013			
			Cumulative Average		0.035

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

Table 11. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite Units: pCi/m^3

Location	D-3			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1024	DAP- 2144		
Volume (m^3)	3690	565 [a]	Discontinued	Discontinued
Be-7	0.077 ± 0.015	< 0.181		
Mn-54	< 0.0006	< 0.0054		
Fe-59	< 0.0023	< 0.0398		
Co-58	< 0.0008	< 0.0110		
Co-60	< 0.0003	< 0.0039		
Zn-65	< 0.0017	< 0.0131		
Nb-95	< 0.0008	< 0.0327		
Zr-95	< 0.0010	< 0.0240		
Ru-103	< 0.0012	< 0.0173		
Ru-106	< 0.0081	< 0.0518		
Cs-134	< 0.0009	< 0.0060		
Cs-137	< 0.0008	< 0.0043		
Ce-141	< 0.0010	< 0.0682		
Ce-144	< 0.0052	< 0.0425		

Location	D-4			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1025	DAP- 2145	DAP- 3386	DAP- 4355
Volume (m^3)	3676	3797	3820	3527
Be-7	0.065 ± 0.014	0.108 ± 0.016	0.078 ± 0.015	0.069 ± 0.019
Mn-54	< 0.0007	< 0.0007	< 0.0007	< 0.0007
Fe-59	< 0.0010	< 0.0007	< 0.0012	< 0.0026
Co-58	< 0.0004	< 0.0006	< 0.0008	< 0.0009
Co-60	< 0.0004	< 0.0004	< 0.0007	< 0.0006
Zn-65	< 0.0007	< 0.0012	< 0.0018	< 0.0011
Nb-95	< 0.0009	< 0.0006	< 0.0009	< 0.0015
Zr-95	< 0.0008	< 0.0013	< 0.0022	< 0.0019
Ru-103	< 0.0010	< 0.0011	< 0.0015	< 0.0012
Ru-106	< 0.0063	< 0.0083	< 0.0057	< 0.0073
Cs-134	< 0.0008	< 0.0008	< 0.0010	< 0.0009
Cs-137	< 0.0005	< 0.0007	< 0.0008	< 0.0007
Ce-141	< 0.0008	< 0.0013	< 0.0020	< 0.0016
Ce-144	< 0.0023	< 0.0029	< 0.0050	< 0.0044

Location	D-5A			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1026	DAP- 2146	DAP- 3387	DAP- 4356
Volume (m^3)	3607	3520	3560	3564
Be-7	0.081 ± 0.018	0.101 ± 0.013	0.110 ± 0.017	0.091 ± 0.020
Mn-54	< 0.0009	< 0.0006	< 0.0009	< 0.0009
Fe-59	< 0.0017	< 0.0013	< 0.0013	< 0.0021
Co-58	< 0.0008	< 0.0005	< 0.0011	< 0.0009
Co-60	< 0.0005	< 0.0004	< 0.0005	< 0.0005
Zn-65	< 0.0008	< 0.0016	< 0.0008	< 0.0007
Nb-95	< 0.0014	< 0.0005	< 0.0013	< 0.0017
Zr-95	< 0.0020	< 0.0012	< 0.0020	< 0.0025
Ru-103	< 0.0010	< 0.0007	< 0.0016	< 0.0015
Ru-106	< 0.0072	< 0.0042	< 0.0054	< 0.0063
Cs-134	< 0.0009	< 0.0008	< 0.0009	< 0.0010
Cs-137	< 0.0009	< 0.0004	< 0.0009	< 0.0010
Ce-141	< 0.0014	< 0.0009	< 0.0016	< 0.0019
Ce-144	< 0.0043	< 0.0040	< 0.0041	< 0.0032

[a] Collection stopped at 4/16/21

Table 11. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite Units: pCi/m^3

Location	D-6			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1027	DAP- 2147		
Volume (m^3)	3810	548 [a]	Discontinued	Discontinued
Be-7	0.081 ± 0.013	< 0.210		
Mn-54	< 0.0008	< 0.0062		
Fe-59	< 0.0008	< 0.0374		
Co-58	< 0.0006	< 0.0111		
Co-60	< 0.0004	< 0.0043		
Zn-65	< 0.0006	< 0.0129		
Nb-95	< 0.0009	< 0.0226		
Zr-95	< 0.0008	< 0.0182		
Ru-103	< 0.0009	< 0.0304		
Ru-106	< 0.0044	< 0.0331		
Cs-134	< 0.0008	< 0.0059		
Cs-137	< 0.0009	< 0.0064		
Ce-141	< 0.0014	< 0.0448		
Ce-144	< 0.0026	< 0.0301		
Location	D-7			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1028	DAP- 2148		
Volume (m^3)	3675	560 [a]	Discontinued	Discontinued
Be-7	0.076 ± 0.016	< 0.086		
Mn-54	< 0.0008	< 0.0040		
Fe-59	< 0.0010	< 0.0294		
Co-58	< 0.0006	< 0.0063		
Co-60	< 0.0005	< 0.0022		
Zn-65	< 0.0014	< 0.0045		
Nb-95	< 0.0009	< 0.0191		
Zr-95	< 0.0014	< 0.0151		
Ru-103	< 0.0010	< 0.0235		
Ru-106	< 0.0070	< 0.0425		
Cs-134	< 0.0010	< 0.0040		
Cs-137	< 0.0007	< 0.0045		
Ce-141	< 0.0018	< 0.0260		
Ce-144	< 0.0043	< 0.0308		
Location	D-11			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1029	DAP- 2149		
Volume (m^3)	3813	599 [a]	Discontinued	Discontinued
Be-7	0.079 ± 0.012	< 0.095		
Mn-54	< 0.0005	< 0.0035		
Fe-59	< 0.0009	< 0.0339		
Co-58	< 0.0006	< 0.0046		
Co-60	< 0.0004	< 0.0029		
Zn-65	< 0.0016	< 0.0094		
Nb-95	< 0.0009	< 0.0312		
Zr-95	< 0.0017	< 0.0205		
Ru-103	< 0.0006	< 0.0152		
Ru-106	< 0.0055	< 0.0451		
Cs-134	< 0.0010	< 0.0039		
Cs-137	< 0.0006	< 0.0036		
Ce-141	< 0.0011	< 0.0303		
Ce-144	< 0.0036	< 0.0194		

[a] Collection stopped at 4/16/21

Table 11. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite Units: pCi/m^3

Location	D-13			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1031	DAP- 2150	DAP- 3388	DAP- 4357
Volume (m^3)	3500	3452	3555	3561
Be-7	0.075 ± 0.013	0.102 ± 0.012	0.066 ± 0.018	0.051 ± 0.021
Mn-54	< 0.0009	< 0.0007	< 0.0010	< 0.0012
Fe-59	< 0.0012	< 0.0010	< 0.0018	< 0.0028
Co-58	< 0.0006	< 0.0005	< 0.0012	< 0.0012
Co-60	< 0.0008	< 0.0005	< 0.0005	< 0.0008
Zn-65	< 0.0019	< 0.0008	< 0.0018	< 0.0014
Nb-95	< 0.0010	< 0.0009	< 0.0016	< 0.0012
Zr-95	< 0.0012	< 0.0013	< 0.0018	< 0.0018
Ru-103	< 0.0008	< 0.0008	< 0.0016	< 0.0013
Ru-106	< 0.0062	< 0.0052	< 0.0094	< 0.0047
Cs-134	< 0.0010	< 0.0007	< 0.0010	< 0.0010
Cs-137	< 0.0006	< 0.0006	< 0.0011	< 0.0005
Ce-141	< 0.0016	< 0.0010	< 0.0023	< 0.0026
Ce-144	< 0.0043	< 0.0022	< 0.0052	< 0.0064
Location	D-15			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1032	DAP- 2151	DAP- 3390	DAP- 4358
Volume (m^3)	3707	3601	3628	3431
Be-7	0.064 ± 0.015	0.117 ± 0.017	0.102 ± 0.019	0.080 ± 0.017
Mn-54	< 0.0007	< 0.0009	< 0.0009	< 0.0009
Fe-59	< 0.0013	< 0.0012	< 0.0022	< 0.0025
Co-58	< 0.0011	< 0.0007	< 0.0008	< 0.0006
Co-60	< 0.0007	< 0.0004	< 0.0005	< 0.0004
Zn-65	< 0.0019	< 0.0016	< 0.0011	< 0.0017
Nb-95	< 0.0009	< 0.0010	< 0.0014	< 0.0012
Zr-95	< 0.0017	< 0.0013	< 0.0022	< 0.0012
Ru-103	< 0.0006	< 0.0011	< 0.0013	< 0.0010
Ru-106	< 0.0059	< 0.0075	< 0.0093	< 0.0052
Cs-134	< 0.0010	< 0.0008	< 0.0010	< 0.0009
Cs-137	< 0.0010	< 0.0007	< 0.0007	< 0.0008
Ce-141	< 0.0014	< 0.0012	< 0.0011	< 0.0027
Ce-144	< 0.0039	< 0.0030	< 0.0045	< 0.0038
Location	D-16			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1033	DAP- 2152	DAP- 3391	DAP- 4359
Volume (m^3)	3976	3769	3660	3453
Be-7	0.073 ± 0.012	0.097 ± 0.015	0.091 ± 0.016	0.092 ± 0.021
Mn-54	< 0.0004	< 0.0007	< 0.0007	< 0.0016
Fe-59	< 0.0006	< 0.0017	< 0.0011	< 0.0043
Co-58	< 0.0005	< 0.0007	< 0.0006	< 0.0021
Co-60	< 0.0005	< 0.0005	< 0.0005	< 0.0012
Zn-65	< 0.0005	< 0.0015	< 0.0009	< 0.0048
Nb-95	< 0.0006	< 0.0007	< 0.0011	< 0.0026
Zr-95	< 0.0017	< 0.0010	< 0.0015	< 0.0020
Ru-103	< 0.0008	< 0.0010	< 0.0008	< 0.0015
Ru-106	< 0.0055	< 0.0056	< 0.0067	< 0.0060
Cs-134	< 0.0008	< 0.0007	< 0.0008	< 0.0016
Cs-137	< 0.0005	< 0.0007	< 0.0006	< 0.0007
Ce-141	< 0.0017	< 0.0010	< 0.0012	< 0.0025
Ce-144	< 0.0036	< 0.0029	< 0.0037	< 0.0039

