MICROBAC

700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

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

REPORT

to the

UNITED STATES
NUCLEAR REGULATORY COMMISSION

Annual Radiological Environmental Operating Report

January 1 to December 31, 2025

Prepared by

Microbac Laboratories - Northbrook

Project No. 8001

Approved: 05/06/2026

Michelle L. Z. Carpenter, Ph.D.
Laboratory Director

PREFACE

Staff members of the Microbac Laboratories - Northbrook 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.

TABLE OF CONTENTS

PART I

APPENDICES

TABLE OF CONTENTS (continued)

PART II Page

LIST OF TABLES

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

Appendix A

Appendix C

LIST OF FIGURES

1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory at the Duane Arnold Energy Center, Palo, Iowa, during the period January - December 2025. 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.

The DAEC permanently shut down on August 10, 2020. NextEra Energy Duane Arnold (NEDA) informed the NRC by letter dated August 27, 2020 (Accession No. ML20240A067); certifying the permanent cessation of power operations at the DAEC.

In October 2020 NEDA certified by letter (ML20286A317) the permanent defueling of the reactor at DAEC. Therefore, as specified in 10 CFR 50.82(a)(2), the 10 CFR Part 50 license for DAEC no longer authorizes operations of the reactor or emplacement or retention of fuel into the reactor vessel.
In April 2022 all the nuclear fuel had been removed from the fuel pool and placed in dry cask storage at the site Independent Spent Fuel Storage Installation (ISFSI). There are no effluents from the ISFSI based on the design of the casks.

By December 2022 the plant was in SAFSTOR (a long-term storage condition for a permanently shutdown nuclear power plant). During SAFSTOR, radioactive contamination decreases substantially, making subsequent decontamination and demolition easier and reducing the amount of low level radioactive waste requiring disposal. All radioactive and service water systems were drained or placed in a stable condition. Plant systems are monitored, and adverse conditions are documented and addressed as needed.

The contribution of dose to a member of the public is most likely to be exposed from liquid and gaseous effluent releases. Calculation methods in the Defueled Offsite Dose Assessment Manual (DODAM) 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".

2.0 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 2025 are summarized and discussed. Information regarding DAEC effluents and the Defueled Offsite Dose Assessment Manual (DODAM) can be found in the 2025 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 which are fission products, and tritium, which is produced by cosmic rays, atmospheric nuclear detonations, and also by nuclear power plants. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, and cerium-144. These three gamma-emitting isotopes were selected as radiological impact indicators because of the different characteristic proportions in which they appear in the fission product mix produced by a nuclear reactor and that produced by a nuclear detonation. Each of the three isotopes is produced in roughly equivalent amounts by a reactor: each constitutes about 10% of the total activity of fission products ten (10) days after reactor shutdown. Alternatively, ten (10) days after a nuclear explosion, the contributions of zirconium-95, cerium-144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud,1963). The other group quantified consists of niobium-95, ruthenium-103 and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the next group, manganese-54, cobalt-58 and-60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of nuclear power plant effluents, but are not produced in significant quantities by nuclear detonations. Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occurring isotope, were chosen as calibration monitors and provide a comparison between levels of naturally occurring radionuclides and radionuclides that could be attributed to the operation of the plant.

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

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

3.2 Program Description

3.2.1 Environmental Monitoring

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

To monitor the air environment, a continuous air sampler is employed. Airborne particulates at the remaining locations are indicators: D-15 and D-16. Filters are changed and counted bi-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.

Ambient gamma radiation is monitored at a total of 32 locations. A TLD is placed at each location and exchanged and analyzed quarterly.

Surface water is collected monthly from two total locations: D-49 and D-61. The monthly samples are analyzed for tritium and gamma-emitting isotopes.

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 and D-51. The samples are analyzed for gamma-emitting isotopes.

Drinking water is collected monthly from D-52 and D-53. 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.

Milk sampling was discontinued in November of 2020.

Additional monitoring of the terrestrial environment, grain, forage and broadleaf vegetation samples are collected annually, as available, from two indicators locations D-015 and D-016. Grain, forage 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

The Duane Arnold Energy Center has committed to the Nuclear Energy Institute's Industry Groundwater Protection Initiative – NEI 07-07. The sampling program is described in Section 2.8 of the DODAM; sample locations are shown in Figure 5-1 and Figure 5-2.

3.3 Program Execution

The program was executed as described in the preceding section without exception.

3.4 Laboratory Procedures

Levels of iodine-131 in vegetation and concentrations of airborne iodine-131 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.

Microbac Laboratories – Northbrook (previously 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 (Microbac Laboratories Inc - Northbrook, 2024). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

No changes for 2025.

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 2025 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 2025. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2025. 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 2025.

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were 0.026 pCi/m3 at the indicator locations. Sampling has been discontinued at the control location. The results are consistent with levels observed from 2000 through 2025. The historical results are tabulated below.

Year	Indicators	Controls		Year	Indicators	Controls
Concentration (pCi/m^3)				Concentration (pCi/m^3)		
2000	0.026	0.027		2013	0.028	0.025
2001	0.026	0.026		2014	0.026	0.025
2002	0.027	0.027		2015	0.027	0.024
2003	0.029	0.029		2016	0.027	0.023
2004	0.028	0.028		2017	0.028	0.025
2005	0.031	0.031		2018	0.028	0.026
2006	0.029	0.027		2019	0.026	0.025
2007	0.031	0.031		2020	0.026	0.026
2008	0.029	0.029		2021	0.031	0.028
2009	0.031	0.030		2022	0.030	0.053
2010	0.028	0.028		2023	0.030	NA
2011	0.030	0.029		2024	0.024	NA
2012	0.030	0.029		2025	0.026	NA

Average annual gross beta concentrations in airborne particulates.

NA – Not analyzed. Sampling has been discontinued at the control location.

4.2 Program Findings, Airborne Particulates (continued)

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded Beryllium-7 results for the indicator locations similar to last year's results. Sampling has been discontinued at the control location. Beryllium-7,produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955), is typically detected in quarterly air samples. No reactor by-product radionuclides were identified in any of the air samples analyzed. All samples met required lower limits of detection as specified in the DODAM.

Airborne Iodine

All iodine sampling has been discontinued.

Ambient Radiation (TLDs)

At the control location, D-4, thermoluminescent dosimeter (TLD) readings averaged 15.1 mR/quarter. At locations within a half mile, one mile and three mile radius of the stack, the measurements averaged 17.5, 17.4 and 14.9 mR/quarter, respectively. The on-site location D-15 averaged 14.1 mR/quarter. 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 58.6 mR/quarter.

Groundwater (drinking water-potable)

24 drinking water samples from two locations were collected in 2025. Tritium concentrations in ground water samples were less than the MDC of 182 pCi/L in all samples analyzed. I-131 and other gamma-emitting isotopes were below detection limits.

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

4.2 Program Findings (continued)

Vegetation

Seven vegetation samples from two locations were collected in 2025 consisting of green leafy vegetation, forage and grain samples. Iodine-131 concentrations in all vegetation samples were less than the LLD level of 0.059 pCi/g wet weight in the two green leafy vegetation samples and less 0.058 pCi/g wet in the five grain and forage samples analyzed.

Naturally occurring potassium-40 was the only other gamma-emitting isotope observed in all vegetation samples, all other gamma-emitting isotopes were below detection limits. All samples met required lower limits of detection as specified in the DODAM.

Surface Water

20 surface water samples were collected from two locations in 2025. One sample tested positive for tritium at a concentration of 176 ± 92 pCi/L. No gamma emitting isotopes were measured above their respective LLD's in any of the samples tested. The positive tritium value is from the surface water control location and is not attributed to plant effluents.

Fish

Eight fish samples from five sport fish species were collected in April and October, 2025, 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 average potassium-40 level was similar at both the indicator and control locations (3.85 and 3.94 pCi/g wet, respectively).

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

River Sediments

Four river sediment samples from two locations were collected in 2025 during the months of June and October and analyzed for gamma-emitting isotopes. Potassium-40 activity ranged from 10.74 to 12.78 pCi/g dry weight at the indicator locations and between 8.79 and 8.88 pCi/g dry weight at the control location.

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

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	15 16	On-site North On-site South	Continuous operation of sampler with sample collection at least once monthly 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.
Ambient Radiation	4 15,17,18, 20,22,29, 31, 83, 85 33,35,37, 39,42 43,46,48 161-164	(Controls) (Indicators) Within 0.5 mile of Stack Within 3.0 miles of Stack Within 1.0 mile of Stack ISFSI Fence line	One dosimeter continuously at each location. Dosimeters are changed at least quarterly.	Read gamma radiation dose quarterly.
Surface Water	49 61	Lewis Access (C) Plant Discharge ~ ½ mi. downstream from Plant Discharge	Once per month.	Gamma isotopic and tritium analysis for each sample (by location).

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	Plant potable water Treated Municipal Water	Grab sample at least once per quarter	Analysis gamma emitting isotopes, 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 51	Lewis Access Plant Discharge	At least once every six months.	Gamma isotopic analysis of each sample
Vegetation	15,16	Farms raising food crops	Annually at harvest time. Two samples of each: grain, green leafy, and forage.	Gamma isotopic analysis, of each sample.
Fish	49 61	Cedar River upstream of DAEC not influenced by effluent (C) Downstream of DAEC in influence of effluent	One sample per 6 months (once during January through June and once during July through December).	Gamma isotopic analysis on edible portions.

[a] (C) denotes control location. All other locations are indicators.
[b] Gamma isotopic analysis and analysis for gamma-emitting nuclides refer to high resolution gamma ray spectrum analysis.
[c] Sample collection discontinued after 01-08-22 collection period

Table 5.3 Sampling locations, Duane Arnold Energy Center.

