NEXTera ENERGY
DUANE ARNOLD

May 4, 2021

NG-21-0011
TS 5.6.2

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

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

Subject: 2020 Annual Radiological Environmental Operating Report

Please find as Enclosure 1 to this letter, a copy of NextEra Energy Duane Arnold, LLC's 2020 Annual Radiological Environmental Operating Report for the Duane Arnold Energy Center, pursuant to the requirements of DODAM Section 8.2.2 and Technical Specification Section 5.6.2.

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.

Sincerely,

P 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-21-0011

Duane Arnold Energy Center

2020 Annual Radiological Environmental Operating Report

132 pages follow

2020

Annual Radiological Environmental Operating Report

Duane Arnold Energy Center

Cedar Rapids, Iowa

Docket No. 50-331

January 1, 2020 through December 31, 2020

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2020
Annual Radiological Environmental Operating Report

Duane Arnold Energy Center
DOCKET NUMBER. 50-331

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DUANE ARNOLD ENERGY CENTER
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DOCKET NO. 50-331

REPORT

to the

UNITED STATES
NUCLEAR REGULATORY COMMISSION

Annual Radiological Environmental Operating Report

January 1 to December 31, 2020

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

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 2020. 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 2020 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 2020 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. On the other hand, ten (10) days after a nuclear explosion, the contributions of zirconium-95, cerium-144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud,1963). The other group quantified consists of niobium-95, ruthenium-103 and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the next group, manganese-54, cobalt-58 and-60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of nuclear power plant effluents, but are not produced in significant quantities by nuclear detonations. Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occurring isotope, were chosen as calibration monitors and provide a comparison between levels of naturally occurring radionuclides and radionuclides that could be attributed to the operation of the plant.

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

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

3.2 Program Description

3.2.1 Environmental Monitoring

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

To monitor the air environment, a continuous air sampler is employed. Airborne particulates and activated charcoal canisters are mounted on the intake of the air sampler to collect airborne particulates and airborne iodine respectively 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.

For 2020, dairy cow milk was collected monthly from one indicator D-110 and D-138. Monthly sampling was determined to be sufficient due to the milk sampling locations more than five miles from the facility. The samples are analyzed for iodine-131 and gamma-emitting isotopes. This dairy cow milk sampling is supplemented with goat's milk when available from indicator location D-76.

Additional monitoring of the terrestrial environment, grain, hay, grass and broadleaf vegetation samples are collected annually, as available, from eight locations: D-138 and seven indicators D-57, D-58, D-77, D-96, D-109, D-110, D-118, and D-138. 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, 2020 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:

D-16, sample damaged 2/7/20.

D-04, sample damaged 2/21/20.

D-15, sample not collected 8/21/20 due to an area power outage from 8/10/20 windstorm.

(2) Thermoluminescent Dosimetry (TLD):

D-91, TLD for 2nd quarter was missing from field, likely vandalized.

D-05, D-18, D-28, D-39, D-42 and D-82 TLD's for the 3rd quarter were all lost in field due to severe windstorms in the area.

(3) Milk:

D-76, goat milk was unavailable throughout 2020 due to limited herd production.

D-138, milk unavailable for collection due to 8/10/20 windstorm, which caused considerable damage and rendered location D-138 unviable for milk collection for the remainder of 2020.

D-110, milk unavailable for collection 12/15/20.

(4) Well Water:

D-52, Sample not collected 8/17/20 due to system structural damage.

(5) Surface Water:

D-99, surface water sample not available 2/25/20 due to frozen conditions.

D-51, D-61 and D-99 surface water samples not collected 8/19/20 due to fallen trees blocking access to area.

D-51 surface water sample not collected 10/08/20 due to fallen trees blocking access to area.

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

There were a few changes to the REMP program in 2020 except for the elimination of milk sampling after November 2020. REMP and GWPP standards and requirements can be found in the Duane Arnold Energy Center 2020 Annual Radiological Material Release Report in Attachment 2, ODAM and Attachment 3, DODAM.

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 2020 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 2020. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2020. 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 2020. The trace levels of cesium-137, still measurable in soil, are attributed to deposition of fallout from nuclear weapons testing from previous decades.

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were the same at both the indicator and control locations (0.026 pCi/m^3) and similar to 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				

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 0.081 pCi/m^3 for indicator locations and 0.080 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

517 weekly air samples were collected in 2020 from ten air monitoring stations. Levels of airborne iodine-131 measured below the required limit of 0.030 pCi/m^3 with the exception of the samples collected at location D-16 for the week ending 02/07/20 (sample damage), location D-04 for the week ending 02/21/20 (sample damage) and at location D-15 for the week ending 08/21/20 (sample damage).

Ambient Radiation (TLDs)

201 TLDs were collected and analyzed in 2020. At twelve control locations, thermoluminescent dosimeter (TLD) readings averaged 16.4 mR/quarter. At locations within a half mile, one mile and three mile radius of the stack, the measurements averaged 18.2, 18.9 and 16.6 mR/quarter, respectively. The two on-site locations D-15 and D-16 averaged 15.3 and 17.5 mR/quarter respectively. These average measurements are similar to the estimated average natural background radiation for Middle America, 19.5 mR/quarter, which is based on data on Pages 71 and 108 of the report, "Natural Background Radiation in the United States" (National Council on Radiation Protection and Measurements, 1975). The terrestrial absorbed dose (uncorrected for structural and body shielding) ranges from 8.8 to 18.8 mrad/quarter and averages 11.5 mrad/quarter for Middle America. Cosmic radiation and cosmogenic radionuclides contribute 8.0 mrad/quarter for a total average of 19.5 mrad/quarter. No plant effect is indicated.

ISFSI Facility Operations Monitoring

Four TLDs, placed directionally along the ISFSI fence line, averaged 34.8 mR/quarter. The TLD site D-30, located between the nearest residence and the ISFSI site averaged 17.4 mR/quarter. Calculated dose rates indicate the site is in compliance with 10 CFR 72.104 and 40 CFR 190.

Milk

18 milk samples were collected from two commercial dairies in 2020. Iodine-131 concentrations in milk samples were less than the LLD level of 1.0 pCi/L.

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

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

Groundwater (drinking water-potable)

53 drinking water samples from seven locations were collected in 2020. Tritium concentrations in ground water samples were less than the MDC of 161 pCi/L in all samples analyzed. Gamma-emitting isotopes were below detection limits.

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

4.2 Program Findings (continued)

Vegetation

Twelve broadleaf and nine grain and forage vegetation samples from nine locations were collected in 2020. Iodine-131 concentrations in vegetation samples were less than the LLD level of 0.059 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

55 surface water samples were collected from five locations in 2020. Surface water was tested for tritium and gamma emitting isotopes. No measurable tritium activity was detected above an LLD of 161 pCi/L.

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

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

No plant effect on surface water is indicated.

Fish

Ten fish samples from five sport fish species were collected in June and August, 2020, 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 (10.72 and 7.17 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

Six river sediment samples from three locations were collected in 2020 during the months of July and October, and analyzed for gamma-emitting isotopes. Potassium-40 activity ranged from 4.38 to 8.24 pCi/g dry weight at the indicator locations and between 7.16 and 7.60 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 2020 Annual Radiological Material Release Report.

Groundwater

284 groundwater samples (non-potable water) were collected from 56 permitted monitoring wells and three permitted extraction wells in 2020. Tritium was the only plant by-product identified. Concentrations of tritium ranged from less than 150 pCi/L to 51,271 pCi/L at D-128A, monitoring

well MW-08A. An explanation of tritium mitigation can be found in the Duane Arnold Energy Center 2020 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.

Soil

Two soil samples were collected in 2020, from D-15a and from D-16. Both samples were positive for cesium-137 with an average level of 0.08 pCi/g dry weight which is consistent with previous results at these locations. The cesium-137 source is determined to be from nuclear weapons testing and not from plant activities.

Precipitation

82 precipitation samples were collected in 2020 from eight precipitation collection locations. Tritium was consistently identified at locations D-127 and D-128. Tritium concentrations range from less than 150 pCi/L to 1,380 pCi/L (+/- 134 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

15 electrical vaults samples were collected in 2020 from six electrical vaults. Electrical vaults are below grade structures designed for electrical cabling. Surface water and groundwater may seep into the vaults. Tritium concentrations range from less than 157 pCi/L to 261 pCi/L (+/- 92 pCi/L) from D-119, which is consistent with rainfall recapture of tritiated water vapor from plant gaseous effluent release points.

Storm Drains, Sluice Pond, and Drainage Ditches.

35 samples were collected in 2020 from storm drains, sluice ponds and drainage ditches. Surface water sampling from these locations is consistent with non-point source runoff sampling activities. Similar to electrical vaults, tritium recapture is the source for tritium. Tritium concentrations range from less than 157 pCi/L to 4,867 pCi/L(+/- 221 pCi/L) from D-125B.

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 collection.

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
MI		D-76	01-09-20	Goat's milk unavailable due to limited herd production.
AP/AI		D-16	02-07-20	Sample damaged; appears very light. Samples discarded.
MI		D-76	02-11-20	Goat's milk unavailable due to limited herd production.
AP/AI		D-04	02-21-20	Sample damaged; appears very light; Samples discarded.
SW		D-99	02-25-20	No sample; river frozen.
MI		D-76	03-11-20	Goat's milk unavailable due to limited herd production.
MI		D-76	04-14-20	Goat's milk unavailable due to limited herd production.
MI		D-76	05-12-20	Goat's milk unavailable due to limited herd production.
TLD		D-91	2nd Qtr '20	TLD lost in field.
MI		D-76	06-16-20	Goat's milk unavailable due to limited herd production.
MI		D-76	07-14-20	Goat's milk unavailable due to limited herd production.
MI		D-76	08-11-20	Goat's milk unavailable due to limited herd production.
MI		D-138	08-11-20	Location inaccessible due to extreme damage after severe winds in area.
WW		D-52	08-17-20	Sample not collected due to system structural damage.
SW		D-51	08-19-20	Sample not collected due to fallen trees blocking access to the area.
SW		D-61	08-19-20	Sample not collected due to fallen trees blocking access to area.
SW		D-99	08-19-20	Sample not collected due to fallen trees blocking access to area.
AP/AI		D-15	08-21-20	No power at the station due to severe damage in the area. Samples not collected.

Table 5.6. Program Deviations, Duane Arnold Energy Center.(Continued).

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
TLD		D-05	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-18	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-28	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-39	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-42	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-82	3rd Qtr '20	TLD found broken, declared lost due to the strong windstorms in the area.
MI		D-76	09-15-20	Goat's milk unavailable due to limited herd production.
MI		D-138	09-15-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.
SW		D-51	10-08-20	Sample not collected due to fallen trees in area.
MI		D-76	10-15-20	Goat's milk unavailable due to limited herd production.
MI		D-138	10-15-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.
MI		D-76	11-17-20	Goat's milk unavailable due to limited herd production.
MI		D-138	11-17-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.
MI		D-76	12-15-20	Goat's milk unavailable due to limited herd production.
MI		D-110	12-15-20	Sample not available.
MI		D-138	12-15-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.

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, 2020

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 517	0.003	0.026 (465/465) (0.001-0.065)	D-16	0.028 (51/51) (0.012-0.056)	0.026 (53/53) (0.009-0.071)	0
	GS 40						
	Be-7	0.020	0.081 (36/36) (0.056-0.114)	D-11	0.092 (4/4) (0.076-0.110)	0.080 (4/4) (0.065-0.100)	0
	Mn-54	0.0013	< LLD	-	-	< LLD	0
	Fe-59	0.0034	< LLD	-	-	< LLD	0
	Co-58	0.0012	< LLD	-	-	< LLD	0
	Co-60	0.0015	< LLD	-	-	< LLD	0
	Zn-65	0.0055	< LLD	-	-	< LLD	0
	Nb-95	0.0016	< LLD	-	-	< LLD	0
	Zr-95	0.0027	< LLD	-	-	< LLD	0
	Ru-103	0.0016	< LLD	-	-	< LLD	0
	Ru-106	0.0107	< LLD	-	-	< LLD	0
	Cs-134	0.0016	< LLD	-	-	< LLD	0
	Cs-137	0.0013	< LLD	-	-	< LLD	0
	Ce-141	0.0027	< LLD	-	-	< LLD	0
	Ce-144	0.0067	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 517	0.030	< LLD	-	-	< LLD	0
Direct Radiation							
TLDs (m R/quarter) Control Locations	Gamma 47	1.0	None	D-5	19.1 (3/3) (15.5-23.7)	16.4 (47/47) (11.2-23.7)	0
Within 0.5 mi. of Stack	Gamma 76	1.0	21.5 (76/76) (9.3-24.6)	D-17	21.5 (4/4) (19.3-24.4)	None	0
Within 1.0 mi. of Stack	Gamma 24	1.0	18.9 (24/24) (12.9-23.5)	D-46	20.2 (4/4) (18.0-23.5)	None	0
Within 3.0 mi.of Stack	Gamma 38	1.0	16.6 (38/38) (11.4-23.3)	D-41	19.3 (4/4) (16.9-23.3)	None	0
ISFSI border	Gamma 16	1.0	34.8 (16/16) (15.0-34.8)	D-161	52.8 (4/4) (41.4-69.5)	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, 2020

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Waterborne Pathway							
Surface Water (pCi/L)	H-3 55	177	< LLD	-	-	< LLD	0
	I-131chem 23	0.5	< LLD	-	-	< LLD	0
	Sr-89 8	0.69	< LLD	-	-	< LLD	0
	Sr-90 8	0.57	< LLD	-	-	< LLD	0
	GS 55						
	Mn-54	6.8	< LLD	-	-	< LLD	0
	Fe-59	11.4	< LLD	-	-	< LLD	0
	Co-58	6.0	< LLD	-	-	< LLD	0
	Co-60	5.3	< LLD	-	-	< LLD	0
	Zn-65	19.2	< LLD	-	-	< LLD	0
	Nb-95	10.8	< LLD	-	-	< LLD	0
	Zr-95	12.4	< LLD	-	-	< LLD	0
	I-131	13.8	< LLD	-	-	< LLD	0
	Cs-134	6.8	< LLD	-	-	< LLD	0
	Cs-137	6.8	< LLD	-	-	< LLD	0
	Ba-140	34.5	< LLD	-	-	< LLD	0
	La-140	10.7	< LLD	-	-	< LLD	0
Sediments (pCi/g dry)	GS 6						
	K-40	1.0	6.05 (4/4) (4.38-8.24)	D-51	7.57 (2/2) (6.90-8.24)	7.38 (2/2) (7.16-7.60)	0
	Mn-54	0.017	< LLD	-	-	< LLD	0
	Fe-59	0.051	< LLD	-	-	< LLD	0
	Co-58	0.023	< LLD	-	-	< LLD	0
	Co-60	0.014	< LLD	-	-	< LLD	0
	Zn-65	0.033	< LLD	-	-	< LLD	0
	Nb-95	0.028	< LLD	-	-	< LLD	0
	Zr-95	0.035	< LLD	-	-	< LLD	0
	Ru-103	0.031	< LLD	-	-	< LLD	0
	Ru-106	0.101	< LLD	-	-	< LLD	0
	Cs-134	0.012	< LLD	-	-	< LLD	0
	Cs-137	0.015	< LLD	-	-	< LLD	0
	Ce-141	0.068	< LLD	-	-	< LLD	0
	Ce-144	0.064	< 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, 2020

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 53	0.5	< LLD	-	-	< LLD	0
	H-3 53	161	< LLD	-	-	< LLD	0
	GS 53						
	Mn-54	5.6	< LLD	-	-	< LLD	0
	Fe-59	11.9	< LLD	-	-	< LLD	0
	Co-58	6.3	< LLD	-	-	< LLD	0
	Co-60	4.5	< LLD	-	-	< LLD	0
	Zn-65	16.6	< LLD	-	-	< LLD	0
	Nb-95	9.3	< LLD	-	-	< LLD	0
	Zr-95	9.4	< LLD	-	-	< LLD	0
	I-131	9.3	< LLD	-	-	< LLD	0
	Cs-134	6.4	< LLD	-	-	< LLD	0
	Cs-137	5.3	< LLD	-	-	< LLD	0
	Ba-140	30.5	< LLD	-	-	< LLD	0
	La-140	6.6	< LLD	-	-	< LLD	0
Ingestion Pathway							
Milk (pCi/L)	I-131 18	0.4	< LLD	-	-	< LLD	0
	GS 18						
	K-40	100	1434 (11/11) (1322-1527)	D-138	1462 (7/7) (1346-1575)	1462 (7/7) (1346-1575)	0
	Cs-134	5	< LLD	-	-	< LLD	0
	Cs-137	5	< LLD	-	-	< LLD	0
	Ba-140	60	< LLD	-	-	< LLD	0
	La-140	5	< LLD	-	-	< LLD	0
Broadleaf Vegetation (pCi/gwet)	GS 12						
	K-40	0.05	4.07 (11/11) (2.08-5.43)	D-57	4.93 (1/1)	3.45 (1/1)	0
	Mn-54	0.032	< LLD	-	-		0
	Fe-59	0.074	< LLD	-	-		0
	Co-58	0.034	< LLD	-	-		0
	Co-60	0.035	< LLD	-	-		0
	Zn-65	0.069	< LLD	-	-		0
	Nb-95	0.036	< LLD	-	-		0
	Zr-95	0.046	< LLD	-	-		0
	Ru-103	0.031	< LLD	-	-		0
	Ru-106	0.284	< LLD	-	-		0
	I-131	0.059	< LLD	-	-		0
	Cs-134	0.031	< LLD	-	-		0
	Cs-137	0.031	< LLD	-	-		0
	Ce-141	0.046	< LLD	-	-		0
	Ce-144	0.184	< 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, 2020

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Ingestion Pathway (cont.)							
Vegetation (Grain and Forage) (pCi/g wet)	GS 9						
	K-40	0.05	10.72 (7/7) (2.61-21.02)	D-96	12.83 (2/2) (8.80-16.86)	7.17 (2/2) (2.89-11.45)	0
	Mn-54	0.028	< LLD	-	-		0
	Fe-59	0.112	< LLD	-	-		0
	Co-58	0.028	< LLD	-	-		0
	Co-60	0.050	< LLD	-	-		0
	Zn-65	0.113	< LLD	-	-		0
	Nb-95	0.037	< LLD	-	-		0
	Zr-95	0.048	< LLD	-	-		0
	Ru-103	0.027	< LLD	-	-		0
	Ru-106	0.330	< LLD	-	-		0
	I-131	0.059	< LLD	-	-		0
	Cs-134	0.045	< LLD	-	-		0
	Cs-137	0.034	< LLD	-	-		0
	Ce-141	0.067	< LLD	-	-		0
	Ce-144	0.282	< LLD	-	-		0
Fish (pCi/g wet)	GS	10					
	K-40	1.0	3.63 (5/5) (2.97-4.22)	D-49	3.63 (5/5) (2.97-4.22)	3.46 (5/5) (2.82-4.14)	0 0
	Mn-54	0.026	< LLD	-	-	< LLD	0
	Fe-59	0.0821	< LLD	-	-	< LLD	0
	Co-58	0.045	< LLD	-	-	< LLD	0
	Co-60	0.019	< LLD	-	-	< LLD	0
	Zn-65	0.038	< LLD	-	-	< LLD	0
	Nb-95	0.069	< LLD	-	-	< LLD	0
	Zr-95	0.086	< LLD	-	-	< LLD	0
	Ru-103	0.048	< LLD	-	-	< LLD	0
	Ru-106	0.201	< LLD	-	-	< LLD	0
	Cs-134	0.024	< LLD	-	-	< LLD	0
	Cs-137	0.022	< LLD	-	-	< LLD	0
	Ce-141	0.121	< LLD	-	-	< LLD	0
	Ce-144	0.173	< LLD	-	-	< LLD	0

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

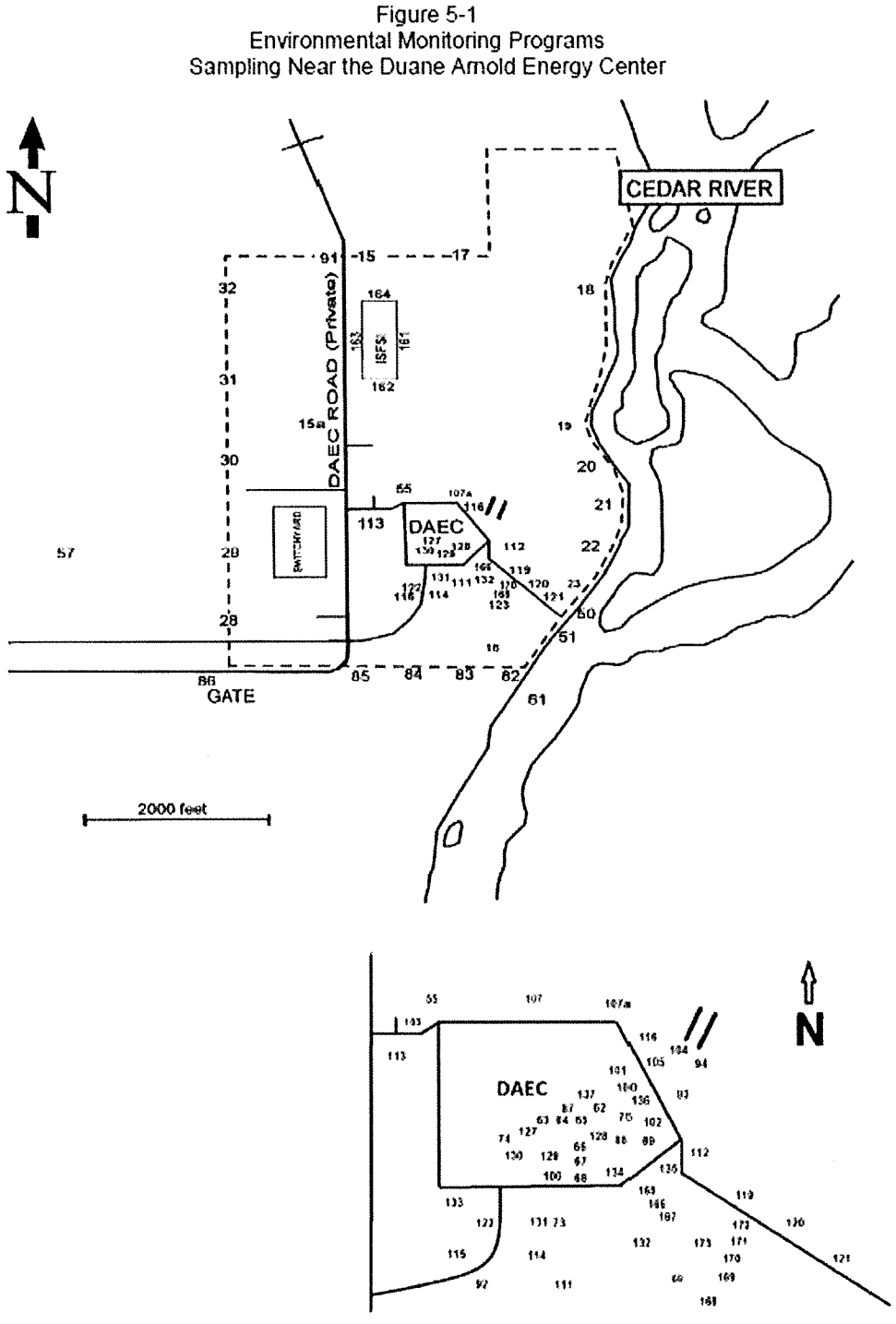
[b] LLD = Nominal lower limit of detection based on 4.66 sigma counting error for the background sample.

[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.

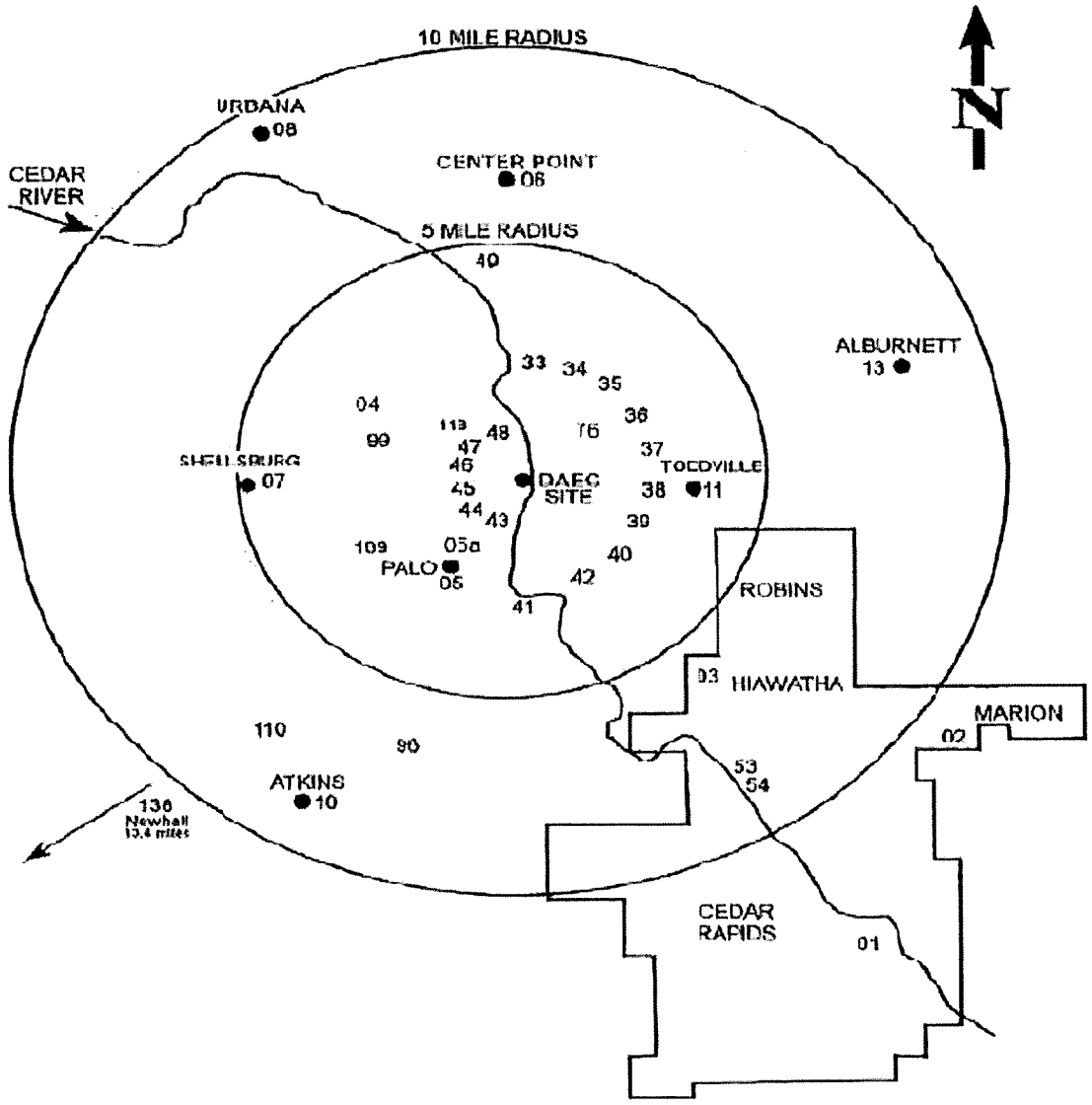
Figure 5.1 Radiological Environmental Monitoring Program Sampling Stations near the Duane Arnold Energy Center.



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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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, 2020

Prepared by

ATI ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8001

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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 2020. 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
MI		D-76	01-09-20	Goat's milk unavailable due to limited herd production.
AP/AI		D-16	02-07-20	Sample damaged; appears very light. Samples discarded.
MI		D-76	02-11-20	Goat's milk unavailable due to limited herd production.
AP/AI		D-04	02-21-20	Sample damaged; appears very light. Samples discarded.
SW		D-99	02-25-20	No sample; river frozen.
MI		D-76	03-11-20	Goat's milk unavailable due to limited herd Production.
MI		D-76	04-14-20	Goat's milk unavailable due to limited herd production.
MI		D-76	05-12-20	Goat's milk unavailable due to limited herd production.
TLD		D-91	2nd Qtr '20	TLD lost in field.
MI		D-76	06-16-20	Goat's milk unavailable due to limited herd production.
MI		D-76	07-14-20	Goat's milk unavailable due to limited herd production.
MI		D-76	08-11-20	Location inaccessible due to extreme damage after severe winds in area.
MI		D-138	08-11-20	Location inaccessible due to system structural damage.
WW		D-52	08-17-20	Sample not collected due to structural damage.
SW		D-51	08-19-20	Sample not collected due to fallen trees blocking access to area.
SW		D-61	08-19-20	Sample not collected due to fallen trees blocking access to area.
SW		D-99	08-19-20	Sample not collected due to fallen trees blocking access to area.
AP/AI		D-15	08-21-20	No power at station due to severe damage in the area. Samples not collected.

2.0 PROGRAM DEVIATIONS (continued).

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
TLD		D-05	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-18	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-28	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-39	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-42	3rd Qtr '20	TLD lost in field due to severe wind storms in the area.
TLD		D-82	3rd Qtr '20	TLD found broken, declared lost in field due to severe wind storms in the area.
MI		D-76	09-15-20	Goat's milk unavailable due to limited herd production.
MI		D-138	09-15-20	Sample location no longer viable due to derecho storm damage on 08/10/20.
SW		D-51	10-08-20	Sample not collected due to fallen trees in area.
MI		D-76	10-15-20	Goat's milk unavailable due to limited herd production.
MI		D-138	10-15-20	Sample location no longer viable due to derecho storm damage on 08/10/20.
MI		D-76	11-17-20	Goat's milk unavailable due to limited herd production.
MI		D-138	11-17-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.
MI		D-76	12-15-20	Goat's milk unavailable due to limited herd production.
MI		D-110	12-15-20	Sample not available.
MI		D-138	12-15-20	Sample location no longer viable for milk collection due to derecho storm damage on 08/10/20.