Table 11. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite Units: pCi/m^3

Location	D-40			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1034	DAP- 2153		
Volume (m^3)	3845	571 [a]	Discontinued	Discontinued
Be-7	0.077 ± 0.013	< 0.127		
Mn-54	< 0.0008	< 0.0043		
Fe-59	< 0.0007	< 0.0339		
Co-58	< 0.0006	< 0.0100		
Co-60	< 0.0007	< 0.0046		
Zn-65	< 0.0010	< 0.0099		
Nb-95	< 0.0007	< 0.0202		
Zr-95	< 0.0012	< 0.0142		
Ru-103	< 0.0008	< 0.0209		
Ru-106	< 0.0078	< 0.0386		
Cs-134	< 0.0007	< 0.0049		
Cs-137	< 0.0004	< 0.0030		
Ce-141	< 0.0012	< 0.0291		
Ce-144	< 0.0036	< 0.0217		

[a] Collection stopped at 4/16/21

Table 12. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD). Quarterly collection. Units: mR/91 days

Control Locations	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-1	14.0 ± 1.2	12.5 ± 1.6	14.3 ± 1.1	14.1 ± 1.2
D-2	ND[a]	15.2 ± 0.6	14.3 ± 0.8	14.9 ± 0.5
D-3	12.3 ± 0.7	13.1 ± 0.7	13.5 ± 0.8	14.3 ± 0.9
D-4	14.0 ± 1.2	15.3 ± 1.1	15.4 ± 1.2	16.9 ± 1.4
D-5	15.7 ± 0.8	17.5 ± 1.0	17.9 ± 0.9	18.4 ± 0.6
D-5A	14.4 ± 0.8	13.5 ± 0.5	13.9 ± 0.8	15.3 ± 0.6
D-6	13.0 ± 0.9	13.8 ± 0.7	13.9 ± 0.9	15.1 ± 0.7
D-7	11.5 ± 0.7	13.5 ± 1.2	12.8 ± 0.7	14.9 ± 0.8
D-8	16.1 ± 0.9	17.7 ± 1.5	18.2 ± 0.9	ND[a]
D-10	16.0 ± 0.9	15.5 ± 0.8	16.9 ± 0.9	17.2 ± 1.1
D-11	12.7 ± 0.7	11.8 ± 1.4	13.6 ± 0.7	13.2 ± 0.9
D-13	13.3 ± 0.7	13.6 ± 0.9	14.5 ± 1.4	16.0 ± 0.7
Mean ± s.d.	13.9 ± 1.6	14.4 ± 1.9	14.9 ± 1.8	15.5 ± 1.5
Within 0.5 mi. of Stack				
D-15	14.2 ± 0.9	13.0 ± 0.6	15.0 ± 0.9	14.6 ± 0.6
D-16	13.2 ± 0.9	13.8 ± 1.5	13.5 ± 1.0	15.7 ± 1.0
D-17	16.6 ± 1.0	18.5 ± 0.9	18.4 ± 1.0	17.6 ± 0.9
D-18	14.2 ± 0.7	14.6 ± 0.8	15.4 ± 1.3	16.6 ± 0.5
D-19	13.8 ± 1.2	14.1 ± 0.6	15.6 ± 0.8	15.7 ± 0.6
D-20	13.5 ± 1.0	14.7 ± 1.3	15.3 ± 1.6	12.9 ± 1.2
D-21	14.6 ± 0.7	15.6 ± 1.2	15.4 ± 0.8	16.7 ± 0.8
D-22	13.1 ± 0.8	14.8 ± 0.9	13.9 ± 0.9	16.7 ± 0.7
D-23	10.3 ± 1.2	9.8 ± 0.6	11.0 ± 1.1	11.4 ± 0.8
D-28	15.8 ± 1.1	19.1 ± 1.0	18.5 ± 0.9	20.6 ± 1.1
D-29	15.9 ± 1.3	18.2 ± 1.5	19.2 ± 1.6	20.2 ± 1.0
D-30	15.5 ± 1.2	16.9 ± 1.6	17.9 ± 1.3	17.9 ± 1.6
D-31	15.8 ± 1.3	18.7 ± 1.8	18.0 ± 1.3	20.9 ± 1.5
D-32	15.3 ± 1.0	16.3 ± 1.4	17.2 ± 0.9	18.2 ± 1.5
D-82	13.9 ± 0.8	13.8 ± 0.9	13.4 ± 0.7	14.3 ± 0.9
D-83	ND[a]	13.1 ± 0.9	17.5 ± 1.2	14.4 ± 0.5
D-84	13.6 ± 1.1	16.1 ± 0.9	15.7 ± 1.2	16.7 ± 1.1
D-85	15.3 ± 0.6	14.7 ± 1.0	16.7 ± 0.6	16.6 ± 1.0
D-86	13.8 ± 1.1	16.8 ± 1.8	15.4 ± 1.0	15.4 ± 1.6
D-91	15.4 ± 0.9	18.0 ± 1.2	16.8 ± 1.1	18.8 ± 0.8
Mean ± s.d.	14.4 ± 1.4	15.5 ± 2.4	16.0 ± 2.1	16.6 ± 2.5

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

Table 12. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD). Quarterly collection. Units: mR/91 days

Within 1.0 mi. of Stack	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-43	14.8 ± 1.1	13.2 ± 1.5	16.5 ± 0.8	14.6 ± 1.3
D-44	16.3 ± 1.1	20.3 ± 0.7	18.2 ± 1.0	20.6 ± 0.8
D-45	13.0 ± 1.0	14.6 ± 0.9	14.2 ± 0.8	16.6 ± 1.7
D-46	17.2 ± 1.1	20.0 ± 1.1	19.8 ± 1.3	20.0 ± 1.3
D-47	15.6 ± 1.0	18.6 ± 1.2	17.8 ± 0.9	20.4 ± 0.8
D-48	17.3 ± 1.6	17.0 ± 1.0	19.4 ± 1.7	17.9 ± 1.5
Mean ± s.d.	15.7 ± 1.6	17.3 ± 2.9	17.6 ± 2.1	18.4 ± 2.4
Within 3.0 mi. of Stack				
D-33	11.0 ± 0.8	14.5 ± 0.5	12.4 ± 0.8	15.0 ± 0.6
D-34	12.1 ± 0.8	12.9 ± 1.0	12.9 ± 0.8	14.6 ± 1.0
D-35	13.0 ± 0.8	12.9 ± 0.9	13.9 ± 0.6	13.4 ± 0.7
D-36	13.7 ± 1.0	13.5 ± 0.7	14.7 ± 0.7	15.5 ± 0.8
D-37	15.9 ± 1.6	13.6 ± 1.0	16.7 ± 1.4	15.3 ± 1.0
D-38	16.0 ± 1.4	16.5 ± 1.2	18.0 ± 1.3	19.2 ± 1.2
D-39	14.8 ± 0.9	16.1 ± 0.9	15.8 ± 0.9	17.8 ± 0.8
D-40	14.8 ± 0.8	13.3 ± 1.0	15.4 ± 0.8	14.5 ± 0.6
D-41	16.8 ± 1.2	16.0 ± 1.3	19.2 ± 1.7	17.9 ± 1.3
D-42	14.6 ± 1.0	17.4 ± 1.4	16.3 ± 1.7	16.6 ± 0.7
Mean ± s.d.	14.3 ± 1.8	14.7 ± 1.7	15.5 ± 2.2	16.0 ± 1.8
ISFSI Fenceline				
D-161	63.1 ± 3.9	53.3 ± 3.7	58.4 ± 3.1	62.9 ± 3.9
D-162	19.0 ± 1.2	17.3 ± 1.4	18.2 ± 0.9	18.5 ± 1.0
D-163	58.6 ± 3.1	49.6 ± 2.2	52.3 ± 1.4	55.9 ± 2.6
D-164	16.9 ± 1.2	17.2 ± 0.9	16.6 ± 1.1	21.4 ± 1.4
Mean ± s.d.	39.4 ± 24.9	34.4 ± 19.8	36.4 ± 22.1	39.7 ± 23.0