Sampling Location		
Code	Location Description	Distance and Direction from Site Stack
D-4	Pleasant Creek SRA	4,960 meters NW
D-15	On-site, North-Northwest	1,050 meters NNW
D-17	On-site, N	1,050 meters N
D-18	On-site, NNE	630 meters NNE
D-20	On-site, ENE	550 meters ENE
D-22	On-site, ESE	535 meters ESE
D-29	On-site, W	630 meters W
D-31	On-site, NW	1,020 meters NW
D-33	3 mile ring	4,340 meters N
D-35	3 mile ring	2,800 meters NE
D-37	3 mile ring	2,960 meters E
D-39	3 mile ring	2,510 meters SE
D-42	3 mile ring	4,380 meters SSE
D-43	1 mile ring	1,590 meters SSW
D-46	1 mile ring	1,580 meters WNW
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-51	Plant Discharge	600 meters SE
D-52	Plant potable water	On-site
D-53	Treated Municipal Water	13,900 meters SE
D-61	Downstream of plant discharge	670 meters SSE
D-83	On-site, SSE	620 meters SSE
D-85	On-site, SSW	660 meters SSW
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	Monthly	Quarterly	Semiannually	Annually
D-4		TLD		
D-15	AP	TLD		G
D-16	AP			G
D-17		TLD		
D-18		TLD		
D-20		TLD		
D-22		TLD		
D-29		TLD		
D-31		TLD		
D-33		TLD		
D-35		TLD		
D-37		TLD		
D-39		TLD		
D-42		TLD		
D-43		TLD		
D-46		TLD		
D-48		TLD		
D-49	SW		BS, F	
D-51			BS	
D-52	WW			
D-53	WW			
D-61	SW		F	
D-83, D-85		TLD		
D-161 to D-164		TLD		

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

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

Table 5.6. Program Deviations, Duane Arnold Energy Center.

Sample Type	Analysis	Location(s)	Collection Date or Period	Comments
SW	H-3, Gamma	D-49	January '25	River frozen.
SW	H-3, Gamma	D-61	January '25	River frozen
AP	Gross Beta	D-16	03/31/25	Sample accidentally Destroyed during collection. (AR-2510357)
SW	H-3, Gamma	D-49	December '25	River frozen.
SW	H-3, Gamma	D-61	December '25	River frozen.

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, 2025

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 51	0.003	0.026 (51/51) (0.003-0.052)	D-15	0.027 (26/26) (0.003-0.049)	None	0
	GS 8						
	Be-7	0.146	0.059 (8/8) (0.024-0.074)	D-16	0.060 (4/4) (0.040-0.070)	None	0
	Mn-54	0.0010	< LLD	-	-	None	0
	Fe-59	0.0023	< LLD	-	-	None	0
	Co-58	0.0013	< LLD	-	-	None	0
	Co-60	0.0013	< LLD	-	-	None	0
	Zn-65	0.0021	< LLD	-	-	None	0
	Nb-95	0.0019	< LLD	-	-	None	0
	Zr-95	0.0025	< LLD	-	-	None	0
	Ru-103	0.0016	< LLD	-	-	None	0
	Ru-106	0.0087	< LLD	-	-	None	0
	Cs-134	0.0012	< LLD	-	-	None	0
	Cs-137	0.0014	< LLD	-	-	None	0
	Ce-141	0.0026	< LLD	-	-	None	0
	Ce-144	0.0052	< LLD	-	-	None	0
Direct Radiation							
TLDs (mR/quarter) Control Locations	Gamma 4	1.0	None	D-4	15.1 (4/4) (13.4-16.1)	15.1 (4/4) (13.4-16.1)	0
Within 0.5 mi. of Stack	Gamma 36	1.0	16.4 (36/36) (12.4-31.1)	D-17	22.3 (4/4) (17.1-28.9)	None	0
Within 1.0 mi. of Stack	Gamma 12	1.0	17.4 (12/12) (13.5-20.8)	D-46	20.0 (4/4) (19.1-20.8)	None	0
Within 3.0 mi.of Stack	Gamma 20	1.0	14.9 (20/20) (10.1-18.8)	D-42	16.9 (4/4) (14.3-18.8)	None	0
ISFSI border	Gamma 32	1.0	43.0 (64/64) (17.5-86.0)	D-ISFSI-2	81.3 (4/4) (75.7-86.0)	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, 2025

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 20	186	< LLD	D-49	176 (1/10)	176 (1/10)	0
	GS 20						
	Mn-54	6.9	< LLD	-	-	< LLD	0
	Fe-59	11.0	< LLD	-	-	< LLD	0
	Co-58	4.3	< LLD	-	-	< LLD	0
	Co-60	4.8	< LLD	-	-	< LLD	0
	Zn-65	8.3	< LLD	-	-	< LLD	0
	Nb-95	4.9	< LLD	-	-	< LLD	0
	Zr-95	13.2	< LLD	-	-	< LLD	0
	I-131	14.7	< LLD	-	-	< LLD	0
	Cs-134	7.5	< LLD	-	-	< LLD	0
	Cs-137	7.8	< LLD	-	-	< LLD	0
	Ba-140	26.8	< LLD	-	-	< LLD	0
	La-140	6.9	< LLD	-	-	< LLD	0
Sediments Ci/g dry)	GS 4						
	K-40	1.0	11.76 (2/2) (10.74-12.78)	D-51	11.76 (2/2) (10.74-12.78)	8.83 (2/2) (8.79-8.88)	0
	Mn-54	0.025	< LLD	-	-	< LLD	0
	Fe-59	0.082	< LLD	-	-	< LLD	0
	Co-58	0.025	< LLD	-	-	< LLD	0
	Co-60	0.026	< LLD	-	-	< LLD	0
	Zn-65	0.040	< LLD	-	-	< LLD	0
	Nb-95	0.044	< LLD	-	-	< LLD	0
	Zr-95	0.052	< LLD	-	-	< LLD	0
	Ru-103	0.036	< LLD	-	-	< LLD	0
	Ru-106	0.166	< LLD	-	-	< LLD	0
	Cs-134	0.022	< LLD	-	-	< LLD	0
	Cs-137	0.023	< LLD	-	-	< LLD	0
	Ce-141	0.082	< LLD	-	-	< LLD	0
	Ce-144	0.168	< 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, 2025

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean		Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
				Location [d]	Mean (F) [c] Range [c]		
Waterborne Pathway							
Ground Water, potable (pCi/L)							
	H-3 24	182	< LLD	-	-	< LLD	0
	GS 24						
	Mn-54	6.2	< LLD	-	-	< LLD	0
	Fe-59	9.3	< LLD	-	-	< LLD	0
	Co-58	6.7	< LLD	-	-	< LLD	0
	Co-60	6.4	< LLD	-	-	< LLD	0
	Zn-65	11.1	< LLD	-	-	< LLD	0
	Nb-95	6.8	< LLD	-	-	< LLD	0
	Zr-95	9.9	< LLD	-	-	< LLD	0
	I-131	12.5	< LLD	-	-	< LLD	0
	Cs-134	7.0	< LLD	-	-	< LLD	0
	Cs-137	7.2	< LLD	-	-	< LLD	0
	Ba-140	29.8	< LLD	-	-	< LLD	0
	La-140	10.6	< LLD	-	-	< LLD	0
Ingestion Pathway							
Broadleaf Vegetation (pCi/g wet)	GS 2						
	K-40	0.05	5.53 (2/2) (3.76-7.30)	D-15	7.30 (1/1)	None	0
	Mn-54	0.024	< LLD	-	-	-	0
	Fe-59	0.034	< LLD	-	-	-	0
	Co-58	0.025	< LLD	-	-	-	0
	Co-60	0.026	< LLD	-	-	-	0
	Zn-65	0.055	< LLD	-	-	-	0
	Nb-95	0.043	< LLD	-	-	-	0
	Zr-95	0.050	< LLD	-	-	-	0
	Ru-103	0.031	< LLD	-	-	-	0
	Ru-106	0.275	< LLD	-	-	-	0
	I-131	0.059	< LLD	-	-	-	0
	Cs-134	0.031	< LLD	-	-	-	0
	Cs-137	0.038	< LLD	-	-	-	0
	Ce-141	0.070	< LLD	-	-	-	0
	Ce-144	0.233	<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, 2025

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 5						
	K-40	0.05	4.80 (5/5) (2.37-8.70)	D-16	5.23 (2/2) (3.49-8.70)	None	0
	Mn-54	0.026	< LLD	-	-		0
	Fe-59	0.075	< LLD	-	-		0
	Co-58	0.019	< LLD	-	-		0
	Co-60	0.035	< LLD	-	-		0
	Zn-65	0.042	< LLD	-	-		0
	Nb-95	0.026	< LLD	-	-		0
	Zr-95	0.071	< LLD	-	-		0
	Ru-103	0.040	< LLD	-	-		0
	Ru-106	0.220	< LLD	-	-		0
	I-131	0.058	< LLD	-	-		0
	Cs-134	0.032	< LLD	-	-		0
	Cs-137	0.034	< LLD	-	-		0
	Ce-141	0.040	< LLD	-	-		0
	Ce-144	0.214	< LLD	-	-		0
Fish (pCi/g wet)	GS 8						
	K-40	1.0	3.85 (4/4) (3.43-4.14)	D-49	3.94 (4/4) (3.05-4.51)	3.94 (3/3) (3.05-4.51)	0 0
	Mn-54	0.017	< LLD	-	-	< LLD	0
	Fe-59	0.092	< LLD	-	-	< LLD	0
	Co-58	0.026	< LLD	-	-	< LLD	0
	Co-60	0.022	< LLD	-	-	< LLD	0
	Zn-65	0.040	< LLD	-	-	< LLD	0
	Nb-95	0.051	< LLD	-	-	< LLD	0
	Zr-95	0.055	< LLD	-	-	< LLD	0
	Ru-103	0.053	< LLD	-	-	< LLD	0
	Ru-106	0.200	< LLD	-	-	< LLD	0
	Cs-134	0.019	< LLD	-	-	< LLD	0
	Cs-137	0.024	< LLD	-	-	< LLD	0
	Ce-141	0.096	< LLD	-	-	< LLD	0
	Ce-144	0.121	< LLD	-	-	< LLD	0