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
01-10-20	278	0.017 ± 0.004	07-10-20	334	0.033 ± 0.004
01-16-20	240	0.031 ± 0.005	07-17-20	295	0.023 ± 0.003
01-22-20	241	0.043 ± 0.005	07-24-20	294	0.018 ± 0.003
01-30-20	319	0.024 ± 0.003	07-31-20	294	0.022 ± 0.003
02-07-20	320	0.011 ± 0.003	08-07-20	299	0.017 ± 0.003
02-15-20	322	0.029 ± 0.004	08-10-20	121	0.039 ± 0.008 [b]
02-21-20	237	0.031 ± 0.004	08-21-20	102	0.019 ± 0.007 [b]
02-28-20	295	0.026 ± 0.004	08-27-20	232	0.053 ± 0.005
03-06-20	293	0.019 ± 0.003	09-04-20	310	0.026 ± 0.003
03-12-20	254	0.026 ± 0.004	09-11-20	266	0.016 ± 0.003
03-21-20	373	0.022 ± 0.003	09-18-20	272	0.027 ± 0.004
03-27-20	254	0.021 ± 0.004	09-25-20	271	0.035 ± 0.004
04-03-20	293	0.016 ± 0.003	10-02-20	272	0.018 ± 0.004
1st Quarter Mean ± s.d.		0.024 ± 0.008	3rd Quarter Mean ± s.d.		0.027 ± 0.011
04-10-20	293	0.022 ± 0.004	10-09-20	270	0.028 ± 0.004
04-17-20	294	0.026 ± 0.004	10-16-20	271	0.033 ± 0.004
04-24-20	294	0.023 ± 0.004	10-23-20	272	0.023 ± 0.004
04-30-20	252	0.020 ± 0.004	10-30-20	272	0.037 ± 0.004
05-07-20	294	0.013 ± 0.003	11-06-20	272	0.049 ± 0.005
05-15-20	336	0.013 ± 0.003	11-13-20	272	0.030 ± 0.004
05-22-20	295	0.010 ± 0.003	11-20-20	271	0.037 ± 0.004
05-29-20	293	0.017 ± 0.003	11-25-20	195	0.040 ± 0.006
			12-03-20	311	0.038 ± 0.004
06-04-20	252	0.016 ± 0.004			
06-12-20	336	0.018 ± 0.003	12-10-20	269	0.045 ± 0.005
06-19-20	302	0.022 ± 0.004	12-17-20	271	0.029 ± 0.004
06-26-20	286	0.015 ± 0.003	12-23-20	232	0.053 ± 0.006
07-02-20	254	0.016 ± 0.004	12-31-20	310	0.037 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.005	4th Quarter Mean ± s.d.		0.037 ± 0.009
			Cumulative Average		0.026

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

[b] Low volume due to power outages caused by heavy winds in the area.

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
01-10-20	269	0.013 ± 0.004	07-10-20	322	0.035 ± 0.004
01-16-20	233	0.030 ± 0.005	07-17-20	282	0.026 ± 0.004
01-22-20	233	0.040 ± 0.005	07-24-20	282	0.024 ± 0.004
01-30-20	310	0.023 ± 0.003	07-31-20	282	0.021 ± 0.003
02-07-20	310	0.009 ± 0.003	08-07-20	278	0.015 ± 0.003
02-15-20	312	0.023 ± 0.003	08-10-20	126	0.032 ± 0.007 [c]
02-21-20	230	NS[b]	08-21-20	154	0.016 ± 0.005 [c]
02-28-20	272	0.021 ± 0.004	08-27-20	228	0.052 ± 0.005
03-06-20	271	0.017 ± 0.003	09-04-20	324	0.028 ± 0.003
03-12-20	234	0.026 ± 0.004	09-11-20	282	0.014 ± 0.003
03-21-20	336	0.021 ± 0.003	09-18-20	284	0.023 ± 0.004
03-27-20	234	0.018 ± 0.004	09-25-20	282	0.031 ± 0.004
04-03-20	270	0.017 ± 0.003	10-02-20	283	0.014 ± 0.003
1st Quarter Mean ± s.d.		0.022 ± 0.008	3rd Quarter Mean ± s.d.		0.025 ± 0.011
04-10-20	271	0.022 ± 0.004	10-09-20	281	0.021 ± 0.004
04-17-20	271	0.024 ± 0.004	10-16-20	283	0.028 ± 0.004
04-24-20	271	0.020 ± 0.004	10-23-20	283	0.020 ± 0.003
04-30-20	233	0.024 ± 0.004	10-30-20	283	0.031 ± 0.004
05-07-20	271	0.013 ± 0.003	11-06-20	284	0.049 ± 0.005
05-15-20	310	0.015 ± 0.003	11-13-20	283	0.033 ± 0.004
05-22-20	272	0.012 ± 0.003	11-20-20	283	0.037 ± 0.004
05-29-20	270	0.016 ± 0.003	11-25-20	203	0.044 ± 0.006
			12-03-20	320	0.037 ± 0.004
06-04-20	233	0.018 ± 0.004			
06-12-20	310	0.024 ± 0.003	12-10-20	278	0.054 ± 0.005
06-19-20	276	0.030 ± 0.004	12-17-20	279	0.036 ± 0.004
06-26-20	278	0.018 ± 0.003	12-23-20	240	0.055 ± 0.005
07-02-20	243	0.019 ± 0.004	12-31-20	320	0.038 ± 0.004
2nd Quarter Mean ± s.d.		0.020 ± 0.005	4th Quarter Mean ± s.d.		0.037 ± 0.011
			Cumulative Average		0.026

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

[b] Sample damaged, discarded per station request.

[c] Low volume due to power outages caused by heavy winds in the area.

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
01-10-20	281	0.018 ± 0.004	07-10-20	338	0.036 ± 0.004
01-16-20	243	0.036 ± 0.005	07-17-20	298	0.023 ± 0.003
01-22-20	243	0.051 ± 0.005	07-24-20	296	0.023 ± 0.004
01-30-20	323	0.023 ± 0.003	07-31-20	296	0.020 ± 0.003
02-07-20	323	0.012 ± 0.003	08-07-20	302	0.017 ± 0.003
02-15-20	326	0.028 ± 0.004	08-10-20	133	0.032 ± 0.007 [b]
02-21-20	240	0.030 ± 0.004	08-21-20	273	0.025 ± 0.004
02-28-20	283	0.027 ± 0.004	08-27-20	254	0.050 ± 0.005
03-06-20	282	0.018 ± 0.003	09-04-20	336	0.023 ± 0.003
03-12-20	240	0.028 ± 0.004	09-11-20	276	0.013 ± 0.003
03-21-20	381	0.022 ± 0.003	09-18-20	278	0.026 ± 0.004
03-27-20	257	0.019 ± 0.004	09-25-20	276	0.031 ± 0.004
04-03-20	295	0.017 ± 0.003	10-02-20	277	0.020 ± 0.004
1st Quarter Mean ± s.d.		0.025 ± 0.010	3rd Quarter Mean ± s.d.		0.026 ± 0.009
04-10-20	296	0.025 ± 0.004	10-09-20	276	0.029 ± 0.004
04-17-20	297	0.026 ± 0.004	10-16-20	277	0.031 ± 0.004
04-24-20	297	0.024 ± 0.004	10-23-20	277	0.025 ± 0.004
04-30-20	255	0.019 ± 0.004	10-30-20	278	0.032 ± 0.004
05-07-20	297	0.017 ± 0.003	11-06-20	278	0.049 ± 0.005
05-15-20	339	0.015 ± 0.003	11-13-20	276	0.031 ± 0.004
05-22-20	298	0.012 ± 0.003	11-20-20	277	0.038 ± 0.004
05-29-20	296	0.015 ± 0.003	11-25-20	199	0.042 ± 0.006
			12-03-20	317	0.037 ± 0.004
06-04-20	255	0.016 ± 0.004			
06-12-20	339	0.019 ± 0.003	12-10-20	275	0.051 ± 0.005
06-19-20	300	0.026 ± 0.004	12-17-20	277	0.034 ± 0.004
06-26-20	294	0.019 ± 0.003	12-23-20	237	0.065 ± 0.006
07-02-20	256	0.019 ± 0.004	12-31-20	317	0.035 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.038 ± 0.011
			Cumulative Average		0.027

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

[b] Low volume due to power outages caused by heavy winds in the area.

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	
01-10-20	275	0.019 ± 0.004		07-10-20	335	0.021 ± 0.003	
01-16-20	238	0.031 ± 0.005		07-17-20	284	0.019 ± 0.003	
01-22-20	238	0.041 ± 0.005		07-24-20	294	0.018 ± 0.003	
01-30-20	316	0.022 ± 0.003		07-31-20	294	0.017 ± 0.003	
02-07-20	316	0.013 ± 0.003		08-07-20	294	0.014 ± 0.003	
02-15-20	319	0.032 ± 0.004		08-12-20	216	0.027 ± 0.005	c
02-21-20	235	0.026 ± 0.004		08-21-20	294	0.020 ± 0.003	
02-28-20	277	0.003 ± 0.003	b	08-27-20	252	0.036 ± 0.004	
03-06-20	276	0.018 ± 0.003		09-04-20	337	0.022 ± 0.003	
03-12-20	238	0.027 ± 0.004		09-11-20	294	0.011 ± 0.003	
03-21-20	355	0.023 ± 0.003		09-18-20	295	0.021 ± 0.003	
03-27-20	237	0.018 ± 0.004		09-25-20	294	0.032 ± 0.004	
04-03-20	276	0.016 ± 0.003		10-02-20	295	0.015 ± 0.003	
1st Quarter Mean ± s.d.		0.022 ± 0.010		3rd Quarter Mean ± s.d.		0.021 ± 0.007	
04-10-20	276	0.022 ± 0.004		10-09-20	292	0.023 ± 0.004	
04-17-20	277	0.024 ± 0.004		10-16-20	294	0.025 ± 0.004	
04-24-20	277	0.025 ± 0.004		10-23-20	294	0.022 ± 0.003	
04-30-20	238	0.022 ± 0.004		10-30-20	294	0.028 ± 0.004	
05-07-20	277	0.015 ± 0.003		11-06-20	292	0.005 ± 0.002	b
05-15-20	336	0.019 ± 0.003		11-13-20	292	0.031 ± 0.004	
05-22-20	295	0.013 ± 0.003		11-20-20	291	0.036 ± 0.004	
05-29-20	293	0.017 ± 0.003		11-25-20	209	0.045 ± 0.006	
				12-03-20	333	0.041 ± 0.004	
06-04-20	252	0.018 ± 0.004					
06-12-20	336	0.021 ± 0.003		12-10-20	290	0.051 ± 0.005	
06-19-20	300	0.025 ± 0.004		12-17-20	291	0.034 ± 0.004	
06-26-20	288	0.013 ± 0.003		12-23-20	249	0.057 ± 0.005	
07-02-20	254	0.015 ± 0.004		12-31-20	333	0.036 ± 0.004	
2nd Quarter Mean ± s.d.		0.019 ± 0.004		4th Quarter Mean ± s.d.		0.033 ± 0.014	
				Cumulative Average		0.024	

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

[b] Filter appears lighter than usual.

[c] Lower volume due to power outages caused by heavy winds in the area.

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
01-10-20	289	0.017 ± 0.004	07-10-20	325	0.038 ± 0.004
01-16-20	250	0.030 ± 0.005	07-17-20	286	0.026 ± 0.004
01-22-20	250	0.006 ± 0.003 [b]	07-24-20	285	0.022 ± 0.004
01-30-20	332	0.024 ± 0.003	07-31-20	285	0.024 ± 0.004
02-07-20	333	0.011 ± 0.003	08-07-20	290	0.019 ± 0.003
02-15-20	335	0.027 ± 0.003	08-10-20	127	0.032 ± 0.007 [c]
02-21-20	247	0.026 ± 0.004	08-21-20	237	0.029 ± 0.004
02-28-20	292	0.025 ± 0.004	08-27-20	245	0.045 ± 0.005
03-06-20	290	0.016 ± 0.003	09-04-20	328	0.027 ± 0.003
03-12-20	250	0.022 ± 0.004	09-11-20	284	0.016 ± 0.003
03-21-20	374	0.021 ± 0.003	09-18-20	287	0.024 ± 0.004
03-27-20	252	0.020 ± 0.004	09-25-20	284	0.033 ± 0.004
04-03-20	290	0.015 ± 0.003	10-02-20	286	0.001 ± 0.002 [b]
1st Quarter Mean ± s.d.		0.020 ± 0.007	3rd Quarter Mean ± s.d.		0.026 ± 0.011
04-10-20	290	0.020 ± 0.003	10-09-20	284	0.022 ± 0.004
04-17-20	292	0.029 ± 0.004	10-16-20	286	0.030 ± 0.004
04-24-20	291	0.020 ± 0.004	10-23-20	286	0.025 ± 0.004
04-30-20	250	0.022 ± 0.004	10-30-20	286	0.032 ± 0.004
05-07-20	291	0.017 ± 0.003	11-06-20	280	0.048 ± 0.005
05-15-20	327	0.016 ± 0.003	11-13-20	280	0.030 ± 0.004
05-22-20	286	0.014 ± 0.003	11-20-20	280	0.039 ± 0.004
05-29-20	285	0.018 ± 0.003	11-25-20	201	0.050 ± 0.006
			12-03-20	321	0.039 ± 0.004
06-04-20	245	0.022 ± 0.004			
06-12-20	326	0.022 ± 0.003	12-10-20	278	0.053 ± 0.005
06-19-20	289	0.023 ± 0.004	12-17-20	280	0.032 ± 0.004
06-26-20	282	0.014 ± 0.003	12-23-20	240	0.061 ± 0.006
07-02-20	246	0.025 ± 0.004	12-31-20	320	0.035 ± 0.004
2nd Quarter Mean ± s.d.		0.020 ± 0.004	4th Quarter Mean ± s.d.		0.038 ± 0.012
			Cumulative Average		0.026

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

[b] Filter appears lighter than normal.

[c] Low volume due to power outages caused by heavy winds in the area.

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
01-10-20	275	0.016 ± 0.004	07-10-20	347	0.036 ± 0.004
01-16-20	238	0.040 ± 0.005	07-17-20	306	0.025 ± 0.003
01-22-20	238	0.041 ± 0.005	07-24-20	305	0.021 ± 0.004
01-30-20	316	0.023 ± 0.003	07-31-20	305	0.026 ± 0.004
02-07-20	316	0.014 ± 0.003	08-07-20	310	0.018 ± 0.003
02-15-20	319	0.028 ± 0.004	08-11-20	199	0.041 ± 0.005 [b]
02-21-20	235	0.034 ± 0.005	08-21-20	306	0.028 ± 0.004
02-28-20	278	0.025 ± 0.004	08-27-20	262	0.049 ± 0.005
03-06-20	276	0.019 ± 0.003	09-04-20	350	0.029 ± 0.003
03-12-20	240	0.027 ± 0.004	09-11-20	305	0.015 ± 0.003
03-21-20	351	0.022 ± 0.003	09-18-20	307	0.026 ± 0.004
03-27-20	239	0.025 ± 0.004	09-25-20	288	0.023 ± 0.004
04-03-20	304	0.017 ± 0.003	10-02-20	289	0.017 ± 0.003
1st Quarter Mean ± s.d.		0.026 ± 0.009	3rd Quarter Mean ± s.d.		0.027 ± 0.010
04-10-20	305	0.023 ± 0.003	10-09-20	287	0.028 ± 0.004
04-17-20	306	0.025 ± 0.004	10-16-20	288	0.027 ± 0.004
04-24-20	305	0.012 ± 0.003	10-23-20	289	0.024 ± 0.004
04-30-20	262	0.020 ± 0.004	10-30-20	290	0.029 ± 0.004
05-07-20	305	0.016 ± 0.003	11-06-20	289	0.045 ± 0.004
05-15-20	349	0.016 ± 0.003	11-13-20	289	0.028 ± 0.004
05-22-20	306	0.012 ± 0.003	11-20-20	288	0.038 ± 0.004
05-29-20	305	0.016 ± 0.003	11-25-20	207	0.041 ± 0.006
			12-03-20	331	0.037 ± 0.004
06-04-20	262	0.020 ± 0.004			
06-12-20	349	0.023 ± 0.003	12-10-20	286	0.049 ± 0.005
06-19-20	313	0.025 ± 0.004	12-17-20	288	0.035 ± 0.004
06-26-20	298	0.020 ± 0.003	12-23-20	247	0.053 ± 0.005
07-02-20	263	0.021 ± 0.004	12-31-20	330	0.030 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.004	4th Quarter Mean ± s.d.		0.036 ± 0.009
			Cumulative Average		0.027

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

[b] Lower volume due to power outages caused by heavy winds in the area.

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
01-10-20	267	0.018 ± 0.004	07-10-20	334	0.031 ± 0.004
01-16-20	230	0.033 ± 0.005	07-17-20	294	0.020 ± 0.003
01-22-20	231	0.049 ± 0.005	07-24-20	294	0.022 ± 0.004
01-30-20	307	0.023 ± 0.003	07-31-20	294	0.018 ± 0.003
02-07-20	307	0.009 ± 0.003	08-07-20	299	0.013 ± 0.003
02-15-20	309	0.023 ± 0.003	08-10-20	121	0.034 ± 0.007 [b]
02-21-20	228	0.032 ± 0.005	08-21-20	146	0.019 ± 0.006 [b]
02-28-20	295	0.024 ± 0.004	08-27-20	232	0.036 ± 0.005
03-06-20	294	0.020 ± 0.003	09-04-20	311	0.021 ± 0.003
03-12-20	253	0.028 ± 0.004	09-11-20	271	0.013 ± 0.003
03-21-20	375	0.021 ± 0.003	09-18-20	272	0.023 ± 0.004
03-27-20	254	0.025 ± 0.004	09-25-20	271	0.030 ± 0.004
04-03-20	293	0.018 ± 0.003	10-02-20	272	0.017 ± 0.003
1st Quarter Mean ± s.d.		0.025 ± 0.010	3rd Quarter Mean ± s.d.		0.023 ± 0.007
04-10-20	293	0.019 ± 0.003	10-09-20	270	0.029 ± 0.004
04-17-20	294	0.024 ± 0.004	10-16-20	271	0.028 ± 0.004
04-24-20	294	0.021 ± 0.004	10-23-20	272	0.024 ± 0.004
04-30-20	252	0.021 ± 0.004	10-30-20	272	0.032 ± 0.004
05-07-20	294	0.013 ± 0.003	11-06-20	272	0.037 ± 0.004
05-15-20	336	0.018 ± 0.003	11-13-20	272	0.020 ± 0.004
05-22-20	295	0.014 ± 0.003	11-20-20	271	0.040 ± 0.004
05-29-20	293	0.016 ± 0.003	11-25-20	195	0.048 ± 0.006
			12-03-20	310	0.041 ± 0.004
06-04-20	252	0.017 ± 0.004			
06-12-20	336	0.020 ± 0.003	12-10-20	270	0.064 ± 0.005
06-19-20	301	0.017 ± 0.003	12-17-20	271	0.041 ± 0.004
06-26-20	287	0.016 ± 0.003	12-23-20	232	0.071 ± 0.006
07-02-20	254	0.021 ± 0.004	12-31-20	311	0.041 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.003	4th Quarter Mean ± s.d.		0.040 ± 0.015
			Cumulative Average		0.026

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

[b] Low volume due to power outages caused by heavy winds in the area.

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
01-10-20	303	0.017 ± 0.004	07-10-20	319	0.033 ± 0.004
01-16-20	262	0.036 ± 0.005	07-17-20	279	0.022 ± 0.004
01-22-20	263	0.056 ± 0.005	07-24-20	279	0.022 ± 0.004
01-30-20	349	0.025 ± 0.003	07-31-20	280	0.022 ± 0.004
02-07-20	349	0.018 ± 0.003	08-07-20	275	0.016 ± 0.003
02-15-20	352	0.004 ± 0.002 [b]	08-10-20	125	0.034 ± 0.007
02-21-20	259	0.027 ± 0.004	08-21-20		NS[c]
02-28-20	306	0.024 ± 0.004	08-27-20	220	0.042 ± 0.005
03-06-20	305	0.019 ± 0.003	09-04-20	320	0.024 ± 0.003
03-12-20	271	0.027 ± 0.004	09-11-20	285	0.018 ± 0.003
03-21-20	349	0.024 ± 0.003	09-18-20	286	0.026 ± 0.004
03-27-20	242	0.019 ± 0.004	09-25-20	285	0.031 ± 0.004
04-03-20	278	0.017 ± 0.003	10-02-20	286	0.021 ± 0.004
1st Quarter Mean ± s.d.		0.024 ± 0.012	3rd Quarter Mean ± s.d.		0.025 ± 0.008
04-10-20	279	0.024 ± 0.004	10-09-20	284	0.026 ± 0.004
04-17-20	280	0.029 ± 0.004	10-16-20	286	0.030 ± 0.004
04-24-20	280	0.022 ± 0.004	10-23-20	286	0.028 ± 0.004
04-30-20	240	0.023 ± 0.004	10-30-20	286	0.031 ± 0.004
05-07-20	279	0.017 ± 0.003	11-06-20	286	0.052 ± 0.005
05-15-20	320	0.015 ± 0.003	11-13-20	286	0.031 ± 0.004
05-22-20	280	0.010 ± 0.003	11-20-20	285	0.033 ± 0.004
05-29-20	279	0.013 ± 0.003	11-25-20	205	0.044 ± 0.006
			12-03-20	327	0.038 ± 0.004
06-04-20	240	0.019 ± 0.004			
06-12-20	320	0.018 ± 0.003	12-10-20	284	0.051 ± 0.005
06-19-20	291	0.025 ± 0.004	12-17-20	285	0.036 ± 0.004
06-26-20	269	0.014 ± 0.003	12-23-20	245	0.060 ± 0.006
07-02-20	241	0.021 ± 0.004	12-31-20	327	0.037 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.038 ± 0.010
			Cumulative Average		0.027

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

[b] Filter appears lighter than usual.

[c] "NS" - no power at the station due to heavy winds in the area. Samples not collected.

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
01-10-20	281	0.019 ± 0.004	07-10-20	316	0.036 ± 0.004
01-16-20	242	0.030 ± 0.005	07-17-20	277	0.024 ± 0.004
01-22-20	243	0.046 ± 0.005	07-24-20	277	0.025 ± 0.004
01-30-20	323	0.025 ± 0.003	07-31-20	277	0.031 ± 0.004
02-07-20	323	NS[b]	08-07-20	277	0.018 ± 0.003
02-15-20	326	0.030 ± 0.004	08-14-20	277	0.032 ± 0.004
02-21-20	240	0.034 ± 0.005	08-21-20	277	0.029 ± 0.004
02-28-20	283	0.024 ± 0.004	08-27-20	238	0.048 ± 0.005
03-06-20	282	0.021 ± 0.003	09-04-20	316	0.026 ± 0.003
03-12-20	251	0.028 ± 0.004	09-11-20	277	0.018 ± 0.003
03-21-20	352	0.022 ± 0.003	09-18-20	278	0.024 ± 0.004
03-27-20	244	0.021 ± 0.004	09-25-20	277	0.038 ± 0.004
04-03-20	281	0.014 ± 0.003	10-02-20	278	0.022 ± 0.004
1st Quarter Mean ± s.d.		0.026 ± 0.008	3rd Quarter Mean ± s.d.		0.029 ± 0.009
04-10-20	282	0.021 ± 0.004	10-09-20	275	0.023 ± 0.004
04-17-20	283	0.026 ± 0.004	10-16-20	277	0.029 ± 0.004
04-24-20	283	0.024 ± 0.004	10-23-20	277	0.022 ± 0.004
04-30-20	242	0.023 ± 0.004	10-30-20	277	0.031 ± 0.004
05-07-20	282	0.016 ± 0.003	11-06-20	278	0.049 ± 0.005
05-15-20	323	0.017 ± 0.003	11-13-20	278	0.030 ± 0.004
05-22-20	283	0.012 ± 0.003	11-20-20	277	0.037 ± 0.004
05-29-20	282	0.016 ± 0.003	11-25-20	199	0.041 ± 0.006
			12-03-20	346	0.037 ± 0.004
06-04-20	243	0.018 ± 0.004			
06-12-20	323	0.022 ± 0.003	12-10-20	301	0.046 ± 0.004
06-19-20	294	0.024 ± 0.004	12-17-20	302	0.034 ± 0.004
06-26-20	266	0.019 ± 0.004	12-23-20	259	0.054 ± 0.005
07-02-20	238	0.022 ± 0.004	12-31-20	346	0.032 ± 0.003
2nd Quarter Mean ± s.d.		0.020 ± 0.004	4th Quarter Mean ± s.d.		0.036 ± 0.010
			Cumulative Average		0.028

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

[b] Sample damaged, discarded per station request.

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
01-10-20	267	0.021 ± 0.004	07-10-20	299	0.036 ± 0.004
01-16-20	230	0.041 ± 0.005	07-17-20	263	0.025 ± 0.004
01-22-20	231	0.047 ± 0.005	07-24-20	262	0.023 ± 0.004
01-30-20	307	0.024 ± 0.004	07-31-20	262	0.022 ± 0.004
02-07-20	306	0.013 ± 0.003	08-07-20	267	0.017 ± 0.003
02-15-20	309	0.031 ± 0.004	08-10-20	117	0.029 ± 0.007 [b]
02-21-20	228	0.032 ± 0.005	08-21-20	242	0.025 ± 0.004
02-28-20	269	0.033 ± 0.004	08-27-20	225	0.046 ± 0.005
03-06-20	268	0.020 ± 0.004	09-04-20	301	0.021 ± 0.003
03-12-20	234	0.028 ± 0.004	09-11-20	262	0.010 ± 0.003
03-21-20	339	0.023 ± 0.003	09-18-20	264	0.019 ± 0.004
03-27-20	232	0.023 ± 0.004	09-25-20	292	0.028 ± 0.004
04-03-20	261	0.016 ± 0.003	10-02-20	295	0.019 ± 0.003
1st Quarter Mean ± s.d.		0.027 ± 0.010	3rd Quarter Mean ± s.d.		0.025 ± 0.009
04-10-20	262	0.025 ± 0.004	10-09-20	292	0.021 ± 0.004
04-17-20	263	0.028 ± 0.004	10-16-20	294	0.019 ± 0.003
04-24-20	263	0.021 ± 0.004	10-23-20	294	0.023 ± 0.003
04-30-20	225	0.023 ± 0.004	10-30-20	294	0.026 ± 0.004
05-07-20	262	0.016 ± 0.003	11-06-20	290	0.041 ± 0.004
05-15-20	300	0.016 ± 0.003	11-13-20	287	0.030 ± 0.004
05-22-20	263	0.013 ± 0.004	11-20-20	294	0.035 ± 0.004
05-29-20	262	0.016 ± 0.004	11-25-20	211	0.039 ± 0.005
			12-03-20	337	0.027 ± 0.004
06-04-20	225	0.015 ± 0.004			
06-12-20	300	0.019 ± 0.003	12-10-20	292	0.027 ± 0.004
06-19-20	270	0.025 ± 0.004	12-17-20	290	0.032 ± 0.004
06-26-20	255	0.017 ± 0.004	12-23-20	252	0.059 ± 0.005
07-02-20	227	0.031 ± 0.005	12-31-20	337	0.034 ± 0.004
2nd Quarter Mean ± s.d.		0.020 ± 0.006	4th Quarter Mean ± s.d.		0.032 ± 0.010
			Cumulative Average		0.026

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless noted otherwise.
[b] Low volume due to power outages caused by heavy winds in the area.