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

Collection: Monthly

Units: pCi/L

Location	D-52 Drinking Water			
	HP Breakroom	TSC	PSC	HP Breakroom
Lab Code	DWW- 152	DWW- 376	DWW- 725	DWW- 1228
Date Collected	01-18-21	02-08-21	03-24-21	04-27-21
H-3	< 160	< 161	< 159	< 159
I-131	< 0.3	< 0.4	< 0.3	< 0.4
Mn-54	< 3.8	< 4.2	< 2.5	< 3.1
Fe-59	< 3.0	< 6.1	< 6.3	< 5.2
Co-58	< 2.5	< 3.7	< 2.7	< 4.0
Co-60	< 2.8	< 2.7	< 2.4	< 3.5
Zn-65	< 6.3	< 4.4	< 9.9	< 6.7
Nb-95	< 3.5	< 4.4	< 5.2	< 4.8
Zr-95	< 4.8	< 5.4	< 5.0	< 8.5
I-131	< 4.0	< 4.0	< 5.0	< 6.0
Cs-134	< 4.3	< 4.4	< 4.5	< 4.6
Cs-137	< 2.6	< 2.5	< 4.6	< 2.4
Ba-140	< 12.9	< 13.7	< 12.7	< 11.6
La-140	< 2.6	< 4.3	< 3.4	< 2.9
				PSC
Lab Code	DWW- 1516	DWW- 1953	DWW- 2321	DWW- 2649
Date Collected	05-20-21	06-28-21	07-22-21	08-19-21
H-3	< 158	< 158	< 156	< 157
I-131	< 0.5	< 0.3	< 0.4	< 0.3
Mn-54	< 2.2	< 2.9	< 3.3	< 2.0
Fe-59	< 2.8	< 6.8	< 4.1	< 5.0
Co-58	< 3.3	< 3.4	< 3.5	< 2.9
Co-60	< 3.1	< 1.6	< 2.6	< 2.5
Zn-65	< 4.4	< 2.4	< 3.6	< 3.5
Nb-95	< 3.6	< 1.8	< 2.9	< 2.0
Zr-95	< 4.8	< 3.6	< 3.6	< 4.1
I-131	< 5.6	< 4.3	< 6.1	< 4.5
Cs-134	< 3.5	< 3.5	< 3.9	< 2.9
Cs-137	< 2.5	< 2.2	< 2.0	< 1.9
Ba-140	< 17.8	< 14.3	< 16.5	< 10.6
La-140	< 3.5	< 2.3	< 4.0	< 3.8

Table 13. Well water samples, analyses for gamma-emitting isotopes iodine-131 and tritium.
Collection: Monthly
Units: pCi/L

Location	D-52 Drinking Water			
	OPS	PSC	HP	
Lab Code	DWW- 3049	DWW- 3415	DWW- 3841	DWW- 4105
Date Collected	09-14-21	10-14-21	11-10-21	12-15-21
H-3	< 161	< 163	< 162	< 167
I-131	< 0.4	< 0.5	< 0.4	< 0.3
Mn-54	< 1.6	< 2.5	< 3.2	< 3.0
Fe-59	< 5.5	< 3.4	< 6.4	< 3.3
Co-58	< 1.8	< 3.7	< 2.3	< 2.8
Co-60	< 1.7	< 2.5	< 2.0	< 2.1
Zn-65	< 3.9	< 5.9	< 2.5	< 3.8
Nb-95	< 3.0	< 2.2	< 1.9	< 2.9
Zr-95	< 3.8	< 5.0	< 3.3	< 4.2
I-131	< 5.0	< 6.3	< 7.2	< 7.0
Cs-134	< 2.6	< 3.6	< 4.0	< 4.3
Cs-137	< 2.7	< 3.6	< 2.9	< 3.1
Ba-140	< 14.0	< 13.8	< 14.4	< 17.7
La-140	< 3.8	< 4.3	< 2.5	< 1.8

Table 13. Well water samples, analyses for gamma-emitting isotopes iodine-131 and tritium.
Collection: Monthly
Units: pCi/L

Location	D-53 Treated Municipal Water, Drinking Water			
Lab Code	DWW- 153	DWW- 377	DWW- 726	DWW- 1229
Date Collected	01-18-21	02-08-21	03-24-21	04-27-21
H-3	< 160	< 161	< 159	< 159
I-131	< 0.4	< 0.3	< 0.3	< 0.4
Mn-54	< 2.2	< 2.0	< 3.3	< 3.3
Fe-59	< 6.8	< 4.5	< 4.6	< 2.7
Co-58	< 2.3	< 2.3	< 3.0	< 4.3
Co-60	< 2.6	< 3.0	< 3.7	< 2.7
Zn-65	< 4.4	< 2.5	< 7.1	< 3.1
Nb-95	< 4.7	< 2.5	< 2.8	< 2.6
Zr-95	< 6.4	< 4.3	< 6.2	< 3.7
I-131	< 2.3	< 3.1	< 4.2	< 4.3
Cs-134	< 3.7	< 3.2	< 4.0	< 3.8
Cs-137	< 3.9	< 2.0	< 3.1	< 3.2
Ba-140	< 17.0	< 12.5	< 10.7	< 8.1
La-140	< 5.7	< 3.7	< 4.4	< 2.8
Lab Code	DWW- 1517	DWW- 1954	DWW- 2322	DWW- 2650
Date Collected	05-20-21	06-28-21	07-22-21	08-19-21
H-3	< 158	< 158	< 156	< 157
I-131	< 0.4	< 0.4	< 0.3	< 0.3
Mn-54	< 2.6	< 1.2	< 3.8	< 3.4
Fe-59	< 2.1	< 3.3	< 7.0	< 4.6
Co-58	< 2.6	< 2.1	< 3.4	< 3.8
Co-60	< 1.7	< 2.1	< 3.2	< 2.1
Zn-65	< 4.9	< 1.9	< 2.1	< 4.5
Nb-95	< 3.0	< 2.2	< 4.2	< 2.6
Zr-95	< 4.8	< 4.0	< 7.3	< 3.3
I-131	< 4.4	< 4.1	< 6.8	< 3.9
Cs-134	< 2.6	< 2.8	< 3.9	< 3.3
Cs-137	< 3.2	< 2.8	< 3.5	< 2.6
Ba-140	< 11.8	< 13.1	< 17.9	< 15.5
La-140	< 2.6	< 1.5	< 4.6	< 3.1

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

Collection: Monthly

Units: pCi/L

Location	D-53 Treated Municipal Water, Drinking Water			
Lab Code	DWW- 3050	DWW- 3416	DWW- 3842	DWW- 4106
Date Collected	09-14-21	10-14-21	11-10-21	12-15-21
H-3	< 161	< 163	< 162	< 167
I-131	< 0.5	< 0.5	< 0.4	< 0.3
Mn-54	< 2.7	< 1.6	< 2.6	< 5.7
Fe-59	< 1.7	< 4.4	< 4.4	< 9.2
Co-58	< 1.6	< 1.2	< 2.7	< 4.4
Co-60	< 3.6	< 1.7	< 1.6	< 4.0
Zn-65	< 2.8	< 5.1	< 5.3	< 10.3
Nb-95	< 2.0	< 3.5	< 3.3	< 6.1
Zr-95	< 5.7	< 4.8	< 4.2	< 7.9
I-131	< 8.8	< 4.1	< 6.3	< 9.6
Cs-134	< 3.2	< 2.9	< 3.5	< 7.0
Cs-137	< 3.6	< 3.0	< 2.9	< 4.8
Ba-140	< 18.5	< 14.6	< 14.7	< 24.0
La-140	< 1.9	< 2.5	< 2.9	< 5.1