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

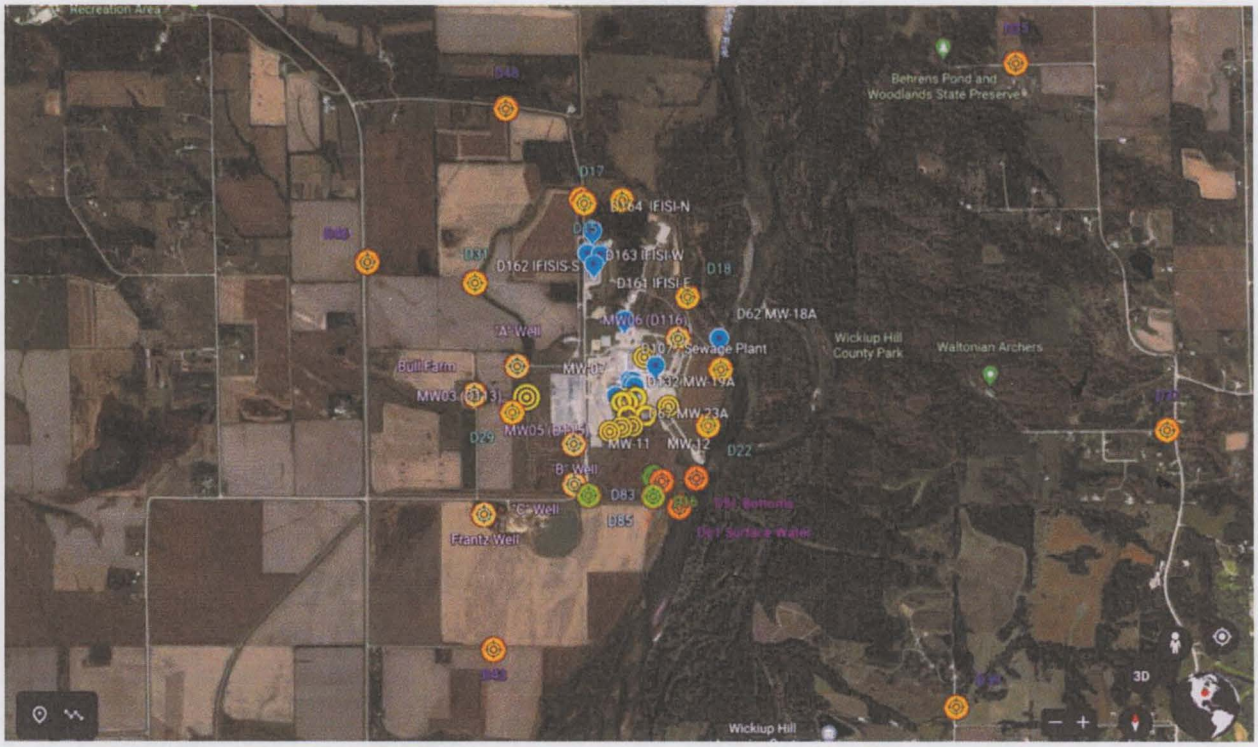
[b] LLD = Nominal lower limit of detection based on 4.66 sigma counting error for the background sample.

[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.

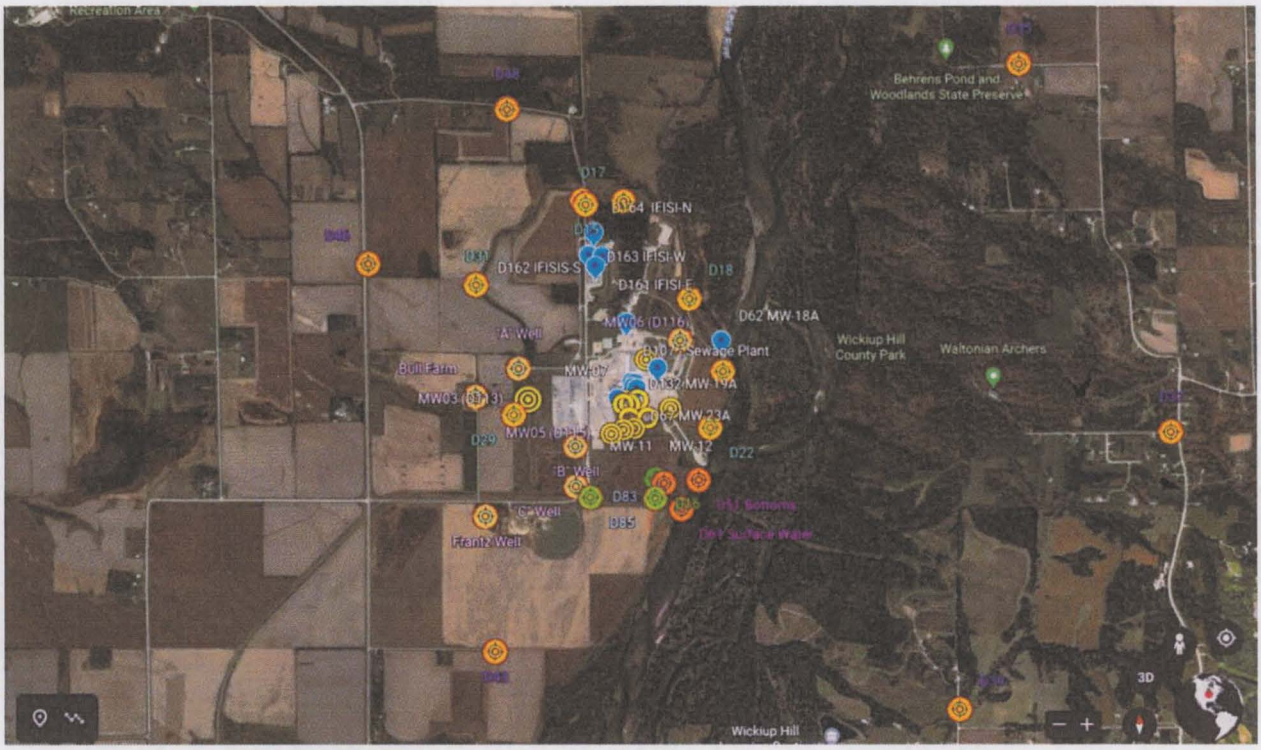
[e] Non-routine results are those which exceed ten times the control station value for the location. If a control station value is not available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.

Figure 5-1
Environmental Monitoring Programs
Sampling Near the Duane Arnold Energy Center
Small Area



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 from DAEC
Large Area



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

6.0 REFERENCES CITED

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

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

Environmental, Inc., Midwest Laboratory.

_____2015 Study Plan, SP-DAEC-8001, revision 24 February 12, 2015, The Operational Radiological Environmental Monitoring Program for the Duane Arnold Energy Center, Cedar Rapids, Iowa

_____2001 through 2022. Environmental Radiological Monitoring Program for the Duane Arnold Energy Center, Annual Report - Part II, Data Tabulations and Analyses, January - December, 2001 – 2019.

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

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

_____2024. Quality Manual, Rev. 10, 28 October 2024.

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

_____2022. Quality Control Procedures Manual, Rev. 5, 9 May 2022.

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

Microbac Laboratories-Northbrook (Before June 1, 2023 Environmental Inc.)

_____2023. Quality Manual, Rev. 9, 25 August 2023.

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

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

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

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

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

MICROBAC®
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

APPENDIX A

INTERLABORATORY AND INTRALABORATORY COMPARISON PROGRAM RESULTS

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

January, 2025 through December, 2025

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

Microbac Laboratories Inc. - Northbrook, formerly 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 operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

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

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

Table A-3 lists results of the analyses on intralaboratory "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

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

Table A-5 lists analytical results from the intralaboratory "duplicate" program for the past twelve months. Acceptance is based on a relative percent difference of 25% or the two sigma incertainties overlap, subject to matrix homogeneity.

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

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

Attachment A lists the laboratory acceptance criteria for various analyses.

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

Attachment A

ACCEPTANCE CRITERIA FOR INTRALABORATORY "SPIKED" SAMPLES

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

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code	Analysis	Concentration (pCi/L) Reported Value	Assigned Value	Acceptance Limits	Acceptance
RAD-140 Study (study dates 01/13/25 - 02/27/25)					
ERDW-3283	Ba-133	88.7	89.7	71.5 - 108	Pass
ERDW-3283	Cs-134	35.3	38.4	25.4 - 51.4	Pass
ERDW-3283	Cs-137	155	157	123 - 191	Pass
ERDW-3283	Co-60	67.2	66.8	50.9 - 82.7	Pass
ERDW-3283	Zn-65	71.6	74.3	39.3 - 109	Pass
ERDW-3281	Gr. Alpha	49.4	72.2	55.3 - 89.1	Fail[b]
ERDW-3281	G. Beta	59.0	59.2	44.1 - 74.3	Pass
ERDW-3279	Ra-228	5.54	6.00	3.98 - 8.02	Pass
ERDW-3279	Uranium	67.1	63.6	56.6 - 70.6	Pass
ERDW-3285	H-3	11,884	11,400	9,340 - 13,500	Pass
ERA-032425M Study (study dates 03/24/25 - 04/04/25)					
ERDW-3786	Gr. Alpha	43.8	51.7	38.9 - 64.5	Pass
ERA-030525U Study (study dates 03/05/25 - 04/15/25)					
ERDW-3631	Ra-226	17.5	18.2	15.5 - 20.9	Pass
ERA-060325P Study (study dates 06/03/25 - 06/30/25)					
ERDW-4378	Ra-226	12.2	10.9	8.89 - 12.9	Pass
ERDW-4378	Ra-228	2.34	3.25	1.78 - 4.72	Pass
ERDW-4378	Uranium	52.4	49.6	44.0 - 55.2	Pass
ERA-060525P Study (study dates 06/05/25 - 06/23/25)					
ERDW-4417	Gr. Alpha	17.4	15.6	10.0 - 21.2	Pass
ERDW-4417	G. Beta	21.7	22.9	15.0 - 30.8	Pass
RAD-142 Study (study dates 07/07/25 - 08/21/25)					
ERDW-4671	Ba-133	30.1	30.1	17.9 - 42.3	Pass
ERDW-4671	Cs-134	58.5	65.6	49.8 - 81.4	Pass
ERDW-4671	Cs-137	156	152	118 - 186	Pass
ERDW-4671	Co-60	122.0	113.0	92.5 - 134	Pass
ERDW-4671	Zn-65	85.5	80.6	44.9 - 116	Pass
ERDW-4672	Gr. Alpha	24.1	33.8	24.6 - 43.0	Fail[b]
ERDW-4672	G. Beta	41.0	41.7	30.1 - 53.3	Pass
ERDW-4674	H-3	16,400	15,800	13,300 - 18,300	Pass

[a] Results obtained by Microbac Laboratories Inc. - Northbrook as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resource Associates (ERA).

[b] The gross alpha failures of ERA studies RAD-140 and RAD-142 are believed to be due to inhomegeity of the solids in the sample matrices which is assumed to have a greater effect on the gross alpha results than on the gross beta results.