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- 1101	DAP- 2405	DAP- 3955	DAP- 4913
Volume (m^3)	3719	3782	3362	3488
Be-7	0.064 ± 0.014	0.090 ± 0.014	0.111 ± 0.019	0.059 ± 0.013
Mn-54	< 0.0007	< 0.0008	< 0.0009	< 0.0007
Fe-59	< 0.0019	< 0.0010	< 0.0021	< 0.0017
Co-58	< 0.0006	< 0.0006	< 0.0008	< 0.0008
Co-60	< 0.0009	< 0.0007	< 0.0011	< 0.0003
Zn-65	< 0.0009	< 0.0005	< 0.0008	< 0.0010
Nb-95	< 0.0009	< 0.0004	< 0.0009	< 0.0009
Zr-95	< 0.0015	< 0.0013	< 0.0013	< 0.0019
Ru-103	< 0.0011	< 0.0008	< 0.0015	< 0.0012
Ru-106	< 0.0053	< 0.0053	< 0.0064	< 0.0056
Cs-134	< 0.0009	< 0.0009	< 0.0016	< 0.0009
Cs-137	< 0.0003	< 0.0006	< 0.0011	< 0.0007
Ce-141	< 0.0010	< 0.0013	< 0.0018	< 0.0018
Ce-144	< 0.0052	< 0.0045	< 0.0053	< 0.0034
Location	D-4			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1102	DAP- 2406	DAP- 3956	DAP- 4914
Volume (m^3)	3514	3509	3409	3620
Be-7	0.058 ± 0.012	0.108 ± 0.025	0.104 ± 0.017	0.058 ± 0.014
Mn-54	< 0.0010	< 0.0008	< 0.0008	< 0.0004
Fe-59	< 0.0011	< 0.0034	< 0.0020	< 0.0011
Co-58	< 0.0007	< 0.0006	< 0.0007	< 0.0007
Co-60	< 0.0006	< 0.0015	< 0.0008	< 0.0006
Zn-65	< 0.0015	< 0.0055	< 0.0008	< 0.0007
Nb-95	< 0.0009	< 0.0010	< 0.0012	< 0.0011
Zr-95	< 0.0011	< 0.0027	< 0.0015	< 0.0012
Ru-103	< 0.0011	< 0.0010	< 0.0012	< 0.0010
Ru-106	< 0.0080	< 0.0070	< 0.0054	< 0.0052
Cs-134	< 0.0008	< 0.0016	< 0.0011	< 0.0009
Cs-137	< 0.0006	< 0.0012	< 0.0007	< 0.0003
Ce-141	< 0.0013	< 0.0014	< 0.0015	< 0.0014
Ce-144	< 0.0029	< 0.0046	< 0.0043	< 0.0044
Location	D-5A			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1103	DAP- 2407	DAP- 3957	DAP- 4915
Volume (m^3)	3716	3819	3633	3560
Be-7	0.069 ± 0.018	0.091 ± 0.016	0.114 ± 0.021	0.073 ± 0.017
Mn-54	< 0.0008	< 0.0010	< 0.0013	< 0.0007
Fe-59	< 0.0019	< 0.0025	< 0.0013	< 0.0009
Co-58	< 0.0007	< 0.0012	< 0.0005	< 0.0006
Co-60	< 0.0008	< 0.0008	< 0.0007	< 0.0006
Zn-65	< 0.0024	< 0.0020	< 0.0011	< 0.0011
Nb-95	< 0.0012	< 0.0010	< 0.0006	< 0.0014
Zr-95	< 0.0013	< 0.0011	< 0.0008	< 0.0014
Ru-103	< 0.0012	< 0.0014	< 0.0010	< 0.0013
Ru-106	< 0.0103	< 0.0100	< 0.0076	< 0.0071
Cs-134	< 0.0011	< 0.0011	< 0.0010	< 0.0009
Cs-137	< 0.0010	< 0.0007	< 0.0005	< 0.0005
Ce-141	< 0.0013	< 0.0016	< 0.0019	< 0.0016
Ce-144	< 0.0057	< 0.0067	< 0.0057	< 0.0035

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- 1104	DAP- 2408	DAP- 3958	DAP- 4916
Volume (m^3)	3597	3699	3776	3756
Be-7	0.059 ± 0.014	0.085 ± 0.014	0.083 ± 0.015	0.073 ± 0.017
Mn-54	< 0.0007	< 0.0008	< 0.0007	< 0.0007
Fe-59	< 0.0015	< 0.0012	< 0.0027	< 0.0016
Co-58	< 0.0006	< 0.0005	< 0.0006	< 0.0007
Co-60	< 0.0005	< 0.0006	< 0.0007	< 0.0003
Zn-65	< 0.0016	< 0.0012	< 0.0009	< 0.0015
Nb-95	< 0.0008	< 0.0005	< 0.0006	< 0.0012
Zr-95	< 0.0010	< 0.0012	< 0.0011	< 0.0015
Ru-103	< 0.0010	< 0.0010	< 0.0016	< 0.0012
Ru-106	< 0.0058	< 0.0047	< 0.0075	< 0.0033
Cs-134	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Cs-137	< 0.0005	< 0.0006	< 0.0004	< 0.0005
Ce-141	< 0.0010	< 0.0008	< 0.0016	< 0.0018
Ce-144	< 0.0051	< 0.0031	< 0.0054	< 0.0054
Location	D-7			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1105	DAP- 2410	DAP- 3959	DAP- 4917
Volume (m^3)	3785	3700	3550	3621
Be-7	0.061 ± 0.014	0.088 ± 0.013	0.076 ± 0.018	0.074 ± 0.018
Mn-54	< 0.0007	< 0.0005	< 0.0010	< 0.0009
Fe-59	< 0.0021	< 0.0014	< 0.0021	< 0.0009
Co-58	< 0.0006	< 0.0007	< 0.0010	< 0.0009
Co-60	< 0.0005	< 0.0003	< 0.0007	< 0.0007
Zn-65	< 0.0012	< 0.0010	< 0.0013	< 0.0018
Nb-95	< 0.0009	< 0.0009	< 0.0015	< 0.0012
Zr-95	< 0.0011	< 0.0008	< 0.0007	< 0.0010
Ru-103	< 0.0009	< 0.0009	< 0.0014	< 0.0010
Ru-106	< 0.0056	< 0.0059	< 0.0083	< 0.0065
Cs-134	< 0.0008	< 0.0010	< 0.0011	< 0.0007
Cs-137	< 0.0003	< 0.0005	< 0.0010	< 0.0005
Ce-141	< 0.0011	< 0.0012	< 0.0016	< 0.0013
Ce-144	< 0.0048	< 0.0039	< 0.0048	< 0.0031
Location	D-11			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1106	DAP- 2411	DAP- 3960	DAP- 4918
Volume (m^3)	3625	3929	3878	3708
Be-7	0.076 ± 0.016	0.110 ± 0.021	0.102 ± 0.018	0.077 ± 0.014
Mn-54	< 0.0010	< 0.0010	< 0.0008	< 0.0005
Fe-59	< 0.0028	< 0.0020	< 0.0011	< 0.0017
Co-58	< 0.0012	< 0.0004	< 0.0011	< 0.0008
Co-60	< 0.0012	< 0.0010	< 0.0010	< 0.0005
Zn-65	< 0.0033	< 0.0020	< 0.0007	< 0.0015
Nb-95	< 0.0011	< 0.0012	< 0.0009	< 0.0013
Zr-95	< 0.0022	< 0.0015	< 0.0010	< 0.0011
Ru-103	< 0.0016	< 0.0010	< 0.0011	< 0.0012
Ru-106	< 0.0097	< 0.0055	< 0.0072	< 0.0056
Cs-134	< 0.0015	< 0.0012	< 0.0011	< 0.0008
Cs-137	< 0.0013	< 0.0006	< 0.0005	< 0.0007
Ce-141	< 0.0018	< 0.0017	< 0.0019	< 0.0014
Ce-144	< 0.0056	< 0.0040	< 0.0036	< 0.0053

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- 1107	DAP- 2412	DAP- 3961	DAP- 4919
Volume (m^3)	3640	3783	3410	3488
Be-7	0.069 ± 0.013	0.088 ± 0.014	0.100 ± 0.024	0.065 ± 0.015
Mn-54	< 0.0006	< 0.0006	< 0.0009	< 0.0009
Fe-59	< 0.0006	< 0.0020	< 0.0025	< 0.0014
Co-58	< 0.0004	< 0.0005	< 0.0008	< 0.0003
Co-60	< 0.0004	< 0.0010	< 0.0011	< 0.0007
Zn-65	< 0.0006	< 0.0015	< 0.0019	< 0.0006
Nb-95	< 0.0008	< 0.0007	< 0.0015	< 0.0011
Zr-95	< 0.0011	< 0.0018	< 0.0024	< 0.0021
Ru-103	< 0.0006	< 0.0012	< 0.0015	< 0.0009
Ru-106	< 0.0060	< 0.0070	< 0.0092	< 0.0079
Cs-134	< 0.0008	< 0.0010	< 0.0011	< 0.0009
Cs-137	< 0.0006	< 0.0005	< 0.0006	< 0.0006
Ce-141	< 0.0015	< 0.0018	< 0.0014	< 0.0012
Ce-144	< 0.0044	< 0.0048	< 0.0038	< 0.0034
Location	D-15			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1108	DAP- 2413	DAP- 3962	DAP- 4920
Volume (m^3)	3888	3598	3240	3671
Be-7	0.080 ± 0.017	0.093 ± 0.015	0.101 ± 0.018	0.065 ± 0.014
Mn-54	< 0.0011	< 0.0007	< 0.0008	< 0.0004
Fe-59	< 0.0021	< 0.0009	< 0.0015	< 0.0007
Co-58	< 0.0007	< 0.0002	< 0.0009	< 0.0009
Co-60	< 0.0008	< 0.0006	< 0.0008	< 0.0003
Zn-65	< 0.0036	< 0.0016	< 0.0012	< 0.0014
Nb-95	< 0.0014	< 0.0007	< 0.0013	< 0.0013
Zr-95	< 0.0015	< 0.0016	< 0.0012	< 0.0008
Ru-103	< 0.0011	< 0.0008	< 0.0009	< 0.0011
Ru-106	< 0.0070	< 0.0045	< 0.0075	< 0.0050
Cs-134	< 0.0013	< 0.0008	< 0.0012	< 0.0009
Cs-137	< 0.0009	< 0.0008	< 0.0009	< 0.0007
Ce-141	< 0.0017	< 0.0010	< 0.0022	< 0.0021
Ce-144	< 0.0054	< 0.0047	< 0.0042	< 0.0047
Location	D-16			
Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Lab Code	DAP- 1109	DAP- 2414	DAP- 3963	DAP- 4921
Volume (m^3)	3671	3624	3640	3693
Be-7	0.067 ± 0.012	0.105 ± 0.017	0.077 ± 0.017	0.070 ± 0.016
Mn-54	< 0.0010	< 0.0009	< 0.0012	< 0.0007
Fe-59	< 0.0015	< 0.0018	< 0.0022	< 0.0008
Co-58	< 0.0005	< 0.0010	< 0.0005	< 0.0007
Co-60	< 0.0007	< 0.0010	< 0.0007	< 0.0007
Zn-65	< 0.0019	< 0.0011	< 0.0011	< 0.0013
Nb-95	< 0.0011	< 0.0007	< 0.0013	< 0.0010
Zr-95	< 0.0018	< 0.0019	< 0.0020	< 0.0014
Ru-103	< 0.0010	< 0.0012	< 0.0010	< 0.0011
Ru-106	< 0.0107	< 0.0086	< 0.0066	< 0.0056
Cs-134	< 0.0011	< 0.0010	< 0.0010	< 0.0008
Cs-137	< 0.0006	< 0.0008	< 0.0007	< 0.0006
Ce-141	< 0.0012	< 0.0013	< 0.0017	< 0.0010
Ce-144	< 0.0047	< 0.0054	< 0.0041	< 0.0040

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- 1110	DAP- 2415	DAP- 3964	DAP- 4922
Volume (m^3)	3480	3378	3351	3766
Be-7	0.072 ± 0.013	0.104 ± 0.019	0.072 ± 0.017	0.056 ± 0.015
Mn-54	< 0.0006	< 0.0009	< 0.0010	< 0.0005
Fe-59	< 0.0009	< 0.0016	< 0.0016	< 0.0018
Co-58	< 0.0003	< 0.0009	< 0.0011	< 0.0009
Co-60	< 0.0005	< 0.0007	< 0.0010	< 0.0003
Zn-65	< 0.0010	< 0.0010	< 0.0016	< 0.0006
Nb-95	< 0.0009	< 0.0015	< 0.0016	< 0.0012
Zr-95	< 0.0007	< 0.0023	< 0.0007	< 0.0007
Ru-103	< 0.0007	< 0.0014	< 0.0014	< 0.0009
Ru-106	< 0.0061	< 0.0101	< 0.0087	< 0.0022
Cs-134	< 0.0009	< 0.0010	< 0.0011	< 0.0008
Cs-137	< 0.0005	< 0.0005	< 0.0008	< 0.0005
Ce-141	< 0.0012	< 0.0020	< 0.0027	< 0.0017
Ce-144	< 0.0039	< 0.0046	< 0.0041	< 0.0047

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	21.7 ± 1.7	14.2 ± 2.0	16.1 ± 1.6	12.2 ± 1.2
D-2	19.7 ± 1.1	12.8 ± 1.1	13.6 ± 1.1	11.9 ± 0.5
D-3	20.8 ± 1.4	14.9 ± 1.1	15.9 ± 0.9	12.1 ± 0.5
D-4	21.8 ± 1.7	17.6 ± 1.8	15.0 ± 1.6	14.2 ± 1.2
D-5	23.7 ± 1.2	18.0 ± 1.0	ND[a]	15.5 ± 0.5
D-5A	21.8 ± 0.7	14.0 ± 1.1	16.6 ± 1.0	12.7 ± 0.4
D-6	21.1 ± 0.9	14.8 ± 1.2	15.5 ± 1.0	13.0 ± 0.7
D-7	18.4 ± 1.1	15.7 ± 1.1	13.4 ± 1.1	12.5 ± 0.6
D-8	22.9 ± 1.0	17.2 ± 1.2	19.4 ± 1.3	16.2 ± 1.1
D-10	22.4 ± 1.7	16.5 ± 2.2	17.8 ± 1.3	13.8 ± 0.5
D-11	18.2 ± 0.8	12.8 ± 1.2	14.7 ± 1.0	11.2 ± 0.9
D-13	21.3 ± 0.6	14.2 ± 1.7	15.9 ± 1.0	13.1 ± 0.9
Mean ± s.d.	21.1 ± 1.7	15.2 ± 1.8	15.8 ± 1.7	13.2 ± 1.5
Within 0.5 mi. of Stack				
D-15	19.6 ± 1.2	13.6 ± 0.9	15.6 ± 1.2	12.3 ± 0.4
D-16	23.8 ± 1.2	17.0 ± 1.3	16.1 ± 1.3	13.1 ± 0.8
D-17	24.4 ± 1.0	22.4 ± 1.1	20.1 ± 1.2	19.3 ± 0.6
D-18	22.7 ± 1.8	15.8 ± 1.1	ND[a]	14.0 ± 0.5
D-19	21.5 ± 1.4	17.3 ± 1.0	16.3 ± 1.6	13.0 ± 0.4
D-20	24.6 ± 1.2	18.8 ± 2.0	16.1 ± 1.2	14.2 ± 1.3
D-21	23.9 ± 1.1	19.6 ± 1.7	16.5 ± 0.9	13.5 ± 0.8
D-22	22.2 ± 1.0	20.0 ± 1.2	15.8 ± 1.2	14.3 ± 0.7
D-23	19.2 ± 1.6	12.1 ± 1.4	13.0 ± 1.0	9.3 ± 0.7
D-28	23.2 ± 1.6	20.7 ± 1.4	ND[a]	17.6 ± 0.7
D-29	24.6 ± 1.2	19.1 ± 1.3	19.4 ± 1.4	17.2 ± 0.5
D-30	21.0 ± 1.3	16.7 ± 2.2	16.7 ± 1.4	15.2 ± 1.5
D-31	24.6 ± 1.6	19.9 ± 2.0	19.8 ± 1.5	17.9 ± 1.4
D-32	22.6 ± 1.0	16.9 ± 1.5	18.7 ± 1.1	14.4 ± 1.2
D-82	23.3 ± 1.2	15.2 ± 1.4	ND[a]	16.1 ± 0.7
D-83	20.5 ± 0.8	14.1 ± 1.7	15.6 ± 1.0	13.5 ± 0.7
D-84	22.4 ± 1.1	17.5 ± 1.3	16.1 ± 1.5	17.0 ± 1.1
D-85	24.0 ± 0.6	16.3 ± 1.3	18.2 ± 0.9	16.6 ± 0.8
D-86	22.9 ± 2.3	23.7 ± 1.5	15.7 ± 1.6	18.7 ± 2.0
D-91	23.5 ± 1.2	ND[a]	17.8 ± 1.4	19.9 ± 0.9
Mean ± s.d.	22.7 ± 1.6	17.7 ± 3.0	16.9 ± 1.8	15.4 ± 2.7

[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	21.7 ± 1.5	12.9 ± 1.9	17.4 ± 1.4	14.5 ± 1.3
D-44	22.2 ± 1.0	18.4 ± 0.9	18.2 ± 1.1	20.7 ± 0.6
D-45	20.0 ± 1.1	16.4 ± 1.3	15.8 ± 1.3	16.8 ± 1.1
D-46	23.5 ± 1.4	18.0 ± 1.6	19.0 ± 1.6	20.1 ± 1.3
D-47	23.1 ± 1.2	17.4 ± 1.3	18.4 ± 1.2	20.2 ± 1.0
D-48	22.9 ± 2.0	16.8 ± 1.1	22.0 ± 1.8	17.9 ± 0.6
Mean ± s.d.	22.3 ± 1.3	16.7 ± 2.0	18.5 ± 2.0	18.3 ± 2.4
Within 3.0 mi. of Stack				
D-33	19.1 ± 0.9	14.8 ± 1.1	12.8 ± 0.9	11.9 ± 0.5
D-34	18.6 ± 0.9	14.7 ± 1.6	13.7 ± 0.9	11.4 ± 0.8
D-35	20.6 ± 0.8	13.9 ± 1.6	14.4 ± 0.8	11.8 ± 0.7
D-36	20.9 ± 0.7	14.6 ± 1.4	15.0 ± 1.0	12.2 ± 0.8
D-37	22.5 ± 1.5	15.0 ± 1.2	17.0 ± 1.5	12.5 ± 0.9
D-38	22.3 ± 1.1	17.9 ± 1.7	16.4 ± 1.4	16.0 ± 0.8
D-39	22.5 ± 1.3	17.8 ± 1.3	ND[a]	15.0 ± 0.7
D-40	21.1 ± 0.7	14.4 ± 1.4	16.2 ± 1.1	14.3 ± 0.7
D-41	23.3 ± 1.3	16.9 ± 1.7	19.3 ± 1.7	17.5 ± 1.2
D-42	19.9 ± 1.0	15.5 ± 1.5	ND[a]	17.2 ± 1.1
Mean ± s.d.	21.1 ± 1.6	15.5 ± 1.4	15.6 ± 2.1	14.0 ± 2.3
ISFSI Fenceline				
D-161	52.0 ± 3.3	41.1 ± 2.1	47.9 ± 3.2	69.5 ± 4.3
D-162	22.2 ± 0.7	15.0 ± 1.5	17.8 ± 1.3	20.0 ± 1.2
D-163	48.3 ± 1.5	37.0 ± 1.3	48.1 ± 1.1	64.4 ± 2.1
D-164	22.4 ± 0.9	15.0 ± 2.1	16.7 ± 1.2	18.7 ± 1.2
Mean ± s.d.	36.2 ± 16.2	27.0 ± 14.0	32.6 ± 17.8	43.1 ± 27.6

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

Table 13. Milk samples, analyses for iodine-131 and gamma emitting isotopes.
Collection: Milk samples are collected monthly throughout the year.

Location		D-76					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-09-20				ND[a]			
02-11-20				ND[a]			
03-11-20				ND[a]			
04-14-20				ND[a]			
05-12-20				ND[a]			
06-16-20				ND[a]			
07-14-20				ND[a]			
08-11-20				ND[a]			
09-15-20				ND[a]			
10-13-20				ND[a]			
11-17-20				ND[a]			
12-15-20				ND[a]			

Location		D-110					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-09-20	DMI- 68	< 0.3	1527 ± 120	< 4.6	< 3.8	< 19.6	< 2.0
02-11-20	DMI- 315	< 0.3	1493 ± 128	< 2.6	< 2.6	< 9.4	< 1.6
03-11-20	DMI- 719	< 0.3	1475 ± 122	< 4.1	< 3.9	< 8.6	< 1.9
04-14-20	DMI- 1120	< 0.4	1472 ± 115	< 3.3	< 2.4	< 9.7	< 2.9
05-12-20	DMI- 1468	< 0.3	1334 ± 123	< 4.2	< 3.7	< 13.9	< 4.4
06-16-20	DMI- 2027	< 0.4	1505 ± 119	< 4.2	< 3.0	< 8.0	< 4.0
07-14-20	DMI- 2382	< 0.3	1364 ± 110	< 3.7	< 3.2	< 13.1	< 3.0
08-11-20	DMI- 2855	< 0.4	1451 ± 119	< 3.4	< 3.5	< 14.3	< 2.4
09-15-20	DMI- 3269	< 0.3	1337 ± 107	< 3.6	< 3.9	< 14.8	< 1.0
10-13-20	DMI- 3708	< 0.3	1322 ± 115	< 4.1	< 3.5	< 16.2	< 2.0
11-17-20	DMI- 4325	< 0.2	1499 ± 119	< 4.6	< 3.8	< 16.1	< 1.9
12-15-20				ND[a]			

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

Table 13. Milk samples, analyses for iodine-131 and gamma emitting isotopes.
Collection: Milk samples are collected monthly throughout the year.

Location		D-138					
Date	Lab	Concentration (pCi/L)					
Collected	Code	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
01-09-20	DMI- 106	< 0.4	1381 ± 118	< 4.0	< 3.1	< 11.0	< 4.5
02-11-20	DMI- 316	< 0.3	1556 ± 120	< 3.7	< 3.7	< 11.2	< 1.1
03-11-20	DMI- 720	< 0.3	1346 ± 130	< 4.6	< 3.3	< 15.9	< 1.9
04-14-20	DMI- 1121	< 0.3	1413 ± 115	< 3.5	< 2.9	< 10.3	< 1.3
05-12-20	DMI- 1469	< 0.3	1483 ± 117	< 3.9	< 4.8	< 8.6	< 2.8
06-16-20	DMI- 2028	< 0.4	1575 ± 116	< 3.6	< 4.4	< 9.8	< 2.7
07-14-20	DMI- 2383	< 0.3	1479 ± 110	< 3.1	< 3.1	< 10.0	< 1.0
08-11-20	DMI- 2856			ND[a]			
09-15-20				ND[a]			
10-13-20				ND[a]			
11-17-20				ND[a]			
12-15-20				ND[a]			

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

Table 14. Well water samples, analyses for gamma emitting isotopes iodine-131 and tritium.
Collection: Monthly
Units: pCi/L

Location	D-52 Drinking Water			
Lab Code	DWW- 113	HP Breakroom DWW- 352	PSC DWW- 353	T.C. DWW- 354
Date Collected	01-14-20	02-11-20	02-11-20	02-11-20
H-3	< 158	< 154	< 154	< 154
I-131	< 0.3	< 0.3	< 0.3	< 0.3
Mn-54	< 3.4	< 3.7	< 1.4	< 1.7
Fe-59	< 6.3	< 4.7	< 4.7	< 2.9
Co-58	< 3.1	< 2.3	< 3.1	< 1.8
Co-60	< 2.4	< 3.0	< 3.3	< 1.6
Zn-65	< 4.8	< 4.8	< 5.2	< 1.8
Nb-95	< 4.6	< 1.9	< 2.3	< 1.5
Zr-95	< 3.9	< 4.0	< 4.5	< 2.9
I-131	< 3.5	< 2.9	< 4.8	< 2.1
Cs-134	< 3.2	< 3.5	< 3.6	< 2.1
Cs-137	< 2.2	< 4.0	< 2.3	< 1.7
Ba-140	< 17.5	< 15.3	< 11.4	< 9.1
La-140	< 3.0	< 1.8	< 1.7	< 2.2
	PSC		W.C.C.	PSC
Lab Code	DWW- 697	DWW- 1122	DWW- 1496	DWW- 1999
Date Collected	03-09-20	04-14-20	05-14-20	06-11-20
H-3	< 151	< 158	< 153	< 156
I-131	< 0.3	< 0.3	< 0.3	< 0.3
Mn-54	< 4.1	< 4.1	< 4.1	< 3.3
Fe-59	< 6.0	< 6.8	< 6.5	< 5.7
Co-58	< 2.5	< 2.2	< 3.0	< 2.9
Co-60	< 3.3	< 3.1	< 2.9	< 3.4
Zn-65	< 7.7	< 3.6	< 8.8	< 3.7
Nb-95	< 2.6	< 2.5	< 3.6	< 3.1
Zr-95	< 6.3	< 4.4	< 4.4	< 4.2
I-131	< 4.2	< 2.5	< 3.1	< 2.8
Cs-134	< 3.5	< 3.5	< 3.8	< 3.6
Cs-137	< 3.5	< 3.7	< 3.3	< 3.5
Ba-140	< 10.3	< 13.3	< 10.0	< 11.1
La-140	< 1.3	< 1.5	< 4.3	< 4.5

Table 14. Well water samples, analyses for gamma emitting isotopes iodine-131 and tritium.
Collection: Monthly
Units: pCi/L

Location	D-52 Drinking Water			
Lab Code	DWW- 2479	ND[a]	DWW- 3270	DWW- 3807
Date Collected	07-14-20	08-17-20	09-14-20	10-15-20
H-3	< 159	-	< 159	< 157
I-131	< 0.3	-	< 0.2	< 0.3
Mn-54	< 3.3	-	< 3.3	< 2.5
Fe-59	< 4.7	-	< 5.1	< 5.2
Co-58	< 2.2	-	< 0.7	< 1.8
Co-60	< 2.2	-	< 1.6	< 2.4
Zn-65	< 4.0	-	< 7.4	< 2.7
Nb-95	< 1.3	-	< 3.3	< 2.6
Zr-95	< 3.9	-	< 5.0	< 4.4
I-131	< 3.2	-	< 4.6	< 8.1
Cs-134	< 3.0	-	< 3.8	< 3.9
Cs-137	< 3.0	-	< 3.6	< 4.0
Ba-140	< 10.2	-	< 8.2	< 11.9
La-140	< 2.4	-	< 1.9	< 3.3

Lab Code	DWW- 4352	DWW- 4651
Date Collected	11-17-20	12-16-20
H-3	< 160	< 161
I-131	< 0.3	< 0.4
Mn-54	< 1.7	< 3.9
Fe-59	< 5.8	< 3.9
Co-58	< 2.1	< 3.7
Co-60	< 2.4	< 4.5
Zn-65	< 5.3	< 7.9
Nb-95	< 4.2	< 2.4
Zr-95	< 5.2	< 4.5
I-131	< 3.7	< 4.4
Cs-134	< 3.5	< 4.7
Cs-137	< 2.3	< 3.2
Ba-140	< 10.7	< 9.8
La-140	< 2.2	< 3.2

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

Table 14. 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- 114	DWW- 271	DWW- 698	DWW- 1188
Date Collected	01-14-20	02-06-20	03-09-20	04-15-20
H-3	< 158	< 154	< 151	< 156
I-131	< 0.3	< 0.4	< 0.3	< 0.4
Mn-54	< 1.5	< 1.7	< 2.6	< 1.5
Fe-59	< 4.1	< 4.5	< 4.3	< 2.7
Co-58	< 2.2	< 1.6	< 2.1	< 1.6
Co-60	< 2.5	< 2.3	< 2.7	< 1.9
Zn-65	< 2.0	< 5.3	< 2.4	< 4.8
Nb-95	< 3.3	< 2.9	< 3.8	< 1.7
Zr-95	< 4.2	< 5.4	< 5.5	< 2.9
I-131	< 4.3	< 4.2	< 2.9	< 2.6
Cs-134	< 3.3	< 3.4	< 3.7	< 2.3
Cs-137	< 2.9	< 3.0	< 4.0	< 2.3
Ba-140	< 11.8	< 11.0	< 10.0	< 8.3
La-140	< 1.3	< 1.4	< 3.5	< 1.2

Lab Code	DWW- 1497	DWW- 2000	DWW- 2480	DWW- 2998
Date Collected	05-14-20	06-11-20	07-14-20	08-17-20
H-3	< 153	< 156	< 159	< 156
I-131	< 0.3	< 0.4	< 0.3	< 0.4
Mn-54	< 2.2	< 2.2	< 1.9	< 2.3
Fe-59	< 7.7	< 2.6	< 1.7	< 4.6
Co-58	< 2.6	< 0.7	< 1.1	< 1.8
Co-60	< 2.2	< 1.7	< 1.5	< 1.9
Zn-65	< 7.8	< 1.5	< 2.1	< 4.8
Nb-95	< 2.3	< 1.4	< 1.6	< 3.4
Zr-95	< 3.5	< 2.7	< 2.6	< 5.2
I-131	< 4.9	< 3.6	< 2.9	< 7.0
Cs-134	< 4.0	< 2.1	< 2.1	< 3.1
Cs-137	< 2.2	< 2.3	< 2.5	< 2.5
Ba-140	< 10.3	< 11.6	< 8.9	< 10.6
La-140	< 3.7	< 1.2	< 1.6	< 3.5

Table 14. 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- 3271	DWW- 3808	DWW- 4353	DWW- 4652
Date Collected	09-14-20	10-15-20	11-17-20	12-16-20
H-3	< 159	< 157	< 160	< 161
I-131	< 0.4	< 0.3	< 0.2	< 0.5
Mn-54	< 4.1	< 2.8	< 3.7	< 5.6
Fe-59	< 4.3	< 2.8	< 7.2	< 11.9
Co-58	< 3.0	< 1.4	< 3.1	< 6.3
Co-60	< 3.8	< 2.8	< 2.7	< 3.8
Zn-65	< 6.0	< 5.9	< 3.9	< 16.6
Nb-95	< 2.8	< 2.5	< 3.4	< 9.3
Zr-95	< 8.9	< 5.3	< 7.3	< 6.5
I-131	< 5.0	< 6.5	< 7.0	< 9.3
Cs-134	< 4.0	< 3.8	< 4.9	< 6.4
Cs-137	< 5.0	< 3.3	< 3.6	< 5.3
Ba-140	< 17.0	< 13.5	< 16.0	< 30.5
La-140	< 1.6	< 3.3	< 2.3	< 6.6

Table 14. 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- 115	DWW- 272	DWW- 699	DWW- 1189
Date Collected	01-14-20	02-06-20	03-09-20	04-15-20
H-3	< 158	< 154	< 151	< 156
I-131	< 0.4	< 0.5	< 0.3	< 0.4
Mn-54	< 2.3	< 3.2	< 3.5	< 4.0
Fe-59	< 3.3	< 3.9	< 3.7	< 8.9
Co-58	< 2.3	< 3.4	< 2.3	< 3.7
Co-60	< 2.8	< 2.3	< 2.5	< 2.3
Zn-65	< 5.1	< 6.8	< 5.2	< 7.1
Nb-95	< 5.8	< 6.2	< 2.4	< 5.0
Zr-95	< 7.1	< 7.6	< 5.6	< 4.1
I-131	< 4.5	< 3.1	< 3.8	< 3.1
Cs-134	< 4.3	< 4.3	< 3.9	< 4.1
Cs-137	< 3.7	< 4.7	< 2.8	< 3.0
Ba-140	< 13.5	< 17.1	< 14.2	< 8.0
La-140	< 3.2	< 4.3	< 2.8	< 1.7
Lab Code	DWW- 1498	DWW- 2002	DWW- 2481	DWW- 2999
Date Collected	05-14-20	06-11-20	07-14-20	08-17-20
H-3	< 153	< 156	< 159	< 156
I-131	< 0.3	< 0.3	< 0.3	< 0.4
Mn-54	< 3.0	< 3.4	< 3.9	< 3.2
Fe-59	< 4.7	< 6.5	< 4.8	< 5.5
Co-58	< 2.8	< 2.6	< 4.9	< 1.8
Co-60	< 2.3	< 2.8	< 3.6	< 3.2
Zn-65	< 3.2	< 2.0	< 4.5	< 4.2
Nb-95	< 4.4	< 3.4	< 3.3	< 3.5
Zr-95	< 5.2	< 6.0	< 6.6	< 3.6
I-131	< 3.5	< 4.4	< 4.6	< 6.7
Cs-134	< 3.3	< 3.3	< 4.4	< 3.9
Cs-137	< 2.0	< 3.2	< 2.7	< 2.9
Ba-140	< 13.2	< 8.3	< 16.9	< 8.9
La-140	< 3.7	< 4.1	< 3.8	< 5.6

Table 14. 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- 3272	DWW- 3809	DWW- 4354	DWW- 4653
Date Collected	09-14-20	10-15-20	11-17-20	12-16-20
H-3	< 159	< 157	< 160	< 161
I-131	< 0.5	< 0.5	< 0.3	< 0.4
Mn-54	< 3.7	< 4.6	< 4.7	< 2.0
Fe-59	< 5.5	< 5.7	< 4.3	< 4.7
Co-58	< 2.3	< 3.6	< 5.2	< 2.1
Co-60	< 3.6	< 3.0	< 2.8	< 1.7
Zn-65	< 5.7	< 8.9	< 9.7	< 4.8
Nb-95	< 2.6	< 6.2	< 3.2	< 4.4
Zr-95	< 6.0	< 8.1	< 9.4	< 4.2
I-131	< 4.4	< 7.3	< 6.5	< 5.2
Cs-134	< 4.4	< 5.3	< 5.4	< 3.6
Cs-137	< 3.1	< 4.8	< 4.8	< 3.1
Ba-140	< 11.1	< 16.6	< 13.4	< 12.6
La-140	< 3.1	< 2.4	< 5.1	< 1.8