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

Collection: Monthly

Units: pCi/L

Location	D-54 Untreated Municipal Water, Drinking Water			
Lab Code	DWW- 154	DWW- 378	DWW- 727	DWW- 1230
Date Collected	01-18-21	02-08-21	03-24-21	04-27-21
H-3	< 160	< 161	< 159	< 159
I-131	< 0.3	< 0.2	< 0.4	< 0.5
Mn-54	< 2.5	< 1.9	< 3.6	< 2.5
Fe-59	< 5.5	< 4.6	< 3.4	< 3.5
Co-58	< 4.0	< 2.7	< 1.9	< 2.7
Co-60	< 3.6	< 3.1	< 2.0	< 2.8
Zn-65	< 5.3	< 7.9	< 6.9	< 5.3
Nb-95	< 4.6	< 3.4	< 2.2	< 4.3
Zr-95	< 5.9	< 5.1	< 6.0	< 5.3
I-131	< 4.6	< 5.7	< 4.3	< 4.3
Cs-134	< 3.7	< 3.6	< 3.4	< 3.3
Cs-137	< 2.9	< 2.9	< 3.7	< 4.2
Ba-140	< 11.3	< 12.4	< 11.5	< 12.4
La-140	< 3.9	< 5.4	< 3.0	< 3.1
Lab Code	DWW- 1518	DWW- 1955	DWW- 2323	DWW- 2651
Date Collected	05-20-21	06-28-21	07-22-21	08-19-21
H-3	< 158	< 158	< 156	< 157
I-131	< 0.4	< 0.3	< 0.4	< 0.4
Mn-54	< 2.4	< 3.7	< 2.0	< 1.6
Fe-59	< 1.4	< 7.7	< 5.6	< 2.8
Co-58	< 2.6	< 4.0	< 1.4	< 2.2
Co-60	< 2.5	< 1.8	< 2.1	< 1.7
Zn-65	< 2.9	< 5.1	< 3.1	< 3.0
Nb-95	< 2.6	< 3.4	< 1.9	< 1.9
Zr-95	< 6.0	< 7.0	< 4.2	< 4.8
I-131	< 5.9	< 4.1	< 4.8	< 6.3
Cs-134	< 3.2	< 4.5	< 2.7	< 3.2
Cs-137	< 2.7	< 3.1	< 3.3	< 3.2
Ba-140	< 12.6	< 14.9	< 14.5	< 13.5
La-140	< 2.5	< 2.5	< 2.5	< 1.9

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

Collection: Quarterly

Units: pCi/L

Location	D-55 On-site Treated Drinking Water			
Lab Code	DWW- 432	DWW- 1519	DWW- 2734	DWW- 3864
Date Collected	02-22-21	05-20-21	08-25-21	11-18-21
H-3	< 161	< 158	< 164	< 161
I-131	< 0.5	< 0.5	< 0.3	< 0.4
Mn-54	< 2.9	< 3.3	< 2.2	< 2.9
Fe-59	< 4.8	< 5.3	< 5.2	< 5.1
Co-58	< 2.4	< 2.1	< 2.5	< 2.4
Co-60	< 3.7	< 2.9	< 2.1	< 3.5
Zn-65	< 6.1	< 8.0	< 4.9	< 3.1
Nb-95	< 3.4	< 4.4	< 3.5	< 4.5
Zr-95	< 5.5	< 5.1	< 4.3	< 3.7
I-131	< 6.8	< 5.3	< 4.7	< 5.3
Cs-134	< 5.6	< 3.6	< 2.7	< 3.1
Cs-137	< 3.9	< 3.2	< 2.8	< 3.2
Ba-140	< 14.8	< 18.2	< 9.1	< 13.8
La-140	< 3.0	< 3.1	< 2.7	< 3.6

Location	D-57 Untreated Drinking Water			
Lab Code	DWW- 433	DWW- 1520	DWW- 2735	DWW- 3865
Date Collected	02-22-21	05-20-21	08-25-21	11-18-21
H-3	< 161	< 158	< 164	< 161
I-131	< 0.5	< 0.4	< 0.3	< 0.5
Mn-54	< 2.4	< 2.5	< 2.1	< 2.3
Fe-59	< 5.8	< 3.3	< 4.8	< 3.5
Co-58	< 2.2	< 1.4	< 1.4	< 2.9
Co-60	< 2.4	< 1.7	< 2.3	< 2.4
Zn-65	< 6.0	< 3.9	< 3.0	< 8.3
Nb-95	< 2.1	< 2.4	< 2.2	< 4.0
Zr-95	< 4.7	< 2.8	< 5.1	< 6.2
I-131	< 3.6	< 5.1	< 4.4	< 5.4
Cs-134	< 2.9	< 3.0	< 2.7	< 3.8
Cs-137	< 3.5	< 4.1	< 3.4	< 3.1
Ba-140	< 9.2	< 15.4	< 12.6	< 15.8
La-140	< 3.0	< 1.4	< 3.5	< 4.4

Table 13. Well water samples, analyses for gamma-emitting isotopes iodine-131 and tritium.
Collection: Quarterly
Units: pCi/L

Location	D-58 Untreated Drinking Water			
Lab Code	DWW- 434	DWW- 1521	ND[a]	ND[a]
Date Collected	02-22-21	05-20-21	08-25-21	11-18-21
H-3	< 161	< 158	-	-
I-131	< 0.4	< 0.3	-	-
Mn-54	< 3.3	< 3.8	-	-
Fe-59	< 5.1	< 5.9	-	-
Co-58	< 4.0	< 3.5	-	-
Co-60	< 2.4	< 2.2	-	-
Zn-65	< 6.9	< 5.8	-	-
Nb-95	< 3.1	< 3.2	-	-
Zr-95	< 4.3	< 4.9	-	-
I-131	< 5.2	< 6.3	-	-
Cs-134	< 4.3	< 4.7	-	-
Cs-137	< 4.4	< 2.4	-	-
Ba-140	< 9.8	< 20.9	-	-
La-140	< 2.4	< 3.2	-	-

Location	D-72(C) Untreated Drinking Water			
Lab Code	DWW- 435	DWW- 1522	DWW- 2736	DWW- 3866
Date Collected	02-22-21	05-20-21	08-25-21	11-18-21
H-3	< 161	< 158	< 164	< 161
I-131	< 0.3	< 0.4	< 0.4	< 0.3
Mn-54	< 1.6	< 3.6	< 2.3	< 6.1
Fe-59	< 7.3	< 6.6	< 3.8	< 14.1
Co-58	< 2.6	< 3.7	< 1.3	< 4.1
Co-60	< 2.5	< 4.5	< 1.7	< 4.3
Zn-65	< 7.2	< 7.0	< 3.0	< 5.8
Nb-95	< 3.2	< 4.4	< 2.1	< 4.7
Zr-95	< 6.5	< 7.3	< 3.1	< 11.1
I-131	< 5.2	< 5.8	< 5.1	< 13.1
Cs-134	< 4.3	< 4.4	< 2.9	< 9.3
Cs-137	< 2.9	< 4.4	< 2.7	< 7.7
Ba-140	< 16.2	< 21.0	< 9.2	< 31.5
La-140	< 4.6	< 3.3	< 3.4	< 6.7

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

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

Location	D-57	D-58	D-59	D-59
Lab Code	DVE- 2568	DVE- 2569	DVE- 2737	DVE- 2738
Date Collected	08-10-21	08-10-21	08-25-21	08-25-21
Sample Type	Vegetation	Vegetation	Green Leafy	Green Leafy
K-40	4.93 ± 0.60	6.58 ± 0.52	5.70 ± 0.28	4.47 ± 0.26
Mn-54	< 0.022	< 0.017	< 0.007	< 0.009
Fe-59	< 0.051	< 0.031	< 0.027	< 0.012
Co-58	< 0.018	< 0.019	< 0.009	< 0.007
Co-60	< 0.017	< 0.019	< 0.010	< 0.008
Zn-65	< 0.043	< 0.033	< 0.025	< 0.021
Nb-95	< 0.020	< 0.019	< 0.010	< 0.010
Zr-95	< 0.037	< 0.023	< 0.017	< 0.014
Ru-103	< 0.020	< 0.023	< 0.012	< 0.015
Ru-106	< 0.233	< 0.162	< 0.117	< 0.092
I-131	< 0.028	< 0.026	< 0.015	< 0.020
Cs-134	< 0.026	< 0.019	< 0.011	< 0.012
Cs-137	< 0.022	< 0.012	< 0.009	< 0.008
Ce-141	< 0.056	< 0.028	< 0.018	< 0.020
Ce-144	< 0.179	< 0.091	< 0.053	< 0.098