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

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported[b] Dose (mrem)	Performance[c] Quotient (P)	
Environmental, Inc.		Group 1				
2024-25-1	1/6/2025	Spike 1	92.0	91.8	0.00	
2024-25-1	1/6/2025	Spike 2	92.0	89.7	-0.03	
2024-25-1	1/6/2025	Spike 3	92.0	92.0	0.00	
2024-25-1	1/6/2025	Spike 4	92.0	92.9	0.01	
2024-25-1	1/6/2025	Spike 5	92.0	91.8	0.00	
2024-25-1	1/6/2025	Spike 6	92.0	98.0	0.07	
2024-25-1	1/6/2025	Spike 7	92.0	94.6	0.03	
2024-25-1	1/6/2025	Spike 8	92.0	94.2	0.02	
2024-25-1	1/6/2025	Spike 9	92.0	95.4	0.04	
2024-25-1	1/6/2025	Spike 10	92.0	91.3	-0.01	
2024-25-1	1/6/2025	Spike 11	92.0	89.4	-0.03	
2024-25-1	1/6/2025	Spike 12	92.0	97.7	0.06	
2024-25-1	1/6/2025	Spike 13	92.0	94.1	0.02	
2024-25-1	1/6/2025	Spike 14	92.0	92.2	0.00	
2024-25-1	1/6/2025	Spike 15	92.0	92.9	0.01	
2024-25-1	1/6/2025	Spike 16	92.0	91.7	0.00	
2024-25-1	1/6/2025	Spike 17	92.0	87.4	-0.05	
2024-25-1	1/6/2025	Spike 18	92.0	94.7	0.03	
2024-25-1	1/6/2025	Spike 19	92.0	91.0	-0.01	
2024-25-1	1/6/2025	Spike 20	92.0	92.5	0.01	
Mean (Spike 1-20)				92.8	0.01	Pass[d]
Standard Deviation (Spike 1-20)				2.6	0.03	Pass[d]

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

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

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

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

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

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported[b] Dose (mrem)	Performance[c] Quotient (P)	
Environmental, Inc.		Group 2				
2024-25-2	1/6/2025	Spike 21	74.0	77.5	0.05	
2024-25-2	1/6/2025	Spike 22	74.0	77.6	0.05	
2024-25-2	1/6/2025	Spike 23	74.0	73.2	-0.01	
2024-25-2	1/6/2025	Spike 24	74.0	75.4	0.02	
2024-25-2	1/6/2025	Spike 25	74.0	75.3	0.02	
2024-25-2	1/6/2025	Spike 26	74.0	77.8	0.05	
2024-25-2	1/6/2025	Spike 27	74.0	73.1	-0.01	
2024-25-2	1/6/2025	Spike 28	74.0	74.0	0.00	
2024-25-2	1/6/2025	Spike 29	74.0	75.8	0.02	
2024-25-2	1/6/2025	Spike 30	74.0	76.5	0.03	
2024-25-2	1/6/2025	Spike 31	74.0	73.5	-0.01	
2024-25-2	1/6/2025	Spike 32	74.0	75.5	0.02	
2024-25-2	1/6/2025	Spike 33	74.0	76.5	0.03	
2024-25-2	1/6/2025	Spike 34	74.0	76.4	0.03	
2024-25-2	1/6/2025	Spike 35	74.0	75.1	0.01	
2024-25-2	1/6/2025	Spike 36	74.0	72.8	-0.02	
2024-25-2	1/6/2025	Spike 37	74.0	76.0	0.03	
2024-25-2	1/6/2025	Spike 38	74.0	74.9	0.01	
2024-25-2	1/6/2025	Spike 39	74.0	75.4	0.02	
2024-25-2	1/6/2025	Spike 40	74.0	70.8	-0.04	
Mean (Spike 21-40)				75.2	0.02	Pass[d]
Standard Deviation (Spike 21-40)				1.8	0.02	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 Microbac Laboratories - Northbrook to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

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

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

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

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code[b]	Reference Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
SPDW-60670	1/20/25	Ra-228	11.9 ± 1.6	15.3	10.7 - 19.9	Pass	0.78
SPDW-60708	2/5/25	H-3	20,675 ± 456	22,100	17,680 - 26,520	Pass	0.94
SPDW-60787	3/10/25	H-3	21,002 ± 459	22,100	17,680 - 26,520	Pass	0.95
LCS-W-011525B	8/1/24	Co-57	699 ± 24	713	570 - 855	Pass	0.98
LCS-W-011525B	8/1/24	Cs-134	530 ± 8	602	482 - 723	Pass	0.88
LCS-W-011525B	8/1/24	Zn-65	543 ± 38	616	492 - 739	Pass	0.88
LCS-W-011525B	8/1/24	Mn-54	369 ± 21	343	274 - 411	Pass	1.08
LCS-W-011525B	8/1/24	Fe-59	1,825 ± 325	1,553	1,242 - 1863	Pass	1.18
LCS-W-011625	8/1/23	Mn-54	345 ± 28	343	274 - 412	Pass	1.01
LCS-W-011625	8/1/23	Cs-134	261 ± 15	305	244 - 366	Pass	0.86
LCS-W-011625	8/1/23	Cs-137	246 ± 11	235	188 - 282	Pass	1.05
LCS-W-011625	8/1/23	Co-57	542 ± 39	521	417 - 625	Pass	1.04
LCS-W-011625	8/1/23	Zn-65	527 ± 57	516	413 - 619	Pass	1.02
LCS-VE-012225A	8/1/24	Mn-54	104 ± 6	95.3	76.2 - 114	Pass	1.09
LCS-VE-012225A	8/1/24	Co-60	53.3 ± 3.7	54.3	43.4 - 65.2	Pass	0.98
LCS-VE-012225A	8/1/24	Cs-134	67.8 ± 3.5	78.0	62.4 - 93.6	Pass	0.87
LCS-VE-012225A	8/1/24	Cs-137	48.4 ± 3.3	51.6	41.3 - 61.9	Pass	0.94
LCS-VE-012225A	8/1/24	Zn-65	222 ± 13	247	198 - 296	Pass	0.90
LCS-VE-012225B	2/1/24	Co-57	72.3 ± 5.5	68.3	54.6 - 82.0	Pass	1.06
LCS-VE-012225B	2/1/24	Co-60	78.6 ± 3.5	79.9	63.9 - 95.9	Pass	0.98
LCS-VE-012225B	2/1/24	Cs-134	80.5 ± 3.8	99.1	79.3 - 119	Pass	0.81
LCS-VE-012225B	2/1/24	Cs-137	65.1 ± 3.3	69.4	55.5 - 83.3	Pass	0.94
LCS-VE-012225B	2/1/24	Zn-65	189 ± 17	217	174 - 260	Pass	0.87
LCS-W-012725A	4/8/24	Ba-133	64.9 ± 4.8	65.9	52.7 - 79.1	Pass	0.98
LCS-W-012725A	4/8/24	Cs-134	56.6 ± 4.7	57.8	46.2 - 69.4	Pass	0.98
LCS-W-012725A	4/8/24	Cs-137	195 ± 8	186	149 - 223	Pass	1.05
LCS-W-012725A	4/8/24	Co-60	104.5 ± 4.8	98.8	79.0 - 119	Pass	1.06
LCS-W-012725A	4/8/24	Zn-65	273 ± 42	240	192 - 288	Pass	1.14
LCS-W-012725B	4/8/24	Ba-133	61.7 7.1	65.9	52.7 - 79.1	Pass	0.94
LCS-W-012725B	4/8/24	Cs-134	49.6 6.4	57.8	46.2 - 69.4	Pass	0.86
LCS-W-012725B	4/8/24	Cs-137	189 ± 11	186	149 - 223	Pass	1.02
LCS-W-012725B	4/8/24	Co-60	98.3 7.1	98.8	79.0 - 119	Pass	0.99
LCS-W-012725B	4/8/24	Zn-65	213 ± 32	240	192 - 288	Pass	0.89
LCS-AP-012925	8/1/24	Co-60	10.6 ± 1.5	9.75	7.80 - 11.7	Pass	1.09
LCS-AP-012925	8/1/24	Cs-134	7.45 ± 0.84	9.02	7.22 - 10.8	Pass	0.83
LCS-AP-012925	8/1/24	Cs-137	7.75 ± 1.24	7.26	5.81 - 8.71	Pass	1.07