Table 14. 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- 273	DWW- 1187	DWW- 3000	DWW- 4355
Date Collected	02-06-20	04-14-20	08-17-20	11-17-20
H-3	< 154	< 156	< 156	< 160
I-131	< 0.5	< 0.3	< 0.3	< 0.3
Mn-54	< 2.2	< 2.5	< 3.2	< 3.2
Fe-59	< 3.9	< 6.1	< 4.7	< 7.2
Co-58	< 2.1	< 3.4	< 3.4	< 1.9
Co-60	< 1.7	< 2.4	< 2.2	< 2.6
Zn-65	< 4.7	< 8.7	< 8.0	< 2.6
Nb-95	< 1.7	< 4.8	< 4.0	< 3.1
Zr-95	< 3.9	< 6.1	< 3.7	< 4.6
I-131	< 3.3	< 4.1	< 3.8	< 6.2
Cs-134	< 2.6	< 3.6	< 4.4	< 4.1
Cs-137	< 2.3	< 3.2	< 1.9	< 4.7
Ba-140	< 8.7	< 15.2	< 12.7	< 12.9
La-140	< 2.4	< 2.1	< 2.3	< 5.0

Location	D-57 Untreated Drinking Water			
Lab Code	DWW- 274	DWW- 1123	DWW- 2886	DWW- 4326
Date Collected	02-06-20	04-14-20	08-17-20	11-17-20
H-3	< 154	< 158	< 159	< 157
I-131	< 0.3	< 0.4	< 0.2	< 0.3
Mn-54	< 3.0	< 2.6	< 2.5	< 2.2
Fe-59	< 4.0	< 5.4	< 7.0	< 5.0
Co-58	< 3.6	< 2.5	< 3.4	< 3.8
Co-60	< 3.0	< 2.8	< 2.7	< 3.1
Zn-65	< 4.9	< 5.9	< 4.7	< 2.8
Nb-95	< 2.9	< 4.4	< 3.4	< 4.5
Zr-95	< 3.9	< 7.5	< 5.0	< 6.3
I-131	< 3.6	< 3.3	< 3.1	< 2.5
Cs-134	< 3.9	< 4.2	< 3.6	< 4.5
Cs-137	< 3.1	< 4.4	< 3.1	< 2.1
Ba-140	< 12.9	< 8.3	< 9.3	< 18.6
La-140	< 2.0	< 4.2	< 2.0	< 3.5

Table 14. 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- 275	DWW- 1124	DWW- 2887	DWW- 4327
Date Collected	02-06-20	04-14-20	08-17-20	11-17-20
H-3	< 154	< 158	< 159	< 157
I-131	< 0.3	< 0.5	< 0.2	< 0.3
Mn-54	< 1.3	< 1.1	< 1.8	< 4.4
Fe-59	< 6.4	< 3.7	< 6.3	< 3.3
Co-58	< 3.1	< 1.4	< 1.9	< 4.5
Co-60	< 1.4	< 2.0	< 2.3	< 4.5
Zn-65	< 6.8	< 3.1	< 6.1	< 8.4
Nb-95	< 2.9	< 2.2	< 2.7	< 4.3
Zr-95	< 5.6	< 4.0	< 4.1	< 6.3
I-131	< 4.3	< 2.7	< 3.5	< 3.9
Cs-134	< 3.9	< 2.6	< 4.0	< 4.8
Cs-137	< 2.4	< 2.6	< 2.7	< 4.8
Ba-140	< 12.0	< 7.6	< 10.8	< 12.5
La-140	< 1.7	< 1.6	< 2.9	< 4.0

Location	D-72(C) Untreated Drinking Water			
Lab Code	DWW- 276	DWW- 1125	DWW- 2888	DWW- 4328
Date Collected	02-06-20	04-14-20	08-17-20	11-17-20
H-3	< 154	< 158	< 159	< 157
I-131	< 0.5	< 0.3	< 0.3	< 0.3
Mn-54	< 2.1	< 2.7	< 4.3	< 2.6
Fe-59	< 3.1	< 4.1	< 5.2	< 4.4
Co-58	< 1.8	< 1.7	< 4.3	< 2.6
Co-60	< 2.9	< 1.4	< 4.2	< 1.6
Zn-65	< 4.5	< 3.6	< 4.2	< 6.5
Nb-95	< 1.8	< 3.3	< 3.2	< 4.6
Zr-95	< 3.4	< 4.8	< 7.3	< 4.1
I-131	< 2.4	< 3.6	< 3.7	< 4.2
Cs-134	< 2.6	< 3.4	< 4.7	< 3.2
Cs-137	< 1.9	< 3.8	< 2.3	< 2.6
Ba-140	< 8.6	< 8.4	< 14.2	< 11.7
La-140	< 3.0	< 2.8	< 5.8	< 2.4

Table 15. Vegetation (broadleaf), analyses for iodine-131 and other gamma-emitting isotopes.
Collection: Annually
Units: pCi/g wet

Location	D-118	D-58	D-58	D-58
Lab Code	DVE- 2494	DVE- 2496	DVE- 2497	DVE- 2498
Date Collected	07-16-20	07-16-20	07-16-20	07-16-20
Sample Type	Cabbage	Cucumber Leaves	Pumpkin Leaves	Letuce
K-40	2.08 ± 0.26	4.31 ± 0.58	3.69 ± 0.66	5.03 ± 0.72
Mn-54	< 0.010	< 0.020	< 0.027	< 0.021
Fe-59	< 0.012	< 0.026	< 0.042	< 0.047
Co-58	< 0.008	< 0.013	< 0.016	< 0.015
Co-60	< 0.005	< 0.018	< 0.027	< 0.026
Zn-65	< 0.014	< 0.030	< 0.059	< 0.069
Nb-95	< 0.008	< 0.011	< 0.032	< 0.030
Zr-95	< 0.011	< 0.041	< 0.037	< 0.038
Ru-103	< 0.005	< 0.024	< 0.029	< 0.025
Ru-106	< 0.063	< 0.189	< 0.218	< 0.151
I-131	< 0.013	< 0.034	< 0.032	< 0.036
Cs-134	< 0.011	< 0.022	< 0.031	< 0.025
Cs-137	< 0.008	< 0.016	< 0.026	< 0.027
Ce-141	< 0.019	< 0.034	< 0.029	< 0.040
Ce-144	< 0.087	< 0.114	< 0.162	< 0.110

Location	D-57	D-110	D-138 (C)
Lab Code	DVE- 3083	DVE- 3084	DVE- 3087
Date Collected	08-28-20	08-28-20	08-28-20
Sample Type	Rhubarb Leaves	Rhubarb Leaves	Rhubarb Leaves
K-40	4.93 ± 0.47	3.36 ± 0.31	3.45 ± 0.34
Mn-54	< 0.013	< 0.009	< 0.011
Fe-59	< 0.022	< 0.018	< 0.021
Co-58	< 0.010	< 0.008	< 0.007
Co-60	< 0.019	< 0.011	< 0.017
Zn-65	< 0.029	< 0.015	< 0.023
Nb-95	< 0.012	< 0.009	< 0.008
Zr-95	< 0.022	< 0.014	< 0.015
Ru-103	< 0.012	< 0.009	< 0.008
Ru-106	< 0.113	< 0.078	< 0.071
I-131	< 0.020	< 0.015	< 0.013
Cs-134	< 0.019	< 0.014	< 0.013
Cs-137	< 0.013	< 0.009	< 0.008
Ce-141	< 0.019	< 0.014	< 0.014
Ce-144	< 0.075	< 0.055	< 0.056

Table 15. Vegetation (broadleaf), analyses for iodine-131 and other gamma-emitting isotopes.
Collection: Annually
Units: pCi/g wet

Location	D-59	D-59	D-59	D-59
Lab Code	DVE- 3162	DVE- 3163	DVE- 3164	DVE- 3165
Date Collected	09-04-20	09-04-20	09-04-20	09-04-20
Sample Type	Green Leafy [a]	Cucumber leaves [a]	Pumpkin leaves [a]	Green Leafy
K-40	4.88 ± 0.47	3.15 ± 0.45	5.43 ± 0.60	3.07 ± 0.38
Mn-54	< 0.022	< 0.032	< 0.020	< 0.012
Fe-59	< 0.044	< 0.054	< 0.074	< 0.024
Co-58	< 0.030	< 0.022	< 0.034	< 0.012
Co-60	< 0.013	< 0.014	< 0.035	< 0.017
Zn-65	< 0.051	< 0.056	< 0.060	< 0.012
Nb-95	< 0.030	< 0.036	< 0.036	< 0.013
Zr-95	< 0.046	< 0.037	< 0.040	< 0.021
Ru-103	< 0.026	< 0.031	< 0.025	< 0.011
Ru-106	< 0.222	< 0.273	< 0.284	< 0.102
I-131	< 0.059	< 0.055	< 0.047	< 0.021
Cs-134	< 0.022	< 0.026	< 0.029	< 0.016
Cs-137	< 0.026	< 0.031	< 0.019	< 0.010
Ce-141	< 0.026	< 0.046	< 0.043	< 0.020
Ce-144	< 0.120	< 0.170	< 0.184	< 0.072

Location	D-59
Lab Code	DVE- 3166
Date Collected	09-04-20
Sample Type	Green Leafy [a]
K-40	4.80 ± 0.59
Mn-54	< 0.017
Fe-59	< 0.034
Co-58	< 0.016
Co-60	< 0.024
Zn-65	< 0.036
Nb-95	< 0.020
Zr-95	< 0.030
Ru-103	< 0.019
Ru-106	< 0.157
I-131	< 0.039
Cs-134	< 0.026
Cs-137	< 0.017
Ce-141	< 0.029
Ce-144	< 0.102

[a] Sample size less than 100 g.

Table 16. Vegetation (hay and grain), analyses for gamma-emitting isotopes.
Collection: Annually
Units: pCi/g wet

Location	D-16	D-57	D-57	D-96	D-96
Lab Code	DVE- 3747	DVE- 3082	DVE- 3748	DVE- 3750	DVE- 3751
Date Collected	10-12-20	08-28-20	10-12-20	10-12-20	10-12-20
Sample Type	Corn	Hay	Corn	Beans	Hay
K-40	2.77 ± 0.29	21.02 ± 1.37	2.88 ± 0.26	16.86 ± 0.69	8.80 ± 0.44
Mn-54	< 0.009	< 0.023	< 0.012	< 0.014	< 0.021
Fe-59	< 0.027	< 0.112	< 0.024	< 0.026	< 0.036
Co-58	< 0.009	< 0.023	< 0.010	< 0.014	< 0.017
Co-60	< 0.009	< 0.050	< 0.007	< 0.009	< 0.017
Zn-65	< 0.012	< 0.113	< 0.009	< 0.034	< 0.038
Nb-95	< 0.008	< 0.037	< 0.014	< 0.018	< 0.019
Zr-95	< 0.017	< 0.046	< 0.016	< 0.041	< 0.023
Ru-103	< 0.012	< 0.026	< 0.011	< 0.018	< 0.018
Ru-106	< 0.110	< 0.330	< 0.049	< 0.136	< 0.111
I-131	< 0.045	< 0.053	< 0.059	< 0.047	< 0.032
Cs-134	< 0.011	< 0.045	< 0.010	< 0.014	< 0.019
Cs-137	< 0.006	< 0.032	< 0.011	< 0.013	< 0.021
Ce-141	< 0.018	< 0.067	< 0.018	< 0.023	< 0.042
Ce-144	< 0.057	< 0.282	< 0.073	< 0.092	< 0.114

Location	D-110	D-110	D-138 (C)	D-138 (C)
Lab Code	DVE- 3086	DVE- 3752	DVE- 3088	DVE- 3753
Date Collected	08-28-20	10-12-20	08-28-20	10-12-20
Sample Type	Hay	Corn	Hay	Corn
K-40	20.13 ± 1.12	2.61 ± 0.22	11.45 ± 0.94	2.89 ± 0.26
Mn-54	< 0.024	< 0.007	< 0.028	< 0.008
Fe-59	< 0.049	< 0.014	< 0.028	< 0.022
Co-58	< 0.028	< 0.008	< 0.021	< 0.010
Co-60	< 0.031	< 0.005	< 0.019	< 0.010
Zn-65	< 0.061	< 0.017	< 0.074	< 0.013
Nb-95	< 0.029	< 0.010	< 0.035	< 0.013
Zr-95	< 0.047	< 0.007	< 0.048	< 0.011
Ru-103	< 0.021	< 0.010	< 0.027	< 0.009
Ru-106	< 0.175	< 0.066	< 0.149	< 0.076
I-131	< 0.043	< 0.055	< 0.041	< 0.049
Cs-134	< 0.031	< 0.008	< 0.033	< 0.009
Cs-137	< 0.034	< 0.007	< 0.023	< 0.007
Ce-141	< 0.044	< 0.017	< 0.059	< 0.016
Ce-144	< 0.197	< 0.045	< 0.266	< 0.070

Table 17. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.

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

Lab Code	DSW- 116	DSW- 508	DSW- 790	DSW- 1190	DSW- 1564	DSW- 2039
Date Collected	01-14-20	02-25-20	03-17-20	04-15-20	05-18-20	06-17-20
H-3	< 158	< 157	< 159	< 156	< 158	< 156
I-131(Chemistry)	< 0.3	< 0.5	< 0.3	< 0.3	< 0.3	< 0.3
Mn-54	< 2.9	< 2.2	< 3.1	< 2.9	< 3.2	< 2.9
Fe-59	< 7.1	< 4.9	< 2.4	< 7.0	< 4.1	< 4.1
Co-58	< 3.9	< 3.5	< 1.7	< 2.2	< 3.5	< 3.6
Co-60	< 2.6	< 2.2	< 2.5	< 3.2	< 2.3	< 1.3
Zn-65	< 4.8	< 6.6	< 3.2	< 3.9	< 4.6	< 7.2
Nb-95	< 3.5	< 1.7	< 3.7	< 3.2	< 3.5	< 2.2
Zr-95	< 6.0	< 3.3	< 6.6	< 7.3	< 3.8	< 4.8
I-131	< 3.8	< 4.0	< 3.0	< 3.6	< 2.2	< 4.5
Cs-134	< 4.2	< 3.4	< 3.3	< 3.9	< 3.3	< 3.5
Cs-137	< 4.2	< 3.1	< 4.0	< 4.1	< 2.7	< 3.0
Ba-140	< 13.6	< 10.1	< 9.0	< 10.7	< 12.5	< 8.8
La-140	< 2.6	< 3.1	< 1.6	< 4.2	< 4.4	< 2.8

Lab Code	DSW- 2487	DSW- 2986	DSW- 3355	DSW- 3675	DSW- 4274	DSW- 4646
Date Collected	07-16-20	08-19-20	09-17-20	10-08-20	11-12-20	12-14-20
H-3	< 159	< 156	< 158	< 158	< 157	< 161
I-131(Chemistry)	< 0.4	< 0.3	< 0.4	< 0.3	< 0.4	< 0.4
Mn-54	< 2.2	< 2.4	< 3.0	< 2.8	< 4.4	< 3.0
Fe-59	< 5.2	< 2.3	< 4.1	< 3.7	< 2.3	< 2.5
Co-58	< 2.1	< 3.9	< 2.6	< 2.2	< 2.1	< 2.4
Co-60	< 1.5	< 3.5	< 4.2	< 2.9	< 3.1	< 1.6
Zn-65	< 4.5	< 8.7	< 7.2	< 3.9	< 5.1	< 2.5
Nb-95	< 2.0	< 6.2	< 4.6	< 3.3	< 3.7	< 1.8
Zr-95	< 5.7	< 5.3	< 6.8	< 5.4	< 5.1	< 3.8
I-131	< 4.7	< 3.8	< 6.5	< 6.1	< 5.0	< 4.3
Cs-134	< 3.5	< 4.4	< 3.7	< 3.6	< 3.8	< 2.9
Cs-137	< 3.1	< 4.6	< 2.6	< 3.5	< 2.8	< 3.0
Ba-140	< 14.4	< 23.0	< 16.6	< 18.6	< 13.7	< 9.0
La-140	< 1.4	< 4.6	< 3.2	< 3.2	< 2.6	< 3.0

Table 17. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-50

Lab Code	DSW- 117	DSW- 509	DSW- 791	DSW- 1191	DSW- 1565	DSW- 2040
Date Collected	01-14-20	02-25-20	03-17-20	04-15-20	05-18-20	06-17-20
H-3	< 158	< 157	< 159	< 156	< 158	< 156
Mn-54	< 3.0	< 3.6	< 2.3	< 2.0	< 3.8	< 3.3
Fe-59	< 4.7	< 4.2	< 4.7	< 5.2	< 8.3	< 11.3
Co-58	< 3.8	< 4.1	< 2.1	< 3.2	< 3.3	< 5.6
Co-60	< 3.9	< 2.8	< 1.5	< 2.1	< 3.8	< 4.3
Zn-65	< 12.5	< 6.6	< 6.0	< 5.5	< 10.8	< 10.7
Nb-95	< 2.8	< 2.6	< 2.2	< 3.0	< 5.0	< 5.6
Zr-95	< 5.8	< 4.2	< 5.8	< 3.5	< 6.7	< 5.3
I-131	< 5.2	< 6.7	< 3.4	< 4.6	< 6.5	< 5.1
Cs-134	< 4.0	< 3.8	< 3.4	< 3.5	< 4.8	< 4.7
Cs-137	< 3.9	< 4.4	< 2.9	< 2.6	< 3.1	< 4.7
Ba-140	< 13.6	< 18.5	< 19.4	< 15.9	< 13.8	< 9.9
La-140	< 2.4	< 1.9	< 1.9	< 2.8	< 7.2	< 4.8

Lab Code	DSW- 2488	DSW- 2987	DSW- 3356	DSW- 3676	DSW- 4275	DSW- 4647
Date Collected	07-16-20	08-19-20	09-17-20	10-08-20	11-12-20	12-14-20
H-3	< 159	< 156	< 158	< 158	< 157	< 161
Mn-54	< 1.8	< 4.6	< 5.5	< 4.3	< 4.8	< 6.8
Fe-59	< 3.4	< 7.1	< 7.6	< 9.4	< 9.4	< 8.0
Co-58	< 1.8	< 2.6	< 3.9	< 3.3	< 3.6	< 3.9
Co-60	< 1.6	< 4.0	< 4.6	< 3.5	< 2.3	< 3.4
Zn-65	< 3.0	< 11.0	< 10.1	< 2.9	< 8.0	< 19.2
Nb-95	< 1.4	< 3.8	< 5.5	< 3.0	< 6.2	< 10.8
Zr-95	< 2.4	< 6.8	< 10.8	< 7.4	< 8.1	< 12.4
I-131	< 3.5	< 8.6	< 7.8	< 7.3	< 12.9	< 13.7
Cs-134	< 2.2	< 4.7	< 5.2	< 4.5	< 4.7	< 6.8
Cs-137	< 2.7	< 2.9	< 3.2	< 3.1	< 4.4	< 6.8
Ba-140	< 10.9	< 22.7	< 26.4	< 24.2	< 22.5	< 34.5
La-140	< 1.7	< 7.4	< 4.1	< 5.7	< 5.0	< 10.7

Table 17. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-51

Lab Code	DSW- 118	DSW- 510	DSW- 792	DSW- 1192	DSW- 1566	DSW- 2041
Date Collected	01-14-20	02-25-20	03-17-20	04-15-20	05-18-20	06-17-20
H-3	< 158	< 157	< 159	< 156	< 158	< 156
Mn-54	< 2.4	< 2.7	< 2.9	< 2.1	< 1.7	< 2.7
Fe-59	< 4.8	< 3.6	< 5.2	< 2.9	< 4.4	< 5.2
Co-58	< 1.6	< 2.9	< 3.7	< 1.9	< 2.6	< 2.8
Co-60	< 1.5	< 2.6	< 2.8	< 1.7	< 2.9	< 3.9
Zn-65	< 1.5	< 5.0	< 3.2	< 6.7	< 5.5	< 5.1
Nb-95	< 3.3	< 2.4	< 6.8	< 3.1	< 4.2	< 2.9
Zr-95	< 4.7	< 4.8	< 7.6	< 3.6	< 3.3	< 4.8
I-131	< 4.4	< 3.4	< 8.1	< 3.6	< 6.0	< 5.2
Cs-134	< 3.0	< 3.5	< 4.6	< 2.9	< 3.5	< 4.0
Cs-137	< 3.0	< 2.6	< 3.8	< 2.0	< 3.2	< 2.1
Ba-140	< 11.5	< 12.4	< 10.0	< 13.1	< 16.6	< 12.1
La-140	< 3.8	< 3.7	< 3.4	< 1.9	< 5.7	< 3.9

Lab Code	DSW- 2489	NS[a]	DSW- 3357	NS[a]	DSW- 4276	DSW- 4648
Date Collected	07-16-20	08-19-20	09-17-20	10-08-20	11-12-20	12-14-20
H-3	< 159	-	< 158	-	< 157	< 161
Mn-54	< 2.1	-	< 3.8	-	< 4.7	< 3.4
Fe-59	< 3.6	-	< 8.2	-	< 4.6	< 7.1
Co-58	< 1.4	-	< 4.5	-	< 4.4	< 3.8
Co-60	< 1.4	-	< 2.8	-	< 4.1	< 5.2
Zn-65	< 3.2	-	< 6.1	-	< 3.0	< 5.4
Nb-95	< 1.9	-	< 2.1	-	< 3.2	< 4.2
Zr-95	< 3.4	-	< 6.7	-	< 5.4	< 7.1
I-131	< 3.1	-	< 8.5	-	< 10.7	< 8.9
Cs-134	< 2.1	-	< 4.5	-	< 5.0	< 5.1
Cs-137	< 1.6	-	< 3.2	-	< 3.6	< 4.9
Ba-140	< 10.7	-	< 19.5	-	< 30.2	< 21.6
La-140	< 2.0	-	< 4.9	-	< 3.8	< 4.1

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

Table 17. Surface water samples, analyses for iodine-131, tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-61

Lab Code	DSW- 119	DSW- 511	DSW- 793	DSW- 1193	DSW- 1567	DSW- 2042
Date Collected	01-14-20	02-25-20	03-17-20	04-15-20	05-18-20	06-17-20
H-3	< 158	< 157	< 159	< 156	< 158	< 156
I-131(Chemistry)	< 0.3	< 0.5	< 0.5	< 0.4	< 0.4	< 0.3
Mn-54	< 2.4	< 2.2	< 3.2	< 2.1	< 2.5	< 2.4
Fe-59	< 5.5	< 3.0	< 4.6	< 4.7	< 4.4	< 4.7
Co-58	< 1.6	< 2.0	< 1.9	< 2.5	< 2.8	< 1.9
Co-60	< 2.5	< 1.3	< 2.6	< 2.8	< 2.4	< 2.4
Zn-65	< 7.5	< 1.7	< 3.7	< 2.8	< 3.6	< 5.8
Nb-95	< 2.5	< 1.4	< 3.1	< 2.6	< 4.0	< 2.3
Zr-95	< 3.8	< 3.1	< 6.1	< 6.3	< 5.0	< 3.1
I-131	< 4.8	< 2.7	< 5.7	< 4.2	< 2.8	< 3.2
Cs-134	< 4.3	< 2.7	< 3.3	< 3.8	< 3.8	< 3.1
Cs-137	< 3.4	< 2.6	< 3.7	< 2.9	< 2.2	< 3.4
Ba-140	< 12.9	< 7.4	< 9.1	< 11.8	< 7.5	< 12.1
La-140	< 1.4	< 2.4	< 1.9	< 3.6	< 3.5	< 2.5

Lab Code	DSW- 2490	NS[a]	DSW- 3358	DSW- 3677	DSW- 4277	DSW- 4649
Date Collected	07-16-20	08-19-20	09-17-20	10-08-20	11-12-20	12-14-20
H-3	< 159	-	< 158	< 158	< 157	< 161
I-131(Chemistry)	< 0.4	-	< 0.3	< 0.4	< 0.3	< 0.4
		-				
Mn-54	< 3.0	-	< 1.7	< 3.1	< 3.1	< 3.2
Fe-59	< 7.0	-	< 3.7	< 6.5	< 3.2	< 5.2
Co-58	< 3.9	-	< 2.5	< 3.1	< 3.9	< 3.6
Co-60	< 3.6	-	< 2.3	< 1.0	< 5.3	< 1.0
Zn-65	< 9.9	-	< 4.1	< 5.9	< 4.7	< 6.0
Nb-95	< 4.4	-	< 2.6	< 3.7	< 2.5	< 2.5
Zr-95	< 6.4	-	< 3.1	< 5.7	< 7.8	< 5.8
I-131	< 3.8	-	< 3.9	< 7.2	< 5.0	< 6.7
Cs-134	< 5.1	-	< 3.3	< 3.9	< 4.8	< 4.1
Cs-137	< 4.1	-	< 2.0	< 3.7	< 4.7	< 3.6
Ba-140	< 15.2	-	< 13.1	< 19.5	< 22.6	< 14.8
La-140	< 2.7	-	< 2.1	< 2.7	< 3.2	< 2.7

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

Table 17. Surface water samples, analyses for tritium and gamma-emitting isotopes.
Collection: Monthly
Units: pCi/L
Location: D-99

Lab Code	DSW- 120	ND[a]	DSW- 794	DSW- 1194	DSW- 1569	DSW- 2043
Date Collected	01-14-20	02-25-20	03-17-20	04-15-20	05-18-20	06-17-20
H-3	< 158	-	< 159	< 156	< 158	< 156
Mn-54	< 3.6	-	< 2.4	< 2.7	< 1.8	< 3.7
Fe-59	< 7.1	-	< 4.4	< 6.4	< 5.3	< 9.0
Co-58	< 2.7	-	< 2.7	< 3.0	< 2.0	< 4.3
Co-60	< 2.3	-	< 1.8	< 2.2	< 1.6	< 4.5
Zn-65	< 7.0	-	< 7.5	< 6.7	< 4.1	< 7.9
Nb-95	< 5.5	-	< 2.5	< 3.9	< 2.7	< 2.7
Zr-95	< 5.1	-	< 4.7	< 5.4	< 3.7	< 5.4
I-131	< 6.1	-	< 4.4	< 6.3	< 4.7	< 4.4
Cs-134	< 4.0	-	< 3.3	< 4.1	< 2.5	< 4.9
Cs-137	< 3.5	-	< 3.4	< 3.6	< 3.0	< 3.5
Ba-140	< 15.2	-	< 11.8	< 12.5	< 10.0	< 16.3
La-140	< 5.2	-	< 1.7	< 3.5	< 2.4	< 6.2

Lab Code	DSW- 2491	NS[b]	DSW- 3359	DSW- 3678	DSW- 4278	DSW- 4650
Date Collected	07-16-20	08-19-20	09-17-20	10-08-20	11-12-20	12-14-20
H-3	< 159	-	< 158	< 158	< 157	< 161
Mn-54	< 1.7	-	< 3.9	< 3.0	< 2.6	< 3.7
Fe-59	< 2.4	-	< 11.4	< 5.7	< 3.2	< 7.1
Co-58	< 1.7	-	< 6.0	< 3.5	< 3.6	< 3.7
Co-60	< 1.4	-	< 3.8	< 4.9	< 3.3	< 3.7
Zn-65	< 1.5	-	< 14.7	< 6.9	< 4.6	< 5.8
Nb-95	< 2.3	-	< 10.2	< 4.2	< 4.8	< 3.7
Zr-95	< 2.2	-	< 9.1	< 5.7	< 7.9	< 8.4
I-131	< 2.9	-	< 8.5	< 7.2	< 10.5	< 7.6
Cs-134	< 2.3	-	< 6.5	< 4.8	< 5.0	< 5.0
Cs-137	< 2.5	-	< 6.4	< 2.9	< 5.0	< 3.8
Ba-140	< 11.3	-	< 27.7	< 18.7	< 12.8	< 26.8
La-140	< 2.0	-	< 5.9	< 3.5	< 2.9	< 5.3

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

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

Table 18. 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-834	DSW-2054	DSW-3387	DSW-4669
Sr-89	< 0.58	< 0.59	< 0.52	< 0.59
Sr-90	< 0.52	< 0.46	< 0.47	< 0.51
Location	D-61			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	DSW-835	DSW-2055	DSW-3388	DSW-4670
Sr-89	< 0.69	< 0.67	< 0.61	< 0.65
Sr-90	< 0.57	< 0.49	< 0.53	< 0.52

Table 19. Fish, analyses of edible portion for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g wet

Location	Upstream, D-49		
Lab Code	DF- 1896	DF- 1897	DF- 1898
Date Collected	06-03-20	06-03-20	06-03-20
Sample Type	Channel Catfish	Northern Pike	Largemouth Bass
K-40	2.98 ± 0.38	3.65 ± 0.46	4.14 ± 0.50
Mn-54	< 0.019	< 0.022	< 0.019
Fe-59	< 0.041	< 0.082	< 0.064
Co-58	< 0.011	< 0.016	< 0.029
Co-60	< 0.014	< 0.011	< 0.011
Zn-65	< 0.021	< 0.037	< 0.035
Nb-95	< 0.042	< 0.056	< 0.063
Zr-95	< 0.041	< 0.059	< 0.056
Ru-103	< 0.034	< 0.028	< 0.047
Ru-106	< 0.120	< 0.132	< 0.155
Cs-134	< 0.016	< 0.021	< 0.021
Cs-137	< 0.018	< 0.009	< 0.022
Ce-141	< 0.095	< 0.099	< 0.061
Ce-144	< 0.130	< 0.142	< 0.173

Location	Upstream, D-49	
Lab Code	DF- 2891	DF- 2893
Date Collected	08-14-20	08-14-20
Sample Type	Channel Catfish	White Crappie
K-40	2.82 ± 0.35	3.72 ± 0.45
Mn-54	< 0.016	< 0.015
Fe-59	< 0.051	< 0.062
Co-58	< 0.015	< 0.027
Co-60	< 0.011	< 0.012
Zn-65	< 0.017	< 0.030
Nb-95	< 0.024	< 0.042
Zr-95	< 0.028	< 0.047
Ru-103	< 0.021	< 0.040
Ru-106	< 0.114	< 0.117
Cs-134	< 0.014	< 0.015
Cs-137	< 0.006	< 0.018
Ce-141	< 0.039	< 0.053
Ce-144	< 0.077	< 0.118

Table 19. Fish, analyses of edible portion for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g wet

Location	Downstream, D-61		
Lab Code	DF- 1899	DF- 1900	DF- 1901
Date Collected	06-03-20	06-03-20	06-03-20
Sample Type	Channel Catfish	Smallmouth Bass	Northern Pike
K-40	2.97 ± 0.40	4.22 ± 0.56	3.95 ± 0.48
Mn-54	< 0.012	< 0.019	< 0.014
Fe-59	< 0.041	< 0.075	< 0.044
Co-58	< 0.015	< 0.045	< 0.017
Co-60	< 0.011	< 0.012	< 0.008
Zn-65	< 0.024	< 0.024	< 0.027
Nb-95	< 0.043	< 0.069	< 0.032
Zr-95	< 0.043	< 0.086	< 0.065
Ru-103	< 0.030	< 0.045	< 0.045
Ru-106	< 0.188	< 0.201	< 0.166
Cs-134	< 0.017	< 0.023	< 0.019
Cs-137	< 0.012	< 0.021	< 0.016
Ce-141	< 0.048	< 0.121	< 0.116
Ce-144	< 0.087	< 0.147	< 0.104