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

Location	D-16	D-57
Lab Code	DVE- 3742	DVE- 3743
Date Collected	11-04-21	11-04-21
Sample Type	Beans	Corn
K-40	13.56 ± 0.54	3.07 ± 0.31
Mn-54	< 0.014	< 0.006
Fe-59	< 0.025	< 0.020
Co-58	< 0.013	< 0.012
Co-60	< 0.015	< 0.008
Zn-65	< 0.026	< 0.014
Nb-95	< 0.011	< 0.013
Zr-95	< 0.027	< 0.022
Ru-103	< 0.009	< 0.010
Ru-106	< 0.121	< 0.084
I-131	< 0.017	< 0.019
Cs-134	< 0.013	< 0.012
Cs-137	< 0.013	< 0.009
Ce-141	< 0.018	< 0.021
Ce-144	< 0.081	< 0.085

Table 16. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-49

Lab Code	NS[a]	NS[a]	DSW- 715	DSW- 998	DSW- 1408	DSW- 1872
Date Collected	01-13-21	02-11-21	03-23-21	04-13-21	05-11-21	06-15-21
H-3			< 161	< 160	< 158	< 158
I-131(Chemistry)			< 0.4	< 0.3	< 0.5	< 0.3
Mn-54			< 2.4	< 3.0	< 2.7	< 2.4
Fe-59			< 4.2	< 3.2	< 6.2	< 6.5
Co-58			< 2.2	< 2.9	< 3.5	< 2.5
Co-60			< 2.7	< 2.0	< 2.1	< 2.3
Zn-65			< 2.4	< 3.8	< 4.8	< 3.4
Nb-95			< 2.2	< 2.2	< 2.2	< 2.5
Zr-95			< 7.1	< 6.1	< 4.5	< 5.4
I-131			< 3.1	< 4.7	< 3.4	< 5.5
Cs-134			< 4.3	< 4.2	< 3.7	< 3.9
Cs-137			< 3.2	< 2.0	< 2.6	< 3.8
Ba-140			< 13.3	< 16.5	< 14.9	< 14.9
La-140			< 4.5	< 1.8	< 1.9	< 2.7

Lab Code	DSW- 2279	DSW- 2652	DSW- 3067	DSW- 3486	DSW- 3861	DSW- 4134
Date Collected	07-20-21	08-19-21	09-21-21	10-18-21	11-16-21	12-21-21
H-3	< 156	< 157	< 161	< 163	< 161	< 167
I-131(Chemistry)	< 0.3	< 0.3	< 0.4	< 0.4	< 0.4	< 0.4
Mn-54	< 2.6	< 4.1	< 2.9	< 1.8	< 2.7	< 2.5
Fe-59	< 5.6	< 6.7	< 5.1	< 4.0	< 3.9	< 3.3
Co-58	< 3.4	< 3.6	< 3.4	< 1.8	< 4.0	< 2.7
Co-60	< 2.1	< 1.5	< 2.3	< 2.0	< 2.1	< 2.3
Zn-65	< 6.6	< 8.1	< 3.2	< 3.0	< 7.5	< 6.9
Nb-95	< 3.6	< 2.8	< 2.2	< 3.1	< 3.0	< 2.7
Zr-95	< 2.8	< 8.1	< 1.9	< 4.5	< 6.2	< 5.1
I-131	< 5.6	< 8.2	< 4.2	< 3.8	< 7.1	< 7.5
Cs-134	< 3.5	< 4.4	< 3.5	< 3.4	< 4.0	< 3.5
Cs-137	< 3.7	< 4.8	< 2.8	< 3.5	< 4.5	< 4.3
Ba-140	< 14.1	< 13.8	< 12.9	< 12.5	< 18.4	< 16.6
La-140	< 3.2	< 2.8	< 1.7	< 2.0	< 2.9	< 2.3

[a] "NS" = No sample; see Table 2.0, Program Deviations.

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-50

Lab Code	DSW- 135	NS[a]	DSW- 716	DSW- 999
Date Collected	01-13-21	02-11-21	03-23-21	04-13-21
H-3	< 154		< 161	< 160
Mn-54	< 3.3		< 2.0	< 4.0
Fe-59	< 4.7		< 6.9	< 7.5
Co-58	< 2.8		< 2.8	< 2.7
Co-60	< 2.8		< 1.8	< 1.9
Zn-65	< 4.0		< 3.6	< 8.0
Nb-95	< 3.0		< 4.3	< 3.5
Zr-95	< 4.6		< 6.7	< 5.8
I-131	< 5.4		< 6.2	< 5.7
Cs-134	< 3.0		< 4.4	< 4.9
Cs-137	< 3.0		< 4.2	< 6.1
Ba-140	< 18.3		< 18.8	< 16.3
La-140	< 4.4		< 5.4	< 2.9

[a] "NS" = No sample; see Table 2.0, Program Deviations.

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-51

Lab Code	DSW- 136	NS[b]	DSW- 717	DSW- 1000	DSW- 1409	DSW- 1873
Date Collected	01-13-21	02-11-21	03-23-21	04-13-21	05-11-21	06-15-21
H-3	1335 ±132 [a]		< 161	< 160	< 158	< 158
Mn-54	< 2.6		< 2.2	< 4.2	< 4.1	< 4.2
Fe-59	< 4.6		< 5.1	< 7.5	< 6.6	< 7.7
Co-58	< 2.8		< 1.5	< 3.7	< 3.5	< 2.3
Co-60	< 4.0		< 2.8	< 2.1	< 2.4	< 2.3
Zn-65	< 4.3		< 7.3	< 7.4	< 5.1	< 5.1
Nb-95	< 3.1		< 2.5	< 2.5	< 2.0	< 4.0
Zr-95	< 3.0		< 5.5	< 6.9	< 7.7	< 6.8
I-131	< 6.1		< 6.4	< 4.3	< 5.0	< 3.9
Cs-134	< 3.3		< 3.3	< 5.0	< 4.3	< 3.7
Cs-137	< 2.2		< 2.1	< 4.5	< 3.7	< 3.8
Ba-140	< 11.9		< 20.3	< 19.4	< 17.5	< 11.2
La-140	< 4.1		< 4.1	< 4.0	< 2.8	< 3.0

Lab Code	DSW- 2280	DSW- 2653	DSW- 3068	DSW- 3487	DSW- 3862	DSW- 4135
Date Collected	07-20-21	08-19-21	09-21-21	10-18-21	11-16-21	12-21-21
H-3	< 156	< 157	< 161	< 163	< 161	< 157
Mn-54	< 4.4	< 2.8	< 1.3	< 2.3	< 4.0	< 3.1
Fe-59	< 6.5	< 4.7	< 4.4	< 5.3	< 2.7	< 4.0
Co-58	< 3.6	< 3.4	< 1.9	< 1.9	< 3.7	< 2.0
Co-60	< 2.4	< 2.0	< 2.3	< 2.1	< 2.6	< 3.0
Zn-65	< 3.1	< 2.5	< 3.9	< 6.6	< 4.1	< 3.7
Nb-95	< 4.4	< 3.0	< 2.7	< 2.7	< 3.1	< 2.2
Zr-95	< 6.5	< 3.8	< 5.1	< 5.4	< 4.7	< 5.2
I-131	< 9.7	< 6.5	< 3.8	< 4.7	< 6.2	< 4.4
Cs-134	< 4.4	< 3.8	< 2.6	< 3.1	< 4.2	< 2.8
Cs-137	< 3.8	< 2.9	< 3.0	< 2.9	< 2.4	< 2.3
Ba-140	< 20.8	< 14.0	< 11.1	< 14.1	< 15.0	< 11.7
La-140	< 3.8	< 3.2	< 1.0	< 4.5	< 2.9	< 3.9

[a] Tritium from liquid radwaste system.
[b] "NS" = No sample; see Table 2.0, Program Deviations.

