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U. S. Nuclear Regulatory Commission
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Calvert Cliffs Nuclear Power Plant; Unit Nos. 1 & 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
Docket Nos. 50-317 & 50-318

Independent Spent Fuel Storage Installation
Material License No. SNM-2505
NRC Docket No. 72-8

Subject: **Annual Radiological Environmental Operating Report**

References:
1. Calvert Cliffs Nuclear Power Plant Technical Specification 5.6.2
2. Calvert Cliffs Independent Spent Fuel Storage Installation Technical Specification 6.2

In accordance with References 1 and 2, Calvert Cliffs Nuclear Power Plant is submitting the Annual Radiological Environmental Operating Report (Attachment 1).

There are no regulatory commitments contained in this correspondence.

Should you have questions regarding this matter, please contact me at (667) 313-6503 or Mr. Doug Grimmig at (410) 495-6982.

Respectfully,

Larry D. Smith
Manager - Regulatory Assurance
LDS/aj

Attachment: (1) Annual Radiological Environmental Operating Report for the Calvert Cliffs Nuclear Power Plant Units 1 and 2 and the Independent Spent Fuel Storage Installation

cc: NRC Regional Administrator, Region 1
NRC Project Manager, Calvert Cliffs
NRC Resident Inspector, Calvert Cliffs
S. Seaman, MD-DNR

ATTACHMENT (1)

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR THE

CALVERT CLIFFS NUCLEAR POWER PLANT

UNITS 1 AND 2

AND THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

Calvert Cliffs Nuclear Power Plant

May 15, 2024

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT UNITS 1 AND 2 AND THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

January 1 - December 31, 2023

A. M. Barnett
M.N.Brady
D. A. Grimmig

CONSTELLATION NUCLEAR, LLC

MAY 2024

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. SUMMARY

During 2023, Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 2177 radiological analyses were performed, and the analytical results reviewed. Most of these analyses were performed to satisfy the requirements of the Offsite Dose Calculation Manual (ODCM) (Ref. 6), the Environmental Technical Specifications (Ref. 5) and the Independent Spent Fuel Storage Installation (ISFSI) Technical Specifications (Ref. 10). Some of these samples, although not required by either the ODCM or the Technical Specifications, were collected to maintain our commitments to the surrounding community and to maintain historical continuity of the CCNPP Radiological Environmental Monitoring Program (REMP) that started in 1970. The entire monitoring program in place around CCNPP is divided into three parts: the original REMP, the ISFSI monitoring program, and the Non-ODCM Radiological Environmental Monitoring. The following paragraphs describe each of these parts in more detail.

A total of 944 radiochemical analyses were performed on 904 environmental samples; and 368 Optically Stimulated Luminescent Dosimeters (OSLDs) were analyzed for ambient radiation exposure rates as part of the original REMP. These analyses were performed to satisfy the requirements of the ODCM (Ref. 6) and the Environmental Technical Specifications (Ref. 5).

For the ISFSI monitoring program, 320 radiochemical analyses were performed on 300 environmental samples, 224 of which were in common with the original REMP. In addition, 320 OSLDs, 16 in common with the original REMP, were analyzed for ambient radiation exposure rates. These analyses were performed to satisfy the requirements of the ODCM (Ref. 6) and the ISFSI Technical Specifications (Ref. 10).

Lastly, 409 radiochemical analyses were performed on 257 quality assurance samples as part of an internal and external quality assurance program associated with Teledyne Brown Engineering. Laboratory inter-comparison samples obtained from Environmental Resource Associates (ERA) and Analytics' Inc. were also analyzed.

Samples collected from the aquatic environment included bay water, fish, oysters, and shoreline sediment. Bay water was analyzed for tritium and gamma emitters. Fish, oysters, and shoreline sediments were analyzed for gamma emitting radionuclides.

Monitoring the atmospheric environment involved sampling the air at various locations surrounding CCNPP and the ISFSI. Air particulates and gaseous iodine were collected on glass fiber filters and charcoal cartridges, respectively. The particulate filters were analyzed for beta activity and gamma emitting nuclides. The charcoal cartridges were analyzed for airborne gaseous radioiodine.

Samples from the terrestrial environment consisted of vegetation and soil samples collected and analyzed for gamma emitters. Vegetation samples for the original REMP were also analyzed for I-131.

Measurements of direct radiation, as required by the ODCM, were performed by analyzing OSLDs from forty-two locations surrounding CCNPP and the ISFSI.

Natural radioactivity was detected in essentially all 2177 radiological analyses performed. Low levels of man-made fission products were also observed in 5 of these analyses for the CCNPP REMP. Three of these observations were for low level Tritium and is attributed to normal plant operations. The other 2 observations were for Cs-137 and attributed to fallout from past atmospheric weapons testing. Detailed discussions about the results of these analyses are contained in the body of this report.

To assess the plant's contribution to the radiation levels of the ambient environment, dose calculations were performed by Murray and Trettel, Inc. using 2023 data from the plant's effluent releases, 2023 on-site meteorological data, and appropriate pathways. Details on these dose calculations and meteorological trends from 2023 are provided in the Annual Report on the Meteorological Monitoring Program at the Calvert Cliffs Nuclear Power Station 2023. The results of these dose calculations indicate:

a. a maximum thyroid dose of 5.15×10^{-3} mrem via liquid and gaseous pathways, which is about 0.00687% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 "Environmental Radiation Protection Standards for Nuclear Power Operations" and 10CFR72.104, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste”;

b. a maximum whole-body dose of 6.60×10^{-3} mrem via liquid and gaseous pathways, which is about 0.0264% of the acceptable limit of 25 mrem/yr as specified in both 40CFR190 and 10CFR72.104; and

c. a maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 2.68×10^{-2} mrem. This dose is about 0.107% of the allowable limit of 25 mrem/yr as specified in both 40CFR190 and 10CFR72.104.

Thus, it is concluded based upon the levels of radioactivity observed and the various dose calculations performed, that CCNPP Units 1 and 2 and the ISFSI did not cause any significant radiological impact on the surrounding environment.

II. CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

II.A. INTRODUCTION

The REMP has been conducted in the vicinity of CCNPP since the summer of 1970. The Calvert Cliffs site is an operating nuclear generating station consisting of two pressurized water reactors. Unit 1 achieved criticality on October 7, 1974 and commenced commercial operation in May 1975. Unit 2 achieved criticality on November 30, 1976 and went into commercial operation April 1, 1977. The location of the plant in relation to local metropolitan areas is shown on Figure A-1.

Results of the monitoring program for the pre-operational period have been reported in a series of documents (Ref. 1-4). The results from previous operational periods are contained in annual reports submitted to the Nuclear Regulatory Commission (NRC) as required.

Results of the monitoring program for the current operational period are included in this report. The report presents the content of the REMP (Table 1), the sampling locations (Appendix A), the summary of the analytical results (Table 2), a compilation of the analytical data (Appendix B), the results of the CGS Interlaboratory Comparison Program and the Quality Assurance Program (Appendix C), the results of the Land Use Survey (Appendix D), and a compilation of the analytical data for extra samples collected (Appendix E). Interpretation of the data and conclusions are presented in the body of the report.

The environmental surveillance data collected during this reporting period were compared with that generated in previous periods whenever possible to evaluate the environmental radiological impact of CCNPP Units 1 and 2.

II.B. PROGRAM

II.B.1 Objectives

The objectives of the REMP for the Calvert Cliffs Nuclear Power Plant are:

a. To verify that radioactivity and ambient radiation levels attributable to plant operation are within the limits specified in the ODCM (Ref. 6) and the Environmental Radiation Protection Standards as stated in 40CFR190,

b. To detect any measurable buildup of long-lived radionuclides in the environment,

c. To monitor and evaluate ambient radiation levels, and

d. To determine whether any statistically significant increase occurs in the concentration of radionuclides in important pathways.

II.B.2 Sample Collection

The locations of the individual sampling stations are listed in Table A-1 and shown in Figures A-2 and A-3. All samples were collected by contractors to, or personnel of Constellation Generation Solutions (CGS) according to Procedures (Ref. 7, 12 and 15).

II.B.3 Data Interpretation

Many results in environmental monitoring occur at or below the minimum detectable activity (MDA). In this report, all results at or below the relevant MDA are reported as being "less than" the MDA value which is the minimum detectable activity for each nuclide in that sample at the time of analysis.

II.B.4 Program Exceptions

There was one air sampler program exception during this operating period.
A loss of power due to a GFCI trip resulted in lost samples at station A5 for air iodine and air particulate for the week ending April 10th 2023. This event was captured in the Nuclear Corrective Action Program in Issue Report 04668910 to document the event and trend future events should they occur.

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year were analyzed using Constellation Generation Solutions (CGS) laboratory procedures (Ref. 8), except Tritium which was analyzed by Teledyne Brown Engineering (Ref. 14) and Dosimetry analysis provided by Landauer using OSLDs (Ref. 17). The analytical results for this reporting period are presented in Appendix B and are also summarized in Table 2. For discussion, the analytical results are divided into four categories. The categories are Aquatic Environment, Atmospheric Environment, Terrestrial Environment, and Direct Radiation. These categories are further divided into subcategories according to sample type (e.g. Bay Water and Aquatic Organisms for Aquatic Environment).

II.C.1 Aquatic Environment

The aquatic environment surrounding the plant was monitored by analyzing samples of bay water, aquatic organisms, and shoreline sediment. The samples were obtained from various sampling locations on the Chesapeake Bay near the plant.

II.C.1.a Bay Water

Monthly bay water samples were taken from two locations during the year. These locations are the Intake Area (sample code WA1) and the Discharge Area (sample code WA2). Composite samples were obtained from each location for the entire sampling period. These samples were analyzed for tritium and gamma emitters.

The tritium analyses, performed on quarterly composites of the monthly bay water samples, revealed low level concentrations of Tritium in the second quarterly sample at the Intake Area (sample code WA1) collected from 03/30/2023 to 06/30/2023 at 214 +/- 130 pCi/L. Tritium was also observed in two samples at the Discharge Area (sample code WA2). Tritium was identified in the third quarterly sample collected from 06/30/2023 to 09/29/2023 at 573 +/- 138 pCi/L and the fourth quarterly sample collected from 09/29/2023 to 12/28/2023 at 638 +/- 149 pCi/L.

Figure 1 compares tritium observed in the plant discharge and intake with annual effluent releases as reported in the Radioactive Effluent Release Report.

Monthly analyses of bay water samples from both locations for gamma emitters exhibited no detectable concentrations of any plant-related radionuclides.

II.C.1.b Aquatic Organisms

Twelve samples of aquatic organisms were obtained from four locations during the year. Samples of fish, when in season, are normally collected from the Discharge Area (sample codes IA1 and IA2) and from the Patuxent River (sample codes IA4 and IA5). As shown in Table B-2, two species of fish were sampled at both the plant discharge and the control point in the Patuxent River. Oyster samples were obtained quarterly from Camp Conoy (sample code IA3) and Kenwood Beach (IA6).

Figure 2 compares K-40 and Ag-110m observed in oysters from Camp Conoy (IA3) with annual effluent releases of Ag-110m as reported in the Radioactive Effluent Release Report.

Edible portion of the fish and oyster samples were analyzed for gamma emitters.

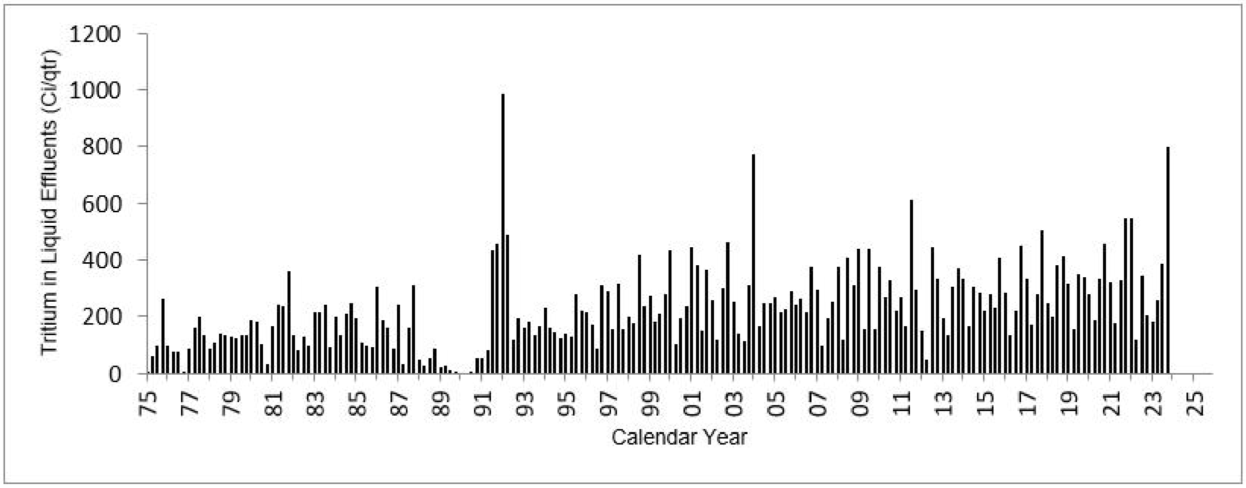
Gamma spectrometric analyses of the fish exhibited naturally occurring K-40 but no detectable concentrations of any plant-related radionuclides. Oyster samples likewise exhibited naturally occurring K-40 but no detectable concentrations of any plant-related radionuclides.