Location	Downstream, D-61	
Lab Code	DF- 2894	DF- 2895
Date Collected	08-14-20	08-14-20
Sample Type	Channel Catfish	Smallmouth Bass
K-40	3.31 ± 0.47	3.68 ± 0.53
Mn-54	< 0.021	< 0.026
Fe-59	< 0.049	< 0.066
Co-58	< 0.021	< 0.024
Co-60	< 0.016	< 0.019
Zn-65	< 0.038	< 0.027
Nb-95	< 0.055	< 0.053
Zr-95	< 0.051	< 0.032
Ru-103	< 0.048	< 0.041
Ru-106	< 0.194	< 0.193
Cs-134	< 0.024	< 0.024
Cs-137	< 0.013	< 0.012
Ce-141	< 0.069	< 0.069
Ce-144	< 0.133	< 0.118

Table 20. River sediment, analysis for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g dry

Location	D-49 (Control)	
Lab Code	DBS- 2225	DBS- 4080
Date Collected	07-02-20	10-20-20
K-40	7.16 ± 0.41	7.60 ± 0.43
Mn-54	< 0.010	< 0.013
Fe-59	< 0.042	< 0.046
Co-58	< 0.012	< 0.009
Co-60	< 0.011	< 0.005
Zn-65	< 0.025	< 0.025
Nb-95	< 0.024	< 0.017
Zr-95	< 0.027	< 0.028
Ru-103	< 0.021	< 0.021
Ru-106	< 0.075	< 0.062
Cs-134	< 0.009	< 0.009
Cs-137	< 0.010	< 0.012
Ce-141	< 0.062	< 0.041
Ce-144	< 0.056	< 0.064

Location	D-51 (Discharge)	
Lab Code	DBS- 2226	DBS- 4081
Date Collected	07-02-20	10-20-20
K-40	8.24 ± 0.45	6.90 ± 0.41
Mn-54	< 0.017	< 0.015
Fe-59	< 0.049	< 0.040
Co-58	< 0.023	< 0.019
Co-60	< 0.012	< 0.013
Zn-65	< 0.024	< 0.027
Nb-95	< 0.025	< 0.023
Zr-95	< 0.032	< 0.035
Ru-103	< 0.023	< 0.018
Ru-106	< 0.088	< 0.092
Cs-134	< 0.012	< 0.010
Cs-137	< 0.009	< 0.015
Ce-141	< 0.066	< 0.047
Ce-144	< 0.058	< 0.101

Table 20. River sediment, analysis for gamma-emitting isotopes.
Collection: Semiannually
Units: pCi/g dry

Location	D-107A (North Drainage Ditch)	
Lab Code	DBS- 2227	DBS- 4082
Date Collected	07-02-20	10-20-20
K-40	4.70 ± 0.37	4.38 ± 0.41
Mn-54	< 0.014	< 0.017
Fe-59	< 0.051	< 0.049
Co-58	< 0.015	< 0.014
Co-60	< 0.014	< 0.011
Zn-65	< 0.025	< 0.033
Nb-95	< 0.027	< 0.028
Zr-95	< 0.029	< 0.024
Ru-103	< 0.020	< 0.031
Ru-106	< 0.097	< 0.101
Cs-134	< 0.010	< 0.011
Cs-137	< 0.008	< 0.012
Ce-141	< 0.068	< 0.049
Ce-144	< 0.058	< 0.098

Table 21. Soil, analysis for tritium, strontium-90 and gamma-emitting isotopes.
Collection: Annually
Units: pCi/g dry

Location	D-15a	D-16
Lab Code	DSO- 2261	DSO- 2262
Date Collected	07-06-20	07-06-20
Sr-90	< 0.032	< 0.044
H-3 (pCi/L)	< 160	< 160
K-40	12.39 ± 0.60	9.50 ± 0.48
Mn-54	< 0.024	< 0.019
Fe-59	< 0.063	< 0.054
Co-58	< 0.024	< 0.015
Co-60	< 0.017	< 0.013
Zn-65	< 0.054	< 0.038
Nb-95	< 0.041	< 0.028
Zr-95	< 0.044	< 0.024
Ru-103	< 0.034	< 0.023
Ru-106	< 0.129	< 0.090
Cs-134	< 0.014	< 0.012
Cs-137	0.068 ± 0.021 [a]	0.092 ± 0.017 [a]
Ce-141	< 0.095	< 0.056
Ce-144	< 0.127	< 0.067

[a] Cs-137 determined to be from nuclear weapons testing and not from Duane Arnold Energy Center operations.

Table 22. Groundwater Protection Program Summary.

Precipitation samples for tritium analysis. Units: pCi/L

Lab Code	Date	H-3	Lab Code	Date	H-3
D-016			D-111		
DP- 22	01/02/20	< 158	DP- 24	01/02/20	< 158
DP- 241	02/03/20	172 ± 85	DP- 243	02/03/20	283 ± 91
DP- 584	03/02/20	< 157	DP- 586	03/02/20	< 157
DP- 961	04/02/20	165 ± 82	DP- 963	04/02/20	< 157
DP- 1402	05/04/20	< 152	DP- 1404	05/04/20	201 ± 82
DP- 1844	06/01/20	< 150	DP- 1846	06/01/20	223 ± 86
DP- 2263	07/06/20	< 158	DP- 2266	07/06/20	< 158
DP- 2737	08/03/20	< 158	DP- 2739	08/03/20	< 158
DP- 3136	09/02/20	< 162	DP- 3138	09/02/20	< 162
DP- 3575	10/05/20	< 158	DP- 3577	10/05/20	161 ± 86
DP- 4187	11/02/20	< 155	DP- 4182	11/02/20	< 155
DP- 4500	12/02/20	< 155	DP- 4503	12/02/20	< 155
D-112			D-114		
DP- 25	01/02/20	< 158		ND[a]	
DP- 244	02/03/20	172 ± 85		ND[a]	
DP- 587	03/02/20	< 157		ND[a]	
DP- 964	04/02/20	< 157		ND[a]	
DP- 1405	05/04/20	< 152		ND[a]	
DP- 1847	06/01/20	< 150		ND[a]	
DP- 2267	07/06/20	192 ± 85		ND[a]	
DP- 2740	08/03/20	< 158		ND[a]	
DP- 3139	09/02/20	< 162		ND[a]	
DP- 3578	10/05/20	< 156		ND[a]	
DP- 4183	11/02/20	< 155		ND[a]	
DP- 4504	12/02/20	< 155		ND[a]	
D-127			D-128		
DP- 26	01/02/20	210 ± 85	DP- 27	01/02/20	< 158
DP- 245	02/03/20	1380 ± 134	DP- 246	02/03/20	300 ± 92
DP- 590	03/02/20	466 ± 97	DP- 591	03/02/20	211 ± 85
DP- 966	04/02/20	792 ± 111	DP- 967	04/02/20	267 ± 87
DP- 1407	05/04/20	1086 ± 121	DP- 1408	05/04/20	300 ± 87
DP- 1849	06/01/20	700 ± 108	DP- 1851	06/01/20	230 ± 87
DP- 2269	07/06/20	970 ± 120	DP- 2270	07/06/20	329 ± 92
DP- 2742	08/03/20	529 ± 101	DP- 2743	08/03/20	166 ± 84
DP- 3141	09/02/20	509 ± 103	DP- 3142	09/02/20	260 ± 92
DP- 3581	10/05/20	342 ± 95	DP- 3582	10/05/20	241 ± 90
DP- 4185	11/02/20	279 ± 90	DP- 4186	11/02/20	< 155
DP- 4506	12/02/20	242 ± 86	DP- 4507	12/02/20	< 155
D-081			D-115		
DP- 23	01/02/20	< 158		01/02/20	NS[b]
DP- 242	02/03/20	< 153		02/03/20	NS[b]
DP- 585	03/02/20	169 ± 82	DP- 589	03/02/20	< 157
DP- 962	04/02/20	< 157	DP- 965	04/02/20	< 157
DP- 1403	05/04/20	192 ± 82	DP- 1406	05/04/20	161 ± 80
DP- 1845	06/01/20	< 150	DP- 1848	06/01/20	152 ± 83
DP- 2264	07/06/20	< 158	DP- 2268	07/06/20	< 158
DP- 2738	08/03/20	< 158	DP- 2741	08/03/20	< 158
DP- 3137	09/02/20	< 162	DP- 3140	09/02/20	< 162
DP- 3576	10/05/20	< 156	DP- 3580	10/05/20	< 156
DP- 4180	11/02/20	< 155	DP- 4184	11/02/20	< 155
DP- 4501	12/02/20	< 155	DP- 4505	12/02/20	< 155

[a] No sampler at the location. [b] No sample sent.

Table 22. 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- 22	01/02/20	< 5.9	< 8.6	< 4.3	< 7.1	< 11.3	< 6.1	< 7.9	< 8.4	< 5.8	< 7.7	< 29.8	< 4.3
DP- 241	02/03/20	< 7.1	< 10.8	< 8.9	< 8.5	< 15.9	< 6.8	< 12.9	< 9.6	< 9.3	< 9.6	< 28.0	< 6.2
DP- 584	03/02/20 [a]												
DP- 961	04/02/20	< 4.8	< 15.8	< 7.1	< 5.3	< 10.2	< 6.4	< 9.6	< 9.2	< 7.3	< 5.6	< 34.3	< 10.0
DP- 1402	05/04/20	< 3.0	< 4.9	< 3.5	< 3.8	< 4.0	< 2.8	< 5.7	< 3.0	< 3.4	< 2.8	< 12.0	< 3.3
DP- 1844	06/01/20	< 3.7	< 2.6	< 3.1	< 1.6	< 2.2	< 4.1	< 6.6	< 6.2	< 3.7	< 4.6	< 17.2	< 5.6
DP- 2263	07/06/20	< 3.6	< 8.3	< 6.6	< 3.5	< 5.1	< 7.1	< 11.9	< 9.0	< 7.6	< 6.0	< 27.9	< 7.1
DP- 2737	08/03/20	< 1.9	< 5.0	< 2.2	< 3.2	< 6.9	< 1.8	< 6.3	< 3.6	< 3.1	< 3.4	< 9.1	< 3.6
DP- 3136	09/02/20	< 2.7	< 3.7	< 3.2	< 3.4	< 6.6	< 3.5	< 3.5	< 6.0	< 3.0	< 2.9	< 15.5	< 3.5
DP- 3575	10/05/20	< 6.3	< 8.5	< 4.3	< 6.0	< 9.1	< 7.2	< 10.6	< 10.5	< 6.9	< 3.8	< 29.8	< 6.6
DP- 4187	11/02/20	< 6.8	< 7.9	< 7.5	< 8.8	< 11.2	< 7.3	< 12.3	< 11.9	< 9.8	< 7.0	< 37.0	< 6.0
DP- 4500	12/02/20	< 3.1	< 5.4	< 3.7	< 2.4	< 5.3	< 4.0	< 5.8	< 5.3	< 3.3	< 3.9	< 19.3	< 4.4

[a] Sample very small; LLD not met; results discarded per station request.

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-111A		(01A)	
DWW- 457	02/17/20	218 ± 85			
DWW- 1650	05/11/20	< 157			
DWW- 2807	08/04/20	< 158			
DWW- 4370	11/03/20	< 160			
		D-111B		(01B)	
DWW- 458	02/17/20	< 156			
DWW- 1651	05/11/20	< 157			
DWW- 2808	08/04/20	< 158			
DWW- 4371	11/03/20	< 160			
		D-112A		(02A)	
DWW- 459	02/17/20	< 156			
DWW- 1652	05/11/20	< 157			
DWW- 2898	08/04/20	< 160			
DWW- 4372	11/03/20	< 160			
		D-112B		(02B)	
DWW- 460	02/17/20	< 156			
DWW- 1653	05/11/20	< 157			
DWW- 2899	08/04/20	< 160			
DWW- 4373	11/03/20	< 160			
		D-113A		(03A)	
DWW- 467	02/18/20	< 156			
DWW- 1654	05/11/20	< 157			
DWW- 2900	08/04/20	< 160			
DWW- 4375	11/03/20	< 160			
		D-113B		(03B)	
DWW- 468	02/18/20	< 156			
DWW- 1656	05/11/20	< 157			
DWW- 2901	08/04/20	< 160			
DWW- 4376	11/03/20	< 160			
		D-114A		(04A)	
DWW- 469	02/18/20	172 ± 82			
DWW- 1692	05/12/20	205 ± 84			
DWW- 2902	08/04/20	190 ± 85			
DWW- 4514	11/05/20	162 ± 86			
		D-114B		(04B)	
DWW- 470	02/18/20	< 156			
DWW- 1693	05/12/20	< 157			
DWW- 2903	08/04/20	< 160			
DWW- 4515	11/05/20	< 161			
		D-115A		(05A)	
DWW- 461	02/17/20	< 156			
DWW- 1694	05/11/20	< 157			
DWW- 2904	08/04/20	< 160			
DWW- 4377	11/03/20	201 ± 85			
		D-115B		(05B)	
DWW- 462	02/17/20	< 156			
DWW- 1695	05/11/20	< 157			
DWW- 2905	08/04/20	< 160			
DWW- 4378	11/03/20	< 160			

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

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-116A		(06A)	
DWW- 471	02/18/20	< 156			
DWW- 1696	05/11/20	< 157			
DWW- 2906	08/04/20	< 160			
DWW- 4379	11/03/20	< 160			
		D-116B		(06B)	
DWW- 472	02/18/20	< 156			
DWW- 1698	05/11/20	< 157			
DWW- 2907	08/04/20	< 160			
DWW- 4380	11/03/20	< 160			
		D-127A		(07A)	
DWW- 513	02/19/20	3094 ± 180	DWW- 4397	11/04/20	339 ± 92
DWW- 854	03/19/20	1455 ± 135			
DWW- 1051	04/07/20	1235 ± 128			
DWW- 1661	05/13/20	1720 ± 143			
DWW- 2144	06/16/20	679 ± 109			
DWW- 2335	07/07/20	734 ± 110			
DWW- 2908	08/05/20	873 ± 116			
DWW- 3276	09/10/20	748 ± 110			
		D-127B		(07B)	
DWW- 514	02/19/20	< 156			
DWW- 1662	05/13/20	< 157			
DWW- 2909	08/05/20	< 159			
DWW- 4398	11/04/20	< 160			
		D-128A		(08A)	
DWW- 69	01/09/20	2658 ± 170			
DWW- 548	02/19/20	36921 ± 575			
DWW- 1635	05/13/20	4785 ± 219			
DWW- 2145	06/16/20	9622 ± 303			
DWW- 2357	07/07/20	15942 ± 385			
DWW- 2603	07/20/20	20441 ± 437			
DWW- 3014	08/05/20	17278 ± 401			
DWW- 3426	09/10/20	14644 ± 371			
DWW- 4091	10/13/20	51271 ± 682			
DWW- 4585	11/04/20	17758 ± 405			
DWW- 4654	12/14/20	3250 ± 188			
		D-128B		(08B)	
DWW- 515	02/19/20	539 ± 100			
DWW- 1646	05/13/20	242 ± 87			
DWW- 2910	08/05/20	478 ± 99			
DWW- 4399	11/04/20	273 ± 89			
		D-129A		(09A)	
DWW- 516	02/19/20	457 ± 96	DWW- 4400	11/04/20	307 ± 91
DWW- 1663	05/12/20	709 ± 108			
DWW- 2911	08/05/20	623 ± 105			
DWW- 3277	09/10/20	589 ± 103			
		D-129B		(09B)	
DWW- 517	02/19/20	< 156			
DWW- 1664	05/12/20	201 ± 84			
DWW- 2912	08/05/20	226 ± 87			
DWW- 4401	11/04/20	177 ± 84			

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

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-130A		(10A)	
DWW- 518	02/19/20	< 156	DWW- 4403	11/04/20	< 160
DWW- 1665	05/12/20	< 157			
DWW- 2914	08/05/20	178 ± 84			
DWW- 3278	09/10/20	< 159			
		D-130B		(10B)	
DWW- 520	02/19/20	< 156			
DWW- 1666	05/12/20	< 157			
DWW- 2915	08/05/20	< 159			
DWW- 4404	11/04/20	< 160			
		D-131A		(11A)	
DWW- 473	02/18/20	268 ± 87			
DWW- 1699	05/12/20	181 ± 83			
DWW- 2916	08/04/20	< 160			
DWW- 4516	11/05/20	184 ± 87			
		D-131B		(11B)	
DWW- 474	02/18/20	< 156			
DWW- 1700	05/12/20	< 157			
DWW- 2917	08/04/20	< 160			
DWW- 4517	11/05/20	< 161			
		D-132A		(12A)	
DWW- 476	02/18/20	191 ± 83			
DWW- 1701	05/12/20	338 ± 91			
DWW- 2918	08/04/20	230 ± 87			
DWW- 4518	11/05/20	< 161			
		D-132B		(12B)	
DWW- 477	02/18/20	438 ± 95			
DWW- 1702	05/12/20	330 ± 91			
DWW- 2919	08/04/20	289 ± 90			
DWW- 4519	11/05/20	207 ± 88			
		D-133A		(13A)	
DWW- 478	02/18/20	< 156			
DWW- 1703	05/12/20	< 157			
DWW- 2920	08/04/20	< 160			
DWW- 4520	11/05/20	< 161			
		D-133B		(13B)	
DWW- 479	02/18/20	< 156			
DWW- 1704	05/12/20	< 157			
DWW- 2921	08/04/20	< 160			
DWW- 4521	11/05/20	< 161			
		D-134A		(14A)	
DWW- 521	02/19/20	330 ± 90	DWW- 3427	09/10/20	2323 ± 164
DWW- 1640	05/12/20	338 ± 91	DWW- 4586	11/04/20	6519 ± 253
DWW- 2599	07/20/20	585 ± 105	DWW- 4656	12/14/20	227 ± 92
DWW- 2922	08/05/20	487 ± 99			

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

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-134B		(14B)	
DWW- 522	02/19/20	422 ± 95			
DWW- 1641	05/12/20	293 ± 89			
		D-135A		(15A)	
DWW- 482	02/18/20	< 156			
DWW- 1705	05/12/20	< 157			
DWW- 2923	08/04/20	< 160			
DWW- 4522	11/05/20	< 161			
		D-135B		(15B)	
DWW- 483	02/18/20	< 156			
DWW- 1706	05/12/20	< 157			
DWW- 2924	08/04/20	< 160			
DWW- 4523	11/05/20	< 161			
		D-136A		(16A)	
DWW- 523	02/19/20	< 156			
DWW- 1642	05/13/20	< 158			
DWW- 2925	08/05/20	< 159			
DWW- 4405	11/05/20	< 160			
		D-136B		(16B)	
DWW- 1643	05/13/20	169 ± 83			
DWW- 2926	08/06/20	< 159			
DWW- 4406	11/05/20	< 160			
		D-137		(17C)	
DWW- 524	02/19/20	< 156			
DWW- 1644	05/13/20	< 158			
DWW- 2927	08/05/20	< 159			
DWW- 4526	11/05/20	< 161			
		D-62		(18A)	
DWW- 525	02/18/20	785 ± 110	DWW- 4407	11/04/20	1717 ± 145
DWW- 1645	05/12/20	511 ± 99			
DWW- 2928	08/05/20	1602 ± 141			
DWW- 3279	09/10/20	917 ± 117			
		D-63		(19A)	
DWW- 526	02/18/20	1368 ± 132			
DWW- 1052	04/07/20	2830 ± 175			
DWW- 1647	05/13/20	546 ± 101			
DWW- 2146	06/16/20	< 159			
DWW- 2929	08/05/20	187 ± 85			
DWW- 3280	09/10/20	< 159			

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

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-64		(20A)	
DWW- 527	02/18/20	236 ± 86			
DWW- 855	03/19/20	204 ± 85			
DWW- 1648	05/13/20	< 157			
DWW- 2930	08/05/20	< 159			
DWW- 3281	09/10/20	< 159			
DWW- 4408	11/04/20	< 160			
		D-65		(21A)	
DWW- 528	02/18/20	1563 ± 138			
DWW- 856	03/19/20	410 ± 95			
DWW- 1636	05/13/20	2614 ± 169			
DWW- 2147	06/16/20	899 ± 118			
DWW- 2931	08/05/20	201 ± 85			
DWW- 3282	09/10/20	< 159			
DWW- 4402	11/04/20	467 ± 98			
		D-66		(22A)	
DWW- 70	01/07/20	24335 ± 470	DWW- 4659	12/14/20	270 ± 94
DWW- 549	02/19/20	28083 ± 503			
DWW- 968	03/26/20	25182 ± 478			
DWW- 1053	04/07/20	37701 ± 583			
DWW- 1637	05/13/20	20662 ± 434			
DWW- 2148	06/16/20	41867 ± 617			
DWW- 2358	07/07/20	40800 ± 609			
DWW- 2604	07/20/20	36039 ± 577			
DWW- 3015	08/05/20	25842 ± 488			
DWW- 3429	09/10/20	24840 ± 478			
DWW- 4092	10/13/20	6275 ± 248			
DWW- 4587	11/04/20	6638 ± 255			
		D-67		(23A)	
DWW- 71	01/07/20	6165 ± 245	DWW- 4094	10/13/20	15271 ± 377
DWW- 550	02/19/20	6340 ± 247	DWW- 4589	11/04/20	13160 ± 351
DWW- 969	03/26/20	4502 ± 212	DWW- 4658	12/14/20	9784 ± 306
DWW- 1054	04/07/20	11787 ± 331			
DWW- 1638	05/13/20	12121 ± 336			
DWW- 2140	06/16/20	11943 ± 336			
DWW- 2359	07/07/20	24819 ± 477			
DWW- 2606	07/20/20	15318 ± 380			
DWW- 3016	08/05/20	20740 ± 438			
DWW- 3430	09/10/20	22952 ± 460			
		D-165		(24A)	
DWW- 484	02/18/20	< 156			
DWW- 1707	05/12/20	< 157			
DWW- 2932	08/04/20	< 160			
DWW- 4524	11/05/20	< 161			
		D-167		(26A)	
DWW- 485	02/18/20	378 ± 93			
DWW- 1708	05/12/20	407 ± 95			
DWW- 2933	08/04/20	300 ± 90			

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

Table 22. Groundwater Protection Program Summary

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-168A		(27A)	
DWW- 488	02/17/20	253 ± 87			
DWW- 1709	05/11/20	< 157			
DWW- 2809	08/04/20	< 158			
DWW- 4381	11/03/20	242 ± 88			
		D-168B		(27B)	
DWW- 489	02/17/20	< 156			
DWW- 1710	05/11/20	< 157			
DWW- 2810	08/04/20	< 158			
DWW- 4382	11/03/20	< 160			
		D-169A		(28A)	
DWW- 490	02/17/20	< 156	DWW- 4383	11/03/20	1202 ± 128
DWW- 1711	05/11/20	472 ± 98			
DWW- 2811	08/04/20	1395 ± 136			
DWW- 3810	10/13/20	1009 ± 119			
		D-169B		(28B)	
DWW- 576	02/26/20	< 157			
DWW- 1712	05/11/20	< 157			
DWW- 2812	08/04/20	< 158			
DWW- 4384	11/03/20	< 160			
		D-170A		(29A)	
DWW- 72	01/07/20	478 ± 98	DWW- 2600	07/20/20	791 ± 114
DWW- 491	02/17/20	383 ± 93	DWW- 2798	08/04/20	904 ± 118
DWW- 1047	04/07/20	478 ± 98	DWW- 3811	10/13/20	419 ± 95
DWW- 1713	05/11/20	561 ± 101	DWW- 4385	11/03/20	309 ± 91
DWW- 2141	06/16/20	585 ± 105			
DWW- 2160	06/23/20	560 ± 104			
DWW- 2336	07/07/20	662 ± 107			
		D-170B		(29B)	
DWW- 492	02/17/20	464 ± 97			
DWW- 1714	05/11/20	387 ± 94			
DWW- 2799	08/04/20	437 ± 99			
DWW- 4386	11/03/20	593 ± 104			
		D-171A		(30A)	
DWW- 452	02/17/20	678 ± 106	DWW- 2601	07/20/20	365 ± 95
DWW- 1715	05/11/20	501 ± 99	DWW- 2801	08/04/20	237 ± 89
DWW- 2161	06/23/20	555 ± 104	DWW- 3812	10/13/20	< 155
DWW- 2337	07/07/20	353 ± 93	DWW- 4387	11/03/20	< 160
		D-171B		(30B)	
DWW- 454	02/17/20	< 156			
DWW- 1716	05/11/20	< 157			
DWW- 2935	08/04/20	< 160			
DWW- 4388	11/03/20	< 160			

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

Table 22. Groundwater Protection Program Summary

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

Lab Code	Date	H-3 (pCi/L)	Lab Code	Date	H-3 (pCi/L)
		D-172A		(31A)	
DWW- 486	02/18/20	< 156			
DWW- 1667	05/11/20	< 157			
DWW- 2936	08/04/20	< 160			
DWW- 4389	11/03/20	< 160			
		D-172B		(31B)	
DWW- 487	02/18/20	< 156			
DWW- 1668	05/11/20	< 157			
DWW- 2937	08/04/20	< 160			
DWW- 4390	11/03/20	< 160			
		D-173A		(32A)	
DWW- 455	02/17/20	777 ± 110	DWW- 2602	07/20/20	476 ± 101
DWW- 1049	04/07/20	677 ± 107	DWW- 2802	08/04/20	435 ± 99
DWW- 1669	05/11/20	921 ± 116	DWW- 3283	09/08/20	363 ± 93
DWW- 2142	06/16/20	865 ± 117	DWW- 3813	10/13/20	401 ± 94
DWW- 2162	06/23/20	817 ± 115	DWW- 4391	11/03/20	352 ± 93
DWW- 2338	07/07/20	727 ± 110			
		D-173B		(32B)	
DWW- 456	02/17/20	297 ± 89			
DWW- 1670	05/11/20	327 ± 91			
DWW- 2803	08/04/20	< 158			
DWW- 4392	11/03/20	264 ± 89			
		D-79		MW-33A	
DWW- 691	02/17/20	< 152			
DWW- 1671	05/11/20	< 157			
DWW- 2804	08/04/20	< 158			
DWW- 4393	11/03/20	< 160			
		D-80		MW-34A	
DWW- 692	02/17/20	267 ± 86			
DWW- 1672	05/11/20	< 157			
DWW- 2805	08/04/20	< 158			
DWW- 4394	11/03/20	199 ± 85			
		D-81		MW-35A	
DWW- 857	03/19/20	228 ± 86			
DWW- 1050	04/07/20	269 ± 88			
DWW- 1649	05/11/20	< 157			
DWW- 2143	06/16/20	< 159			
DWW- 2806	08/04/20	257 ± 90			
DWW- 4396	11/03/20	345 ± 93			

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

Table 22. Groundwater Protection Program Summary

Surface water, analysis for tritium.