Table 16. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-61

Lab Code	NS[a]	NS[a]	DSW- 718	DSW- 1001	DSW- 1410	DSW- 1874
Date Collected	01-13-21	02-11-21	03-23-21	04-13-21	05-11-21	06-15-21
H-3			< 161	< 160	< 158	< 158
I-131(Chemistry)			< 0.2	< 0.3	< 0.5	< 0.4
Mn-54			< 2.8	< 2.4	< 1.7	< 1.7
Fe-59			< 7.6	< 4.5	< 4.1	< 2.5
Co-58			< 4.2	< 2.6	< 2.6	< 1.7
Co-60			< 3.1	< 2.1	< 2.2	< 1.6
Zn-65			< 7.7	< 4.1	< 2.6	< 3.5
Nb-95			< 3.8	< 3.6	< 2.3	< 1.0
Zr-95			< 3.7	< 4.3	< 6.0	< 2.6
I-131			< 6.2	< 2.9	< 5.0	< 2.2
Cs-134			< 5.2	< 3.7	< 3.1	< 1.7
Cs-137			< 4.1	< 2.6	< 3.4	< 1.8
Ba-140			< 19.3	< 13.9	< 14.2	< 7.3
La-140			< 5.0	< 2.7	< 3.0	< 2.2

Lab Code	DSW- 2281	DSW- 2654	DSW- 3069	DSW- 3488	DSW- 3863	DSW- 4136
Date Collected	07-20-21	08-19-21	09-21-21	10-18-21	11-16-21	12-21-21
H-3	< 156	< 157	< 161	< 163	< 161	< 167
I-131(Chemistry)	< 0.4	< 0.5	< 0.4	< 0.4	< 0.4	< 0.5
Mn-54	< 1.2	< 1.6	< 2.2	< 1.4	< 3.9	< 3.2
Fe-59	< 4.3	< 4.3	< 5.4	< 4.6	< 7.7	< 5.5
Co-58	< 2.3	< 1.6	< 1.7	< 1.4	< 3.0	< 2.9
Co-60	< 2.1	< 2.7	< 2.4	< 2.8	< 3.4	< 2.3
Zn-65	< 2.5	< 2.9	< 5.8	< 2.4	< 6.7	< 6.3
Nb-95	< 2.8	< 2.5	< 1.3	< 1.9	< 4.6	< 3.8
Zr-95	< 5.2	< 4.1	< 4.2	< 4.6	< 5.5	< 5.7
I-131	< 4.5	< 4.4	< 3.2	< 3.7	< 5.8	< 4.9
Cs-134	< 2.6	< 2.8	< 2.6	< 2.7	< 3.0	< 3.3
Cs-137	< 3.3	< 2.7	< 2.5	< 2.5	< 3.4	< 3.7
Ba-140	< 11.7	< 8.7	< 9.0	< 10.9	< 13.0	< 11.0
La-140	< 1.3	< 3.2	< 2.7	< 2.0	< 3.4	< 3.3

[a] "NS" = No sample; see Table 2.0, Program Deviations.

Table 16. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-99

Lab Code	NS[a]	NS[a]	DSW- 719	DSW- 1002
Date Collected	01-13-21	02-11-21	03-23-21	04-13-21
H-3			< 161	< 160
Mn-54			< 2.1	< 4.2
Fe-59			< 3.7	< 9.5
Co-58			< 3.2	< 3.3
Co-60			< 1.8	< 3.9
Zn-65			< 4.8	< 4.0
Nb-95			< 2.4	< 3.6
Zr-95			< 3.5	< 8.0
I-131			< 3.2	< 5.8
Cs-134			< 3.1	< 4.5
Cs-137			< 2.7	< 4.4
Ba-140			< 4.6	< 13.3
La-140			< 3.0	< 2.4

[a] "NS" = No sample; see Table 2.0, Program Deviations.

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

Location	D-49			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-715	DSW-1902	DSW-3097	DSW-4235
Sr-89	< 0.48	< 0.71	< 0.59	< 0.54
Sr-90	< 0.42	< 0.49	< 0.54	< 0.46

Location	D-61			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-718	DSW-1903	DSW-3098	DSW-4236
Sr-89	< 0.48	< 0.77	< 0.63	< 0.51
Sr-90	< 0.47	< 0.48	< 0.57	< 0.52

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

Location	Upstream, D-49	
Lab Code	DF- 1501	DF- 1502
Date Collected	05-17-21	05-17-21
Sample Type	Channel Catfish	Walleye
K-40	3.14 ± 0.38	3.55 ± 0.45
Mn-54	< 0.020	< 0.012
Fe-59	< 0.030	< 0.047
Co-58	< 0.017	< 0.022
Co-60	< 0.012	< 0.015
Zn-65	< 0.027	< 0.029
Nb-95	< 0.014	< 0.024
Zr-95	< 0.028	< 0.033
Ru-103	< 0.014	< 0.027
Ru-106	< 0.101	< 0.152
Cs-134	< 0.016	< 0.021
Cs-137	< 0.018	< 0.013
Ce-141	< 0.034	< 0.046
Ce-144	< 0.104	< 0.124

Location	Upstream, D-49	
Lab Code	DF- 3166	DF- 3167
Date Collected	09-28-21	09-28-21
Sample Type	Channel Catfish	Smallmouth Bass
K-40	3.09 ± 0.38	3.66 ± 0.52
Mn-54	< 0.013	< 0.023
Fe-59	< 0.028	< 0.063
Co-58	< 0.016	< 0.020
Co-60	< 0.014	< 0.015
Zn-65	< 0.031	< 0.034
Nb-95	< 0.020	< 0.022
Zr-95	< 0.029	< 0.039
Ru-103	< 0.023	< 0.047
Ru-106	< 0.112	< 0.214
Cs-134	< 0.014	< 0.023
Cs-137	< 0.018	< 0.021
Ce-141	< 0.025	< 0.056
Ce-144	< 0.102	< 0.167

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

Location	Downstream, D-61	
Lab Code	DF- 1503	DF- 1504
Date Collected	05-17-21	05-17-21
Sample Type	Channel Catfish	Smallmouth Bass
K-40	3.87 ± 0.59	3.53 ± 0.41
Mn-54	< 0.023	< 0.013
Fe-59	< 0.047	< 0.041
Co-58	< 0.020	< 0.016
Co-60	< 0.023	< 0.012
Zn-65	< 0.056	< 0.032
Nb-95	< 0.027	< 0.011
Zr-95	< 0.060	< 0.033
Ru-103	< 0.028	< 0.019
Ru-106	< 0.227	< 0.132
Cs-134	< 0.029	< 0.017
Cs-137	< 0.012	< 0.017
Ce-141	< 0.039	< 0.019
Ce-144	< 0.190	< 0.126

Location	Downstream, D-61	
Lab Code	DF- 3168	DF- 3169
Date Collected	09-28-21	09-28-21
Sample Type	Channel Catfish	Walleye
K-40	3.96 ± 0.46	3.72 ± 0.43
Mn-54	< 0.012	< 0.006
Fe-59	< 0.028	< 0.037
Co-58	< 0.012	< 0.019
Co-60	< 0.012	< 0.012
Zn-65	< 0.026	< 0.023
Nb-95	< 0.015	< 0.028
Zr-95	< 0.048	< 0.040
Ru-103	< 0.025	< 0.020
Ru-106	< 0.103	< 0.102
Cs-134	< 0.018	< 0.014
Cs-137	< 0.012	< 0.012
Ce-141	< 0.050	< 0.028
Ce-144	< 0.109	< 0.080

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

Location	D-49 (Control)	
Lab Code	DBS- 806	DBS- 3040
Date Collected	03-29-21	09-14-21
K-40	8.21 ± 0.46	7.35 ± 0.47
Mn-54	< 0.015	< 0.018
Fe-59	< 0.051	< 0.065
Co-58	< 0.014	< 0.014
Co-60	< 0.013	< 0.008
Zn-65	< 0.042	< 0.026
Nb-95	< 0.012	< 0.024
Zr-95	< 0.030	< 0.052
Ru-103	< 0.017	< 0.026
Ru-106	< 0.128	< 0.103
Cs-134	< 0.014	< 0.016
Cs-137	< 0.016	< 0.014
Ce-141	< 0.041	< 0.066
Ce-144	< 0.091	< 0.125

Location	D-51 (Discharge)	
Lab Code	DBS- 807	DBS- 3041
Date Collected	03-29-21	09-14-21
K-40	8.51 ± 0.41	8.39 ± 0.56
Mn-54	< 0.011	< 0.023
Fe-59	< 0.036	< 0.045
Co-58	< 0.014	< 0.022
Co-60	< 0.007	< 0.013
Zn-65	< 0.028	< 0.054
Nb-95	< 0.013	< 0.043
Zr-95	< 0.015	< 0.050
Ru-103	< 0.018	< 0.035
Ru-106	< 0.102	< 0.123
Cs-134	< 0.013	< 0.018
Cs-137	< 0.015	< 0.016
Ce-141	< 0.045	< 0.060
Ce-144	< 0.091	< 0.137

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

Location	D-107A (North Drainage Ditch)
Lab Code	DBS- 808
Date Collected	03-29-21
K-40	5.18 ± 0.35
Mn-54	< 0.014
Fe-59	< 0.028
Co-58	< 0.019
Co-60	< 0.011
Zn-65	< 0.030
Nb-95	< 0.028
Zr-95	< 0.026
Ru-103	< 0.021
Ru-106	< 0.106
Cs-134	< 0.011
Cs-137	< 0.013
Ce-141	< 0.042
Ce-144	< 0.050

Table 20. Groundwater Protection Program Summary.