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).
[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).
[c] Results are based on single determinations.
[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code[b]	Reference Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
LCS-SO-012925A	10/14/24	K-40	16,200 ± 473	14,175	11,340 - 17,010	Pass	1.14
LCS-SO-012925A	10/14/24	Mn-54	3,100 ± 73	3,051	2,441 - 3,661	Pass	1.02
LCS-SO-012925A	10/14/24	Co-57	8,490 ± 718	8,910	7,128 - 10,692	Pass	0.95
LCS-SO-012925A	10/14/24	Co-60	17,800 ± 95	18,900	15,120 - 22,680	Pass	0.94
LCS-SO-012925A	10/14/24	Cs-134	9,920 ± 83	11,259	9,007 - 13,511	Pass	0.88
LCS-SO-012925A	10/14/24	Cs-137	44,600 ± 182	44,550	35,640 - 53,460	Pass	1.00
LCS-SO-012925A	10/14/24	Zn-65	11,700 ± 216	11,205	8,964 - 13,446	Pass	1.04
LCS-SO-012925B	2/14/24	K-40	14,302 ± 1308	13,095	10,476 - 15,714	Pass	1.09
LCS-SO-012925B	2/14/24	Mn-54	9,368 ± 413	8,964	7,171 - 10,757	Pass	1.05
LCS-SO-012925B	2/14/24	Co-57	9,451 ± 213	10,827	8,662 - 12,992	Pass	0.87
LCS-SO-012925B	2/14/24	Co-60	17,653 ± 263	17,820	14,256 - 21,384	Pass	0.99
LCS-SO-012925B	2/14/24	Cs-134	8,989 ± 192	10,908	8,726 - 13,090	Pass	0.82
LCS-SO-012925B	2/14/24	Cs-137	42,415 ± 416	41,850	33,480 - 50,220	Pass	1.01
LCS-SO-012925B	2/14/24	Zn-65	18,205 ± 839	18,981	15,185 - 22,777	Pass	0.96
LCS-W-013025	8/1/24	Cs-134	545 ± 9	602	482 - 722	Pass	0.91
LCS-W-013025	8/1/24	Co-57	692 ± 12	713	570 - 856	Pass	0.97
LCS-W-013025	8/1/24	Fe-59	1,781 ± 170	1553	1,242 - 1864	Pass	1.15
LCS-W-013025	8/1/24	Co-60	390 ± 7	405	324 - 486	Pass	0.96
LCS-W-013025	8/1/24	Zn-65	652 ± 23	616	493 - 739	Pass	1.06
LCS-SO-021225	8/1/24	K-40	14,043 ± 1,654	14,175	11,340 - 17,010	Pass	0.99
LCS-SO-021225	8/1/24	Mn-54	3,144 ± 219	3,051	2,441 - 3,661	Pass	1.03
LCS-SO-021225	8/1/24	Co-57	8,547 ± 199	8,910	7,128 - 10,692	Pass	0.96
LCS-SO-021225	8/1/24	Co-60	18,084 ± 195	18,900	15,120 - 22,680	Pass	0.96
LCS-SO-021225	8/1/24	Cs-134	9,296 ± 161	11,259	9,007 - 13,511	Pass	0.83
LCS-SO-021225	8/1/24	Cs-137	44,134 ± 335	44,550	35,640 - 53,460	Pass	0.99
LCS-SO-021225	8/1/24	Zn-65	11,858 ± 450	11,205	8,964 - 13,446	Pass	1.06
LCS-VE-021225	8/1/25	Mn-54	98.5 ± 5	95.3	76.2 - 114	Pass	1.03
LCS-VE-021225	8/1/25	Co-60	58.3 ± 3	54.3	43.4 - 65.2	Pass	1.07
LCS-VE-021225	8/1/25	Cs-134	73.0 ± 3	78.0	62.4 - 93.6	Pass	0.94
LCS-VE-021225	8/1/25	Cs-137	56.1 ± 2	51.6	41.3 - 61.9	Pass	1.09
LCS-VE-021225	8/1/25	Zn-65	287 ± 13	247	198 - 296	Pass	1.16
LCS-SO-031225	8/1/24	K-40	15,335 ± 1276	14,175	11,340 - 17,010	Pass	1.08
LCS-SO-031225	8/1/24	Mn-54	3,335 ± 308	3,051	2,441 - 3,661	Pass	1.09
LCS-SO-031225	8/1/24	Co-57	7,901 ± 179	8,910	7,128 - 10,692	Pass	0.89
LCS-SO-031224	8/1/24	Co-60	18,579 ± 283	18,900	15,120 - 22,680	Pass	0.98
LCS-SO-031225	8/1/24	Cs-134	9,450 ± 257	11,259	9,007 - 13,511	Pass	0.84
LCS-SO-031225	8/1/24	Cs-137	44,894 ± 431	44,550	35,640 - 53,460	Pass	1.01
LCS-SO-031225	8/1/24	Zn-65	10,261 ± 627	11,205	8,964 - 13,446	Pass	0.92

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).
[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).
[c] Results are based on single determinations.
[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code[b]	Reference Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
SPDW-60780	3/4/25	Gr. Alpha	36.2 ± 1.9	34.8	17.4 - 41.8	Pass	1.04
SPDW-60780	3/4/25	Gr. Beta	132 ± 2	137	109.9 - 164.9	Pass	0.96
SPDW-60815	3/21/25	H-3	21,670 ± 466	22,100	17,680 - 26,520	Pass	0.98
SPDW-60797	3/11/25	Th-230	63.2 ± 7.8	72.2	58 - 0,087	Pass	0.88
SPDW-60842	4/1/25	H-3	20,939 ± 460	22,100	17,680 - 26,520	Pass	0.95
SPDW-60860	4/8/25	H-3	20,388 ± 454	22,100	17,680 - 26,520	Pass	0.92
SPDW-60865	4/18/25	H-3	20,672 ± 457	22,100	17,680 - 26,520	Pass	0.94
SPDW-60869	4/13/25	Ra-228	6.30 ± 1.11	6.12	4.28 ± 7.96	Pass	1.03
SPDW-60880	5/7/25	H-3	21,535 ± 470	22,100	17,680 - 26,520	Pass	0.97
SPDW-60883	5/7/25	Sr-90	17.6 ± 1.1	15.4	12.3 - 18.5	Pass	1.14
LCS-W-05222025	1/13/25	Co-60	70.1 ± 6.2	66.8	53 - 0,080	Pass	1.05
LCS-W-05222025	1/13/25	Zn-65	80.3 ± 13.7	74.3	59 - 0,089	Pass	1.08
LCS-W-05222025	1/13/25	Ba-133	77.2 ± 6.8	89.7	72 - 0,108	Pass	0.86
LCS-W-05222025	1/13/25	Cs-134	35.5 ± 4.7	38.4	31 - 0,046	Pass	0.92
LCS-W-05222025	1/13/25	Cs-137	161 ± 10	157	126 - 0,188	Pass	1.03
LCS-SO-05222025	3/19/18	Cs-134	3,810 ± 280	4,210	3,368 - 5,052	Pass	0.90
LCS-SO-05222025	3/19/18	Cs-137	3,530 ± 87	4,210	3,368 - 5,052	Pass	0.84
LCS-SO-05222025	3/19/18	Pb-212	1,160 ± 62	1,240	992 - 1,488	Pass	0.94
LCS-SO-05222025	3/19/18	Pb-214	1,860 ± 77	1,850	1,480 - 2,220	Pass	1.01
LCS-SO-05222025	3/19/18	Ac-228	1,120 ± 360	1,240	992 - 1,488	Pass	0.90
LCS-W-052625	1/13/25	Zn-65	69.7 ± 8.6	74.3	59 - 89.2	Pass	0.94
LCS-W-052625	1/13/25	Ba-133	77.0 ± 4.4	89.7	72 - 108	Pass	0.86
LCS-W-052625	1/13/25	Cs-134	30.9 ± 2.8	38.4	30.7 - 46.1	Pass	0.80
LCS-W-052625	1/13/25	Cs-137	161 ± 6	157	126 - 188	Pass	1.03
LCS-W-052625	1/13/25	Co-60	70.6 ± 3.2	66.8	53.4 - 80.2	Pass	1.06
SPDW-60943	7/10/25	H-3	20,923 ± 461	22,100	17,680 - 26,520	Pass	0.95
SPDW-60946	7/18/25	H-3	20,730 ± 461	22,100	17,680 - 26,520	Pass	0.94
SPDW-60957	8/1/25	H-3	20,515 ± 460	22,100	17,680 - 26,520	Pass	0.93
SPDW-60976	8/19/25	H-3	19,131 ± 428	22,100	17,680 - 26,520	Pass	0.87
LCS-W-08/08/25	1/13/25	Ba-133	71.8 ± 4.7	89.7	71.8 - 107.6	Pass	0.80
LCS-W-08/08/25	1/13/25	Cs-134	35.7 ± 5.1	38.4	30.7 - 46.1	Pass	0.93
LCS-W-08/08/25	1/13/25	Cs-137	156 ± 7	157.0	125.6 - 188.4	Pass	0.99
LCS-W-08/08/25	1/13/25	Co-60	65.4 ± 3.7	67	53.4 - 80.2	Pass	0.98
LCS-W-08/08/25	1/13/25	Zn-65	70.7 ± 10.6	74.3	59.4 - 89.2	Pass	0.95
LCS-AP-0814/25	8/1/24	Cs-134	8.74 ± 1.57	9.03	7.22 - 10.8	Pass	0.97
LCS-AP-0814/25	8/1/24	Cs-137	6.32 ± 0.83	7.02	5.62 - 8.42	Pass	0.90
LCS-AP-0814/25	8/1/24	Co-60	8.97 ± 0.71	9.00	7.20 - 10.8	Pass	1.00
SPDW-5045	8/20/25	Sr-90	16.6 ± 1.1	15.4	12.3 - 18.5	Pass	1.08

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg). vegetation (pCi/sample)

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

[c] Results are based on single determinations.

[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code[b]	Reference Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
LCS-W-081325	1/13/25	Ba-133	84.7 ± 4.4	89.7	71.8 - 107.6	Pass	0.94
LCS-W-081325	1/13/25	Cs-134	34.8 ± 3.1	38.4	30.7 - 46.1	Pass	0.91
LCS-W-081325	1/13/25	Cs-137	151 ± 6	157	126 - 188	Pass	0.96
LCS-W-081325	1/13/25	Co-60	67.2 ± 4.1	66.8	53.4 - 80.2	Pass	1.01
LCS-W-081325	1/13/25	Zn-65	76.3 ± 10.6	74.3	59.4 - 89.2	Pass	1.03
SPDW-60989	9/2/25	H-3	19,720 ± 435	22,100	17,680 - 26,520	Pass	0.89
LCS-W-101725	10/17/25	H-3	6,776 ± 264	7,550	6,040 - 9,060	Pass	0.90
LCS-W-102325	10/23/25	H-3	7401 ± 285	7,550	6,040 - 9,060	Pass	0.98
LCS-W-103125	10/31/25	H-3	7,201 ± 273	7,550	6,040 - 9,060	Pass	0.95
LCS-AP-102925	9/22/25	Cs-134	293 ± 5	341	273 - 0,409	Pass	0.86
LCS-AP-102925	9/22/25	Cs-137	385 ± 6	379	303 - 0,455	Pass	1.02
LCS-AP-102925	9/22/25	Co-60	314 ± 4	322	258 - 0,386	Pass	0.98
LCS-AP-102925	9/22/25	Zn-65	207 ± 7	240	192 - 0,288	Pass	0.86
LCS-W-111025	8/1/25	Cs-134	189 ± 34	198	159 - 238	Pass	0.95
LCS-W-111025	8/1/25	Cs-137	172 ± 7	181	145 - 217	Pass	0.95
LCS-W-111025	8/1/25	Co-60	173 ± 5	196	157 - 235	Pass	0.88
LCS-W-111025	8/1/25	Mn-54	198 ± 8	215	172 - 258	Pass	0.92
LCS-W-111025	8/1/25	Zn-65	599 ± 18	624	499 - 749	Pass	0.96
LCS-W-121025	12/10/25	H-3	6,807 ± 265	7,550	6,040 - 9,060	Pass	0.90
LCS-W-121525	12/15/25	H-3	6,970 ± 269	7,550	6,040 - 9,060	Pass	0.92

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg). vegetation (pCi/sample)

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

[c] Results are based on single determinations.