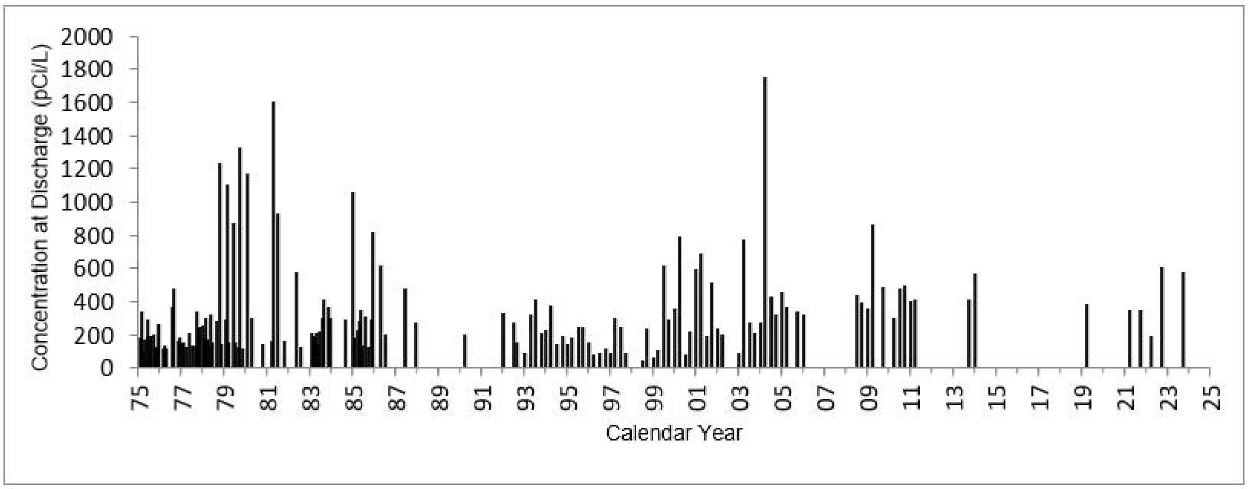
II.C.1.c Shoreline Sediment

Semiannual shoreline sediment samples are taken from one location during the year. This location is Shoreline at Barge Road (sample code WB1). The semiannual shoreline sediment samples obtained from this location were analyzed for gamma emitters.

Gamma spectrometric analyses of these samples exhibited naturally occurring radionuclides, but no detectable concentration of any plant-related radionuclides.

FIGURE 1
Tritium in Chesapeake Bay Water





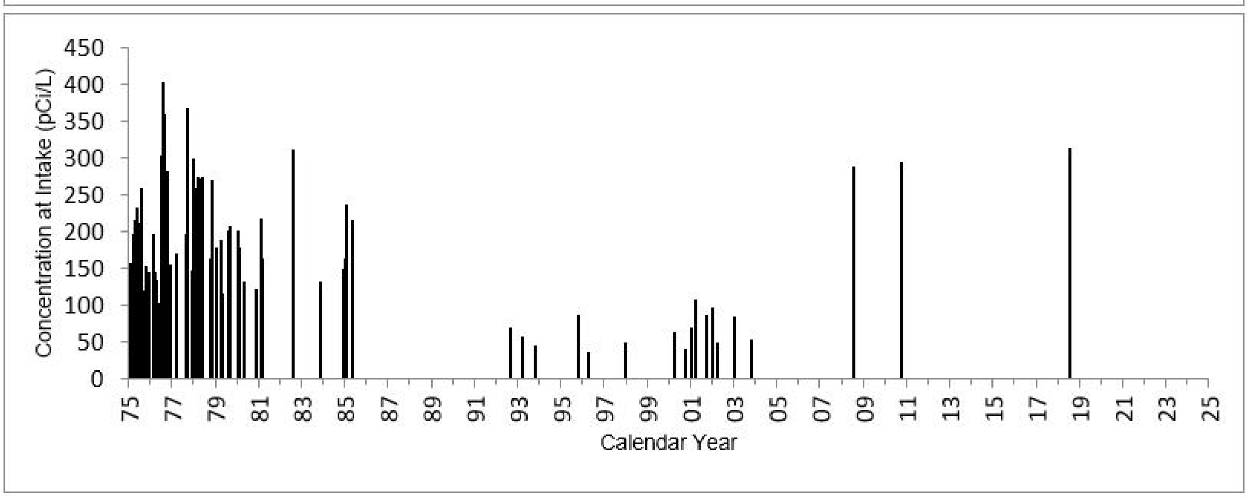
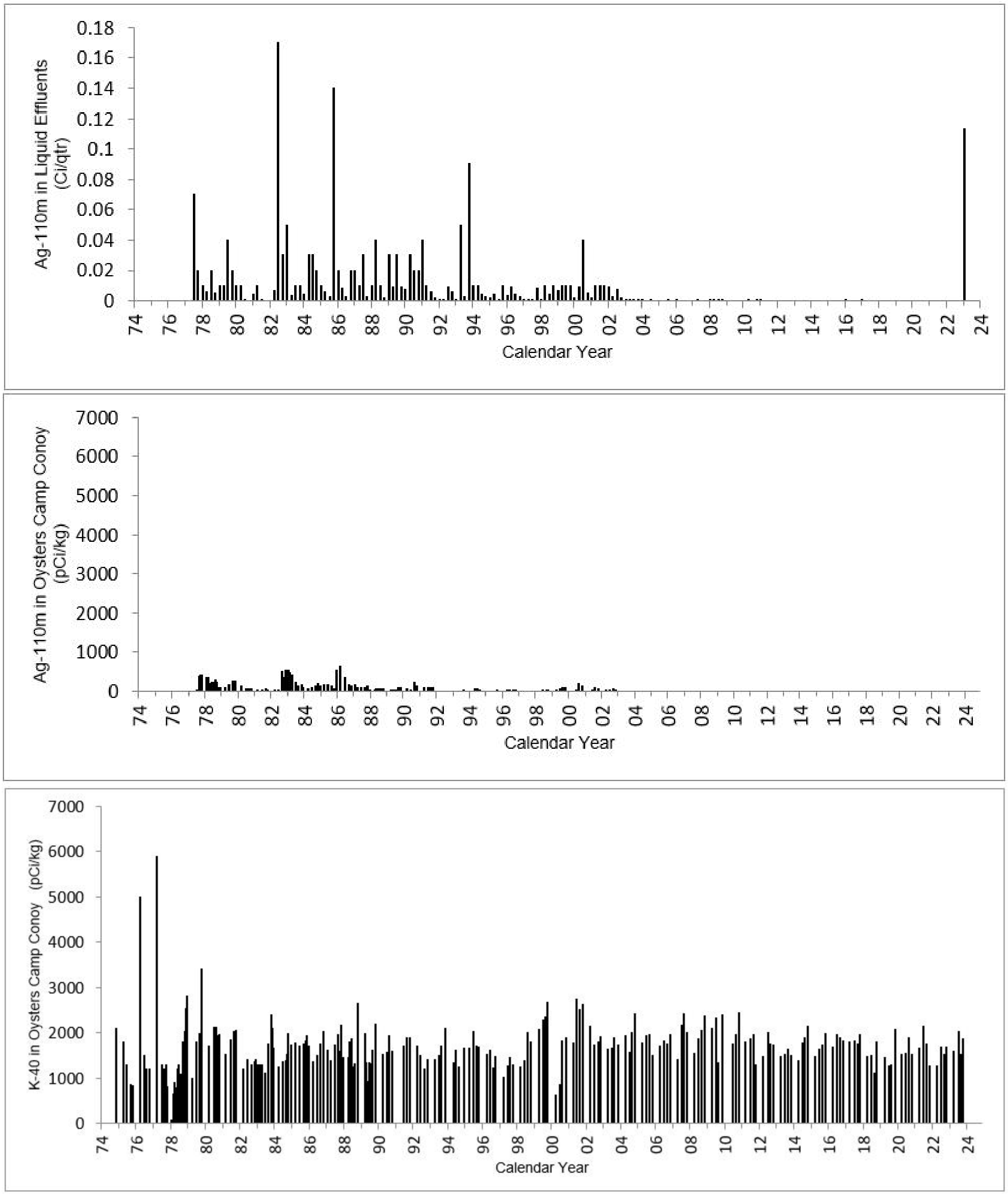


FIGURE 2
Silver-110m and Potassium-40 in Chesapeake Bay Oysters



II.C.2 Atmospheric Environment

The atmospheric environment was monitored by analyzing air particulate filters and charcoal cartridges (for trapping radioiodine species). Samples were collected from eight locations surrounding the plant. The locations are On Site Before Entrance to Camp Conoy (sample code A1), Camp Conoy Road at the Emergency Siren (sample code A2), Bay Breeze Road (sample code A3), Route 765 at Lusby (sample code A4), and at the Emergency Operations Facility (sample code A5), Meteorological Station (sample code SFA1), NNW of ISFSI (sample code SFA3), and SSE of ISFSI (sample code SFA4). Sample locations A1, SFA1, SFA3, and SFA4 are common to the REMP monitoring program and the ISFSI monitoring program.
There was one air sampler program exception during this operating period.
A loss of power due to a GFCI trip resulted in lost samples at station A5 for air iodine and air particulate for the week ending April 10^{th} 2023. This event was captured in the Nuclear Corrective Action Program in Issue Report 04668910 to document the event and trend future events should they occur.

II.C.2.a Air Particulate Filters

Weekly composite air particulate filter samples were collected from the eight locations, referenced, above during the year. These samples were analyzed for beta activity and gamma emitters.

Weekly analyses for beta activity on air particulate filters collected from all eight locations showed values characteristic of background levels. The values ranged from 2.1×10^{-2} to 2.3×10^{-2} pCi/m^3 for the indicator locations and 0.9×10^{-2} to 2.0×10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 2.3×10^{-2} pCi/m^3 was SFA1, Meteorological Station.

Gamma spectrometric analyses of Quarterly composited air particulate weekly samples exhibited no detectable concentrations of any plant-related radionuclides in any of these samples. Naturally occurring radionuclides, such as Be-7, were detected in nearly all samples.

Figure 3 depicts the historical trends of beta activity.