D-119			(2MH209)		
DSW- 575	02/25/20	< 157	DSW- 3076	08/19/20	261 ± 92
DSW- 1657	05/18/20	192 ± 84	DSW- 4527	11/12/20	180 ± 83
D-121			(2MH211)		
DSW- 570	02/25/20	246 ± 86	DSW- 3077	08/19/20	< 162
DSW- 1658	05/18/20	229 ± 86	DSW- 4528	11/12/20	< 161
D-122			(Sluice Pond)		
DSW- 571	02/25/20	187 ± 83	DSW- 3431	09/14/20	< 155
DSW- 1933	05/27/20	< 160	DSW- 3814	10/13/20	< 155
DSW- 3078	08/19/20	< 162	DSW- 4529	11/12/20	< 161
D-123			(S. Drainage Ditch)		
DSW- 572	02/25/20	< 157			
DSW- 1659	05/18/20	< 157			
D-124			(N. Drainage Ditch)		
DSW- 573	02/25/20	< 157	DSW- 3079	08/19/20	< 162
DSW- 1660	05/18/20	< 157	DSW- 4530	11/12/20	< 161
D-125			(Onsite S. Storm Drain Outfall)		
DSW- 574	02/25/20	< 157	DSW- 2153	06/23/20	967 ± 120
DSW- 1639	05/18/20	4049 ± 203	DSW- 2492	07/16/20	536 ± 101
DSW- 1944	05/27/20	2388 ± 163	DSW- 3080	08/19/20	263 ± 92
DSW- 2105	06/16/20	< 158	DSW- 3360	09/17/20	< 158
D-125A			D-125B		
DSW- 1945	05/27/20	3226 ± 185	DSW- 1946	05/27/20	4867 ± 221
DSW- 2106	06/16/20	< 158	DSW- 2107	06/16/20	< 158
DSW- 2154	06/23/20	436 ± 99	DSW- 2155	06/23/20	240 ± 89
D-125C			D-125D		
DSW- 1947	05/27/20	2135 ± 156	DSW- 1934	05/27/20	< 160
DSW- 2108	06/16/20	< 158	DSW- 2109	06/16/20	< 158
DSW- 2156	06/23/20	206 ± 87	DSW- 2157	06/23/20	235 ± 89
D-125E					
DSW- 1935	05/27/20	< 160			
DSW- 2110	06/16/20	321 ± 99			
DSW- 2159	06/23/20	< 159			
(1MH213)			D-25 (MH105)		
			DWW- 888	03/30/20	< 157
MH-217			D-27 (MH-107)		
			DWW- 890	03/30/20	< 157
			DWW- 3534	09/28/20	< 156
MH-219			D-24 (MH-104)		
			DWW- 887	03/30/20	172 ± 83
			DWW- 3634	10/02/20	< 158
MH-102			D-26 (MH-106)		
			DWW- 889	03/30/20	< 157
			DWW- 3635	10/02/20	< 158

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-127A (MW-07A)						
DWW- 513	2/19/2020	< 1.5	< 2.9	< 2.0	< 1.5	< 2.8	< 2.1	< 2.9	< 1.6	< 1.6	< 17.3	< 2.3
DWW- 854	3/19/2020	< 3.4	< 9.5	< 5.0	< 4.1	< 4.9	< 5.3	< 8.3	< 5.3	< 3.6	< 33.3	< 8.7
DWW- 1051	4/7/2020	< 2.2	< 4.8	< 1.5	< 0.8	< 3.0	< 2.0	< 2.9	< 1.9	< 2.0	< 20.2	< 5.6
DWW- 1661	5/13/2020	< 1.5	< 3.8	< 1.6	< 1.0	< 2.9	< 1.8	< 4.3	< 1.6	< 2.0	< 22.4	< 3.9
						D-128A (MW-08A)						
DWW- 69	1/9/2020	< 3.0	< 5.6	< 3.4	< 2.8	< 6.0	< 4.6	< 3.6	< 3.0	< 3.6	< 43.4	< 9.2
DWW- 548	2/19/2020	< 1.9	< 4.2	< 2.0	< 1.4	< 1.9	< 3.9	< 2.8	< 1.9	< 2.0	< 28.8	< 9.0
DWW- 1635	5/13/2020	< 1.5	< 2.9	< 1.4	< 1.2	< 2.6	< 1.4	< 2.2	< 1.2	< 1.6	< 18.9	< 6.4
DWW- 2145	6/16/2020	< 2.7	< 6.0	< 2.4	< 2.1	< 3.7	< 3.5	< 3.8	< 2.4	< 3.4	< 40.9	< 5.8
DWW- 2357	7/7/2020	< 2.4	< 4.7	< 2.0	< 0.9	< 3.1	< 3.2	< 4.8	< 2.0	< 2.2	< 16.6	< 6.8
DWW- 2603	7/20/2020	< 1.8	< 4.2	< 1.3	< 1.3	< 3.5	< 2.5	< 3.6	< 1.6	< 1.8	< 20.7	< 5.6
DWW- 3014	8/5/2020	< 1.8	< 2.7	< 1.9	< 1.4	< 2.9	< 3.1	< 4.2	< 1.6	< 1.7	< 42.7	< 9.6
DWW- 3426	9/10/2020	< 1.7	< 3.0	< 1.5	< 0.8	< 2.9	< 3.0	< 3.6	< 1.4	< 1.5	< 25.0	< 6.5
DWW- 4091	10/13/2020	< 1.6	< 5.5	< 1.6	< 1.8	< 4.0	< 2.7	< 3.0	< 1.9	< 1.4	< 45.3	< 9.4
DWW- 4585	11/4/2020	< 1.3	< 3.2	< 2.6	< 1.8	< 3.2	< 4.1	< 4.4	< 1.7	< 1.6	< 95.0	< 22.8 [a]
DWW- 4654	12/14/2020	< 1.6	< 4.3	< 1.7	< 1.2	< 4.0	< 2.4	< 2.1	< 2.1	< 2.5	< 11.7	< 4.5
						D-134A (MW-14A)						
DWW- 3427	9/10/2020	< 1.9	< 5.2	< 1.9	< 2.1	< 3.0	< 2.8	< 3.3	< 1.9	< 1.5	< 22.8	< 8.1
DWW- 4586	11/4/2020	< 1.8	< 5.6	< 1.9	< 1.4	< 3.8	< 3.6	< 3.0	< 1.5	< 1.5	< 60.6	< 20.1 [a]
						D-62 (MW-18A)						
DWW- 2928	8/5/2020	< 2.6	< 8.0	< 2.4	< 2.3	< 2.9	< 4.2	< 4.5	< 2.4	< 2.4	< 36.9	< 5.5
DWW- 4407	11/4/2020	< 2.6	< 6.3	< 2.5	< 2.2	< 4.5	< 4.1	< 5.5	< 2.2	< 1.6	< 53.6	< 13.0
						D-63 (MW-19A)						
DWW- 526	2/18/2020	< 1.4	< 2.2	< 0.9	< 1.0	< 2.7	< 1.4	< 2.4	< 1.1	< 1.4	< 14.4	< 4.5
DWW- 1052	4/7/2020	< 2.0	< 4.8	< 1.7	< 0.9	< 3.1	< 3.3	< 3.3	< 1.9	< 1.5	< 22.7	< 5.7
						D-65 (MW-21A)						
DWW- 528	2/18/2020	< 2.2	< 4.9	< 1.4	< 1.4	< 3.3	< 3.4	< 3.3	< 2.0	< 1.3	< 29.8	< 9.3
DWW- 1636	5/13/2020	< 1.5	< 3.6	< 1.5	< 1.5	< 3.5	< 2.8	< 4.0	< 1.8	< 1.8	< 18.5	< 6.3
						D-66 (MW-22A)						
DWW- 70	1/7/2020	< 2.3	< 7.1	< 3.2	< 1.3	< 5.1	< 5.7	< 6.3	< 3.1	< 3.5	< 28.3	< 6.1
DWW- 549	2/19/2020	< 1.8	< 4.4	< 1.6	< 1.8	< 3.2	< 2.9	< 2.4	< 1.8	< 1.7	< 25.4	< 3.7
DWW- 968	3/26/2020	< 4.0	< 10.0	< 1.9	< 1.5	< 6.1	< 5.6	< 7.9	< 4.3	< 3.1	< 36.9	< 13.9
DWW- 1053	4/7/2020	< 1.6	< 2.4	< 1.4	< 1.7	< 3.7	< 2.4	< 3.5	< 1.7	< 1.5	< 17.4	< 2.5
DWW- 1637	5/13/2020	< 1.3	< 3.9	< 1.3	< 1.1	< 2.7	< 1.4	< 2.5	< 1.2	< 1.2	< 17.4	< 4.5
DWW- 2148	6/16/2020	< 2.7	< 6.1	< 3.8	< 2.2	< 4.3	< 3.7	< 6.5	< 4.4	< 4.3	< 38.0	< 12.6
DWW- 2358	7/7/2020	< 1.3	< 2.7	< 1.1	< 1.9	< 3.0	< 1.9	< 4.1	< 1.9	< 2.4	< 28.9	< 6.2
DWW- 2604	7/20/2020	< 1.4	< 5.4	< 2.0	< 1.6	< 3.1	< 2.1	< 3.4	< 1.9	< 1.8	< 32.4	< 8.6
DWW- 3015	8/5/2020	< 1.7	< 5.5	< 2.4	< 1.5	< 2.8	< 3.0	< 2.7	< 1.6	< 1.5	< 37.0	< 10.0
DWW- 3429	9/10/2020	< 3.1	< 6.6	< 3.5	< 2.5	< 4.6	< 3.1	< 6.1	< 3.0	< 3.1	< 29.7	< 10.4
DWW- 4092	10/13/2020	< 1.6	< 5.9	< 2.2	< 1.2	< 3.7	< 3.8	< 4.4	< 1.7	< 1.8	< 41.3	< 10.2
DWW- 4587	11/4/2020	< 1.7	< 4.5	< 2.3	< 1.2	< 3.8	< 4.2	< 3.7	< 1.8	< 1.8	< 86.0	< 19.2 [a]
DWW- 4657	12/14/2020	< 2.0	< 4.3	< 1.8	< 2.1	< 3.3	< 2.2	< 3.4	< 1.9	< 1.6	< 18.2	< 3.7

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

Table 22. Groundwater Protection Program Summary.

Monitoring wells, analyses for gamma-emitting isotopes.

Lab Code	Collection Date	^{54}Mn	^{59}Fe	^{58}Co	^{60}Co	^{65}Zn	^{95}Nb	^{95}Zr	^{134}Cs	^{137}Cs	^{140}Ba	^{140}La
						D-67 (MW-23A)						
DWW- 71	1/7/2020	< 2.1	< 5.7	< 2.0	< 1.4	< 3.7	< 2.4	< 4.5	< 1.9	< 2.1	< 26.2	< 7.0
DWW- 550	2/19/2020	< 1.3	< 4.1	< 1.5	< 1.4	< 2.2	< 2.6	< 1.7	< 1.2	< 1.4	< 20.2	< 6.3
DWW- 969	3/26/2020	< 2.8	< 4.7	< 2.5	< 1.9	< 4.8	< 2.2	< 3.6	< 2.5	< 2.7	< 26.5	< 6.1
DWW- 1054	4/7/2020	< 1.4	< 3.6	< 1.2	< 1.0	< 1.6	< 1.2	< 2.0	< 1.1	< 1.4	< 12.0	< 5.0
DWW- 1638	5/13/2020	< 1.5	< 5.1	< 1.6	< 1.6	< 3.5	< 2.2	< 3.6	< 1.7	< 1.8	< 17.4	< 3.8
DWW- 2140	6/16/2020	< 2.7	< 4.0	< 3.1	< 2.4	< 5.1	< 5.3	< 5.7	< 3.1	< 2.7	< 25.6	< 10.6
DWW- 2359	7/7/2020	< 1.3	< 3.0	< 1.6	< 1.5	< 3.6	< 2.2	< 2.7	< 1.6	< 1.8	< 16.5	< 3.8
DWW- 2606	7/20/2020	< 1.7	< 3.8	< 2.2	< 1.1	< 2.6	< 2.7	< 3.3	< 1.6	< 1.9	< 16.5	< 4.9
DWW- 3016	8/5/2020	< 1.4	< 7.2	< 2.3	< 1.6	< 4.1	< 3.9	< 3.7	< 2.0	< 2.2	< 58.5	< 11.5
DWW- 3430	9/10/2020	< 1.0	< 3.9	< 2.2	< 0.9	< 2.6	< 3.1	< 2.8	< 1.5	< 1.9	< 31.7	< 6.6
DWW- 4094	10/13/2020	< 2.2	< 4.3	< 2.0	< 1.7	< 2.8	< 3.5	< 4.7	< 1.9	< 2.0	< 45.2	< 8.6
DWW- 4589	11/4/2020	< 2.8	< 4.8	< 2.1	< 1.7	< 4.4	< 5.0	< 5.6	< 2.0	< 2.1	< 105.1	< 31.6 [a]
DWW- 4658	12/14/2020	< 1.4	< 3.5	< 1.6	< 1.5	< 2.8	< 2.3	< 3.1	< 1.7	< 1.5	< 11.7	< 4.2
						28A						
DWW- 2811	8/4/2020	< 2.9	< 5.9	< 3.1	< 2.1	< 7.8	< 4.8	< 8.6	< 5.3	< 3.1	< 41.4	< 9.6
DWW- 3810	10/13/2020	< 1.5	< 4.0	< 2.8	< 1.7	< 4.0	< 3.0	< 3.4	< 1.6	< 1.7	< 28.5	< 11.2
DWW- 4383	11/3/2020	< 1.5	< 5.0	< 1.8	< 1.5	< 3.8	< 3.9	< 3.7	< 1.9	< 1.9	< 47.1	< 9.4

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

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 70	1/7/2020	d-66	3.2 ± 2.0	< 641	< 71	< 1.3	< 1.0
DWW- 71	1/7/2020	d-67	2.9 ± 1.7	< 634	< 69	< 1.6	< 1.0
DWW- 69	1/9/2020	d-128a	< 1.7	< 650	< 70	< 1.3	< 0.8
DWW- 526	2/18/2020	d-63	< 3.9	< 714	< 70	< 1.5	< 1.0
DWW- 528	2/18/2020	d-65	< 3.4	< 564	< 69	< 1.9	< 1.5
DWW- 513	2/19/2020	d-127a	< 1.4	< 563	< 70	< 1.4	< 1.0
DWW- 548	2/19/2020	d-128a	< 2.8	< 560	< 68	< 1.6	< 1.0
DWW- 549	2/19/2020	d-66	< 4.0	< 563	< 70	< 1.4	< 1.0
DWW- 550	2/19/2020	d-67	5.2 ± 2.0	< 556	< 69	< 1.3	< 0.9
DWW- 854	3/19/2020	d-127a	1.4 ± 0.8	< 517	< 69	< 1.0	< 1.0
DWW- 968	3/26/2020	mw-22a	< 2.4	< 672	< 68	< 1.2	< 1.0
DWW- 969	3/26/2020	mw-23a	< 2.4	< 685	< 69	< 1.3	< 1.1
DWW- 1051	4/7/2020	d-127a	< 1.0	< 641	< 68	< 1.4	< 1.0
DWW- 1052	4/7/2020	mw-19a	< 4.7	< 682	< 67	< 1.4	< 1.0
DWW- 1053	4/7/2020	mw-22a	< 1.9	< 612	< 66	< 1.2	< 0.9
DWW- 1054	4/7/2020	mw-23a	< 2.2	< 641	< 66	< 1.2	< 0.9
DWW- 1635	5/13/2020	d-128a	< 1.7	< 730	< 66	< 1.5	< 1.2
DWW- 1636	5/13/2020	mw-21a	< 3.0	< 682	< 65	< 1.6	< 1.2
DWW- 1637	5/13/2020	mw-22a	< 1.9	< 774	< 66	< 1.4	< 1.1
DWW- 1638	5/13/2020	mw-23a	< 2.2	< 798	< 65	< 1.7	< 1.4
DWW- 1661	5/13/2020	d-127a	6.1 ± 1.1	< 730	< 65	< 1.3	< 1.2
DWW- 2140	6/16/2020	mw-23a	< 2.2	< 604	< 79	< 1.1	< 1.0
DWW- 2145	6/16/2020	d-128a	< 1.3	< 644	< 70	< 1.2	< 1.1
DWW- 2148	6/16/2020	mw-22a	4.3 ± 1.5	< 604	< 77	< 1.6	< 1.3
DWW- 2357	7/7/2020	D-128A	< 2.0	< 648	< 81	< 1.3	< 1.1
DWW- 2358	7/7/2020	MW-22A	< 2.1	< 628	< 82	< 1.3	< 1.1
DWW- 2359	7/7/2020	MW-23A	< 2.0	< 653	< 74	< 1.2	< 1.0
DWW- 2603	7/20/2020	d-128a	< 2.0	< 591	< 70	< 1.5	< 1.0
DWW- 2604	7/20/2020	mw-22a	< 4.8	< 594	< 77	< 2.1	< 1.4
DWW- 2606	7/20/2020	mw-23a	< 5.3	< 602	< 80	< 1.4	< 1.0
DWW- 2811	8/4/2020	mw-28a	5.3 ± 1.7	< 592	< 77	< 1.2	< 0.9
DWW- 2928	8/5/2020	mw-18a	3.2 ± 2.0	< 549	< 76	< 1.5	< 0.9
DWW- 3014	8/5/2020	d-128a	5.6 ± 2.2	< 518	< 72	< 1.8	< 1.1
DWW- 3015	8/5/2020	mw-22a	< 2.4	< 573	< 74	< 1.8	< 1.1
DWW- 3016	8/5/2020	mw-23a	< 2.1	< 552	< 72	< 1.5	< 0.9
DWW- 3426	9/10/2020	d-128a	18.2 ± 3.8 [b]	< 631	< 69	< 1.5	< 1.0
DWW- 3427	9/10/2020	d-134a	< 2.3	< 627	< 66	< 1.6	< 1.0
DWW- 3429	9/10/2020	mw-22a	7.8 ± 3.2	< 639	< 71	< 1.3	< 0.9
DWW- 3430	9/10/2020	mw-23a	< 2.0	< 635	< 69	< 1.3	< 0.8
DWW- 3810	10/13/2020	mw-28a	< 1.9	< 628	< 70	< 1.8	< 1.3
DWW- 4091	10/13/2020	d-128a	< 2.1	< 660	< 69	< 1.9	< 1.3
DWW- 4092	10/13/2020	mw-22a	< 2.4	< 640	< 70	< 1.6	< 1.2
DWW- 4094	10/13/2020	mw-23a	< 2.6	< 648	< 70	< 1.6	< 1.1

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

[b] Recount 17.46 ± 3.79 pCi/L; Reanalysis 25.63 ± 4.3 pCi/L

NOTE: Gross alpha values are related to the natural radioactive decay of radon gas held dissolved in groundwater.

Table 22. Groundwater Protection Program Summary.

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

Lab Code	Collection Date	Location	Gross Alpha	^{55}Fe	^{63}Ni	^{89}Sr	^{90}Sr
DWW- 4383	11/3/2020	mw-28a	< 2.3	< 722	< 72	< 1.7	< 1.1
DWW- 4407	11/4/2020	mw-18a	< 2.7	< 721	< 70	< 1.9	< 1.1
DWW- 4585	11/4/2020	d-128a	< 3.0	< 619	< 72	< 2.1	< 1.1
DWW- 4586	11/4/2020	d-134a	< 2.7	< 639	< 74	< 2.2	< 1.2
DWW- 4587	11/4/2020	mw-22a	< 3.2	< 604	< 70	< 1.9	< 1.0
DWW- 4589	11/4/2020	mw-23a	< 3.1	< 619	< 64	< 1.8	< 0.9
DWW- 4654	12/14/2020	d-128a	< 2.7	< 603	< 72	< 1.2	< 1.0
DWW- 4657	12/14/2020	mw-22a	< 3.0	< 588	< 70	< 1.1	< 0.9
DWW- 4658	12/14/2020	mw-23a	< 3.3	< 599	< 71	< 1.1	< 1.0

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

NOTE: Gross alpha values are related to the natural radioactive decay of radon gas held dissolved in groundwater.

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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, 2020 through December, 2020

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.

Results in Table A-2 were obtained through participation in the New York Department of Health Environmental Laboratory Approval Program (ELAP) PT.

Table A-3 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-4 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-5 lists results of the analyses on intralaboratory "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-6 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-7 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-8 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-120 Study						
ERW-49	1/6/2020	Ba-133	60.8 ± 4.4	64.5	53.7 - 71.0	Pass
ERW-49	1/6/2020	Cs-134	22.7 ± 2.8	22.9	17.5 - 25.6	Pass
ERW-49	1/6/2020	Cs-137	225 ± 8	220	198 - 244	Pass
ERW-49	1/6/2020	Co-60	94.6 ± 4.6	91.2	82.1 - 103	Pass
ERW-49	1/6/2020	Zn-65	331 ± 13	298	268 - 348	Pass
ERDW-51	1/6/2020	Gr. Alpha	52.3 ± 2.4	58.9	30.8 - 73.3	Pass
ERDW-51	1/6/2020	Gr. Beta	19.9 ± 1.0	21.0	12.6 - 29.1	Pass
ERDW-53	1/6/2020	Ra-226	12.8 ± 0.5	17.4	12.9 - 19.9	Fail[b]
ERDW-53	1/6/2020	Ra-228	7.13 ± 0.9	7.95	5.06 - 10.1	Pass
ERDW-53	1/6/2020	Uranium	63.8 ± 1.0	68.2	55.7 - 75.0	Pass
ERW-55	1/6/2020	H-3	18,200 ± 408	17,800	15,600 - 19,600	Pass
RAD-121 Study						
ERDW-1034	4/6/2020	Ra-226	17.8 ± 0.5	18.4	13.7 - 21.0	Pass
ERDW-1034	4/6/2020	Ra-228	6.30 ± 0.86	5.81	3.56 - 7.64	Pass
ERDW-1034	4/6/2020	Uranium	18.7 ± 1.3	18.6	14.9 - 20.9	Pass
RAD-122 Study						
ERW-2297	7/6/2020	Ba-133	43.8 ± 3.4	58.6	48.6 - 64.6	Fail[c]
ERW-2297	7/6/2020	Cs-134	19.8 ± 2.4	22.3	17.0 - 25.0	Pass
ERW-2297	7/6/2020	Cs-137	73.2 ± 5.4	73.0	65.7 - 83.0	Pass
ERW-2297	7/6/2020	Co-60	90.0 ± 4.0	86.1	77.5 - 97.0	Pass
ERW-2297	7/6/2020	Zn-65	84.9 ± 7.5	82.9	74.6 - 99.6	Pass
ERDW-2299	7/6/2020	Gr. Alpha	40.3 ± 2.2	52.40	27.30 - 65.6	Pass
ERDW-2299	7/6/2020	Gr. Beta	19.9 ± 1.0	24.3	15.0 - 32.3	Pass
ERDW-2303	7/6/2020	Ra-226	8.91 ± 0.43	10.8	8.08 - 12.5	Pass
ERDW-2303	7/6/2020	Ra-228	4.79 ± 0.80	5.42	3.28 - 7.19	Pass
ERDW-2303	7/6/2020	Uranium	27.7 ± 0.9	29.3	23.7 - 32.5	Pass
ERW-2305	7/6/2020	H-3	21,100 ± 400	20,300	17,800 - 22,300	Pass
ERW-2301	7/6/2020	I-131	27.8 ± 1.2	26.1	21.7 - 30.8	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] Ra-226 was slightly below the lower limit of the study. The reported value was the mean of two results (12.5 & 13.0). The sample was re-run in duplicate and both results, 15.6 and 13.8 pCi/L, were within the acceptance band.

[c] Ba-133 was below the lower acceptable limit of the study. No cause for the failure could be identified. Going forward gamma results will be monitored to see if any trend develops.

TABLE A-2. Interlaboratory Comparison Crosscheck program, New York Department of Health (ELAP)[a].

Lab Code	Date	Concentration (pCi/L)				
		Analysis	Laboratory Result	Assigned Value	Acceptance Limits	Acceptance
			Shipment 437R			
NYW-3307	9/15/2020	H-3	11,500 ± 465	11,208	9760 - 12,300	Pass
NYW-3331	9/15/2020	Gross Alpha	43.7 ± 2.5	64.9	34.0 - 80.4	Pass
NYW-3331	9/15/2020	Gross Beta	11.1 ± 1.1	8.85	3.62 - 17.4	Pass
NYW-3335	9/15/2020	I-131	14.1 ± 1.4	12.6	10.3 - 16.0	Pass
NYW-3333	9/15/2020	Ra-226	2.24 ± 0.27	2.63	2.06 - 3.44	Pass
NYW-3333	9/15/2020	Ra-228	4.91 ± 1.12	5.41	3.27 - 7.18	Pass
NYW-3333	9/15/2020	Uranium	42.8 ± 1.94	37.1	30.1 - 41.0	Fail[b]
NYW-3337	9/15/2020	Co-60	46.4 ± 3.8	42.3	38.1 - 49.2	Pass
NYW-3337	9/15/2020	Zn-65	133 ± 9	116	104 - 138	Pass
NYW-3337	9/15/2020	Ba-133	49.5 ± 4.1	46.4	38.0 - 51.6	Pass
NYW-3337	9/15/2020	Cs-134	32.5 ± 3.1	33.0	26.0 - 36.3	Pass
NYW-3337	9/15/2020	Cs-137	147 ± 7	134	121 - 150	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by the New York Department of Health Laboratory Approval Program(NY ELAP).

[b] Lab passed all ERA and MAPEP studies for uranium in 2020.(See tables A-1, A-7 and A-8) Uncertainty overlapped upper acceptance limit. Lab will continue to monitor results going forward for trends.

TABLE A-3. 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 1			
2020-1	10/28/2020	Spike 1	172.0	180.0	0.05
2020-1	10/28/2020	Spike 2	172.0	174.5	0.01
2020-1	10/28/2020	Spike 3	172.0	174.3	0.01
2020-1	10/28/2020	Spike 4	172.0	174.0	0.01
2020-1	10/28/2020	Spike 5	172.0	167.1	-0.03
2020-1	10/28/2020	Spike 6	172.0	161.9	-0.06
2020-1	10/28/2020	Spike 7	172.0	167.9	-0.02
2020-1	10/28/2020	Spike 8	172.0	171.0	-0.01
2020-1	10/28/2020	Spike 9	172.0	170.7	-0.01
2020-1	10/28/2020	Spike 10	172.0	170.1	-0.01
2020-1	10/28/2020	Spike 11	172.0	173.8	0.01
2020-1	10/28/2020	Spike 12	172.0	178.3	0.04
2020-1	10/28/2020	Spike 13	172.0	178.2	0.04
2020-1	10/28/2020	Spike 14	172.0	171.9	0.00
2020-1	10/28/2020	Spike 15	172.0	190.4	0.11
2020-1	10/28/2020	Spike 16	172.0	170.9	-0.01
2020-1	10/28/2020	Spike 17	172.0	183.3	0.07
2020-1	10/28/2020	Spike 18	172.0	170.6	-0.01
2020-1	10/28/2020	Spike 19	172.0	164.9	-0.04
2020-1	10/28/2020	Spike 20	172.0	175.7	0.02
Mean (Spike 1-20)				173.5	0.01 Pass[d]
Standard Deviation (Spike 1-20)				6.5	0.04 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. 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				
2020-2	10/28/2020	Spike 21	114.0	117.3	0.03	
2020-2	10/28/2020	Spike 22	114.0	103.3	-0.09	
2020-2	10/28/2020	Spike 23	114.0	106.2	-0.07	
2020-2	10/28/2020	Spike 24	114.0	110.1	-0.03	
2020-2	10/28/2020	Spike 25	114.0	114.9	0.01	
2020-2	10/28/2020	Spike 26	114.0	115.5	0.01	
2020-2	10/28/2020	Spike 27	114.0	110.4	-0.03	
2020-2	10/28/2020	Spike 28	114.0	111.7	-0.02	
2020-2	10/28/2020	Spike 29	114.0	111.3	-0.02	
2020-2	10/28/2020	Spike 30	114.0	113.1	-0.01	
2020-2	10/28/2020	Spike 31	114.0	116.4	0.02	
2020-2	10/28/2020	Spike 32	114.0	111.8	-0.02	
2020-2	10/28/2020	Spike 33	114.0	112.6	-0.01	
2020-2	10/28/2020	Spike 34	114.0	105.7	-0.07	
2020-2	10/28/2020	Spike 35	114.0	104.5	-0.08	
2020-2	10/28/2020	Spike 36	114.0	103.6	-0.09	
2020-2	10/28/2020	Spike 37	114.0	104.4	-0.08	
2020-2	10/28/2020	Spike 38	114.0	104.5	-0.08	
2020-2	10/28/2020	Spike 39	114.0	106.4	-0.07	
2020-2	10/28/2020	Spike 40	114.0	107.7	-0.06	
Mean (Spike 21-40)				109.6	-0.04	Pass[d]
Standard Deviation (Spike 21-40)				4.6	0.04	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-4. 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-481	1/1/2020	Ra-226	10.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.85
SPW-110	1/16/2020	H-3	2,101 ± 154	2,110	1,688 - 2,532	Pass	1.00
W-041620	4/29/2016	Cs-134	35.7 ± 8.8	36.2	29.0 - 43.4	Pass	0.99
W-041620	4/29/2016	Cs-137	75.0 ± 6.6	71.9	57.5 - 86.3	Pass	1.04
W-042020	4/29/2016	Cs-134	40.6 ± 10.2	36.2	29.0 - 43.4	Pass	1.12
W-042020	4/29/2016	Cs-137	71.2 ± 7.0	71.9	57.5 - 86.3	Pass	0.99
SPW-190	1/23/2020	H-3	2,058 ± 153	2,110	1,688 - 2,532	Pass	0.98
SPW-205	1/28/2020	Sr-90	17.6 ± 1.2	17.9	14.3 - 21.5	Pass	0.99
SPW-217	1/31/2020	H-3	2,005 ± 152	2,110	1,688 - 2,532	Pass	0.95
SPW-270	2/7/2020	H-3	2,153 ± 157	2,110	1,688 - 2,532	Pass	1.02
SPW-288	2/11/2020	Ra-228	13.1 ± 1.7	14.9	10.4 - 19.3	Pass	0.88
W-021220	4/29/2016	Cs-134	39.3 ± 18.9	36.2	29.0 - 43.4	Pass	1.09
W-021220	4/29/2016	Cs-137	73.9 ± 15.8	71.9	57.5 - 86.3	Pass	1.03
SPW-396	2/14/2020	H-3	2,298 ± 160	2,110	1,688 - 2,532	Pass	1.09
W-022420	4/29/2016	Cs-134	33.4 ± 10.5	36.2	29.0 - 43.4	Pass	0.92
W-022420	4/29/2016	Cs-137	75.6 ± 7.8	71.9	57.5 - 86.3	Pass	1.05
SPW-716	2/26/2020	Ra-226	11.3 ± 0.4	12.3	8.6 - 16.0	Pass	0.92
W-022820	4/29/2016	Cs-134	34.9 ± 11.6	36.2	29.0 - 43.4	Pass	0.96
W-022820	4/29/2016	Cs-137	82.9 ± 8.5	71.9	57.5 - 86.3	Pass	1.15
SPW-532	2/28/2020	H-3	2,054 ± 153	2,110	1,688 - 2,532	Pass	0.97
W-030420	4/29/2016	Cs-134	29.7 ± 9.6	36.2	29.0 - 43.4	Pass	0.82
W-030420	4/29/2016	Cs-137	74.2 ± 7.3	71.9	57.5 - 86.3	Pass	1.03
W-031020	4/29/2016	Cs-134	41.6 ± 17.8	36.2	29.0 - 43.4	Pass	1.15
W-031020	4/29/2016	Cs-137	78.6 ± 14.3	71.9	57.5 - 86.3	Pass	1.09
SPW-711	3/12/2020	H-3	2,083 ± 154	2,110	1,688 - 2,532	Pass	0.99
SPW-825	3/12/2020	Ra-226	12.4 ± 0.4	12.3	8.6 - 16.0	Pass	1.01
SPW-774	3/18/2020	H-3	2,021 ± 151	2,110	1,688 - 2,532	Pass	0.96
W-031820	4/29/2016	Cs-134	29.7 ± 10.6	36.2	29.0 - 43.4	Pass	0.82
W-031820	4/29/2016	Cs-137	75.5 ± 9.2	71.9	57.5 - 86.3	Pass	1.05
W-032520	4/29/2016	Cs-134	36.4 ± 9.2	36.2	29.0 - 43.4	Pass	1.01
W-032520	4/29/2016	Cs-137	74.9 ± 7.0	71.9	57.5 - 86.3	Pass	1.04
SPW-877	3/31/2020	Ra-228	13.0 ± 2.0	14.9	10.4 - 19.3	Pass	0.88
SPW-925	3/23/2020	Ra-226	10.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.87
SPW-859	3/27/2020	H-3	2,065 ± 153	2,110	1,688 - 2,532	Pass	0.98
W-040320	4/29/2016	Cs-134	38.1 ± 10.3	36.2	29.0 - 43.4	Pass	1.05
W-040320	4/29/2016	Cs-137	78.6 ± 7.5	71.9	57.5 - 86.3	Pass	1.09
SPDW-1009	4/8/2020	Gr. Alpha	11.5 ± 0.9	18.7	9.4 - 28.1	Pass	0.61
SPDW-1009	4/8/2020	Gr. Beta	22.0 ± 1.0	26.1	20.9 - 31.3	Pass	0.84
SPW-1033	4/9/2020	H-3	2,041 ± 153	2,110	1,688 - 2,532	Pass	0.97
W-040920	4/29/2016	Cs-134	34.3 ± 9.4	36.2	29.0 - 43.4	Pass	0.95
W-040920	4/29/2016	Cs-137	77.9 ± 8.0	71.9	57.5 - 86.3	Pass	1.08
SPW-1145	4/15/2020	Ra-228	14.3 ± 2.0	14.9	10.4 - 19.3	Pass	0.96
SPW-1186	4/17/2020	H-3	1,972 ± 151	2,110	1,688 - 2,532	Pass	0.93