Precipitation samples for tritium analysis. Units: pCi/L

Lab Code	Date	H-3	Lab Code	Date	H-3
D-016			D-111		
DP- 24	01/05/21	< 153	DP- 26	01/05/21	< 153
DP- 288	02/01/21	< 154	DP- 290	02/01/21	< 154
DP- 506	03/02/21	< 159	DP- 508	03/02/21	< 160
DP- 855	04/02/21	< 156	DP- 858	04/02/21	< 156
D-112			D-114		
DP- 27	01/05/21	< 153		ND[a]	
DP- 291	02/01/21	< 154		ND[a]	
DP- 509	03/02/21	< 160		ND[a]	
DP- 859	04/02/21	< 156		ND[a]	
D-127			D-128		
DP- 29	01/05/21	313 ± 92	DP- 30	01/05/21	< 153
DP- 293	02/01/21	355 ± 92	DP- 294	02/01/21	< 154
DP- 511	03/02/21	202 ± 86	DP- 513	03/02/21	< 160
DP- 861	04/02/21	213 ± 85	DP- 862	04/02/21	< 156
D-081			D-115		
DP- 25	01/05/21	< 153	DP- 28	01/05/21	< 153
DP- 289	02/01/21	< 154	DP- 292	02/01/21	< 154
DP- 507	03/02/21	< 160	DP- 510	03/02/21	< 160
DP- 856	04/02/21	< 156	DP- 860	04/02/21	< 156

[a] No sampler at the location.

Table 20. Groundwater Protection Program Summary.

Precipitation, monthly collections, analyses for gamma-emitting isotopes.

Location: D-16

			Concentration (pCi/L)											
Lab Code	Date		^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{131}I	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
DP- 24	01/05/21	[a]	< 20.2	< 22.3	< 21.1	< 18.1	< 31.1	< 23.4	< 27.8	< 17.4	< 19.1	< 19.9	< 80.8	< 17.1
DP- 288	02/01/21	[a]	< 15.4	< 24.4	< 12.2	< 17.5	< 27.5	< 13.1	< 22.7	< 22.8	< 17.1	< 21.3	< 66.6	< 22.7
DP- 506	03/02/21	[a]	< 22.3	< 26.7	< 21.6	< 17.0	< 38.2	< 25.6	< 20.0	< 16.7	< 20.6	< 24.9	< 96.2	< 20.5
DP- 855	04/02/21		< 3.4	< 5.1	< 3.1	< 2.9	< 6.4	< 3.8	< 4.7	< 3.1	< 3.1	< 3.5	< 16.1	< 3.2

[a] LLD not met due to a very small sample size.

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-111A		(01A)	
DWW- 728	03/16/21	< 161			
		D-111B		(01B)	
DWW- 729	03/16/21	< 161			
		D-112A		(02A)	
DWW- 730	03/16/21	< 161			
		D-112B		(02B)	
DWW- 731	03/16/21	< 161			
		D-113A		(03A)	
DWW- 732	03/17/21	< 161			
		D-113B		(03B)	
DWW- 733	03/17/21	< 161			
		D-114A		(04A)	
DWW- 734	03/17/21	< 161			
		D-114B		(04B)	
DWW- 735	03/17/21	< 161			
		D-115A		(05A)	
DWW- 736	03/17/21	< 161			
		D-115B		(05B)	
DWW- 737	03/17/21	< 161			

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-116A		(06A)	
DWW- 738	03/16/21	< 161			
		D-116B		(06B)	
DWW- 739	03/16/21	< 161			
		D-127A		(07A)	
DWW- 740	03/16/21	349 ± 93			
DWW- 1875	06/14/21	483 ± 100			
DWW- 2692	08/10/21	403 ± 97			
DWW- 4314	12/18/21	375 ± 94			
		D-127B		(07B)	
DWW- 741	03/16/21	< 161			
DWW- 1876	06/14/21	< 158			
DWW- 2693	08/17/21	< 164			
DWW- 4315	12/18/21	< 156			
		D-128A		(08A)	
DWW- 863	03/16/21	4200 ± 209			
DWW- 1623	05/20/21	4772 ± 224			
DWW- 2799	08/10/21	2858 ± 179			
DWW- 4316	12/18/21	989 ± 120			
		D-128B		(08B)	
DWW- 742	03/16/21	518 ± 101			
DWW- 1879	06/14/21 [b]	9133 ± 298			
DWW- 2800	08/17/21	382 ± 96			
DWW- 4317	12/18/21	495 ± 100			
		D-129A		(09A)	
DWW- 743	03/16/21	167 ± 84			
DWW- 1877	06/14/21	233 ± 88			
DWW- 2694	08/17/21	324 ± 94			
DWW- 4318	12/18/21	317 ± 91			
		D-129B		(09B)	
DWW- 745	03/16/21	< 161			
DWW- 1878	06/14/21	219 ± 87			
DWW- 2695	08/17/21	< 164			
DWW- 4319	12/18/21	227 ± 86			

[b] Sample possibly mislabelled, station informed, resampling in process.

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-130A		(10A)	
DWW- 746	03/16/21	< 161			
		D-130B		(10B)	
DWW- 747	03/16/21	< 161			
		D-131A		(11A)	
DWW- 748	03/17/21	< 161			
DWW- 1605	05/20/21	< 165			
DWW- 2697	08/17/21	< 164			
DWW- 4301	12/21/21	< 156			
		D-131B		(11B)	
DWW- 749	03/17/21	< 161			
DWW- 1606	05/20/21	< 165			
DWW- 2698	08/17/21	< 164			
DWW- 4303	12/21/21	216 ± 86			
		D-132A		(12A)	
DWW- 750	03/17/21	259 ± 89			
DWW- 1607	05/20/21	262 ± 92			
DWW- 2801	08/17/21	650 ± 108			
		D-132B		(12B)	
DWW- 751	03/17/21	194 ± 86			
DWW- 1608	05/20/21	180 ± 88			
DWW- 2696	08/17/21	< 164			
DWW- 4302	12/21/21	< 156			
		D-133A		(13A)	
DWW- 755	03/17/21	< 161			
		D-133B		(13B)	
DWW- 756	03/17/21	< 161			
		D-134A		(14A)	
DWW- 864	03/16/21	5541 ± 236			
DWW- 1900	06/14/21	9220 ± 299			
DWW- 2802	08/10/21	1912 ± 153			
DWW- 4320	12/18/21	1229 ± 129			

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-134B		(14B)	
		D-135A		(15A)	
DWW- 757	03/17/21	< 161			
		D-135B		(15B)	
DWW- 758	03/17/21	< 161			
		D-136A		(16A)	
DWW- 759	03/16/21	< 161			
		D-136B		(16B)	
DWW- 760	03/16/21	< 161			
		D-137		(17C)	
DWW- 761	03/16/21	< 161			
		D-62		(18A)	
DWW- 865	03/16/21	1293 ± 131			
DWW- 1624	05/20/21	1147 ± 129			
DWW- 2803	08/10/21	926 ± 120			
DWW- 4304	12/18/21	502 ± 100			
		D-63		(19A)	
DWW- 1880	06/14/21	276 ± 90			
DWW- 2699	08/17/21	274 ± 91			
DWW- 4305	12/18/21	218 ± 86			

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-64		(20A)	
DWW- 866	03/16/21	599 ± 104			
DWW- 1881	06/14/21	369 ± 94			
DWW- 2700	08/17/21	246 ± 90			
DWW- 4306	12/18/21	331 ± 92			
		D-65		(21A)	
DWW- 867	03/16/21	554 ± 102			
DWW- 1882	06/14/21	515 ± 101			
DWW- 2804	08/17/21	409 ± 98			
DWW- 4295	12/18/21	435 ± 97			
		D-66		(22A)	
DWW- 868	03/16/21	8913 ± 294			
DWW- 1625	05/20/21	23408 ± 472			
DWW- 2805	08/10/21	3208 ± 188			
DWW- 4321	12/18/21	2060 ± 156			
		D-67		(23A)	
DWW- 869	03/16/21	1611 ± 141			
DWW- 1901	06/14/21	28095 ± 512			
DWW- 2806	08/10/21	12559 ± 348			
DWW- 4322	12/18/21	2021 ± 155			
		D-165		(24A)	
DWW- 762	03/17/21	< 161			
DWW- 1609	05/20/21	< 165			
DWW- 2701	08/17/21	< 164			
		D-167		(26A)	
DWW- 1610	05/20/21	271 ± 92			