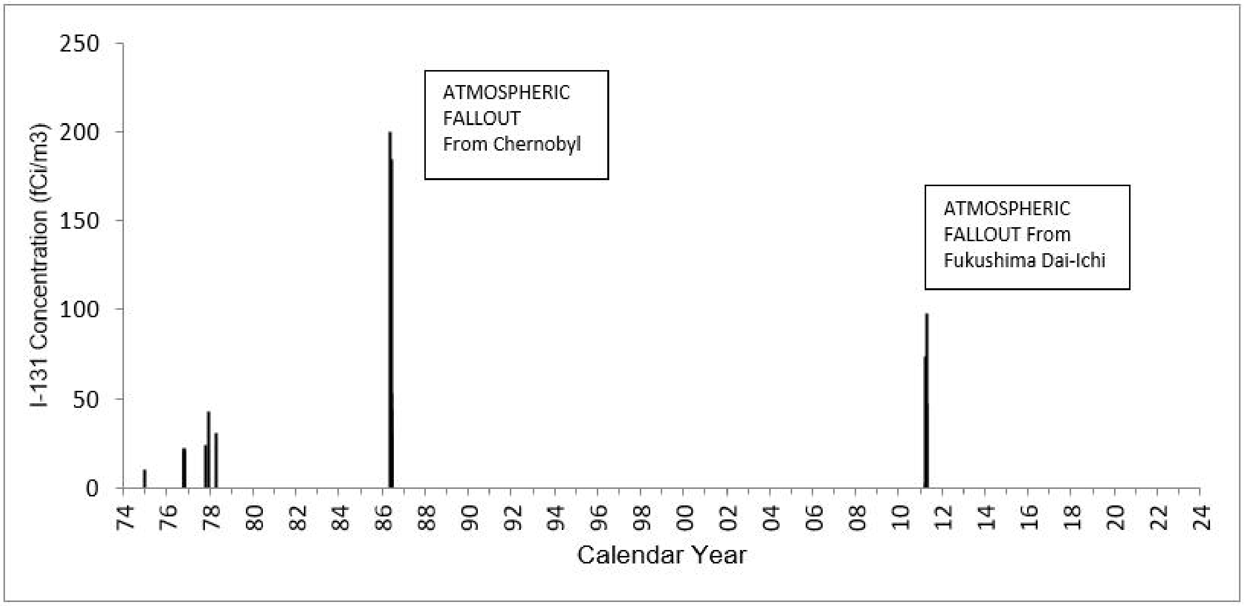
II.C.2.b Air Iodine

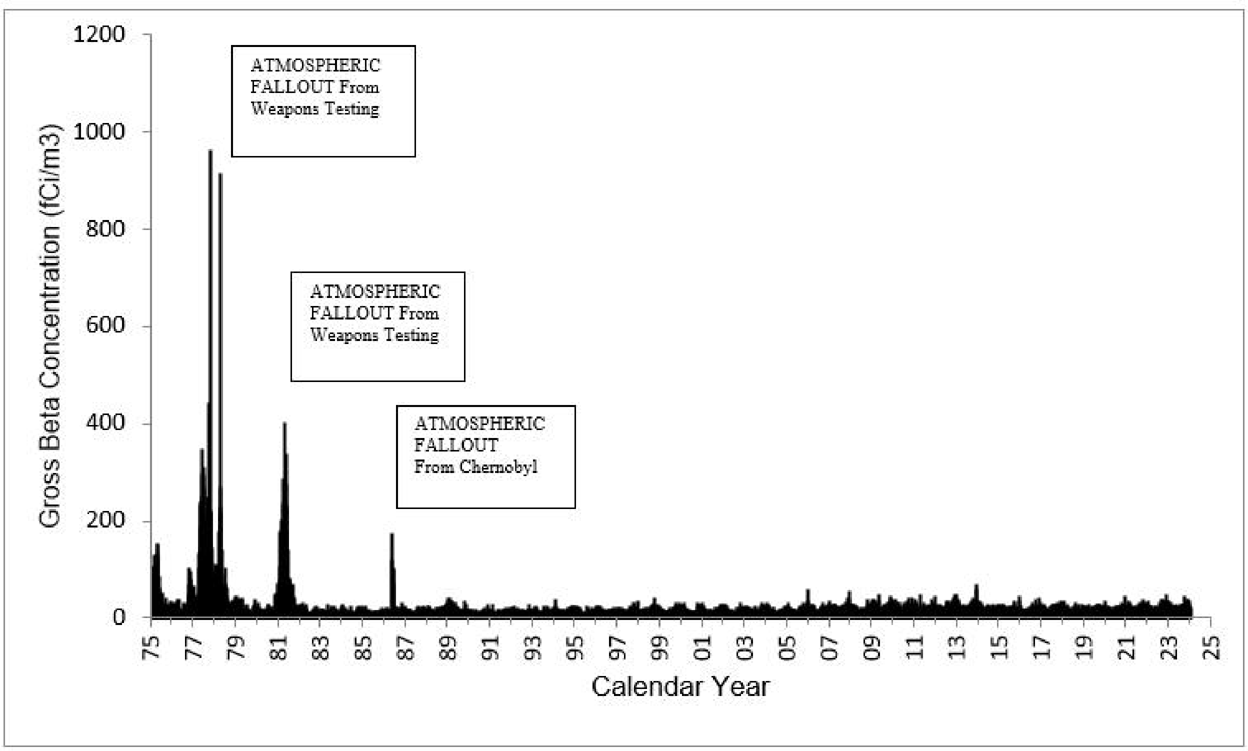
Weekly composited charcoal cartridges (for trapping radioiodine species) were collected from the eight locations, referenced above, during the year. These samples were analyzed for radioiodine species and exhibited no detectable concentrations of I-131 during the year.

Figure 3 depicts the historical trends of manmade radioiodine activity for location A4, Route 765 at Lusby including the impact I-131 due to significant events such as the fallout resulting from the accident event at Chernobyl in 1986 and the accident event at Fukushima Daiichi in 2011. These examples demonstrate the sensitivity of the CCNPP REMP. Since the REMP is able to detect fallout from nuclear accidents from across the world, it is clear that the REMP would be able to detect the environmental accumulation of radioactive material coming directly from CCNPP.

FIGURE 3
Nuclear Fallout in the Calvert Cliffs Area

SURFACE AIR VAPORS, LUSBY, MD (A4)





II.C.3 Terrestrial Environment

The terrestrial environment was monitored by analyzing samples of vegetation collected monthly, when available, from various sampling locations near the plant during the normal growing season.

II.C.3.a Vegetation

Vegetation samples were collected from three locations during the year. These locations are On Site Before Entrance to Camp Conoy (sample codes IB4, IB5, and IB6), the Emergency Operations Facility (sample codes IB7, IB8, and IB9), and the Garden Plot at Meteorological Station (sample codes IB10, IB11, and IB12). These samples were analyzed for gamma emitters, including analyses for I-131.

All samples showed detectable amounts of naturally occurring K-40 and Be-7. No plant related radionuclides were found in any of these samples.

II.C.4 Direct Radiation

Direct radiation is measured by a network of environmental dosimeters in each overland sector surrounding the plant, both at the plant boundary and at 4 miles from the plant.

Environmental Dosimeters were collected quarterly from twenty-three locations surrounding the plant. The twenty indicator locations are On Site Along the Cliffs (sample code DR1), Route 765 Auto Dump (sample code DR2), Giovanni's Tavern (sample code DR3), Route 765 Across from White Sand Dr (sample code DR4), Route 765 at John's Creek (sample code DR5), Lusby (sample code DR6), On Site before the Entrance to Camp Conoy (sample code DR7), On Site at Emergency Siren (sample code DR8), Bay Breeze Road (sample code DR9), Calvert Beach Road & Decatur St (sample code DR10), Dirt Road off Mackall Rd & and Parran Rd (sample code DR11), Bowen Rd & Mackall Rd (sample code DR12), Mackall Rd near Wallville (sample code DR13), Rodney Point (sample code DR14), Mill Bridge Rd & Turner Rd (sample code DR15), Across from Appeal School (sample code DR16), Cove Point Rd & Little Cove Point Rd (sample code DR17), Cove Point (sample code DR18), Long Beach (sample code DR19), and Onsite Near Shore (sample code DR20). The three control locations are the Emergency Operations Facility (sample code DR21), Solomons Island (sample code DR22), and Taylors Island, Anderson’s Property (sample code DR23).

In 2023 OSLDs were provided by and analyzed by Landauer, Inc. The 2023 mean 91-day ambient radiation measured at the indicator locations was 11.6 mrem and ranged from 6.7 to 15.4 mrem as reported in Table 2. The control locations showed a 91-day mean of 13.5 mrem with ranges from 11.1 to 18.2 mrem. The location with the highest overall mean of 14.3 was Cove Point Rd & Little Cove Point Rd (sample code DR17) which ranged from 13.7 to 14.9 Mrem.

Figure 4-a depicts the long-term trend of mean dosimeter exposure for the 4-mile, Control Location, and On-Site dosimeters. In June of 2018 the site adopted the requirements of the updated ANSI 13.37 standard which quantifies the dose due to the environment with enhanced accuracy and quality assurance by removing extraneous dose from the total measurement to give a true facility related dose result. Dosimeters accumulate dose continuously and extraneous dose represents the dose accumulated before and after the time spent at the sample location so the true dose accumulated at that location can be accurately determined.

Figure 4-b depicts quarterly exposure at each Dosimeter location in 2023, with the locations ranked by increasing exposure. From these graphs, it can be seen that there is a slight bias towards higher exposure at the control locations outlined in bold. This is due to higher natural background radiation at DR23 (Taylor's Island, 7.8 miles from CCNPP). This slight bias is due to normal variations in background radiation levels and is consistent with pre-operational data.

For example, in figure 4a this trend can be observed in the first calendar year of the graph, 1973, which was a year prior to the first criticality of Unit 1 (October 7, 1974). Facility-related dose was not detected at any of the monitoring locations in 2023.

FIGURE 4a
Mean Dosimeter Gamma Dose, Calvert Cliffs Nuclear Power Plant

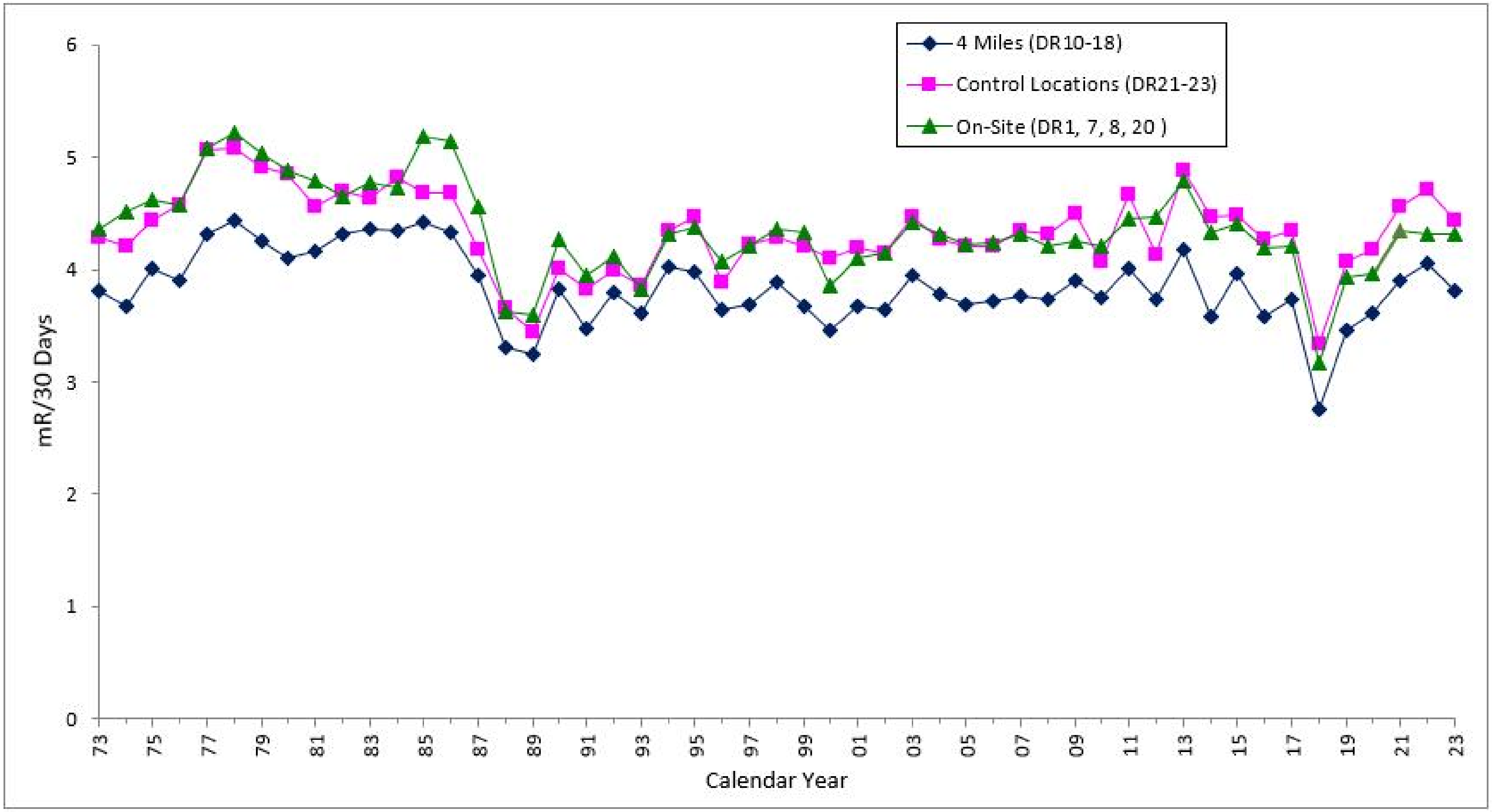
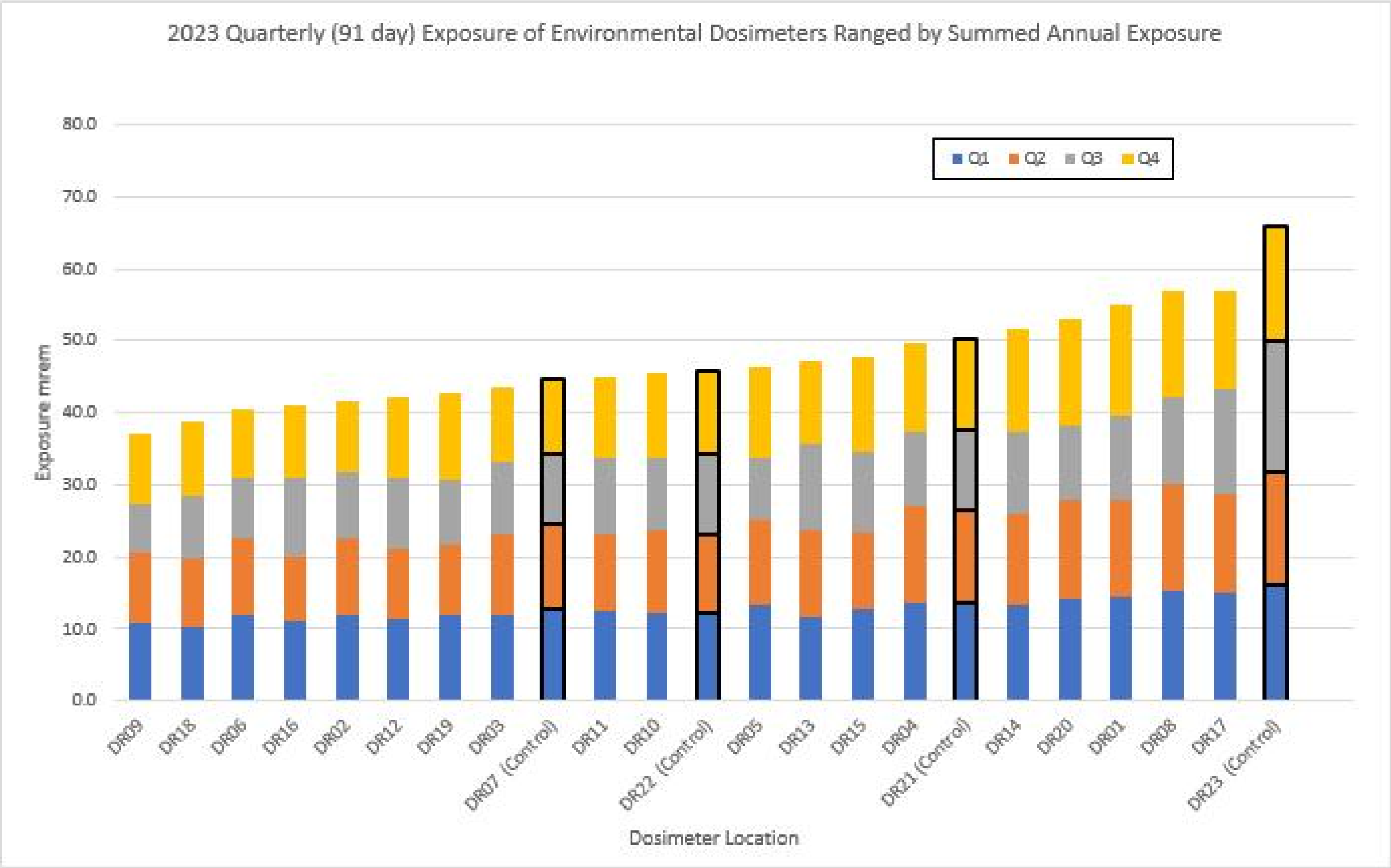