[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 "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-1284	4/24/2020	H-3	2,015 ± 153	2,110	1,688 - 2,532	Pass	0.95
SPW-1745	4/24/2020	Ra-226	11.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.97
W-042220	4/29/2016	Cs-134	33.7 ± 9.2	36.2	29.0 - 43.4	Pass	0.93
W-042220	4/29/2016	Cs-137	74.9 ± 6.6	71.9	57.5 - 86.3	Pass	1.04
W-042420	4/29/2016	Cs-134	33.3 ± 10.8	36.2	29.0 - 43.4	Pass	0.92
W-042420	4/29/2016	Cs-137	73.7 ± 8.5	71.9	57.5 - 86.3	Pass	1.03
W-043020	4/29/2016	Cs-134	33.7 ± 15.7	36.2	29.0 - 43.4	Pass	0.93
W-043020	4/29/2016	Cs-137	72.5 ± 7.1	71.9	57.5 - 86.3	Pass	1.01
SPW-1327	5/1/2020	H-3	2,071 ± 153	2,110	1,688 - 2,532	Pass	0.98
W-050520	4/29/2016	Cs-134	31.1 ± 11.9	36.2	29.0 - 43.4	Pass	0.86
W-050520	4/29/2016	Cs-137	73.2 ± 8.3	71.9	57.5 - 86.3	Pass	1.02
SPW-1394	5/5/2020	Sr-90	18.1 ± 1.1	17.9	14.3 - 21.5	Pass	1.01
W-050720	4/29/2016	Cs-134	39.9 ± 2.0	36.2	29.0 - 43.4	Pass	1.10
W-050720	4/29/2016	Cs-137	75.2 ± 14.3	71.9	57.5 - 86.3	Pass	1.05
SPW-1500	5/18/2020	Ra-228	13.8 ± 1.9	14.9	10.4 - 19.3	Pass	0.93
W-052020	4/29/2016	Cs-134	33.1 ± 1.2	36.2	29.0 - 43.4	Pass	0.91
W-052020	4/29/2016	Cs-137	80.8 ± 8.3	71.9	57.5 - 86.3	Pass	1.12
SPW-1613	5/22/2020	H-3	1,953 ± 149	2,110	1,688 - 2,532	Pass	0.93
W-052620	4/29/2016	Cs-134	31.0 ± 9.2	36.2	29.0 - 43.4	Pass	0.86
W-052620	4/29/2016	Cs-137	74.6 ± 7.5	71.9	57.5 - 86.3	Pass	1.04
SPW-2061	5/21/2020	Ra-226	10.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.85
W-052620	4/29/2016	Cs-134	33.6 ± 12.8	36.2	29.0 - 43.4	Pass	0.93
W-052620	4/29/2016	Cs-137	69.2 ± 7.7	71.9	57.5 - 86.3	Pass	0.96
SPW-1741	5/27/2020	H-3	1,925 ± 150	2,110	1,688 - 2,532	Pass	0.91
SPW-1824	6/3/2020	H-3	1,971 ± 151	2,110	1,688 - 2,532	Pass	0.93
SPW-1853	6/4/2020	H-3	2,027 ± 153	2,110	1,688 - 2,532	Pass	0.96
W-061120	4/29/2016	Cs-134	39.8 ± 21.0	36.2	29.0 - 43.4	Pass	1.10
W-061120	4/29/2016	Cs-137	79.3 ± 13.5	71.9	57.5 - 86.3	Pass	1.10
SPW-1982	6/12/2020	H-3	2,065 ± 154	2,110	1,688 - 2,532	Pass	0.98
SPW-2038	6/18/2020	H-3	2,012 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-2116	6/25/2020	H-3	2,051 ± 159	2,110	1,688 - 2,532	Pass	0.97
SPW-2173	7/1/2020	H-3	2,010 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-2328	7/10/2020	H-3	1,924 ± 151	2,110	1,688 - 2,532	Pass	0.91
SPW-2458	7/16/2020	H-3	1,932 ± 151	2,110	1,688 - 2,532	Pass	0.92
SPW-2556	7/27/2020	Sr-90	16.8 ± 1.1	17.9	14.3 - 21.5	Pass	0.94
SPW-2558	7/6/2020	Gr. Alpha	29.9 ± 2.1	58.9	29.5 - 88.4	Pass	0.51
SPW-2558	7/6/2020	Gr. Beta	20.0 ± 1.0	21.0	16.8 - 25.2	Pass	0.95
SPW-2640	7/31/2020	H-3	1,984 ± 154	2,110	1,688 - 2,532	Pass	0.94
SPW-2778	8/7/2020	H-3	1,936 ± 151	2,110	1,688 - 2,532	Pass	0.92
SPW-2797	6/22/2020	Ra-226	10.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.85
SPW-2852	8/11/2020	Ra-228	10.2 ± 1.6	12.5	8.7 - 16.2	Pass	0.82

[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 "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-2854	8/14/2020	H-3	1,927 ± 153	2,110	1,688 - 2,532	Pass	0.91
SPW-2890	8/4/2020	Ra-226	11.6 ± 0.4	12.3	8.6 - 16.0	Pass	0.95
SPW-3013	8/24/2020	H-3	2,005 ± 153	2,110	1,688 - 2,532	Pass	0.95
SPW-3053	8/28/2020	H-3	1,904 ± 149	2,110	1,688 - 2,532	Pass	0.90
SPW-3123	8/19/2020	Ra-226	10.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.85
SPW-3447	9/3/2020	Ra-226	9.8 ± 0.3	12.3	8.6 - 16.0	Pass	0.80
SPW-3241	9/11/2020	H-3	1,952 ± 154	2,110	1,688 - 2,532	Pass	0.93
SPW-3425	9/23/2020	Ra-228	10.7 ± 1.6	12.3	8.6 - 16.0	Pass	0.87
SPW-3412	9/25/2020	H-3	2,099 ± 155	2,110	1,688 - 2,532	Pass	0.99
SPW-4131	9/30/2020	Ra-226	13.2 ± 0.4	12.3	8.6 - 16.0	Pass	1.07
SPW-3482	10/2/2020	H-3	1,984 ± 154	2,110	1,688 - 2,532	Pass	0.94
SPW-3624	10/9/2020	H-3	1,924 ± 152	2,110	1,688 - 2,532	Pass	0.91
SPW-3794	10/16/2020	H-3	2,109 ± 156	2,110	1,688 - 2,532	Pass	1.00
SPW-3836	10/20/2020	Sr-90	16.8 ± 1.1	17.9	14.3 - 21.5	Pass	0.94
SPW-4043	10/23/2020	H-3	1893.4 ± 148.8	2,110	1,688 - 2,532	Pass	0.90
SPW-4179	10/28/2020	Ra-228	15.4 ± 2.4	12.1	8.5 - 15.7	Pass	1.27
SPW-4422	10/30/2020	Ra-226	12.3 ± 0.3	12.3	8.6 - 16.0	Pass	1.00
SPW-4234	11/11/2020	H-3	2,008 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-4634	11/23/2020	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPW-4509	12/4/2020	H-3	1,873 ± 149	2,110	1,688 - 2,532	Pass	0.89
SPW-4625	12/18/2020	H-3	1,940 ± 152	2,110	1,688 - 2,532	Pass	0.92
SPW-4741	12/18/2020	Ra-226	12.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.02

[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-5. 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-480	Water	1/1/2020	Ra-226	0.03	0.12 ± 0.02	2
SPW-93	Water	1/7/2020	Gr. Alpha	0.35	0.47 ± 0.29	2
SPW-93	Water	1/7/2020	Gr. Beta	0.74	0.18 ± 0.53	4
SPW-109	Water	1/16/2020	H-3	157	-6 ± 73	200
SPW-154	Water	1/16/2020	I-131	0.47	-0.22 ± 0.21	1
SPW-189	Water	1/23/2020	H-3	158	0 ± 73	200
SPW-204	Water	1/28/2020	Sr-89	0.64	-0.16 ± 0.50	5
SPW-204	Water	1/28/2020	Sr-90	0.54	0.11 ± 0.27	1
SPW-216	Water	1/31/2020	H-3	156	86 ± 78	200
SPW-269	Water	2/7/2020	H-3	153	79 ± 80	200
SPW-287	Water	2/11/2020	Ra-228	0.81	1.49 ± 0.53	2
SPW-395	Water	2/14/2020	H-3	154	46 ± 75	200
SPW-463	Water	2/25/2020	I-131	0.16	0.02 ± 0.09	1
SPW-715	Water	2/26/2020	Ra-226	0.01	0.17 ± 0.01	2
SPW-531	Water	2/28/2020	H-3	156	44 ± 75	200
SPW-710	Water	3/12/2020	H-3	157	-16 ± 72	200
SPW-824	Water	3/12/2020	Ra-226	0.03	0.15 ± 0.03	2
SPW-773	Water	3/18/2020	H-3	151	76 ± 76	200
SPW-876	Water	3/31/2020	Ra-228	0.88	0.57 ± 0.47	2
SPW-924	Water	3/23/2020	Ra-226	0.04	0.18 ± 0.03	2
SPW-1032	Water	4/9/2020	H-3	157	68 ± 77	200
SPW-1144	Water	4/15/2020	Ra-228	0.89	0.03 ± 0.42	2
SPW-1185	Water	4/17/2020	H-3	158	8 ± 74	200
SPW-1283	Water	4/24/2020	H-3	156	10 ± 75	200
SPW-1744	Water	4/24/2020	Ra-226	0.03	-0.01 ± 0.03	2
SPW-1326	Water	5/1/2020	H-3	153	67 ± 75	200
SPW-1393	Water	5/5/2020	Sr-89	0.66	0.11 ± 0.44	5
SPW-1393	Water	5/5/2020	Sr-90	0.63	-0.27 ± 0.26	1
SPW-1499	Water	5/18/2020	Ra-228	0.88	0.03 ± 0.41	2
SPW-1541	Water	5/19/2020	I-131	0.20	0.00 ± 0.11	1
SPW-2060	Water	5/21/2020	Ra-226	0.03	-0.01 ± 0.02	2
SPW-1612	Water	5/22/2020	H-3	153	91 ± 76	200
SPW-1740	Water	5/27/2020	H-3	158	-26 ± 71	200
SPW-1823	Water	6/3/2020	H-3	157	18 ± 74	200
SPW-1852	Water	6/4/2020	H-3	159	33 ± 76	200
SPW-1981	Water	6/12/2020	H-3	149	52 ± 77	200
SPW-2037	Water	6/18/2020	H-3	156	101 ± 81	200
SPW-2115	Water	6/25/2020	H-3	158	56 ± 86	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 "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-2172	Water	7/1/2020	H-3	159	-15 ± 75	200
SPW-2327	Water	7/10/2020	H-3	158	50 ± 77	200
SPW-2457	Water	7/16/2020	H-3	159	-46 ± 71	200
SPW-2555	Water	7/27/2020	Sr-89	0.48	0.18 ± 0.40	5
SPW-2555	Water	7/27/2020	Sr-90	0.54	0.03 ± 0.25	1
SPW-2557	Water	7/6/2020	Gr. Alpha	0.37	0.25 ± 0.28	2
SPW-2557	Water	7/6/2020	Gr. Beta	0.75	-0.23 ± 0.52	4
SPW-2639	Water	7/31/2020	H-3	158	80 ± 81	200
SPW-2777	Water	8/7/2020	H-3	157	0 ± 74	200
SPW-2796	Water	6/22/2020	Ra-226	0.03	-0.02 ± 0.03	2
SPW-2851	Water	8/11/2020	Ra-228	0.85	0.44 ± 0.45	2
SPW-2853	Water	8/14/2020	H-3	158	18 ± 77	200
SPW-2880	Water	8/18/2020	I-131	0.42	-0.04 ± 0.22	1
SPW-2889	Water	8/4/2020	Ra-228	0.05	0.13 ± 0.11	2
SPW-3012	Water	8/24/2020	H-3	159	59 ± 77	200
SPW-3052	Water	8/28/2020	H-3	155	46 ± 75	200
SPW-3122	Water	9/3/2020	Ra-226	0.03	0.20 ± 0.03	2
SPW-3240	Water	9/11/2020	H-3	161	3 ± 78	200
SPW-3446	Water	9/3/2020	Ra-226	0.01	0.12 ± 0.02	2
SPW-3424	Water	9/23/2020	Ra-228	0.85	0.81 ± 0.48	2
SPW-3411	Water	9/25/2020	H-3	158	82 ± 78	200
SPW-4130	Water	9/30/2020	Ra-226	0.04	0.01 ± 0.04	2
SPW-3481	Water	10/2/2020	H-3	154	63 ± 80	200
SPW-3623	Water	10/9/2020	H-3	156	57 ± 81	200
SPW-3793	Water	10/16/2020	H-3	157	3 ± 73	200
SPW-3835	Water	10/20/2020	Sr-89	0.55	-0.10 ± 0.43	5
SPW-3835	Water	10/20/2020	Sr-90	0.59	0.09 ± 0.28	1
SPW-4042	Water	10/23/2020	H-3	155	-6 ± 72	200
SPW-4178	Water	10/28/2020	Ra-228	1.04	0.33 ± 0.52	2
SPW-4421	Water	10/30/2020	Ra-226	0.03	0.07 ± 0.03	2
SPW-4233	Water	11/11/2020	H-3	155	78 ± 79	200
SPW-4356	Water	11/20/2020	H-3	157	52 ± 76	200
SPW-4633	Water	11/23/2020	Ra-226	0.05	0.04 ± 0.11	2
SPW-4508	Water	12/4/2020	H-3	159	-68 ± 69	200
SPW-4624	Water	12/18/2020	H-3	160	8 ± 77	200
SPW-4740	Water	12/18/2020	Ra-226	0.04	0.02 ± 0.03	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-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SG-20,21	1/2/2020	Pb-214	2.23 ± 0.12	1.61 ± 0.09	1.92 ± 0.08	Pass
SG-20,21	1/2/2020	Ac-228	1.49 ± 0.20	1.42 ± 0.18	1.46 ± 0.13	Pass
AP-5060,5061	1/3/2020	Be-7	0.052 ± 0.014	0.063 ± 0.012	0.057 ± 0.009	Pass
AP-010720A,B	1/7/2020	Gr. Beta	0.023 ± 0.004	0.022 ± 0.004	0.022 ± 0.003	Pass
WW-72,73	1/7/2020	H-3	547 ± 101	478 ± 98	513 ± 70	Pass
WW-184,185	1/21/2020	H-3	265 ± 88	311 ± 90	288 ± 63	Pass
SWU-253,254	1/28/2020	Gr. Beta	1.73 ± 0.58	2.10 ± 0.62	1.92 ± 0.42	Pass
DW-20014,20015	1/29/2020	Ra-228	3.34 ± 0.74	2.25 ± 0.70	2.80 ± 0.51	Pass
DW-20014,20015	1/29/2020	Ra-226	1.05 ± 0.15	0.64 ± 0.24	0.85 ± 0.14	Pass
S-209,210	1/31/2020	K-40	8.28 ± 0.20	7.95 ± 0.42	8.12 ± 0.23	Pass
LW-383,384	1/31/2020	Gr. Beta	1.67 ± 0.58	0.77 ± 0.52	1.22 ± 0.39	Pass
AP-020320A,B	2/3/2020	Gr. Beta	0.021 ± 0.004	0.024 ± 0.004	0.023 ± 0.003	Pass
S-362,363	2/7/2020	Pb-214	2.39 ± 0.11	2.25 ± 0.10	2.32 ± 0.07	Pass
S-362,363	2/7/2020	Ac-228	1.84 ± 0.18	1.95 ± 0.17	1.90 ± 0.12	Pass
DW-20018,20019	2/7/2020	Gr. Alpha	0.23 ± 0.86	0.37 ± 0.88	0.30 ± 0.62	Pass
DW-20018,20019	2/7/2020	Gr. Beta	0.50 ± 0.56	1.19 ± 0.63	0.85 ± 0.42	Pass
DW-20026,20027	2/7/2020	Ra-226	2.40 ± 0.21	2.11 ± 0.15	2.26 ± 0.13	Pass
DW-20026,20027	2/7/2020	Ra-228	2.60 ± 0.68	1.81 ± 0.57	2.21 ± 0.44	Pass
WW-452,453	2/17/2020	H-3	583 ± 102	678 ± 106	630 ± 74	Pass
DW-20031,20032	2/25/2020	Gr. Alpha	1.02 ± 0.77	0.80 ± 0.81	0.91 ± 0.56	Pass
DW-20031,20032	2/25/2020	Gr. Beta	1.11 ± 0.59	1.19 ± 0.58	1.15 ± 0.41	Pass
DW-20038,20039	3/3/2020	Ra-226	8.39 ± 0.43	8.78 ± 0.49	8.59 ± 0.33	Pass
DW-20038,20039	3/3/2020	Ra-228	2.81 ± 1.00	2.31 ± 0.86	2.56 ± 0.66	Pass
WW-752,753	3/13/2020	H-3	435 ± 94	393 ± 92	414 ± 66	Pass
S-868,869	3/13/2020	Pb-214	0.97 ± 0.10	0.99 ± 0.09	0.98 ± 0.07	Pass
S-868,869	3/13/2020	Ac-228	0.93 ± 0.18	1.01 ± 0.23	0.97 ± 0.15	Pass
LW-977,978	3/25/2020	Gr. Beta	0.98 ± 0.53	0.92 ± 0.51	0.95 ± 0.37	Pass
AP-1220,1221	3/31/2020	Be-7	0.063 ± 0.011	0.062 ± 0.013	0.063 ± 0.009	Pass
SWT-912,913	3/31/2020	Gr. Beta	0.79 ± 0.53	0.49 ± 0.50	0.64 ± 0.37	Pass
AP-956,957	4/2/2020	Be-7	0.189 ± 0.097	0.256 ± 0.130	0.222 ± 0.081	Pass
AP-1110,1111	4/3/2020	Be-7	0.069 ± 0.012	0.072 ± 0.013	0.071 ± 0.009	Pass
WW-1047,1048	4/7/2020	H-3	438 ± 96	478 ± 98	458 ± 69	Pass
VE-1022,1023	4/8/2020	Be-7	9.28 ± 0.57	8.00 ± 0.62	8.64 ± 0.42	Pass
VE-1022,1023	4/8/2020	K-40	3.89 ± 0.67	3.94 ± 0.73	3.92 ± 0.49	Pass
S-1199,1200	4/12/2020	Pb-214	0.77 ± 0.07	0.98 ± 0.08	0.88 ± 0.05	Pass
S-1199,1200	4/12/2020	Ac-228	1.09 ± 0.15	1.18 ± 0.17	1.14 ± 0.11	Pass
SS-1419,1420	4/14/2020	K-40	10.8 ± 0.6	9.4 ± 0.4	10.1 ± 0.4	Pass
AP-1241,1242	4/16/2020	Be-7	0.203 ± 0.113	0.245 ± 0.145	0.224 ± 0.092	Pass
DW-20051,20052	4/23/2020	Ra-228	3.50 ± 0.85	4.60 ± 0.89	4.05 ± 0.62	Pass
DW-20051,20052	4/23/2020	Ra-226	0.80 ± 0.10	0.60 ± 0.10	0.70 ± 0.07	Pass
SS-1310,1311	4/23/2020	K-40	7,827 ± 492	8,157 ± 505	7,992 ± 352	Pass
LW-1375,1376	4/29/2020	Gr. Beta	1.62 ± 0.59	1.61 ± 0.58	1.62 ± 0.41	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
F-1828,1829	4/29/2020	K-40	1.35 ± 0.41	0.98 ± 0.33	1.16 ± 0.27	Pass
SG-1398,1399	5/5/2020	Pb-214	7.51 ± 0.19	8.62 ± 0.17	8.07 ± 0.13	Pass
SG-1398,1399	5/5/2020	Ac-228	6.80 ± 0.31	6.77 ± 0.27	6.79 ± 0.21	Pass
SW-1461,1462	5/7/2020	H-3	315 ± 88	320 ± 89	317 ± 63	Pass
AP-1610,1611	5/14/2020	Be-7	0.179 ± 0.101	0.172 ± 0.086	0.176 ± 0.066	Pass
DW-20062,20063	5/19/2020	Gr. Alpha	6.20 ± 1.30	5.00 ± 1.30	5.60 ± 0.92	Pass
DW-20062,20063	5/19/2020	Gr. Beta	6.09 ± 0.77	5.51 ± 0.72	5.80 ± 0.53	Pass
W-1805,1806	5/25/2020	Ra-226	0.42 ± 0.16	0.24 ± 0.17	0.33 ± 0.12	Pass
F-1763,1764	5/26/2020	K-40	2.82 ± 0.47	3.01 ± 0.45	2.92 ± 0.33	Pass
AP-052620A,B	5/26/2020	Gr. Beta	0.014 ± 0.003	0.016 ± 0.003	0.015 ± 0.002	Pass
DW-20066,20067	6/1/2020	Ra-226	0.21 ± 0.09	0.33 ± 0.12	0.27 ± 0.08	Pass
DW-20066,20067	6/1/2020	Ra-228	0.05 ± 0.43	0.03 ± 0.39	0.04 ± 0.29	Pass
P-1849,1850	6/1/2020	H-3	547 ± 102	700 ± 108	624 ± 74	Pass
AP-1893,1894	6/4/2020	Be-7	0.164 ± 0.080	0.251 ± 0.140	0.208 ± 0.081	Pass
SW-1872,1873	6/4/2020	H-3	385 ± 94	400 ± 95	393 ± 67	Pass
AP-052620A,B	6/8/2020	Gr. Beta	0.024 ± 0.004	0.025 ± 0.005	0.024 ± 0.003	Pass
WW-2025,2026	6/16/2020	H-3	318 ± 92	320 ± 92	319 ± 65	Pass
AP-061620A,B	6/16/2020	Gr. Beta	0.017 ± 0.003	0.019 ± 0.003	0.018 ± 0.002	Pass
DW-20078,20079	6/17/2020	Ra-226	0.53 ± 0.11	0.50 ± 0.10	0.52 ± 0.07	Pass
DW-20078,20079	6/17/2020	Ra-228	1.10 ± 0.50	1.11 ± 0.50	1.11 ± 0.35	Pass
AP-2048,2049	6/18/2020	Be-7	0.222 ± 0.087	0.221 ± 0.092	0.221 ± 0.063	Pass
SW-2157,2158	6/23/2020	H-3	175 ± 86	235 ± 89	205 ± 62	Pass
AP-062320A,B	6/23/2020	Gr. Beta	0.021 ± 0.003	0.023 ± 0.004	0.022 ± 0.003	Pass
AP-2136,2137	6/25/2020	Be-7	0.242 ± 0.099	0.343 ± 0.115	0.292 ± 0.076	Pass
AP-2366,2367	6/30/2020	Be-7	0.144 ± 0.018	0.177 ± 0.019	0.161 ± 0.013	Pass
SWU-2180,2181	6/30/2020	H-3	105 ± 82	199 ± 87	152 ± 60	Pass
AP-2473,2474	7/1/2020	Be-7	0.079 ± 0.011	0.089 ± 0.012	0.084 ± 0.008	Pass
AP-2473,2474	7/1/2020	K-40	0.010 ± 0.006	0.015 ± 0.009	0.013 ± 0.005	Pass
AP-2408,2409	7/2/2020	Be-7	0.084 ± 0.016	0.085 ± 0.014	0.085 ± 0.011	Pass
P-2264,2265	7/6/2020	H-3	149 ± 83	144 ± 83	147 ± 59	Pass
DW-20091,20092	7/10/2020	Ra-226	0.77 ± 0.17	0.69 ± 0.24	0.73 ± 0.15	Pass
DW-20091,20092	7/10/2020	Ra-228	0.61 ± 0.56	0.59 ± 0.55	0.60 ± 0.39	Pass
SW-2450,2451	7/14/2020	H-3	410 ± 96	487 ± 99	448 ± 69	Pass
VE-2494,2495	7/16/2020	K-40	1.68 ± 0.25	2.08 ± 0.26	1.88 ± 0.18	Pass
DW-20102,20103	7/17/2020	Gr. Alpha	1.98 ± 0.82	2.65 ± 0.82	2.32 ± 0.58	Pass
DW-20102,20103	7/17/2020	Ra-226	0.84 ± 0.20	0.89 ± 0.20	0.87 ± 0.14	Pass
DW-20102,20103	7/17/2020	Ra-228	1.24 ± 0.67	1.57 ± 0.70	1.41 ± 0.48	Pass
WW-2604,2605	7/20/2020	H-3	35,989 ± 576	36,039 ± 577	36,014 ± 408	Pass
SWU-2669,2670	7/28/2020	H-3	103 ± 80	101 ± 80	102 ± 57	Pass
SWU-2669,2670	7/28/2020	Gr. Beta	1.49 ± 0.56	1.05 ± 0.51	1.27 ± 0.38	Pass
S-2711,2712	7/29/2020	K-40	17.4 ± 0.9	19.6 ± 1.0	18.5 ± 0.7	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
WW-2799,2800	8/4/2020	H-3	471 ± 100	437 ± 99	454 ± 70	Pass
WW-2933,2934	8/4/2020	H-3	316 ± 91	300 ± 90	308 ± 64	Pass
S-2774,2775	8/4/2020	K-40	5.9 ± 0.9	6.1 ± 0.8	6.0 ± 0.6	Pass
WW-2912,2913	8/5/2020	H-3	176 ± 84	226 ± 87	201 ± 60	Pass
F-3040,3041	8/7/2020	Gr. Beta	4.55 ± 0.12	4.63 ± 0.12	4.59 ± 0.09	Pass
F-3040,3041	8/7/2020	K-40	3.58 ± 0.42	3.32 ± 0.41	3.45 ± 0.29	Pass
WW-2867,2868	8/12/2020	H-3	169 ± 85	219 ± 86	194 ± 61	Pass
VE-2842,2843	8/12/2020	K-40	3.18 ± 0.30	3.14 ± 0.37	3.16 ± 0.24	Pass
F-2891,2892	8/14/2020	K-40	2.98 ± 0.39	2.82 ± 0.35	2.90 ± 0.26	Pass
VE-2954,2955	8/20/2020	Be-7	0.222 ± 0.106	0.283 ± 0.166	0.252 ± 0.099	Pass
VE-2954,2955	8/20/2020	K-40	4.09 ± 0.37	3.75 ± 0.38	3.92 ± 0.27	Pass
DW-20126,20127	8/25/2020	Ra-226	0.90 ± 0.14	0.73 ± 0.12	0.82 ± 0.09	Pass
DW-20126,20127	8/25/2020	Ra-228	1.55 ± 0.52	2.30 ± 0.58	1.93 ± 0.39	Pass
LW-3154,3155	8/26/2020	Gr. Beta	1.43 ± 0.60	1.33 ± 0.55	1.38 ± 0.41	Pass
VE-3084,3085	8/28/2020	Be-7	0.52 ± 0.12	0.48 ± 0.07	0.50 ± 0.07	Pass
VE-3084,3085	8/28/2020	K-40	3.87 ± 0.16	3.36 ± 0.31	3.62 ± 0.17	Pass
SWU-3133,3134	9/1/2020	H-3	107 ± 84	116 ± 84	111 ± 59	Pass
VE-3208,3209	9/8/2020	K-40	5.99 ± 0.43	5.85 ± 0.35	5.92 ± 0.28	Pass
VE-3187,3188	9/8/2020	Be-7	0.50 ± 0.17	0.61 ± 0.23	0.55 ± 0.14	Pass
VE-3187,3188	9/8/2020	K-40	4.64 ± 0.54	4.97 ± 0.45	4.81 ± 0.35	Pass
WW-3427,3428	9/10/2020	H-3	2,321 ± 163	2,323 ± 164	2,322 ± 116	Pass
DW-21033,21034	9/14/2020	Gr. Alpha	1.27 ± 0.79	0.94 ± 0.75	1.11 ± 0.54	Pass
DW-21033,21034	9/14/2020	Gr. Beta	1.02 ± 0.60	1.01 ± 0.59	1.02 ± 0.42	Pass
SG-3265,3266	9/14/2020	Pb-214	11.8 ± 0.49	10.4 ± 0.57	11.1 ± 0.38	Pass
SG-3265,3266	9/14/2020	Ac-228	18.8 ± 1.27	17.3 ± 1.36	18.0 ± 0.93	Pass
SG-3265,3266	9/14/2020	Gr. Alpha	28.0 ± 4.6	33.5 ± 4.9	30.8 ± 3.4	Pass
SG-3265,3266	9/14/2020	Gr. Beta	42.1 ± 2.8	44.5 ± 3.0	43.3 ± 2.1	Pass
VE-3315,3316	9/15/2020	Be-7	0.25 ± 0.10	0.28 ± 0.16	0.27 ± 0.09	Pass
VE-3315,3316	9/15/2020	K-40	5.48 ± 0.34	5.16 ± 0.36	5.32 ± 0.25	Pass
WW-3339,3340	9/16/2020	H-3	196 ± 85	199 ± 85	198 ± 60	Pass
CF-3381,3382	9/21/2020	Be-7	0.20 ± 0.10	0.19 ± 0.11	0.20 ± 0.07	Pass
CF-3381,3382	9/21/2020	K-40	5.94 ± 0.30	5.72 ± 0.29	5.83 ± 0.21	Pass
AP-092120A,B	9/21/2020	Gr. Beta	0.043 ± 0.005	0.041 ± 0.005	0.042 ± 0.004	Pass
F-3706,3707	9/26/2020	K-40	1.86 ± 0.35	1.83 ± 0.39	1.84 ± 0.26	Pass
AP-092820A,B	9/28/2020	Gr. Beta	0.021 ± 0.004	0.023 ± 0.004	0.022 ± 0.003	Pass
XW-3620,3621	9/30/2020	Sr-89	11,760 ± 140	12,487 ± 133	12,124 ± 97	Pass
XW-3620,3621	9/30/2020	Sr-90	2,287 ± 45	2,831 ± 50	2,559 ± 34	Pass
XW-3620,3621	9/30/2020	Fe-55	1,623 ± 462	1,833 ± 474	1,728 ± 331	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SW-3515,3516	10/1/2020	H-3	154 ± 86	111 ± 84	133 ± 60	Pass
DW-20141,20142	10/1/2020	Ra-226	1.34 ± 0.16	1.39 ± 0.16	1.37 ± 0.11	Pass
DW-20141,20142	10/1/2020	Ra-228	1.74 ± 0.62	2.09 ± 0.64	1.92 ± 0.45	Pass
SW-3536,3537	10/5/2020	H-3	376 ± 97	378 ± 97	377 ± 68	Pass
WW-3727,3728	10/8/2020	H-3	152 ± 82	190 ± 84	171 ± 59	Pass
VE-3748,3749	10/12/2020	K-40	3.07 ± 0.25	2.88 ± 0.26	2.98 ± 0.18	Pass
VE-3769,3770	10/12/2020	Be-7	0.80 ± 0.31	0.51 ± 0.15	0.66 ± 0.17	Pass
VE-3769,3770	10/12/2020	K-40	5.69 ± 0.61	5.79 ± 0.39	5.74 ± 0.36	Pass
WW-4092,4093	10/13/2020	H-3	6,484 ± 252	6,275 ± 248	6,380 ± 177	Pass
WW-3838,3839	10/14/2020	H-3	313 ± 90	263 ± 88	288 ± 63	Pass
WW-4394,4395	11/3/2020	H-3	161 ± 83	199 ± 85	180 ± 60	Pass
WW-4587,4588	11/4/2020	H-3	6,468 ± 252	6,638 ± 255	6,553 ± 179	Pass
WW-4524,4525	11/5/2020	H-3	160 ± 86	131 ± 84	145 ± 60	Pass
VE-4415,4416	11/24/2020	Be-7	0.28 ± 0.08	0.22 ± 0.07	0.25 ± 0.05	Pass
VE-4415,4416	11/24/2020	K-40	2.25 ± 0.21	2.20 ± 0.19	2.23 ± 0.14	Pass
AP-4845,4846	12/31/2020	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-7. 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-664	2/1/2020	Gross Alpha	2.26 ± 0.14	1.24	0.37 - 2.11	Fail [d]
MAAP-664	2/1/2020	Gross Beta	2.40 ± 0.07	2.00	1.00 - 3.00	Pass
MAW-536	2/1/2020	Gross Alpha	0.86 ± 0.06	1.03	0.31 - 1.75	Pass
MAW-536	2/1/2020	Gross Beta	3.79 ± 0.07	4.24	2.12 - 6.36	Pass
MASO-662	2/1/2020	Cs-134	955 ± 9	1114	780 - 1448	Pass
MASO-662	2/1/2020	Cs-137	1089 ± 12	1020	714 - 1326	Pass
MASO-662	2/1/2020	Co-57	1106 ± 8	1071	750 - 1392	Pass
MASO-662	2/1/2020	Co-60	0.33 ± 1.26	0	NA [c]	Pass
MASO-662	2/1/2020	Mn-54	1022 ± 27	945	662 - 1229	Pass
MASO-662	2/1/2020	Zn-65	842 ± 17	751	526 - 976	Pass
MASO-662	2/1/2020	K-40	710 ± 42	625	438 - 813	Pass
MAW-534	2/1/2020	I-129	0.81 ± 0.09	1.001	0.701 - 1.301	Pass
MAW-599	2/1/2020	H-3	202 ± 9	196	137 - 255	Pass
MAW-599	2/1/2020	Am-241	0.41 ± 0.09	0.547	0.383 - 0.711	Pass
MAW-599	2/1/2020	Cs-134	16.1 ± 0.3	18.5	13.0 - 24.1	Pass
MAW-599	2/1/2020	Cs-137	11.5 ± 0.4	11.3	7.9 - 14.7	Pass
MAW-599	2/1/2020	Co-57	20.0 ± 0.30	19.7	13.8 - 25.6	Pass
MAW-599	2/1/2020	Co-60	10.6 ± 0.2	10.6	7.4 - 13.8	Pass
MAW-599	2/1/2020	Mn-54	20.5 ± 0.4	19.6	13.7 - 25.5	Pass
MAW-599	2/1/2020	Zn-65	24.1 ± 0.70	22.2	15.5 - 28.9	Pass
MAW-599	2/1/2020	K-40	0.57 ± 1.54	0	NA [c]	Pass
MAW-599	2/1/2020	Fe-55	13.3 ± 12.2	17.8	12.5 - 23.1	Pass
MAW-599	2/1/2020	Ni-63	9.72 ± 0.43	11.1	7.8 - 14.4	Pass
MAW-599	2/1/2020	Sr-90	0.07 ± 0.18	0	NA [c]	Pass
MAW-599	2/1/2020	Tc-99	3.41 ± 0.31	3.63	2.54 - 4.72	Pass
MAW-599	2/1/2020	Ra-226	0.56 ± 0.06	0.365	0.256 - 0.475	Fail [e]
MAW-599	2/1/2020	Pu-238	0.69 ± 0.08	0.94	0.66 - 1.22	Pass
MAW-599	2/1/2020	Pu-239/240	0.48 ± 0.07	0.737	0.516 - 0.958	Fail [f]
MAW-599	2/1/2020	U-234	1.04 ± 0.08	0.97	0.68 - 1.26	Pass
MAW-599	2/1/2020	U-238	1.02 ± 0.08	0.95	0.67 - 1.24	Pass