[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Collection Date	Analysis[c]	Concentration[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[d]	Criteria (4.66 σ)
SPDW-60669	Water	1/20/2025	Ra-228	0.76	0.22 ± 0.38	2
SPDW-60693	Water	2/4/2025	Sr-89	0.65	0.29 ± 0.56	5
SPDW-60693	Water	2/4/2025	Sr-90	0.64	0.18 ± 0.32	1
SPDW-60707	Water	2/5/2025	H-3	173	-10 ± 82	200
SPDW-60715	Water	2/11/2025	I-131	0.16	-0.06 ± 0.08	1
SPDW-60788	Water	3/10/2025	H-3	176	46 ± 90	200
SPDW-60788	Water	3/10/2025	H-3	176	46 ± 90	200
SPDW-60796	Water	3/11/2025	Th-228	1.20	-0.39 ± 0.57	2
SPDW-60796	Water	3/11/2025	Th-230	0.60	0.26 ± 0.51	2
SPDW-60796	Water	3/11/2025	Th-232	0.60	0.13 ± 0.44	2
SPDW-60814	Water	3/21/2025	H-3	177	6 ± 82	200
SPDW-60841	Water	4/1/2025	H-3	175	35 ± 89	200
SPDW-60868	Water	4/13/2025	Ra-228	0.63	-0.28 ± 0.25	2
SPDW-60868	Water	4/13/2025	Ra-228	0.63	-0.28 ± 0.25	2
SPDW-60875	Water	4/24/2025	I-131	0.20	0.02 ± 0.11	1
SPDW-60682	Water	5/7/2025	Sr-89	0.61	-0.36 ± 0.50	5
SPDW-60682	Water	5/7/2025	Sr-90	0.65	0.30 ± 0.34	1
SPDW-60864	Water	4/18/2025	H-3	173	105 ± 91	200
SPDW-60880	Water	5/7/2025	H-3	177	38 ± 90	200
SPDW-60942	Water	7/10/2025	H-3	175	-18 ± 81	200
SPDW-60945	Water	7/18/2025	H-3	177.36	-45.20 ± 85.32	200
SPDW-60956	Water	8/1/2025	H-3	185	-31 ± 90	200
SPDW-60956	Water	8/1/2025	H-3	163	24 ± 82	200
SPDW-5044	Water	8/20/2025	Sr-89	0.50	-0.02 ± 0.43	5
SPDW-5044	Water	8/20/2025	Sr-90	0.60	0.10 ± 0.29	1
SPDW-60983	Water	8/21/2025	I-131	0.16	-0.07 ± 0.08	1
SPDW-60975	Water	8/19/2025	H-3	166	38 ± 89	200
SPDW-60988	Water	9/2/2025	H-3	172	60 ± 86	200
MB-103125	Water	10/31/2025	H-3	173	-10 ± 85	200
MB-1013-BLK	Water	11/3/2025	Gr. Alpha	0.43	0.26 ± 0.48	1
MB-1041-BLK	Water	11/7/2025	Gr. Alpha	0.44	0.03 ± 0.48	1
MB-1041-BLK	Water	11/7/2025	Gr. Beta	0.55	-0.24 ± 0.60	1
MB-1042-BLK	Water	11/10/2025	Gr. Alpha	0.44	-0.30 ± 0.46	1

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

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

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

[d] Activity reported is a net activity result.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Collection Date	Analysis[c]	Concentration[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[d]	Criteria (4.66 σ)
MB-1091-BLK	Water	12/11/2025	Gr. Alpha	0.41	0.11 ± 0.45	1
MB-1091-BLK	Water	12/11/2025	Gr. Beta	0.51	-0.48 ± 0.54	1
MB-120825	Water	12/8/2025	I-131	0.25	0.15 ± 0.15	1
MB-121025	Water	12/10/2025	H-3	170	3 ± 79	200
MB-1098-BLK	Water	12/15/2025	Gr. Alpha	0.43	0.03 ± 0.47	1
MB-1098-BLK	Water	12/15/2025	Gr. Beta	0.55	-0.38 ± 0.58	1
MB-1116-BLK	Water	12/24/2025	Gr. Alpha	0.37	0.25 ± 0.42	1
MB-1116-BLK	Water	12/24/2025	Gr. Beta	0.48	0.20 ± 0.53	1
MB-1162-BLK	Water	12/30/2025	Gr. Alpha	0.94	0.25 ± 0.99	1
MB-1162-BLK	Water	12/30/2025	Gr. Beta	0.52	-0.01 ± 0.57	1

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

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

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

[d] Activity reported is a net activity result.

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]				
Lab Code[b]	Collection Date	Analysis	First Result	Second Result	Averaged Result	RPD	Acceptance
AP-3356,3357	1/1/2025	Be-7	0.043 ± 0.004	0.037 ± 0.006	0.040 ± 0.004	15.4	Pass
AP-3377,3378	1/1/2025	Be-7	0.057 ± 0.009	0.055 ± 0.011	0.056 ± 0.007	4.7	Pass
U-3398,3399	1/2/2025	Beta (-K40)	6.93 ± 1.82	4.76 ± 1.79	5.84 ± 1.28	37.2	Pass [c]
AP-011325A,B	1/13/2025	Gr. Beta	0.023 ± 0.005	0.024 ± 0.005	0.024 ± 0.004	4.3	Pass
AP-020325A,B	2/3/2025	Gr. Beta	0.022 ± 0.004	0.018 ± 0.004	0.020 ± 0.003	20.0	Pass
AP-021725A,B	2/17/2025	Gr. Beta	0.035 ± 0.005	0.036 ± 0.005	0.036 ± 0.004	2.8	Pass
XW-3596,3597	2/20/2025	H-3	270 ± 101	325 ± 104	298 ± 72	18.5	Pass
SG-3588,3589	2/26/2025	Gr. Alpha	37.6 ± 3.9	24.7 ± 3.2	31.2 ± 2.5	41.4	Pass [d]
SG-3588,3589	2/26/2025	Gr. Beta	31.5 ± 1.8	30.1 ± 1.8	30.8 ± 1.3	4.5	Pass
SG-3588,3589	2/26/2025	Ra-226	7.38 ± 0.46	6.63 ± 0.27	7.01 ± 0.27	10.7	Pass
SG-3588,3589	2/26/2025	Ra-228	8.50 ± 0.46	7.60 ± 0.86	8.05 ± 0.49	11.2	Pass
WW-3724,3725	3/12/2025	H-3	199 ± 93	194 ± 93	197 ± 66	2.5	Pass
AP-031725A,B	3/17/2025	Gr. Beta	0.024 ± 0.005	0.030 ± 0.005	0.027 ± 0.004	22.2	Pass
SW-3770,3771	3/19/2025	H-3	13,111 ± 367	12,865 ± 363	12,988 ± 258	1.9	Pass
W-3814,3815	3/26/2025	H-3	159 ± 95	137 ± 94	148 ± 67	14.9	Pass
AP-040725A,B	4/7/2025	Gr. Beta	0.016 ± 0.004	0.018 ± 0.004	0.017 ± 0.003	11.8	Pass
SW-3770,3771	3/19/2025	H-3	13,111 ± 367	12,865 ± 363	12,988 ± 258	1.9	Pass
E-3814,3815	3/26/2025	H-3	159 ± 95	137 ± 94	148 ± 67	14.9	Pass
S-O5E0076-01,02	5/13/2025	Gr. Alpha	33.28 ± 3.39	29.62 ± 3.66	31.45 ± 4.99	11.6	Pass
S-O5E0076-01,02	5/13/2025	Gr. Beta	28.38 ± 1.82	28.50 ± 1.81	28.44 ± 2.57	0.4	Pass
S-O5E0076-01,02	5/13/2025	Ra-226	4.42 ± 0.12	4.13 ± 0.11	4.28 ± 0.16	6.8	Pass
S-O5E0076-01,02	5/13/2025	Ra-228	5.08 ± 0.18	4.31 ± 0.20	4.70 ± 0.27	16.4	Pass
LW-4571,4752	6/17/2025	H-3	104 ± 90	52 ± 87	78 ± 62	66.7	Pass [e]
AP-4734,4735	7/1/2025	Be-7	0.070 ± 0.008	0.078 ± 0.008	0.074 ± 0.006	11.0	Pass
VE-4614,4615	7/1/2025	K-40	3.56 ± 0.45	3.60 ± 0.31	3.58 ± 0.27	1.2	Pass
AP-062525A,B	6/25/2025	Gr. Beta	0.022 ± 0.003	0.022 ± 0.003	0.022 ± 0.004	2.7	Pass
AP-06/26/25A,B	6/26/2025	Gr. Beta	0.020 ± 0.004	0.022 ± 0.004	0.021 ± 0.005	10.7	Pass
AP-06/30/25A,B	6/30/2025	Gr. Beta	0.018 ± 0.004	0.020 ± 0.004	0.019 ± 0.006	10.7	Pass
AP-070125A,B	7/1/2025	Gr. Beta	0.023 ± 0.002	0.023 ± 0.002	0.023 ± 0.003	0.8	Pass
AP-070225A,B	7/2/2025	Gr. Beta	0.014 ± 0.002	0.012 ± 0.002	0.013 ± 0.003	17.4	Pass
AP-070325A,B	7/3/2025	Gr. Beta	0.024 ± 0.002	0.023 ± 0.002	0.023 ± 0.003	4.5	Pass
AP-070825A,B	7/8/2025	Gr. Beta	0.021 ± 0.003	0.022 ± 0.003	0.021 ± 0.004	1.5	Pass
AP-070925A,B	7/9/2025	Gr. Beta	0.017 ± 0.003	0.017 ± 0.003	0.017 ± 0.005	2.5	Pass
AP-071425A,B	7/14/2025	Gr. Beta	0.019 ± 0.004	0.022 ± 0.004	0.020 ± 0.006	11.4	Pass
AP-071525A,B	7/15/2025	Gr. Beta	0.027 ± 0.003	0.027 ± 0.003	0.027 ± 0.004	0.0	Pass
AP-071625A,B	7/16/2025	Gr. Beta	0.028 ± 0.003	0.030 ± 0.003	0.029 ± 0.005	7.6	Pass
AP-072125A,B	7/21/2025	Gr. Beta	0.021 ± 0.005	0.016 ± 0.004	0.018 ± 0.006	22.9	Pass
AP-072225A,B	7/22/2025	Gr. Beta	0.020 ± 0.002	0.016 ± 0.002	0.018 ± 0.003	20.6	Pass
AP-072325A,B	7/23/2025	Gr. Beta	0.019 ± 0.002	0.017 ± 0.002	0.018 ± 0.003	9.5	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