FIGURE 4b
2023 Quarterly Dosimeter Gamma Dose, per Location, Calvert Cliffs Nuclear Power Plant



II.D. CONCLUSION

Two occasions of low level Tritium in plant discharge and once in the plant intake were observed in 2023 and are attributable to normal plant operations. Results are described in section II.C.1.a of this report and are plotted in Figure 1 for which demonstrates consistency with historical trends at a low level of activity that is well below regulatory limits established in 40CFR190 and 10CFR72.104. No other man-made fission or activation by-products attributable to plant operations were observed in the environment surrounding the plant during the year.

Historical trends for tritium in bay water, Ag-110m and K-40 in oyster samples, nuclear fallout in the Calvert Cliffs area, and OSLD data are depicted in Figures 1 through 4. As can be seen from these figures, the plant made no adverse radiological contributions to the surrounding environment.

To assess the plant's contribution to the ambient radiation levels of the surrounding environment, dose calculations were performed by Murray and Trettel, Inc. using the plant's 2023 effluent release data, on site meteorological data (see X/Q and D/Q values presented in Figures 5 and 6), and appropriate pathways. Details on these dose calculations and meteorological trends from 2023 are provided in the Annual Report on the Meteorological Monitoring Program at the Calvert Cliffs Nuclear Power Station 2023. The results of these dose calculations indicate:

Gaseous Pathways

A maximum thyroid dose of 2.37×10^{-5} mrem to a child via the plume, ground, vegetable, and inhalation pathways at 1.7 miles WNW of the containments at Calvert Cliffs.
This is about 0.0000317% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body gamma dose of 2.37×10^{-5} mrem to a child at 1.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0000952% of the acceptable dose limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum dose to any other organ, in this case GI Tract, of 2.37×10^{-5} mrem to a child at 1.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0000952% of the acceptable dose limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

Liquid Pathways

A maximum thyroid dose of 5.13×10^{-3} mrem to a teenager for all liquid pathways, which is about 0.00684% of the acceptable dose limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 6.58×10^{-3} mrem to a teenager via all liquid pathways, which is about 0.0263% of the acceptable dose limit of 25 mrem/yr as stated in 40CFR190 and 10CFR72.104.

A maximum dose to any other organ, in this case GI, of 2.68 x 10^{-2} mrem to an adult for all pathways, which is 0.107% of the acceptable dose limit of 25 mrem/yr specified in 40CFR190 and 10CFR72.104.

Gaseous and Liquid Pathways Combined

A maximum thyroid dose of 5.15 x 10^{-3} mrem via liquid and gaseous pathways, which is about 0.00687% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 6.60 x 10^{-3} mrem via liquid and gaseous pathways, which is about 0.0264% of the acceptable limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 2.68 x 10^{-2} mrem. This dose was about 0.107% of the allowable limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

In all cases, the calculated doses are a small fraction of the applicable limits specified in 40CFR190 and 10CFR72.104.

Therefore, it is concluded that the operation of Calvert Cliffs Units 1 and 2 produced radioactivity and ambient radiation levels significantly below the limits of the ODCM, 40CFR190, and 10CFR72.104. There was no significant buildup of plant-related radionuclides in the environment due to the operation of the CCNPP in 2023.

FIGURE 5

Atmospheric Dispersion Around CCNPP Average Relative Air Concentrations (X/Q)

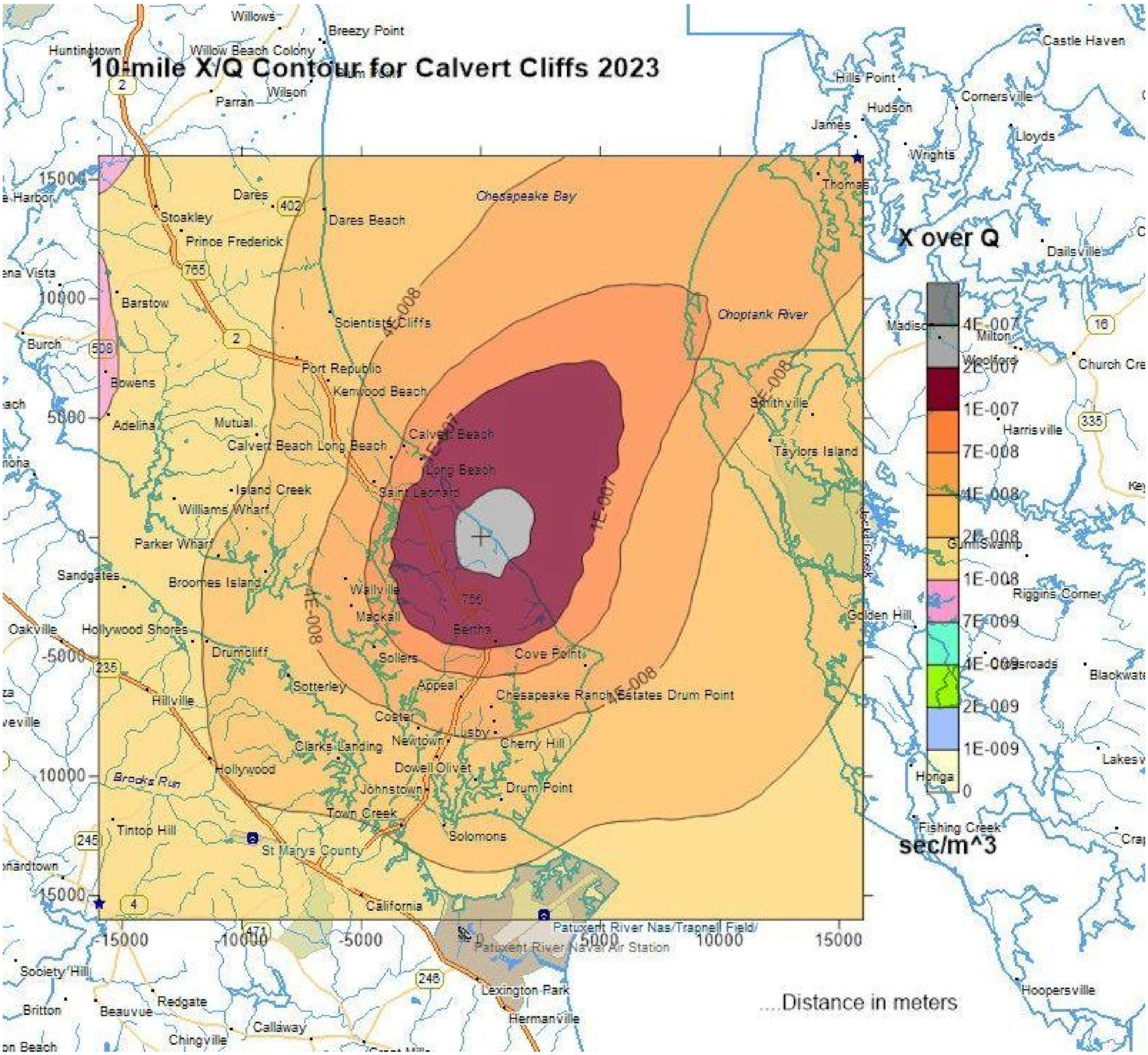


FIGURE 6

Atmospheric Dispersion Around CCNPP Average Relative Ground Deposition (D/Q)

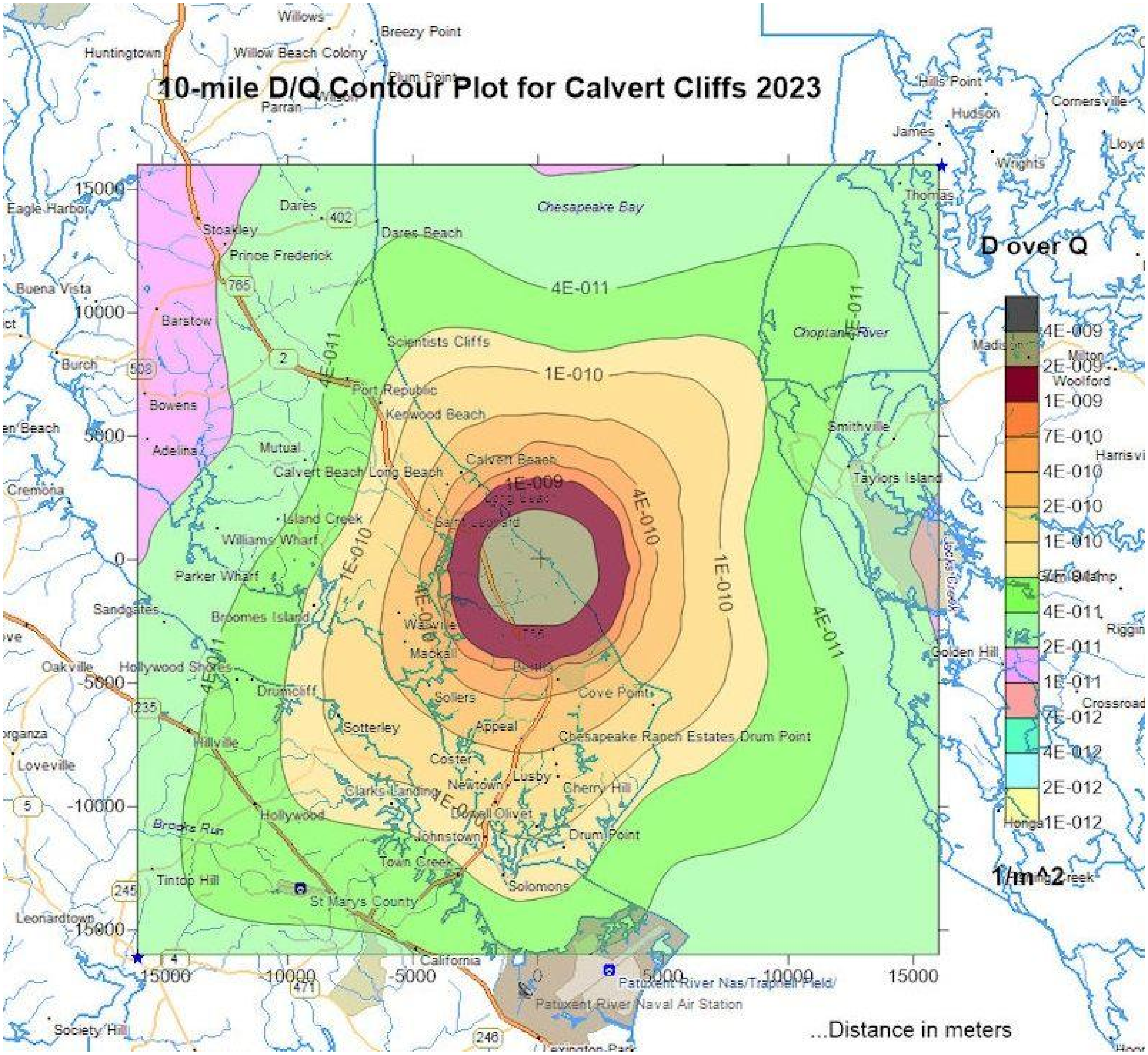


Table 1

Synopsis of 2023 Calvert Cliffs Nuclear Power Plant Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Aquatic Environment						
Bay Water	MC	2	24	Gamma	MC	24
				H-3	QC	8
Fish[2]	A	4	4	Gamma	A	4
Oysters	Q	2	8	Gamma	Q	8
Shoreline Sediment	SA	1	2	Gamma	SA	2
Atmospheric Environment						
Air Iodine[3]	W	8	415	I-131	W	415
Air Particulates[4]	W	8	415	Gross Beta	W	415
				Gamma	QC	32
Direct Radiation						
Ambient Radiation	Q	23	368	OSLD	Q	368
Terrestrial Environment						
Vegetation[5]	M	3	36	Gamma	M	36

[1] W=weekly, M=monthly, Q=quarterly, SA=semiannual, A=annual, C=composite
[2] Once in Season, July through September
[3] The collection device contains charcoal
[4] Beta counting is performed after >72-hour decay, Gamma spectroscopy performed on quarterly composites of weekly samples
[5] Monthly during growing season when available

Table 2

Annual Summary of Radioactivity in the Environs of the Calvert Cliffs Nuclear Power Plant Units 1 and 2

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Aquatic Environment						
Bay Water (pCi/L)	H-3 (8)	200	606 (2/4) (573 - 638)	Discharge Vicinity WA2 0.3 km N	606 (2/4) (573 - 638)	214 (1/4) 214
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (415)	0.5	2.2(364/364) (2.1-2.3)	Meteorological Station SFA1 0.7 km SW	2.3 (52/52) (0.9-4.1)	2.1 (51/51) (0.9-2.0)
Direct Radiation						
Ambient Radiation (mrem/91 days)	OSLD (368)	0.1	11.6 (320/320) (6.7-15.4)	Cove Point Rd & Little Cove Point Rd DR17 5.9 km SSE	14.3 (12/12) (13.7-14.9)	13.5 (48/48) (11.1-18.2)

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] Distance and direction from the central point between the two containment buildings.