TABLE A-7. 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
MAVE-668	2/1/2020	Cs-134	3.51 ± 0.22	3.82	2.67 - 4.97	Pass
MAVE-668	2/1/2020	Cs-137	3.04 ± 0.18	2.77	1.94 - 3.60	Pass
MAVE-668	2/1/2020	Co-57	0.02 ± 0.03	0	NA [c]	Pass
MAVE-668	2/1/2020	Co-60	2.92 ± 0.08	2.79	1.95 - 3.63	Pass
MAVE-668	2/1/2020	Mn-54	5.16 ± 0.14	4.58	3.21 - 5.95	Pass
MAVE-668	2/1/2020	Zn-65	4.36 ± 0.16	3.79	2.65 - 4.93	Pass
MAW-689	2/1/2020	Ra-226	172 ± 1	189	132 - 246	Pass
MAW-689	2/1/2020	Ra-228	65 ± 1	75	53 - 98	Pass
MAAP-3181	8/1/2020	Gross Alpha	0.45 ± 0.06	0.528	0.158 - 0.898	Pass
MAAP-3181	8/1/2020	Gross Beta	0.97 ± 0.04	0.915	0.458 - 1.373	Pass
MADW-3101	8/1/2020	Gross Alpha	0.57 ± 0.04	0.62	0.19 - 1.05	Pass
MADW-3101	8/1/2020	Gross Beta	0.75 ± 0.04	0.83	0.42 - 1.25	Pass
MASO-3179	8/1/2020	Cs-134	599 ± 7	710	497 - 923	Pass
MASO-3179	8/1/2020	Cs-137	3.33 ± 4.81	0	NA [c]	Pass
MASO-3179	8/1/2020	Co-57	1145 ± 8	1100	770 - 1430	Pass
MASO-3179	8/1/2020	Co-60	965 ± 9	1000	700 - 1300	Pass
MASO-3179	8/1/2020	Mn-54	651 ± 11	610	427 - 793	Pass
MASO-3179	8/1/2020	Zn-65	524 ± 14	470	329 - 611	Pass
MASO-3179	8/1/2020	K-40	684 ± 58	622	435 - 809	Pass
MAW-3175	8/1/2020	Cs-134	13.9 ± 0.3	15.2	10.6 - 19.8	Pass
MAW-3175	8/1/2020	Cs-137	15.4 ± 0.4	14.3	10.0 - 18.6	Pass
MAW-3175	8/1/2020	Co-57	0.10 ± 0.16	0	NA [c]	Pass
MAW-3175	8/1/2020	Co-60	12.5 ± 0.3	12.2	8.5 - 15.9	Pass
MAW-3175	8/1/2020	Mn-54	0.07 ± 0.17	0	NA [c]	Pass
MAW-3175	8/1/2020	Zn-65	18.3 ± 0.6	16.9	11.8 - 22.0	Pass
MAW-3175	8/1/2020	K-40	1.06 ± 1.65	0	NA [c]	Pass

TABLE A-7. 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-3177	8/1/2020	Cs-134	1.28 ± 0.05	1.83	1.28 - 2.38	Fail[g]
MAAP-3177	8/1/2020	Cs-137	0.981 ± 0.068	0.996	0.697 - 1.295	Pass
MAAP-3177	8/1/2020	Co-57	0.020 ± 0.027	0	NA [c]	Pass
MAAP-3177	8/1/2020	Co-60	1.57 ± 0.06	1.73	1.21 - 2.25	Pass
MAAP-3177	8/1/2020	Mn-54	0.751 ± 0.077	1.400	0.98 - 1.82	Fail[h]
MAAP-3177	8/1/2020	Zn-65	2.07 ± 0.15	2.00	1.40 - 2.60	Pass
MAVE-3185	8/1/2020	Cs-134	4.73 ± 0.10	4.94	3.46 - 6.42	Pass
MAVE-3185	8/1/2020	Cs-137	0.03 ± 0.06	0	NA [c]	Pass
MAVE-3185	8/1/2020	Co-57	7.83 ± 0.12	6.67	4.67 - 8.67	Pass
MAVE-3185	8/1/2020	Co-60	4.41 ± 0.10	4.13	2.89 - 5.37	Pass
MAVE-3185	8/1/2020	Mn-54	6.52 ± 0.18	5.84	4.09 - 7.59	Pass
MAVE-3185	8/1/2020	Zn-65	7.26 ± 0.19	6.38	4.47 - 8.29	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 lab utilized a MAPEP specific gross alpha/beta filter calibration as discussed in the MAPEP test instructions for MAAP-664. Using the MAPEP specific calibration for MAAP-664 caused the bias to shift from low to high. The subsequent MAPEP study result was acceptable. See Lab code MAAP-3101 (reference date 8/1/2020).

[e] An investigation of the Radium-226 failure was inconclusive. Subsequent Ra-226 PT analyses were satisfactory. See ERA RAD-121 and RAD-122 studies Table A-1 and NY ELAP shipment 437R Table A-2.

[f] Analysis was repeated in duplicate with acceptable results: Pu-238 (0.97 & 1.10 Bq/Kg); Pu-239 (0.83 & 0.83 Bq/Kg). The cause of the failure could not be determined.

[g] Analysis was run in duplicate. Results were (1.18 Bq/sample and 1.37 Bq/sample). The submitted result was the mean of the two results (1.28 ± 0.05 Bq/sample).

[h] A data transcription error resulted in an erroneous reported value. The actual result (1.36 ± 0.08 Bq/L) passes.

TABLE A-8. 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-769	3/16/2020	Am-241	71.0	74.7	53.3 - 99.6	Pass
ERAP-769	3/16/2020	Cs-134	1210	1390	902 - 1700	Pass
ERAP-769	3/16/2020	Cs-137	393	351	288 - 460	Pass
ERAP-769	3/16/2020	Co-60	450.0	422.0	359.0 - 536	Pass
ERAP-769	3/16/2020	Fe-55	1200	1260	460 - 2010	Pass
ERAP-769	3/16/2020	Mn-54	< 2.4	< 50.0	0.00 - 50.0	Pass
ERAP-769	3/16/2020	Zn-65	856	694	569 - 1060	Pass
ERAP-769	3/16/2020	Pu-238	31.4	28.0	21.1 - 34.4	Pass
ERAP-769	3/16/2020	Pu-239	43.9	40.1	30.0 - 48.4	Pass
ERAP-769	3/16/2020	Sr-90	190	175	111 - 238	Pass
ERAP-769	3/16/2020	U-234	56.7	56.2	41.7 - 65.9	Pass
ERAP-769	3/16/2020	U-238	57.0	55.7	42.1 - 66.5	Pass
ERAP-771	3/16/2020	Gross Alpha	33.4	29.3	15.3 - 48.3	Pass
ERAP-771	3/16/2020	Gross Beta	68.3	66.4	40.3 - 100	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 2020 Land Use Census and REMP-GWPP Data

The Duane Arnold Energy Center Land Use Census was completed during July-September 2020. All residences, milk animals, cattle, and gardens greater than 500 square feet were identified within three miles for each of the 16 meteorological sectors. If none were identified within three-mile range, additional surveys were performed out to five miles. The 16 meteorological sectors were identified using Google Earth and digital compass rose overlay for accuracy and precision. Sample locations and information can be found in the Offsite Dose Assessment Manual (ODAM) or the Defueled Offsite Dose Assessment Manual (DODAM), Table 5-1. Both documents are published by the Nuclear Regulatory Commission (NRC) in the DAEC 2020 Annual Radiological Material Release Report, which also includes information on DAEC's decommissioning.

The 2020 Land Use Census identified 81 gardens, which is the same as in 2019, 37 fewer gardens than in 2018, and 40 fewer gardens than in 2017. Seven farmers or residents provided vegetation samples including two adjacent neighbors to DAEC, D-58 and D-57. Gardens were identified using Google Earth, Linn County GIS data, field observation, and interviewing residents.

There are no nearest resident changes. The largest municipality closest to the facility is Palo, Iowa (D-5a and D-5). In addition, the Pleasant Creek State Recreation Area has a large transient population of 50-300 people camping in RV's and tents from April to October and is identified as sample location D-4. Much of the terrain and population consists of suburban communities, rural subdivisions, farms, and a nature preserve.

There are three nearest livestock changes attributed to field observation verification. Farmers in the WNW and ENE sectors were observed to have goats but did not provide goat milk samples. The Iowa Department of Agriculture and Land Stewardship provided a list of permitted commercial dairy farms located Benton and Linn Counties. Large commercial dairies were included in the survey, but none were located within five miles. DAEC collected milk samples from two permitted dairy farms located in WSW and SW sectors for most of 2020. No goat milk samples were collected in 2020.

The derecho storm on August 10, 2020 caused significant property and crop damage to dairy sample locations D-110 and D-138 preventing adequate sampling in the 3rd and 4th quarter of 2020. Following the permanent defueling of the reactor in October 2020 and identified reduction in gaseous effluent matrix from the facility, milk sampling was terminated in December 2020 as a viable sampling method.

The Cedar River was surveyed by the State of Iowa Hygienic Laboratory on June 18, 2020, and September 18, 2020, for water use downstream of the DAEC to Cedar Rapids. Consistent with historical surveys, both 2020 surveys did not identify irrigation systems that withdraw water from the Cedar River to irrigate vegetable gardens or commercial crops. Recreational fishing in the Cedar River is the only identified food pathway.

The State of Iowa Hygienic Laboratory performed fish sampling on June 3, 2020, and August 14, 2020. Fish filets from smallmouth bass, northern pike, white crappie, and channel catfish were processed for off-site laboratory analysis. No DAEC by-products were identified.

Benton County Public Health Department and Linn County Public Health Department provided groundwater well permit data. In 2020, three new drinking wells were installed within three miles of the facility, but none of these new wells are impacted by plant activities or down gradient of the facility. No DAEC by-products were identified in any drinking water samples or water samples from the Cedar River.

The Groundwater Protection Program (GWPP) provides representative monitoring and characterization of radioactivity in the highest potentially exposed aquifer, verification of the accuracy of the GWPP monitoring efforts, and modeling of the subsurface. Additionally, the GWPP is designed to mitigate radiological contaminates to groundwater and protect DAEC employees, the public, and environment. The GWPP is incorporated within REMP and includes standards set forth in Nuclear Energy Institute document, NEI 07-07. Specifically:

- There are 56 monitoring wells on-site. 2020 tritium concentrations from monitoring wells range from non-detectable at less than (<) 152 pCi/L to 51,271 pCi/L, from monitoring well MW-08A (D-128A). Gross alpha values in several samples are believed to be influenced by naturally occurring radioactive materials in the environment, i.e. radon. No on-site or neighboring drinking water wells are installed in this shallow aquifer. Tritiated groundwater remains within the owner-controlled area and the shallow aquifer is undergoing mitigation in accordance with ACP 1411.35.

  From January 1 to December 31, 2020, three extraction wells were in operation and are designed to remove tritiated groundwater continuously from the shallow aquifer. In addition, temporary mitigation of monitoring wells was performed at MW-08A (D-128A) and MW-23A (D-67). For specific liquid effluent release data, see the 2020 Duane Arnold Annual Radioactive Material Release Report.

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

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

As a result of the 2020 Land Use Census, adjustments were made to the MIDAS dose projection software model for changes in receptor distances. Due to continued water use surveys indicating no downstream irrigation usage of Cedar River water, the ingestion pathway for irrigated vegetables was removed from MIDAS for the 2020 dose assessment. The 2020 annual radiation dose assessment can be found in Appendix E.

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

Updates to REMP and GWPP 2020 sampling include:

1. D-76, D-110, and D-138 sample locations were discontinued.
2. D-59 vegetation sample location added.
3. D-57, D-58, and D-72 were renamed, "Drinking Water".

APPENDIX E

ANNUAL RADIATION DOSE ASSESSMENT

Appendix E

Annual Radiation Dose Assessment

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

Section A. Dose Contribution from Direct Radiation

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

1. Pre-operational and 2020 TLD results were evaluated with a paired difference statistical test. The evaluation concluded that there were no significant differences in the TLD populations for the 0.5 mile and 1 mile TLD populations as per Environmental Sampling Procedure, ESP 4.5.

2. As stated in Part 1 of this report, no plant effect was indicated by the TLDs when dose results were compared to the estimated average natural background for the central United States.

Section B. Estimated Offsite Dose from Effluent Releases

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

2. Following calculation of offsite doses, the appropriateness of REMP sampling station types and locations was reviewed. The current sampling scheme was determined to be adequate for the identified receptors.

Results of the MIDAS dose calculations are displayed below.

1.) The maximum dose from tritiated groundwater and liquid radwaste waste system was to a child total body dose of 0.0328 mrem and to a child's liver organ dose of 0.0329 mrem. There were twenty liquid batch releases from the radioactive waste system and batch releases contained tritium, Manganese-54, Cobalt-60, and Cesium-137. There was a total of forty-seven liquid releases from groundwater mitigation. Of which, four releases were from the permanent mitigation system (three extraction wells) and forty-three continuous and combined releases from monitoring wells MW-08A and MW-23A.

2.) The maximum dose to air at the site boundary from noble gases released was 0.0157 mrad from gamma radiation at 481 meters towards the South-Southeast.

3.) The maximum dose to air at the site boundary from noble gases released was 0.0181 mrad beta radiation at 481 meters towards the South-Southeast.

4.) The whole-body dose equivalent to the hypothetical maximally exposed individual from noble gases was 0.0053 mrem, at 805 meters towards the West.

5.) The skin dose equivalent to the hypothetical maximally exposed individual (child) from noble gases was 0.0096 mrem, at 805 meters towards the West.

6.) The hypothetical maximally exposed organ due to airborne iodines and particulates with half-lives greater than eight days (excluding carbon-14) was the thyroid of a child at 805 meters towards the West, with an estimated dose equivalent of 0.00456 mrem.

7.) The hypothetical maximally exposed organ due to airborne carbon-14 was the bone of a child located 1,760 meters to the North of the site. The dose was 0.214 mrem.

Conclusion

No measurable dose due to the operation of the DAEC or the DAEC ISFSI was detected by environmental TLDs in 2020. The calculated doses are below the regulatory limits stated in Appendix I to 10CFR50, 40CFR190, and 10 CFR 72.104.

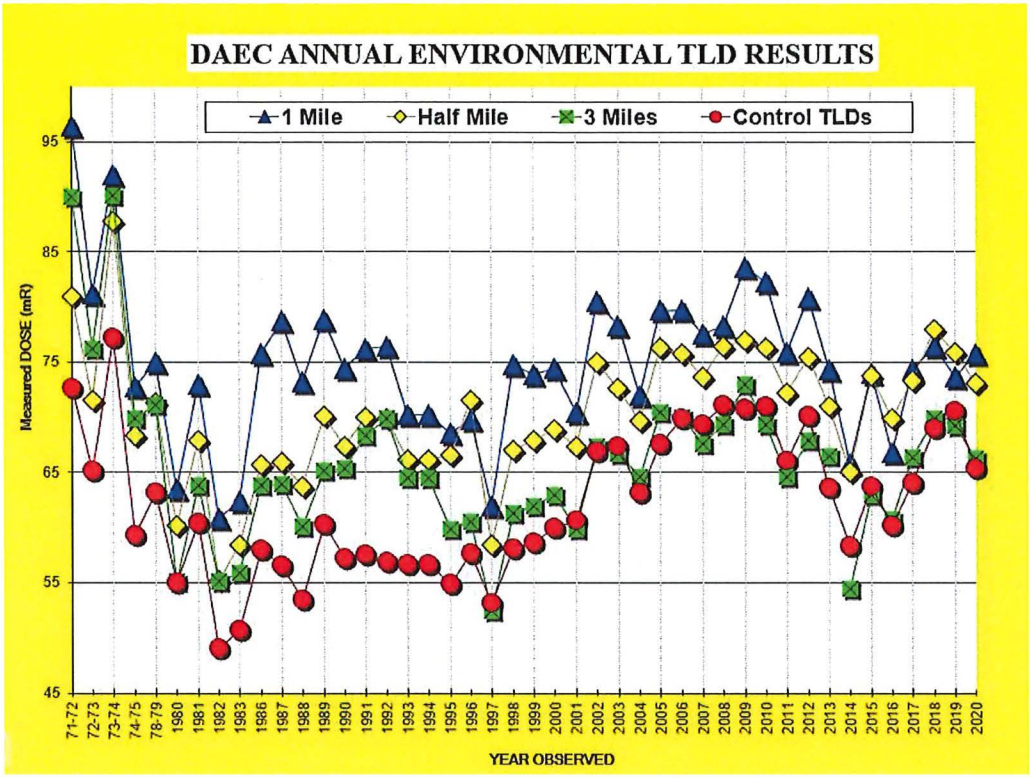
Estimated Maximum Offsite Individual Doses for 2020

Type	Age Group	Distance (meters)	Direction	Dose or Dose Equivalent (mrem)	Annual 10 CFR 50, Appendix I "Limit"
Direct Radiation (as measured by TLDs)				None	*
Liquid Releases					
Whole Body Dose	Child	D*	SE	0.0328 mrem	3 mrem
Organ Dose	Child - Liver	D*	SE	0.0329 mrem	10 mrem
Noble Gas					
Gamma Air Dose		481	SSE	0.0157 mrad	10 mrad
Beta Air Dose		481	SSE	0.0181 mrad	20 mrad
Whole Body	All	805	W	0.00530 mrem	5 mrem
Skin	Child	805	W	0.00960 mrem	15 mrem
Particulates & Iodines					
Organ Dose	Child – Lungs	805	W	0.00456 mrem	15 mrem
Carbon 14					
Organ Dose	Child – Bone	3,015	WNW	0.2140 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 2020 Annual Radiological Environmental Operating Report, subsections "Ambient Radiation (TLDs)" and "ISFSI Facility Operations Monitoring".

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

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


DAEC ANNUAL ENVIRONMENTAL TLD RESULTS
1 Mile
Half Mile
3 Miles
Control TLDs
Measured DOSE (mR)
95
85
75
65
55
45
71-72
72-73
73-74
74-75
78-79
1980
1981
1982
1983
1986
1987
1988
1989
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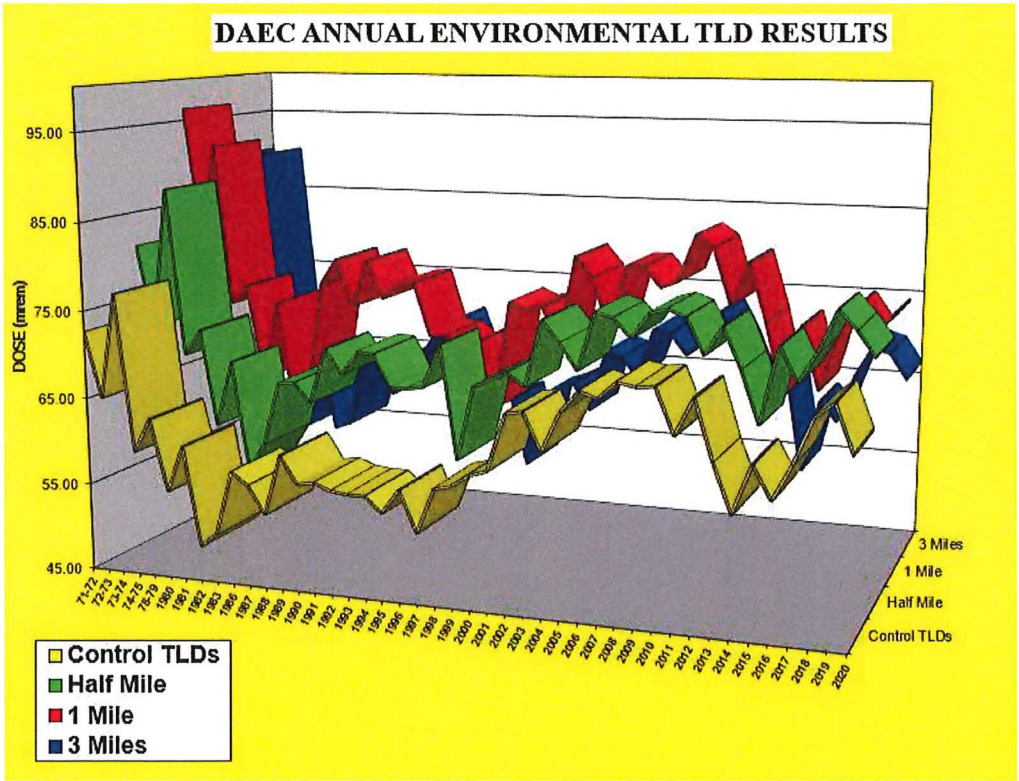
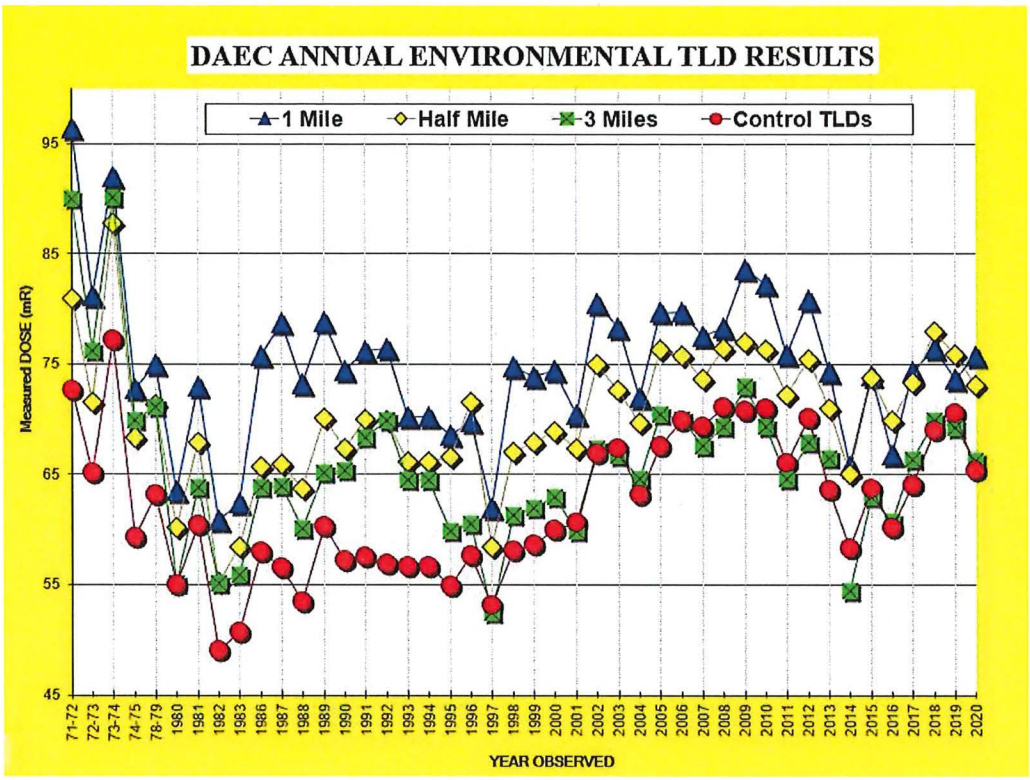

DAEC ANNUAL ENVIRONMENTAL TLD RESULTS
DOSE (mrem)
95.00
85.00
75.00
65.00
55.00
45.00
3 Miles
1 Mile
Half Mile
Control TLDs
Control TLDs
Half Mile
1 Mile
3 Miles


DAEC ANNUAL ENVIRONMENTAL TLD RESULTS
1 Mile
Half Mile
3 Miles
Control TLDs
Measured DOSE (mR)
95
85
75
65
55
45
71-72
72-73
73-74
74-75
78-79
1980
1981
1982
1983
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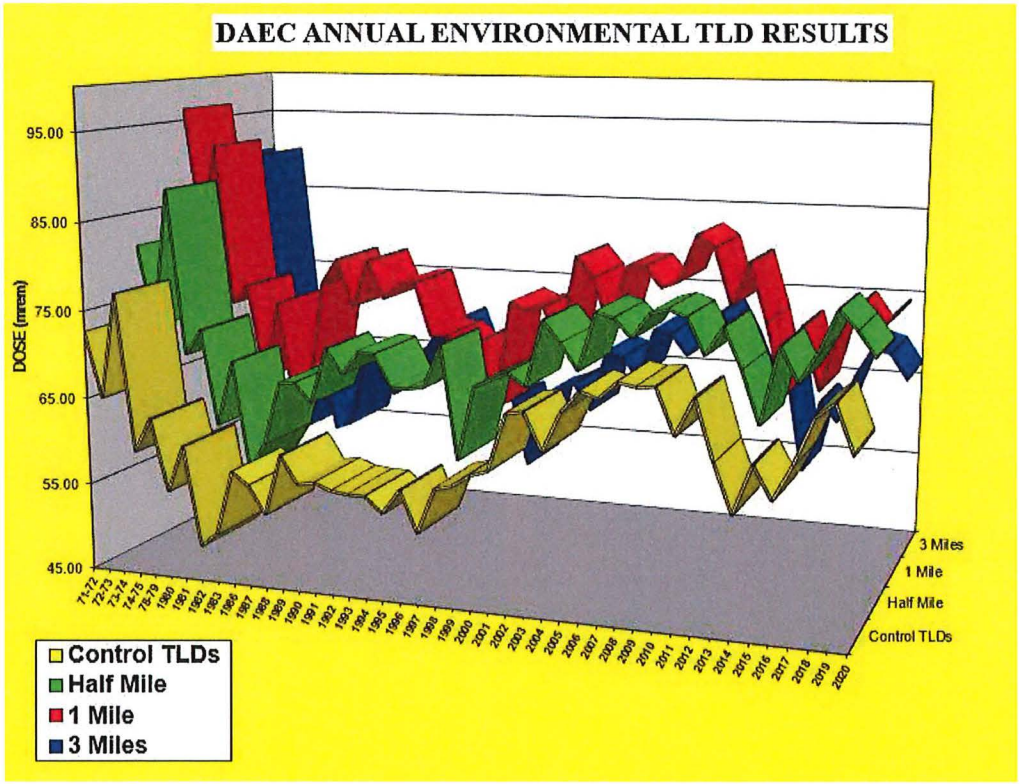
DAEC ANNUAL ENVIRONMENTAL TLD RESULTS
DOSE (mrem)
95.00
85.00
75.00
65.00
55.00
45.00
3 Miles
1 Mile
Half Mile
Control TLDs
Control TLDs
Half Mile
1 Mile
3 Miles