			Concentration[a]				
Lab Code[b]	Collection Date	Analysis	First Result	Second Result	Averaged Result	RPD	Acceptance
AP-0724/25A,B	7/24/2025	Gr. Beta	0.018 ± 0.002	0.018 ± 0.002	0.018 ± 0.003	0.6	Pass
AP-072525A,B	7/28/2025	Gr. Beta	0.024 ± 0.003	0.024 ± 0.003	0.024 ± 0.004	1.2	Pass
AP-072925A,B	7/29/2025	Gr. Beta	0.020 ± 0.002	0.019 ± 0.002	0.019 ± 0.003	5.2	Pass
AP-073025A,B	7/30/2025	Gr. Beta	0.024 ± 0.023	0.023 ± 0.004	0.023 ± 0.023	5.5	Pass
AP-073125A,B	7/31/2025	Gr. Beta	0.017 ± 0.002	0.016 ± 0.002	0.017 ± 0.003	3.4	Pass
AP-080425A,B	8/4/2025	Gr. Beta	0.019 ± 0.003	0.019 ± 0.003	0.019 ± 0.004	1.2	Pass
MI-4986,4987	8/4/2025	K-40	1204 ± 121	1078 ± 107	1141 ± 162	11.0	Pass
AP-080525A,B	8/5/2025	Gr. Beta	0.023 ± 0.002	0.022 ± 0.002	0.023 ± 0.003	6.6	Pass
AP-080625A,B	8/6/2025	Gr. Beta	0.018 ± 0.003	0.020 ± 0.003	0.019 ± 0.004	9.3	Pass
AP-081125A,B	8/11/2025	Gr. Beta	0.028 ± 0.005	0.028 ± 0.005	0.028 ± 0.007	0.3	Pass
AP-081225A,B	8/12/2025	Gr. Beta	0.036 ± 0.003	0.036 ± 0.003	0.036 ± 0.004	0.9	Pass
S-O5H0065-03,04	8/13/2025	Gr. Alpha	33.52 ± 4.14	26.32 ± 3.75	29.92 ± 5.59	24.1	Pass[d]
S-O5H0065-03,04	8/13/2025	Gr. Beta	34.38 ± 2.15	30.92 ± 1.56	32.65 ± 2.66	10.6	Pass
S-O5H0065-03,04	8/13/2025	Ra-226	7.22 ± 0.32	7.05 ± 0.31	7.14 ± 0.44	2.4	Pass
S-O5H0065-03,04	8/13/2025	Ra-228	7.04 ± 0.56	7.45 ± 0.58	7.25 ± 0.80	5.7	Pass
AP-081425A,B	8/14/2025	Gr. Beta	0.031 ± 0.003	0.032 ± 0.003	0.032 ± 0.004	4.2	Pass
AP-081825A,B	8/18/2025	Gr. Beta	0.026 ± 0.003	0.026 ± 0.003	0.026 ± 0.005	2.1	Pass
AP-081925A,B	8/19/2025	Gr. Beta	0.025 ± 0.002	0.029 ± 0.003	0.027 0.004	13.4	Pass
AP-082025A,B	8/20/2025	Gr. Beta	0.024 ± 0.003	0.021 ± 0.003	0.022 ± 0.004	13.0	Pass
AP-082625A,B	8/26/2025	Gr. Beta	0.022 ± 0.004	0.021 ± 0.004	0.022 ± 0.006	3.8	Pass
AP-090225A,B	9/2/2025	Gr. Beta	0.017 ± 0.004	0.017 ± 0.004	0.017 ± 0.006	1.7	Pass
AP-090325A,B	9/3/2025	Gr. Beta	0.022 ± 0.028	0.023 ± 0.003	0.023 ± 0.029	3.8	Pass
MI-5183,5184	9/9/2025	K-40	1318 ± 108	1291 ± 99	1305 ± 147	2.1	Pass
AP-090925A,B	9/9/2025	Gr. Beta	0.019 ± 0.002	0.020 ± 0.002	0.019 ± 0.003	8.1	Pass
AP-091025A,B	9/10/2025	Gr. Beta	0.016 ± 0.003	0.016 ± 0.003	0.016 ± 0.004	0.4	Pass
AP-091525A,B	9/15/2025	Gr. Beta	0.036 ± 0.004	0.034 ± 0.004	0.035 ± 0.005	4.2	Pass
AP-091625A,B	9/16/2025	Gr. Beta	0.053 ± 0.003	0.057 ± 0.003	0.055 ± 0.005	6.2	Pass
AP-091725A,B	9/17/2025	Gr. Beta	0.055 ± 0.005	0.050 ± 0.005	0.053 ± 0.007	8.7	Pass
AP-091825A,B	9/18/2025	Gr. Beta	0.062 ± 0.004	0.067 ± 0.004	0.065 ± 0.005	6.8	Pass
AP-092325A,B	9/23/2025	Gr. Beta	0.050 ± 0.003	0.052 ± 0.003	0.051 ± 0.005	4.8	Pass
AP-092425A,B	9/24/2025	Gr. Beta	0.037 ± 0.004	0.040 ± 0.004	0.038 ± 0.006	8.9	Pass
AP-093025A,B	9/30/2025	Gr. Beta	0.040 ± 0.004	0.042 ± 0.004	0.041 ± 0.005	5.5	Pass
AP-100625A,B	10/6/2025	Gr. Beta	0.056 ± 0.003	0.053 ± 0.005	0.055 ± 0.006	5.4	Pass
AP-100725A,B	10/7/2025	Gr. Beta	0.047 ± 0.003	0.043 ± 0.003	0.045 ± 0.004	8.2	Pass
AP-100825A,B	10/8/2025	Gr. Beta	0.061 ± 0.004	0.058 ± 0.038	0.059 ± 0.039	4.9	Pass
AP-101325A,B	10/13/2025	Gr. Beta	0.028 ± 0.005	0.034 ± 0.005	0.031 ± 0.007	20.1	Pass
AP-101425A,B	10/14/2025	Gr. Beta	0.021 ± 0.002	0.019 ± 0.002	0.020 ± 0.003	13.1	Pass
AP-101525A,B	10/15/2025	Gr. Beta	0.025 ± 0.004	0.023 ± 0.004	0.024 ± 0.005	9.2	Pass
AP-102125A,B	10/21/2025	Gr. Beta	0.022 ± 0.002	0.022 ± 0.002	0.022 ± 0.003	1.0	Pass
AP-102225A,B	10/22/2025	Gr. Beta	0.031 ± 0.003	0.030 ± 0.003	0.031 ± 0.004	5.0	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code[b]	Collection Date	Analysis	Concentration[a] First Result	Second Result	Averaged Result	RPD	Acceptance
AP-102825A,B	10/28/2025	Gr. Beta	0.013 ± 0.002	0.014 ± 0.002	0.014 ± 0.003	6.5	Pass
AP-102925A,B	10/29/2025	Gr, Beta	0.011 ± 0.002	0.011 ± 0.002	0.011 ± 0.004	1.6	Pass
AP-110325A.B	11/3/2025	Gr. Beta	0.019 ± 0.003	0.016 ± 0.003	0.018 ± 0.004	13.6	Pass
SG-O5K0028-03,04	11/5/2025	Gr. Alpha	55.64 ± 5.73	50.63 ± 5.82	53.14 ± 8.17	9.4	Pass
SG-O5K0028-03,04	11/5/2025	Gr. Beta	52.76 ± 2.76	53.15 ± 2.93	52.96 ± 4.03	0.7	Pass
SG-O5K0028-03,04	11/5/2025	Ra-226	11.3 ± 0.4	12.2 ± 0.3	11.8 ± 0.5	7.7	Pass
SG-O5K0028-03,04	11/5/2025	Ra-228	10.9 ± 0.6	11.3 ± 0.5	11.1 ± 0.8	3.6	Pass
AP-110525A.B	11/5/2025	Gr. Beta	0.024 ± 0.003	0.024 ± 0.003	0.024 ± 0.004	0.8	Pass
AP-110625A,B	11/6/2025	Gr. Beta	0.028 ± 0.003	0.027 ± 0.002	0.027 ± 0.004	5.8	Pass
AP-111025A,B	11/10/2025	Gr. Beta	0.022 ± 0.003	0.023 ± 0.003	0.023 ± 0.004	7.1	Pass
AP-111225A,B	11/12/2025	Gr. Beta	0.017 ± 0.002	0.017 ± 0.002	0.017 ± 0.003	0.2	Pass
AP-111425A,B	11/14/2025	Gr. Beta	0.018 ± 0.002	0.021 ± 0.002	0.020 ± 0.003	11.5	Pass
AP-111725A,B	11/17/2025	Gr. Beta	0.027 ± 0.005	0.028 ± 0.005	0.027 ± 0.007	7.1	Pass
AP-111825A,B	11/18/2025	Gr. Beta	0.027 ± 0.002	0.023 ± 0.002	0.025 ± 0.003	16.4	Pass
AP-111925A,B	11/19/2025	Gr. Beta	0.031 ± 0.004	0.032 ± 0.004	0.032 ± 0.006	0.5	Pass
AP-112025A,B	11/20/2025	Gr. Beta	0.023 ± 0.002	0.024 ± 0.002	0.024 ± 0.003	4.6	Pass
AP-112525A,B	11/25/2025	Gr. Beta	0.026 ± 0.003	0.026 ± 0.003	0.026 ± 0.004	0.2	Pass
AP-112625A,B	11/26/2025	Gr. Beta	0.045 ± 0.005	0.047 ± 0.005	0.046 ± 0.007	4.0	Pass
AP-120125A,B	12/1/2025	Gr. Beta	0.018 ± 0.003	0.020 ± 0.003	0.019 ± 0.004	9.2	Pass
AP-120325A,B	12/3/2025	Gr. Beta	0.025 ± 0.003	0.027 ± 0.003	0.026 ± 0.004	7.6	Pass
AP-120425A,B	12/4/2025	Gr. Beta	0.018 ± 0.001	0.018 ± 0.003	0.018 ± 0.003	3.2	Pass
AP-120825A,B	12/8/2025	Gr. Beta	0.019 ± 0.003	0.018 ± 0.003	0.018 ± 0.004	4.1	Pass
AP-121025A,B	12/10/2025	Gr. Beta	0.035 ± 0.003	0.032 ± 0.003	0.033 ± 0.005	7.7	Pass
AP-121125A,B	12/11/2025	Gr. Beta	0.026 ± 0.004	0.026 ± 0.004	0.026 ± 0.006	1.0	Pass
AP-121525A,B	12/15/2025	Gr. Beta	0.032 ± 0.005	0.031 ± 0.005	0.032 ± 0.007	2.4	Pass
AP-121625A,B	12/16/2025	Gr. Beta	0.023 ± 0.002	0.025 ± 0.002	0.024 ± 0.003	5.5	Pass
AP-121725A,B	12/17/2025	Gr. Beta	0.025 ± 0.003	0.022 ± 0.003	0.024 ± 0.004	12.7	Pass
AP-122225A,B	12/22/2025	Gr. Beta	0.035 ± 0.004	0.035 ± 0.004	0.035 ± 0.006	1.5	Pass
AP-122325A,B	12/23/2025	Gr. Beta	0.026 ± 0.004	0.030 ± 0.004	0.028 ± 0.006	17.1	Pass
AP-122925A,B	12/29/2025	Gr. Beta	0.035 ± 0.005	0.031 ± 0.048	0.033 ± 0.048	12.5	Pass
AP-123025A,B	12/30/2025	Gr. Beta	0.029 ± 0.002	0.028 ± 0.002	0.028 ± 0.003	4.4	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), U (Urine), VE (Vegetation), W (Water), WW (Well Water).