III. INDEPENDENT SPENT FUEL STORAGE INSTALLATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

III.A. INTRODUCTION

In August 1990 BGE initiated a program of additional radiological environmental monitoring around the site for the Independent Spent Fuel Storage Installation (ISFSI). The first dry fuel storage canister was loaded into the ISFSI in November of 1993 with more canisters being loaded in subsequent years. In 2021, the site transitioned to Holtec Hi-storm (Holtec International Storage Module) vertically ventilated storage overpack system for Independent Spent Fuel Storage installation. In 2023 there were three such canisters of spent fuel transferred to the ISFSI.

Results of the monitoring program for the ISFSI for the current period are included in this report.

This report presents the content of the ISFSI REMP (Table 3), the ISFSI sampling locations (Appendix A), the summary of the analytical results of the period (Table 4), and a compilation of the analytical data for the period (Appendix B). Interpretation of the data and conclusions are presented in the body of the report.

The ISFSI monitoring program is as described in this section of the report.

The results were compared with that generated during the previous ISFSI pre-operational periods (Ref.11) and the current and previous CCNPP REMP periods. These results are discussed in more detail in Section III. C.

III.B. PROGRAM

III.B.1 Objectives

The objectives of the radiological environmental monitoring program for the ISFSI are:

a. To satisfy the community concern regarding the impact of the ISFSI on the environment,

b. To verify that radioactivity and ambient radiation levels attributable to operation of the ISFSI are within the limits specified in the Environmental Radiation Protection Standards as stated in 40CFRPart190 and 10CFR72.104,

c. To detect any measurable buildup of long-lived radionuclides in the environment due to the ISFSI,

d. To monitor and evaluate ambient radiation levels around the ISFSI, and

e. To determine whether any statistically significant increase occurs in the concentration of radionuclides near the ISFSI.

III.B.2 Sample Collection

The locations of the individual sampling sites are listed in Table A-2 and shown in Figures A-4 and A-5. All samples were collected by contractors to, or personnel of, Constellation Generation Solutions (CGS) personnel according to Constellation Generation Solutions Laboratory Procedures (Ref. 7).

III.B.3 Data Interpretation

Many results in environmental monitoring occur at or below the minimum detectable activity (MDA). In this report, all results at or below the relevant MDA are reported as being "less than" the MDA value which is the minimum detectable activity for each nuclide in that sample at the time of analysis.

III.B.4 Program Exceptions

There were no program exceptions for the ISFSI Monitoring Program in 2023.

III.C. RESULTS AND DISCUSSIONS

All the environmental samples collected were analyzed using Constellation Generation Solutions (CGS) laboratory procedures (Ref. 8). The analytical results for this reporting period are presented in Appendix B and are also summarized for the period in Table 4. For discussion, the analytical results are divided into three categories. The categories are Atmospheric Environment, Terrestrial Environment, and Direct Radiation. These categories are further divided into subcategories according to sample type (e.g., Vegetation and Soil for Terrestrial Environment).

III.C.1 Atmospheric Environment

The atmospheric environment was monitored by analyzing air particulate filters. These samples were collected from five locations surrounding the ISFSI.

No source of airborne radioiodine exists for the ISFSI. Airborne radioiodine is, therefore, not considered in assessing the radiological impact of the ISFSI.

III.C.1.a Air Particulate Filters

Weekly composite air particulate filter samples were collected from five locations during the period. These locations are On Site Before the Entrance to Camp Conoy (sample code A1), Meteorological Station (sample code SFA1), CCNPP Visitor's Center (sample code SFA2), NNW of the ISFSI (sample code SFA3), and SSE of the ISFSI (sample code SFA4). Sample locations A1, SFA1, SFA3, and SFA4 are in common with CCNPP REMP Program. All samples were analyzed for beta radioactivity and gamma emitting radionuclides.

Weekly analyses for beta activity on air particulate filters collected from all five locations showed values characteristic of levels routinely observed in the REMP. These values ranged from 0.8 x 10^{-2} to 4.3 x 10^{-2} pCi/m^3 for the indicator locations and 0.7 x 10^{-2} to 3.6 x 10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 2.3 x 10^{-2} pCi/m^3 was SFA1, Meteorological Station.

Gamma spectrometric analyses of quarterly composited air particulate samples exhibited no detectable concentrations of any plant-related radionuclides in any of these samples. Naturally occurring radionuclides, such as Be-7, were detected in nearly all samples.

III.C.2 Terrestrial Environment

The terrestrial environment was monitored by analyzing samples of vegetation and soil collected quarterly from the vicinity of the air sampling locations for the ISFSI.

III.C.2.a Vegetation

Vegetation samples were collected quarterly from five locations during the year. These locations are Meteorological Station (sample code SFB1), CCNPP Visitor's Center (sample code SFB2), NNW of the ISFSI (sample code SFB3), SSE of the ISFSI (sample code SFB4), and On Site Before the Entrance to Camp Conoy (sample code SFB5).

No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were detected in all samples.

III.C.2.b Soils

Soil samples were collected quarterly from five locations surrounding the ISFSI in the vicinity of the air samplers. These locations are: Meteorological Station (sample code SFS1), CCNPP Visitor's Center (sample code SFS2), NNW of the ISFSI (sample code SFS3), SSE of the ISFSI (sample code SFS4), and On Site before the Entrance to Camp Conoy (sample code SFS5).

Soil samples were analyzed for gamma emitting radionuclides. Cesium-137 was detected in two quarterly samples from indicator locations. The Cs-137 concentrations ranged from 138 ± 48.1 to 209 ± 56.4 pCi/kg. While the presence of Cs-137 in these samples may be plant-related, this range is consistent with that found to be due to the residual fallout from past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40CFR190 and 10CFR72.104. These are comparable to those observed in previous annual reporting periods for the CCNPP REMP and in the earlier pre-operational data for the ISFSI. No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were also detected in all these samples.

III.C.3 Direct Radiation-

Direct radiation is measured by a network of Environmental Dosimeters (OSLDs) surrounding the ISFSI. These dosimeters are collected quarterly from nineteen locations surrounding the ISFSI, plus one control location at the Visitor's Center (sample code SFDR7). The locations include On Site Before the Entrance to Camp Conoy (sample code DR7, common to both the CCNPP Program and the ISFSI Program) and the Meteorological Station (sample code DR30, previously a location maintained for historical continuity.) The other sampling locations are SW of ISFSI, (sample code SFDR1); N of ISFSI (sample code SFDR2); North of ISFSI (sample code SFDR3); NE of ISFSI (sample code SFDR4); East of ISFSI (sample code SFDR5); ESE of ISFSI (sample code SFDR6); NNW of ISFSI (sample code SFDR8); SSE of ISFSI (sample code SFDR9); NW of ISFSI (sample code SFDR10); WNW of ISFSI (sample code SFDR11); WSW of ISFSI (sample code SFDR12); South of ISFSI (sample code SFDR13); SE of ISFSI (sample code SFDR14); ENE of ISFSI (sample code SFDR15); SW of ISFSI (sample code SFDR16); NNE of ISFSI (sample code SFDR17) and West of ISFSI (sample code SFDR18). Sampling locations are shown on Figures A-4 and A-5.

The 2023 mean 91-day ambient radiation measured at the ISFSI indicator locations was 45.5 mrem and ranged from 9.62 to 144 mrem as reported in Table 4. The control location showed a 91-day mean of 15.0 mrem and ranged from 13.6 to 16.3 mrem. The location with the highest overall mean of 126 mrem with a range of 84.2 to 144 mrem was SFDR13, South of ISFSI. These readings are consistent with those expected from the storage of spent fuel in the ISFSI. A comparison of the average monthly radiation levels per calendar year of the ISFSI dosimeter data from the indicator locations with the ISFSI control location at the Visitor's Center, SFDR7, can be seen in Figure 7.

Facility-related dose was detected NE of ISFSI (sample code SFDR4); East of ISFSI (sample code SFDR5); ESE of ISFSI (sample code SFDR6); SSE of ISFSI (sample code SFDR9); South of ISFSI (sample code SFDR13); SE of ISFSI (sample code SFDR14); ENE of ISFSI (sample code SFDR15); SW of ISFSI (sample code SFDR16). This is expected as additional spent fuel casks are generally installed at the ISFSI each year. The ISFSI OSLDs are located directly around the perimeter of the ISFSI. Due to the proximity of these OSLDs to the spent fuel storage structures, they detect the small increase in radiation exposure each year. However, it is clear from Figure 4a that there is no observable direct radiation exposure of the public from the ISFSI, as the other REMP dosimeters (on-site, 4 miles, and beyond) show no observable increase in exposure when compared to control Dosimeters.

The 2023 mean 91-day Facility-related dose measured at the indicator locations was 47.4 mrem and ranged from 14.2 to 120 mrem. Facility-related dose was not detected at the control location. The location with the highest overall mean of 102 mrem was South of ISFSI (sample code SFDR13) which ranged from 60.2 to 120 mrem. A summary of the 2023 results is shown in the table below.

2023 ISFSI Facility-related Dose Quarterly (91-Day) Summary		
	Mean Exposure (mrem)	**Range (mrem)**
Indicator Locations	47.4	14.2 - 120
Control Location	NA	N/A
Highest Overall Location (SFDR13)	102	60.2 - 120

III.D. CONCLUSION

Low levels of Cs-137 were observed in the environment surrounding the ISFSI during the period. The Cs-137 observations were attributed to fallout from past atmospheric weapons testing. No plant-related radionuclides were observed in the environs of the ISFSI.

In general, the results in the following tables continue the historical trends previously observed at the official sites of the CCNPP REMP.