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-168A		(27A)	
DWW- 763	03/16/21	444 ± 98			
		D-168B		(27B)	
DWW- 764	03/16/21	< 161			
		D-169A		(28A)	
DWW- 870	03/16/21	962 ± 119			
DWW- 1613	05/19/21	405 ± 99			
DWW- 2702	08/16/21	299 ± 92			
DWW- 4296	12/18/21	< 156			
		D-169B		(28B)	
DWW- 766	03/16/21	< 161			
DWW- 1614	05/19/21	< 165			
DWW- 2703	08/16/21	< 164			
DWW- 4297	12/21/21	< 156			
		D-170A		(29A)	
DWW- 767	03/16/21	< 161			
DWW- 1615	05/19/21	245 ± 91			
DWW- 2704	08/16/21	< 164			
DWW- 4298	12/18/21	< 156			
		D-170B		(29B)	
DWW- 768	03/16/21	< 161			
DWW- 1616	05/19/21	< 165			
DWW- 2705	08/16/21	< 164			
DWW- 4299	12/21/21	< 156			
		D-171A		(30A)	
DWW- 769	03/16/21	< 161			
DWW- 1617	05/19/21	< 165			
DWW- 2706	08/16/21	< 164			
DWW- 4307	12/21/21	< 156			
		D-171B		(30B)	
DWW- 770	03/16/21	< 159			
DWW- 1618	05/19/21	< 165			
DWW- 2707	08/16/21	< 164			
DWW- 4308	12/21/21	< 156			

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

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-172A		(31A)	
DWW- 771	03/16/21	< 159			
		D-172B		(31B)	
DWW- 772	03/16/21	< 159			
		D-173A		(32A)	
DWW- 773	03/16/21	235 ± 91			
DWW- 1619	05/19/21	< 165			
DWW- 2709	08/16/21	191 ± 87			
DWW- 4310	12/18/21	181 ± 84			
		D-173B		(32B)	
DWW- 774	03/16/21	< 159			
DWW- 1620	05/19/21	< 165			
DWW- 2710	08/16/21	< 164			
DWW- 4311	12/18/21	186 ± 84			
		D-79		MW-33A	
DWW- 775	03/16/21	< 159			
DWW- 1621	05/19/21	< 165			
DWW- 2711	08/16/21	< 164			
DWW- 4312	12/18/21	< 156			
		D-80		MW-34A	
DWW- 776	03/16/21	161 ± 87			
DWW- 1622	05/19/21	183 ± 88			
DWW- 2712	08/16/21	< 164			
DWW- 4313	12/18/21	< 156			
		D-81		MW-35A	
DWW- 777	03/16/21	190 ± 89			
DWW- 1612	05/19/21	173 ± 87			
DWW- 2713	08/10/21	304 ± 93			
DWW- 4300	12/18/21	169 ± 83			

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

Table 20. Groundwater Protection Program Summary.

D-119			(2MH209)
D-121			(2MH211)
DSW- 752	03/23/21	< 161	
D-122			(Sluice Pond)
DSW- 753	03/23/21	< 161	
DSW- 1231	04/24/21	< 159	
D-123			(S. Drainage Ditch)
D-124			(N. Drainage Ditch)
DSW- 754	03/23/21	< 161	
D-125			(Onsite S. Storm Drain Outfall)
DSW- 1003	04/13/21	239 ± 90	
DSW- 1411	05/11/21	No sample	
D-125A			D-125B
D-125C			D-125D
D-125E			
(1MH213)			D-25 (MH105)
MH-217			D-27 (MH-107)
MH-219			D-24 (MH-104)
MH-102			D-26 (MH-106)

Table 20. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
D-127A (MW-07A)												
D-128A (MW-08A)												
DWW- 863	3/16/2021	< 2.3	< 6.6	< 2.8	< 1.7	< 4.2	< 4.3	< 4.5	< 2.2	< 2.3	< 37.6	< 7.5
DWW- 1623	5/20/2021	< 1.1	< 4.3	< 1.3	< 1.6	< 3.8	< 3.2	< 3.5	< 2.0	< 1.8	< 31.2	< 5.0
DWW- 2799	8/10/2021	< 1.7	< 5.1	< 2.2	< 1.9	< 3.5	< 3.4	< 4.0	< 1.7	< 1.9	< 35.2	< 13.7
D-128B (MW-08B)												
DWW- 1879	6/14/2021 [a]	< 2.0	< 4.1	< 1.7	< 1.6	< 3.2	< 3.4	< 3.5	< 1.9	< 1.8	< 33.0	< 8.6
D-134A (MW-14A)												
DWW- 864	3/16/2021	< 2.3	< 4.3	< 1.4	< 1.7	< 2.4	< 3.0	< 3.5	< 2.0	< 1.9	< 39.0	< 7.9
DWW- 1900	6/14/2021	< 1.7	< 5.4	< 1.6	< 1.4	< 2.9	< 2.6	< 3.0	< 1.6	< 1.4	< 20.0	< 8.0
DWW- 2802	8/10/2021	< 1.7	< 4.7	< 1.8	< 2.1	< 3.8	< 3.1	< 5.6	< 2.1	< 1.5	< 48.2	< 5.8
D-62 (MW-18A)												
DWW- 865	3/16/2021	< 1.9	< 5.7	< 2.1	< 1.5	< 3.9	< 3.8	< 4.2	< 1.8	< 1.5	< 36.9	< 11.7
DWW- 1624	5/20/2021	< 2.2	< 3.9	< 2.5	< 1.3	< 2.3	< 2.6	< 3.9	< 2.1	< 2.1	< 37.5	< 7.7
D-63 (MW-19A)												
D-65 (MW-21A)												
D-66 (MW-22A)												
DWW- 868	3/16/2021	< 2.0	< 4.6	< 2.5	< 1.5	< 4.3	< 3.9	< 4.1	< 2.2	< 2.0	< 58.9	< 12.0
DWW- 1625	5/20/2021	< 1.4	< 4.4	< 2.4	< 1.8	< 3.5	< 3.6	< 2.6	< 1.8	< 2.0	< 29.6	< 8.9
DWW- 2805	8/10/2021	< 1.8	< 4.3	< 1.9	< 1.3	< 3.3	< 2.8	< 4.4	< 1.7	< 1.4	< 35.4	< 7.8

[a] Sample possibly mislabelled, station informed, resampling in process.

Table 20. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-67 (MW-23A)						
DWW- 869	3/16/2021	< 1.4	< 5.3	< 2.4	< 1.6	< 3.1	< 3.8	< 3.8	< 1.7	< 1.5	< 37.2	< 6.0
DWW- 1901	6/14/2021	< 2.0	< 5.1	< 1.6	< 1.9	< 3.5	< 3.5	< 4.0	< 1.8	< 2.2	< 28.9	< 6.7
DWW- 2806	8/10/2021	< 2.0	< 5.2	< 1.9	< 1.5	< 4.1	< 3.2	< 4.5	< 2.1	< 2.0	< 38.2	< 7.6
						28A						

Table 20. Groundwater Protection Program Summary.

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

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 863	3/16/2021	d-128a	< 2.0	< 623	< 68	< 0.8	< 0.5
DWW- 864	3/16/2021	d-134a	< 2.4	< 619	< 69	< 0.8	< 0.5
DWW- 865	3/16/2021	mw-18a	3.8 ± 2.0	< 615	< 68	< 0.7	< 0.5
DWW- 868	3/16/2021	mw-22a	< 1.7	< 627	< 70	< 0.7	< 0.4
DWW- 869	3/16/2021	mw-23a	< 2.4	< 611	< 70	< 0.7	< 0.5
DWW- 1623	5/20/2021	d-128a	< 2.3	< 676	< 76	< 1.5	< 1.1
DWW- 1624	5/20/2021	mw-18a	3.0 ± 1.7	< 702	< 70	< 1.7	< 1.1
DWW- 1625	5/20/2021	mw-22a	2.9 ± 1.9	< 644	< 69	< 2.0	< 1.1
DWW- 1879	6/14/2021	d-128b [b]	< 1.4	< 686	< 68	< 1.5	< 1.0
DWW- 1900	6/14/2021	d-134a	< 1.8	< 673	< 66	< 1.6	< 1.0
DWW- 1901	6/14/2021	mw-23a	< 1.4	< 673	< 66	< 1.4	< 0.9
DWW- 2799	8/10/2021	d-128a	< 1.5	< 581	< 65	< 1.5	< 0.8
DWW- 2802	8/10/2021	d-134a	< 1.8	< 599	< 69	< 1.5	< 0.9
DWW- 2805	8/10/2021	mw-22a	< 2.3	< 571	< 69	< 1.8	< 1.0
DWW- 2806	8/10/2021	mw-23a	< 2.7	< 574	< 65	< 1.9	< 1.0

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

[b] Sample possibly mislabelled.