[c] High solids in duplicate urine samples caused inhomogeneity of sample aliquots resulting in higher Relative Percent Difference (37.2%).

[d] Matrix inhomogeneity in sludge and solid samples caused higher relative percent difference in duplicate results.

[e] High Relative Percent Difference value (66.7%) caused by activity concentrations below the MDC's.

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

			Concentration[a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Acceptance Range [c]	Acceptance
MADW-3678	2/1/2025	Cs-134	-0.023 ± 0.098	0	NA [c]	Pass
MADW-3678	2/1/2025	Cs-137	7.3 ± 0.4	6.9	4.8 - 9.0	Pass
MADW-3678	2/1/2025	Co-57	30.9 ± 0.4	32.1	21.6 - 40.2	Pass
MADW-3678	2/1/2025	Co-60	0.31 ± 0.07	0	NA [c]	Pass
MADW-3678	2/1/2025	Mn-54	0.02 ± 0.07	0	NA [c]	Pass
MADW-3678	2/1/2025	Zn-65	26.3 ± 0.8	26.7	18.7 - 34.7	Pass
MADW-3678	2/1/2025	K-40	32.4 ± 2.3	30.3	21.2 - 39.4	Pass
MAAP-3670	2/1/2025	Cs-134	0.34 ± 0.07	0.340	0.238 - 0.442	Pass
MAAP-3670	2/1/2025	Cs-137	0.76 ± 0.12	0.678	0.475 - 0.881	Pass
MAAP-3670	2/1/2025	Co-57	0.74 ± 0.10	0	NA [c, d]	Fail
MAAP-3670	2/1/2025	Co-60	0.48 ± 0.10	0.486	0.340 - 0.632	Pass
MAAP-3670	2/1/2025	Mn-54	0.002 ± 0.041	0	NA [c]	Pass
MAAP-3670	2/1/2025	Zn-65	-0.16 ± 0.16	0	NA [c]	Pass
MAW-05I0013-01	8/1/2025	Gross Alpha	0.78 ± 0.06	0.96	0.29 - 1.63	Pass
MAW-05I0013-01	8/1/2025	Gross Beta	1.76 ± 0.05	1.90	0.95 - 2.85	Pass
MAW-O5I0013-02	8/1/2025	Cs-134	5.50 ± 0.16	7.34	5.14 - 9.54	Pass
MAW-O5I0013-02	8/1/2025	Cs-137	6.51 ± 0.24	6.70	4.7 - 8.7	Pass
MAW-O5I0013-02	8/1/2025	Co-57	0.003 ± 0.066	0	NA [c]	Pass
MAW-O5I0013-02	8/1/2025	Co-60	6.81 ± 0.16	7.24	NA [c]	Pass
MAW-O5I0013-02	8/1/2025	Mn-54	7.39 ± 0.24	7.95	5.57 - 10.34	Pass
MAW-O5I0013-02	8/1/2025	Zn-65	21.3 ± 0.5	23.1	16.2 - 30.0	Pass
MAW-O5I0013-02	8/1/2025	K-40	8.11 ± 0.93	0	NA [c]	Fail [e]
MAW-O5I0013-02	8/1/2025	Ni-63	14.0 ± 2.0	25.0	17.0 - 32.5	Fail [f]
MAW-O5I0013-02	8/1/2025	H-3	240 ± 10	276	193 - 359	Pass
MASO-O5I0013-04	8/1/2025	Cs-134	491 ± 8	613	429 - 797	Pass
MASO-O5I0013-04	8/1/2025	Cs-137	721 ± 11	686	480 - 892	Pass
MASO-O5I0013-04	8/1/2025	Co-57	1.23 ± 17.83	0	NA [c]	Pass
MASO-O5I0013-04	8/1/2025	Co-60	1136 ± 10	1144	801 - 1487	Pass
MASO-O5I0013-04	8/1/2025	Mn-54	846 ± 13	771	540 - 1002	Pass
MASO-O5I0013-04	8/1/2025	Zn-65	0.12 ± 6.20	0	NA [c]	Pass
MASO-O5I0013-04	8/1/2025	K-40	580 ± 39	492	344 - 640	Pass

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

			Concentration[a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Acceptance Range [c]	Acceptance
MAAP-O5I0013-05	8/1/2025	Gross Alpha	1.34 ± 0.08	1.24	0.37 - 2.11	Pass
MAAP-O5I0013-05	8/1/2025	Gross Beta	1.62 ± 0.05	1.75	0.88 - 2.63	Pass
MAVE-O5I0013-06	8/1/2025	Cs-134	-0.01 ± 0.04	0	NA [c]	Pass
MAVE-O5I0013-06	8/1/2025	Cs-137	0.63 ± 0.09	0.986	0.690 - 1.282	Fail [g]
MAVE-O5I0013-06	8/1/2025	Co-57	3.04 ± 0.12	4.47	3.13 - 5.81	Fail [g]
MAVE-O5I0013-06	8/1/2025	Co-60	1.49 ± 0.11	2.30	1.61 - 2.99	Fail [g]
MAVE-O5I0013-06	8/1/2025	Mn-54	2.13 ± 0.15	3.10	2.17 - 4.03	Fail [g]
MAVE-O5I0013-06	8/1/2025	Zn-65	5.88 ± 0.38	9.29	6.50 - 12.08	Fail [g]

[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 an acceptance range.

[d] The false positive is believed to be due to interference from U-234 which has a gamma energy very close to Co-57 and for which the MAPEP study report confirmed to be present in the sample.

[e] False positive detections could have occurred due to a combination of an inadequate background subtraction for this sample geometry compounded by a very long analysis time.

[f] Failure is likely due to inadequate quench correction. Using the "Channels Ratio" quench correction method the lab result would have been 24.9 Bq/L which would have passed the study acceptance criteria.

[g] This sample aliquot weight was very low. It is believed that due to the low weight that the container may not have rested squarely on the detector resulting in lower results for all analytes. Reanalysis of this sample resulted in passing results for all analytes.

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

MRAD-40 Study (Air Filter)

Lab Code	Date	Analysis	Concentration [a] Laboratory Result	ERA Value [b]	Acceptance Limits [c]	Acceptance
O5K0086-02	9/22/2025	Cs-134	302 ± 4	341	221 - 418	Pass
O5K0086-02	9/22/2025	Cs-137	437 ± 4	379	311 - 497	Pass
O5K0086-02	9/22/2025	Co-60	345 ± 4	322	274 - 409	Pass
O5K0086-02	9/22/2025	Mn-54	< 1.80	< 35.0	0.00 - 35.0	Pass
O5K0086-02	9/22/2025	Zn-65	240 ± 7	193	158.0 - 295	Pass
O5K0086-02	9/22/2025	U-234	66.2 ± 2.1	63.4	47.0 - 74.3	Pass
O5K0086-02	9/22/2025	U-238	66.8 ± 2.2	62.9	47.5 - 75.0	Pass
O5K0086-02	9/22/2025	Uranium-Total	136 ± 3.1	129	94.2 - 153	Pass
O5K0086-01	9/22/2025	Gross Alpha	22.4 ± 1.4	22.0	11.5 - 36.2	Pass
O5K0086-01	9/22/2025	Gross Beta	25.1 ± 1.7	40.5	24.6 - 61.2	Pass

[a] Results obtained by Microbac Laboratories - Northbrook 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] 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.

[c] The acceptance limits are established per ERA's SOP for the Generation of Acceptance Limits™ as applicable.

MICROBAC®
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

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.

MICROBAC®
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

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

Conclusions of WO 41003978 Land Use Census:

The ESP 4.4 LAND USE CENSUS is written exceeding the requirements in applicable regulations; this procedure needs to be revised to remove references that are no longer applicable for SAFSTOR pathways.

Environmental samples were collected and analyzed according to NUREG-1302, Appendix I to Part 50, and Reg Guide 4.8. The quality control data for Microbac Inc analytical techniques were reviewed, and the minimum detection capabilities specified in the Reg Guides are achieved. The gaseous effluents do not carry gamma radionuclides and the results of the vegetation samples confirmed background. The IDNR website does not list milk-producing animals are in the 5 mile radius of the site. The plant is not operating; therefore, fission gases such as noble gases and iodine are not a potential. The ESP 4.4 Land Use Census specifies gardens producing fresh leafy vegetables for human consumption having an area of 500 square feet within 5 miles are not applicable to the gaseous effluents because there are no particulates. This demonstrates "no significant impact" on the human pathway.

No changes/new pathways will be added to the REMP program based on the findings of the land use survey.

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.

Calculated Dose from Effluent Releases:

The contribution of dose to a member of the public most likely to be exposed from liquid and gaseous effluent releases was calculated. 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".

Results of the Gaseous and Liquid Effluents are reported in the 2025 Annual Radiological Material Release Report.

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 Defueled Offsite Dose Assessment Manual (DODAM).

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.

Conclusion:

A review of the calculation of offsite doses, the appropriateness of REMP sampling station types and locations was compared to requirements in Regulatory Guide 4.8 Environmental Technical. The current sampling scheme was determined to be adequate for the identified receptors.

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 2024 Annual Radiological Environmental Operating Report, subsections "Ambient Radiation (TLDs)" and "ISFSI Facility Operations Monitoring".