FIGURE 7
Mean Dosimeter Gamma Dose, ISFSI

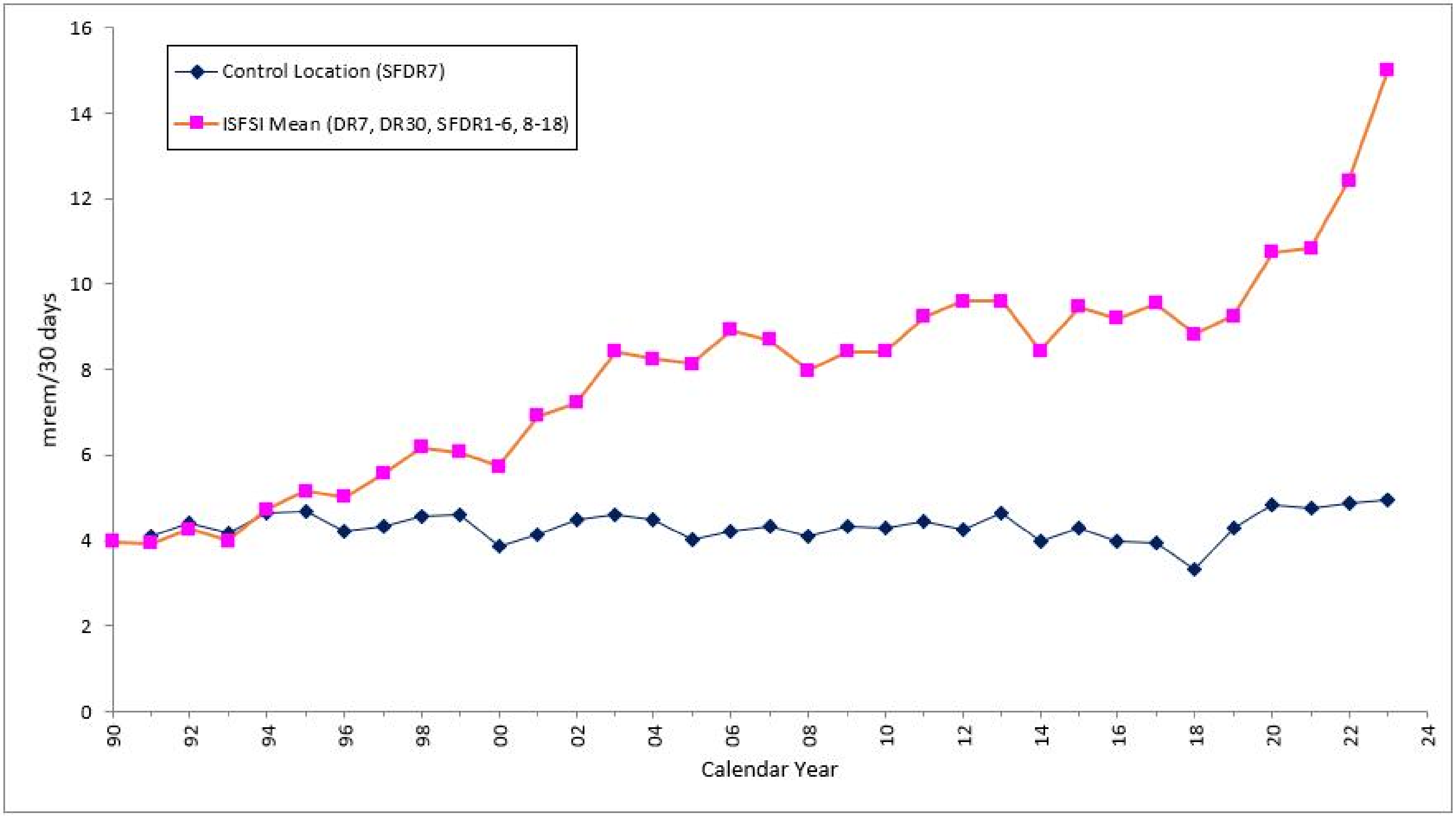


Table 3

Synopsis of 2023 Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Atmospheric Environment						
Air Particulates[2]	W	5	260	Gross Beta	W	260
				Gamma	QC	20
Direct Radiation						
Ambient Radiation	Q	20	320	OSLD	Q	320
Terrestrial Environment						
Vegetation	Q	5	20	Gamma	Q	20
Soil	Q	5	20	Gamma	Q	20

[1] W=weekly, M=monthly, Q=quarterly, SA=semiannual, A=annual, C=composite
[2] Beta counting is performed after >72-hour decay, Gamma spectroscopy performed on monthly composites of weekly samples

Table 4

Annual Summary of Radioactivity in the Environs of the Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (260)	0.5	2.2 (208/208) (0.8 - 4.3)	SW of ISFSI SFA1 0.7 km SW	2.3 (52/52) (0.9 - 4.1)	1.9 (52/52) (0.7 – 3.6)
Direct Radiation						
Ambient Radiation (mrem/91 days)	OSLDs (320)	0.1	45.5 (304/304) (9.62 - 144)	S of ISFSI SFDR13 0.1 km S	126 (16/16) (84.2 - 144)	15.0 (16/16) (13.6 -16.3)
Terrestrial Environment						
Soil (pCi/kg)	Gamma (20) Cs-137	180	174 (2/16) (138 - 209)	NNW of ISFSI SFS3 0.1 km NNW	174 (2/4) (138 - 209)	-- --

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] Distance and direction from the central point between the two containment buildings.

IV. REFERENCES

(1) Cohen, L. K., "Preoperational Environmental Radioactivity Monitoring Program at Calvert Cliffs Units 1 and 2", NUS No. 882 Semiannual Report January-June 1971, December 1971; NUS No. 1025 Annual Report 1971, March 1973.

(2) Cohen, L. K., "Preoperational Environmental Radioactivity Monitoring Program at Calvert Cliffs Units 1 and 2", NUS No. 1137 Annual Report 1972, December 1973.

(3) Cohen, L. K. and Malmberg, M.S., "Preoperational Environmental Radioactivity Monitoring Program at Calvert Cliffs Units 1 and 2", NUS No. 1188, Annual Report 1973, October 1974.

(4) Malmberg, M. S., "Preoperational Environmental Radioactivity Monitoring Program at Calvert Cliffs Units 1 and 2", NUS No. 1333, Data Summary Report, September 1970 to September 1974, July 1975

(5) Calvert Cliffs Nuclear Power Plant, Units 1 and 2, License Nos. DPR-53 and DPR-69, Technical Specification 5.6.2; Annual Radiological Environmental Operating Report.

(6) CY-CA-170-301 Current Revision, Offsite Dose Calculation Manual for the Calvert Cliffs Nuclear Power Plant.

(7) Constellation Generation Solutions Sampling Procedures
  a. CY-ES-214, Collection of RGPP Water Samples for Radiological Analysis
  b. CY-ES-237, Air Iodine and Air Particulate Sample Collection for Radiological
  c. CY-ES-239, CGS Collection Exchange of Field Dosimeters for Radiological Analysis
  d. CY-ES-241, Vegetation Sample Collection for Radiological Analysis
  e. CY-ES-242, Soil and Sediment Sample Collection for Radiological Analysis
  f. CY-ES-247, Precipitation Sampling and Collection for Radiological Analysis

(8) Constellation Generation Solutions Analytical Procedures
  a. CY-ES-204, Sample Preparation for Gamma Analysis
  b. CY-ES-205, Operation of HPGe Detectors with the Genie PC Counting System
  c. CY-ES-206, Operation of the Tennelec S5E Proportional Counter
  d. CY-ES-246, Sample Preparation for Gross Beta Analysis

(9) Land Use Census Around Calvert Cliffs Nuclear Power Plant, August 2023

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(12) CY-AA-110-200, Current Revision, Sampling

(13) CY-AA-170-1000, Radiological Environmental Monitoring Program (REMP) and Meteorological Program Implementation.

(14) Teledyne Browne Engineering, (TBE) 2018 Analysis Procedures Current Revisions

a. TBE-2001 Alpha Isotopic and Pu-241
b. TBE-2006 Iron-55 Activity in Various Matrices
c. TBE-2007 Gamma Emitting Radioisotope Analysis
d. TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices
d. TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation
e. TBE-2013 Radionickel Activity in Various Matrices
f. TBE-2019 Radiostrontium Analysis by Ion Exchange

(15) Normandeau Associates, Inc. (NAI) Sampling Procedures Current Revisions

a. Procedure No. ER20 Collection of Bottom Sediment for Radiological Analysis (Calvert Cliffs Nuclear Power Plant)
b. Procedure No. ER21 Collection of Fish Samples for Radiological Analysis (Calvert Cliffs Nuclear Power Plant)
c. Procedure No. ER22 Collection of Oyster Samples for Radiological Analysis (Calvert Cliffs Nuclear Power Plant

(16) EN-CA-408-4160 Current Revision, RGPP Reference Material for Calvert Cliffs

(17) Landauer Incorporated, Analysis procedure proprietary, Current Revision

(18) Teledyne Brown Engineering Environmental Services. "4th Quarter 2023 Quality Assurance Report", January - December 2023.

(19) GEL 2023 Annual Quality Assurance Report for the Radiological Environmental Monitoring Program (REMP) Rev.1.

(20) AMO Environmental Decisions, "2023 Annual RGPP Monitoring Report Summary of Results and Conclusions Calvert Cliffs Generating Station Lusby, Maryland

APPENDIX A

Sample Locations for the REMP and the ISFSI

Appendix A contains information concerning the environmental samples which were collected during this operating period.

Sample locations and specific information about individual locations for the CCNPP REMP are given in Table A-1. Figure A-1 shows the location of the CCNPP in relation to Southern Maryland and the Chesapeake Bay. Figures A-2 and A-3 show the locations of the power plant sampling sites in relation to the plant site at different degrees of detail.

Sample locations and specific information about individual locations for the ISFSI radiological environmental monitoring program are given in Table A-2. Figures A-4 and A-5 show the locations of the ISFSI sampling sites in relation to the plant site at different degrees of detail.

TABLE OF CONTENTS - SAMPLING LOCATIONS

TABLE A-1

Locations of Environmental Sampling Stations for the Calvert Cliffs Nuclear Power Plant

Station	Description	Distance[1] (KM)	Distance[1] (Miles)	Direction[1] (Sector)
A1[2]	On Site Before Entrance to Camp Conoy	0.7	0.5	S
A2	Camp Conoy Rd, at emergency siren	2.5	1.5	SSE
A3	Bay Breeze Rd	2.6	1.6	SE
A4	Route 765, Lusby	2.9	1.8	SSW
A5	Emergency Operations Facility	19.3	12.1	WNW
DR01	On Site, along Cliffs	0.6	0.4	NW
DR02	Route 765, Auto Dump	2.7	1.7	WNW
DR03	Route 765, Giovanni's Tavern (Knotty Pine)	2.3	1.4	W
DR04	Route 765, across from Vera's Beach Club	2.0	1.2	WSW
DR05	Route 765, John's Creek	2.4	1.5	SW
DR06	Route 765, Lusby	2.9	1.8	SSW
DR07[2]	On Site Before Entrance to Camp Conoy	0.7	0.5	S
DR08	Camp Conoy Rd at Emergency Siren	2.5	1.5	SSE
DR09	Bay Breeze Rd	2.6	1.6	SE
DR10	Calvert Beach Rd and Decatur Street	6.4	4.0	NW
DR11	Dirt road off Mackall & Parren Rd	6.6	4.1	WNW
DR12	Mackall & Bowen Rds	6.7	4.2	W
DR13	Mackall Rd, near Wallville	6.1	3.8	WSW
DR14	Rodney Point	6.4	4.0	SW
DR15	Mill Bridge & Turner Rds	6.2	3.9	SSW
DR16	Across from Appeal School	6.5	4.1	S
DR17	Cove Point & Little Cove Point Rds	5.9	3.7	SSE
DR18	Cove Point	7.1	4.5	SE
DR19	Long Beach	4.4	2.8	NW
DR20	On site, near shore	0.4	0.3	NNW
DR21	Emergency Operations Facility (EOF)	19.3	12.1	WNW
DR22	Solomons Island	12.5	7.8	S
DR23	Taylors Island, Anderson's Property	12.4	7.7	ENE
IA1	Discharge Area	0.3	0.2	N
IA2	Discharge Vicinity	0.3	0.2	N
IA3	Camp Conoy	0.9	0.6	E
IA4	Patuxent River	(Area not influenced		Patuxent
IA5	Patuxent river	by plant)		River
IA6	Kenwood Beach	10.7	6.7	NNW
IB10	Meteorological Station	0.7	0.4	SW
IB11	Meteorological Station	0.7	0.4	SW
IB12	Meteorological Station	0.7	0.4	SW
IB4	On site, before entrance to Camp Conoy	0.7	0.5	S
IB5	On site, before entrance to Camp Conoy	0.7	0.5	S
IB6	On site, before entrance to Camp Conoy	0.7	0.5	S
IB7	Emergency offsite facility	19.3	12.1	WNW
IB8	Emergency offsite facility	19.3	12.1	WNW
IB9	Emergency offsite facility	19.3	12.1	WNW
SFA1[2]	Meteorological Station	0.7	0.4	SW
SFA3[2]	NNW of ISFSI	0.6	0.4	SSW
SFA4[2]	SSE of ISFSI	0.8	0.5	SSW
WA1	Intake area	0.2	0.1	NNE
WA2	Discharge area	0.3	0.2	N
WB1	Shoreline at Barge Rd.	0.6	0.4	ESE

[1] Distance and direction from the central point between the two containment buildings
[2] Common to both the REMP and ISFSI monitoring program

Figure A-1

Map of Southern Maryland and Chesapeake Bay Showing Location of Calvert Cliffs Nuclear Power Plant

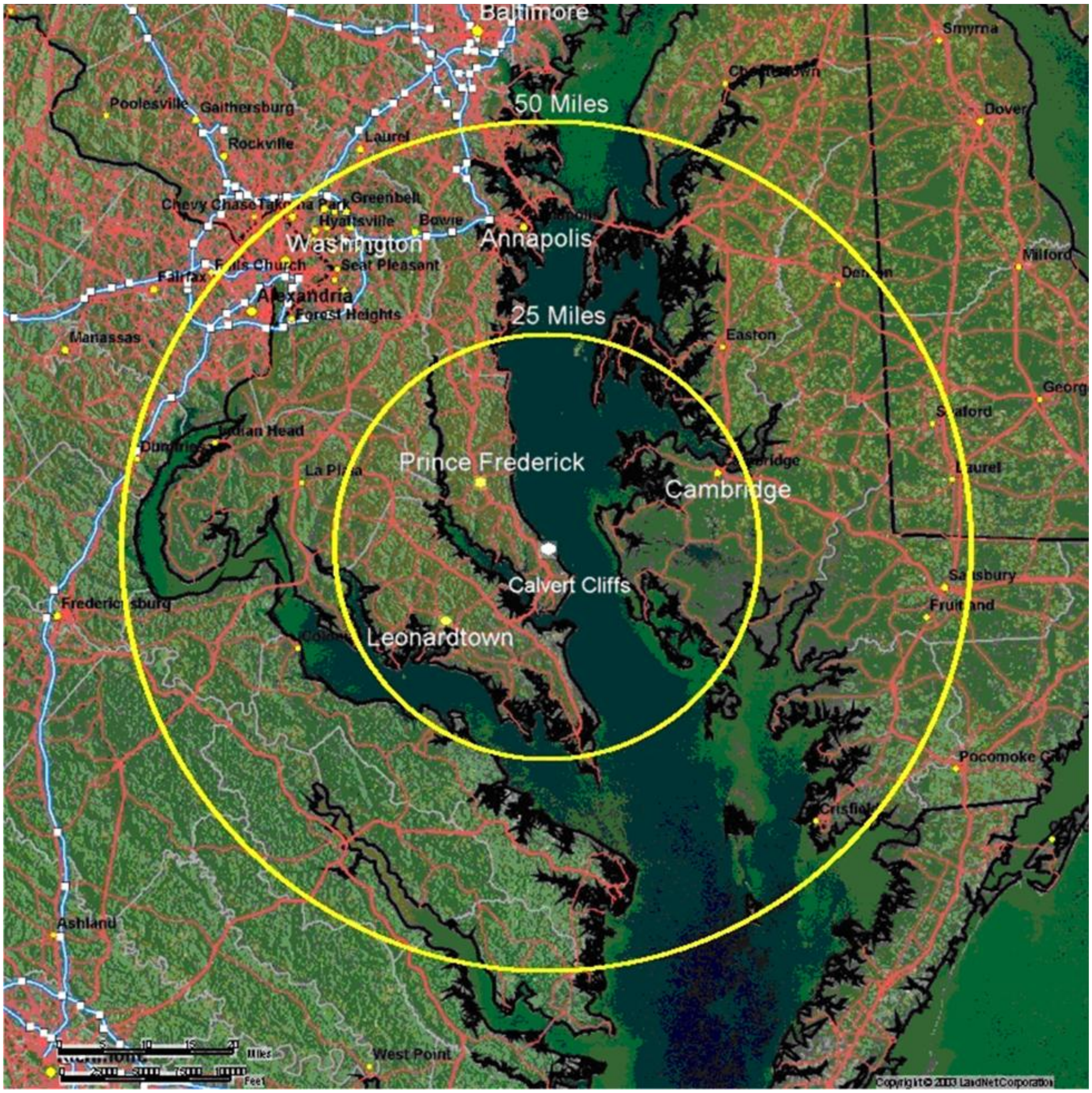


Figure A-2

**Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles**

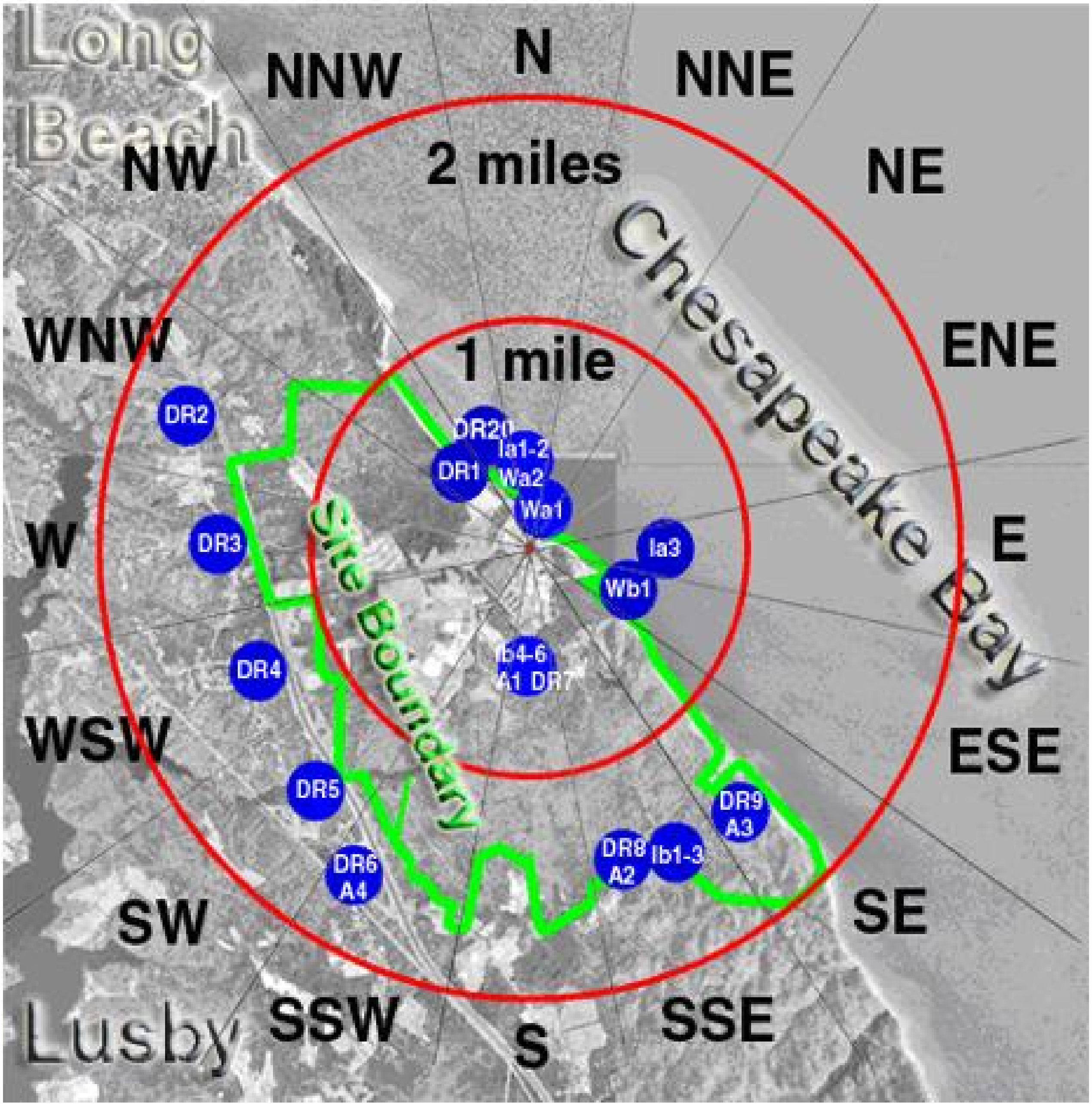


Figure A-3

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-10 Miles

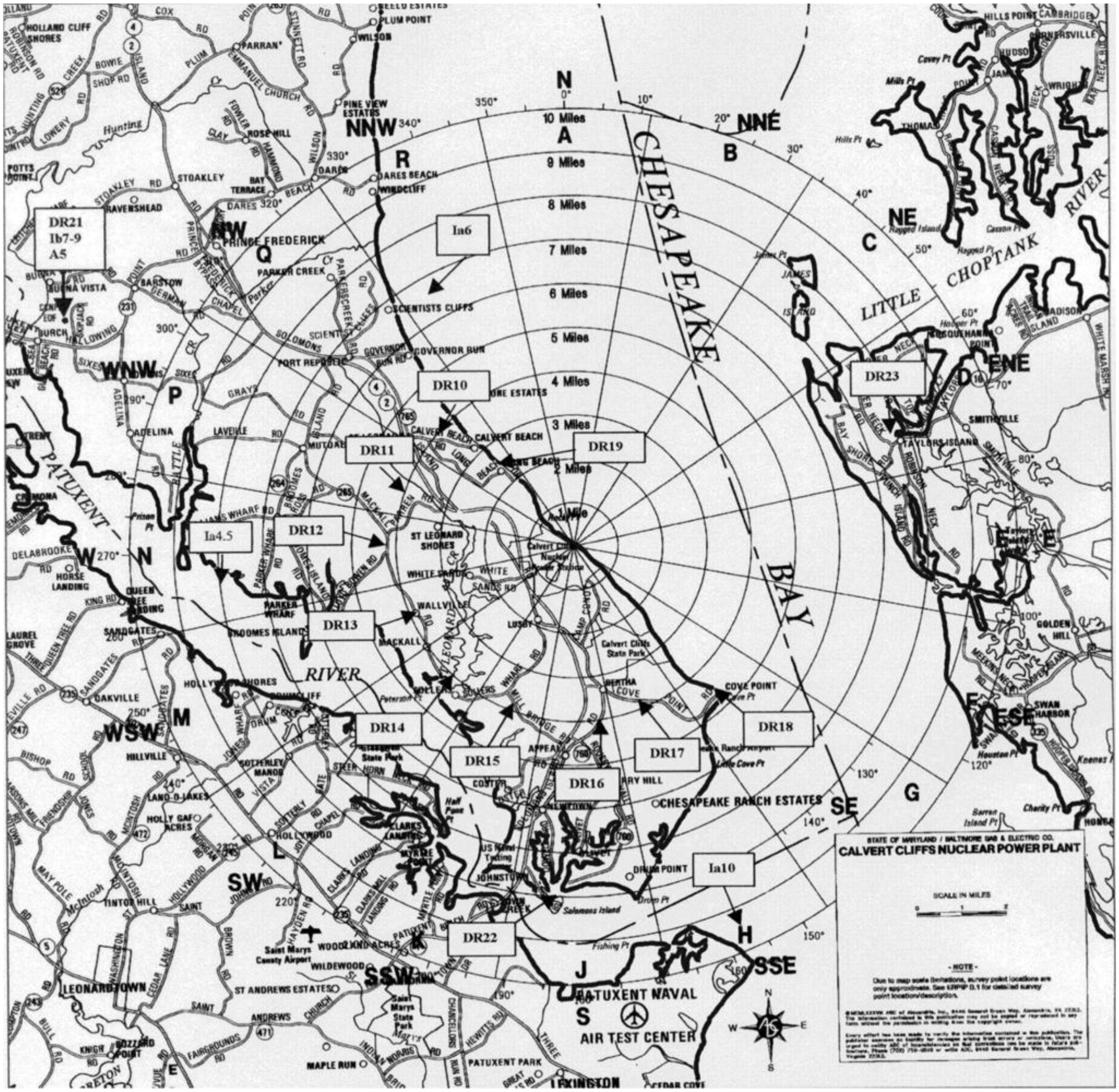


Table A-2

Locations of Environmental Sampling Stations for the Independent Spent Fuel Storage Installation at Calvert Cliffs

Station	Description	Distance[1] (KM)	Direction[1] (Sector)
Air Particulate			
A1[2]	On Site Before Entrance to Camp Conoy	0.3	ESE
SFA1[2]	Meteorological Station	0.3	NW
SFA2	CCNPP Visitor's Center	0.8	N
SFA3[2]	NNW of ISFSI	0.1	NNW
SFA4[2]	SSE of ISFSI	0.1	SSE
Direct Radiation			
DR07[2]	On Site Before Entrance to Camp Conoy	0.3	ESE
DR30	Meteorological Station	0.3	NW
SFDR01	SW of ISFSI	0.2	SW
SFDR02	N of ISFSI	0.2	N
SFDR03	North of ISFSI	0.1	N
SFDR04	NE of ISFSI	<0.1	NE
SFDR05	East of ISFSI	<0.1	E
SFDR06	ESE of ISFSI	0.1	ESE
SFDR07	CCNPP Visitor's Center	0.8	N
SFDR08	NNW of ISFSI	0.1	NNW
SFDR09	SSE of ISFSI	0.1	SSE
SFDR10	NW of ISFSI	0.1	NW
SFDR11	WNW ISFSI	0.1	WNW
SFDR12	WSW of ISFSI	<0.1	WSW
SFDR13	South of ISFSI	<0.1	S
SFDR14	SE of ISFSI	0.1	SE
SFDR15	ENE of ISFSI	<0.1	ENE
SFDR16	SW of ISFSI	<0.1	SW
SFDR17	NNE of ISFSI	0.1	NNE
SFDR18	West of ISFSI	0.04	W
Vegetation			
SFB1	ISFSI Vegetation Met Station	0.3	NW
SFB2	ISFSI Vegetation Visitors Center	0.8	N
SFB3	ISFSI Vegetation NNW of ISFSI	0.1	NNW
SFB4	ISFSI vegetation SSE of ISFSI	0.1	SSE
SFB5	On Site Before Entrance to Camp Conoy	0.3	ESE
Soil			
SFS1	ISFSI Soil Meteorological Station	0.3	NW
SFS2	ISFSI Soil CCNPP Visitors Center	0.8	N
SFS3	ISFSI Soil NNW of ISFSI	0.1	NNW
SFS4	ISFSI Soil SSE of ISFSI	0.1	SSE
SFS5	ISFSI Soil On Site Before entrance to Camp Conoy	0.3	ESE

[1] Distance and direction from the central point of the ISFSI
[2] Common to both the REMP and ISFSI monitoring program

Figure A-4

Independent Spent Fuel Storage Installation Sampling Locations

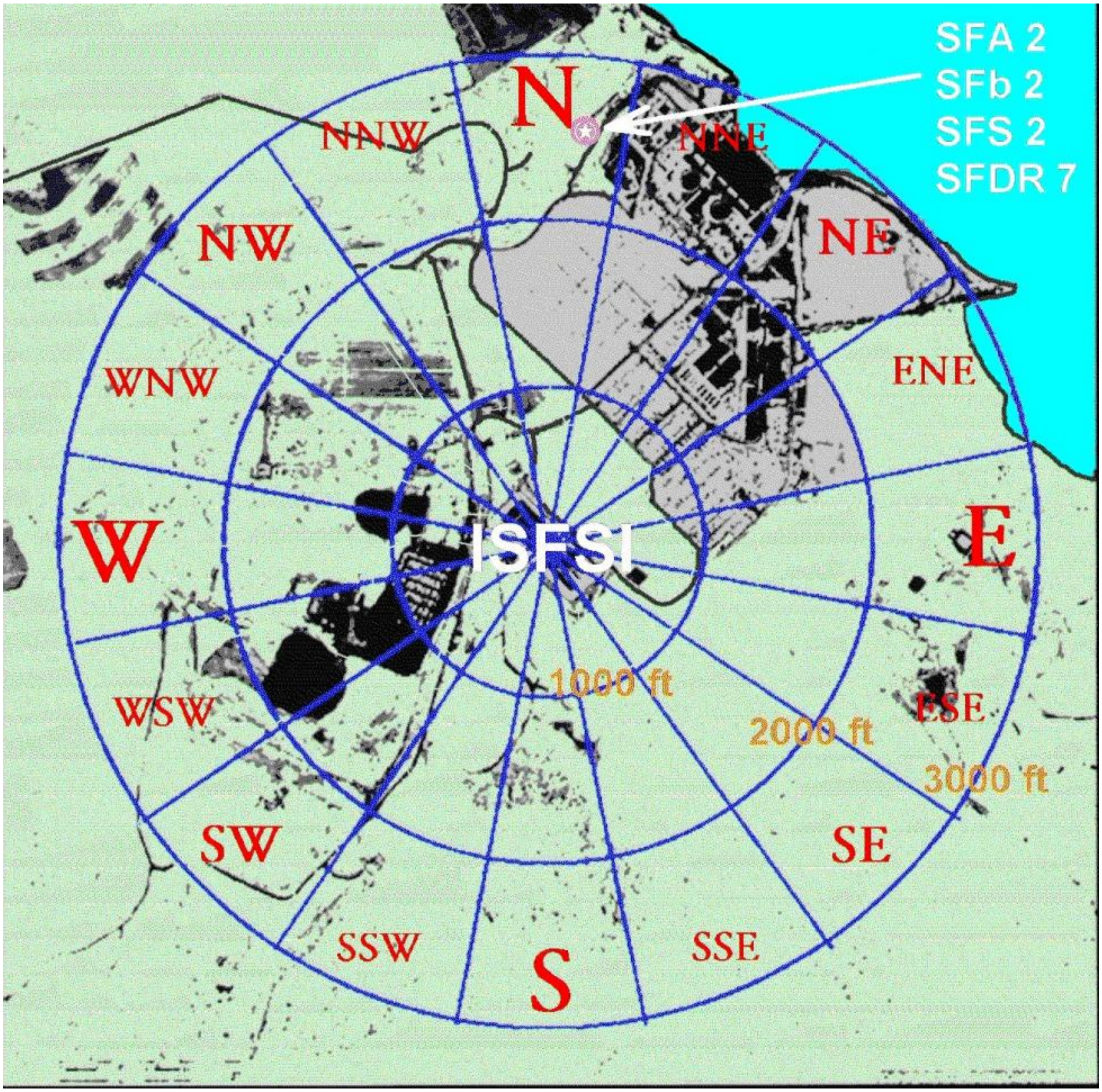
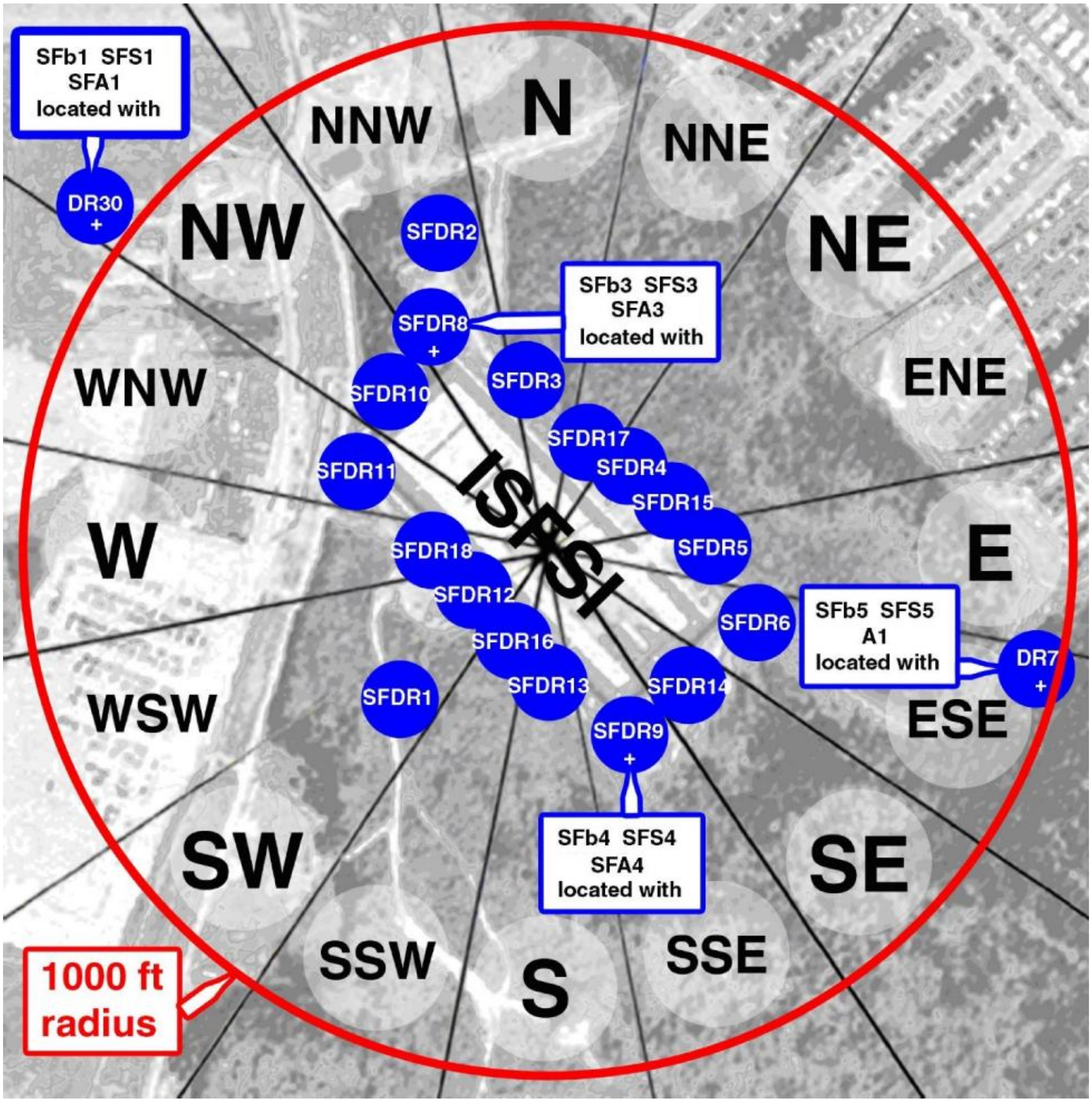


Figure A-5

Enlarged Map of the Independent Spent Fuel Storage Installation Sampling Locations



APPENDIX B
Analysis Results for the REMP and the ISFSI

Appendix B is a presentation of the analytical results for the CCNPP and the ISFSI radiological environmental monitoring programs.

TABLE OF CONTENTS - ANALYTICAL RESULTS

Table B-1

Concentration of Tritium and Gamma Emitters in Bay Water
(Results in units of pCi/L ± 2σ)

Sample Code	Sample Date	Gamma Emitters	H-3[1]
Intake			
WA1	1/31/2023	*	
	3/2/2023	*	
	3/30/2023	*	<199
	4/28/2023	*	
	5/30/2023	*	
	6/30/2023	*	214 ± 130
	7/28/2023	*	
	8/29/2023	*	
	9/29/2023	*	<181
	11/2/2023	*	
	11/29/2023	*	
	12/28/2023	*	<185
Discharge			
WA2	1/31/2023	*	
	3/2/2023	*	
	3/30/2023	*	<193
	4/28/2023	*	
	5/30/2023	*	
	6/30/2023	*	<199
	7/28/2023	*	
	8/29/2023	*	
	9/29/2023	*	573 ± 138
	11/2/2023	*	
	11/29/2023	*	
	12/28/2023	*	638 ± 149

[1] Quarterly composite of monthly samples.
* All Non-Natural Gamma Emitters <MDA

Table B-2

Concentration of Gamma Emitters in the Flesh of Edible Fish
(Results in units of pCi/kg (wet) ± 2 σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
IA1 Discharge Area	9/8/2023	Spot	*
IA2 Discharge Area	9/15/2023	White Perch	*
IA4[1] Patuxent River	9/8/2023	Spot	*
IA5[1] Patuxent River	9/15/2023	White Perch	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-3

Concentration of Gamma Emitters in Oyster Samples
(Results in units of pCi/kg (wet) ± 2 σ)

Sample Code	Sample Date	Gamma Emitters
IA3		
Camp Conoy	3/22/2023	*
	6/28/2023	*
	8/23/2023	*
	10/10/2023	*
IA6[1]		
Kenwood Beach	3/22/2023	*
	6/28/2023	*
	8/23/2023	*
	10/10/2023	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-4

Concentration of Gamma Emitters in Shoreline Sediment
(Results in units of pCi/kg (dry) ± 2σ)

Sample Code	Sample Date	Gamma Emitters
WB1		
Shoreline at Barge Rd.	3/27/2023	*
	9/25/2023	*

* All Non-Natural Gamma Emitters <MDA

Table B-5

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Collection Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF	SFA1[2] Met Sta	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
1/9/2023	*	*	*	*	*	*	*	*
1/17/2023	*	*	*	*	*	*	*	*
1/23/2023	*	*	*	*	*	*	*	*
1/31/2023	*	*	*	*	*	*	*	*
2/6/2023	*	*	*	*	*	*	*	*
2/13/2023	*	*	*	*	*	*	*	*
2/20/2023	*	*	*	*	*	*	*	*
2/27/2023	*	*	*	*	*	*	*	*
3/6/2023	*	*	*	*	*	*	*	*
3/13/2023	*	*	*	*	*	*	*	*
3/20/2023	*	*	*	*	*	*	*	*
3/27/2023	*	*	*	*	*	*	*	*
4/3/2023	*	*	*	*	*	*	*	*
4/10/2023	*	*	*	*	[2]	*	*	*
4/17/2023	*	*	*	*	*	*	*	*
4/24/2023	*	*	*	*	*	*	*	*
5/1/2023	*	*	*	*	*	*	*	*
5/8/2023	*	*	*	*	*	*	*	*
5/15/2023	*	*	*	*	*	*	*	*
5/22/2023	*	*	*	*	*	*	*	*
5/30/2023	*	*	*	*	*	*	*	*
6/5/2023	*	*	*	*	*	*	*	*
6/12/2023	*	*	*	*	*	*	*	*
6/19/2023	*	*	*	*	*	*	*	*
6/26/2023	*	*	*	*	*	*	*	*
7/3/2023	*	*	*	*	*	*	*	*
7/10/2023	*	*	*	*	*	*	*	*
7/17/2023	*	*	*	*	*	*	*	*
7/24/2023	*	*	*	*	*	*	*	*
7/31/2023	*	*	*	*	*	*	*	*
8/7/2023	*	*	*	*	*	*	*	*
8/14/2023	*	*	*	*	*	*	*	*
8/21/2023	*	*	*	*	*	*	*	*
8/28/2023	*	*	*	*	*	*	*	*
9/5/2023	*	*	*	*	*	*	*	*
9/11/2023	*	*	*	*	*	*	*	*
9/18/2023	*	*	*	*	*	*	*	*
9/25/2023	*	*	*	*	*	*	*	*
10/2/2023	*	*	*	*	*	*	*	*

Table B-5

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Collection Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF	SFA1[2] Met Sta	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
10/9/2023	*	*	*	*	*	*	*	*
10/16/2023	*	*	*	*	*	*	*	*
10/23/2023	*	*	*	*	*	*	*	*
10/30/2023	*	*	*	*	*	*	*	*
11/6/2023	*	*	*	*	*	*	*	*
11/13/2023	*	*	*	*	*	*	*	*
11/20/2023	*	*	*	*	*	*	*	*
11/27/2023	*	*	*	*	*	*	*	*
12/4/2023	*	*	*	*	*	*	*	*
12/11/2023	*	*	*	*	*	*	*	*
12/19/2023	*	*	*	*	*	*	*	*
12/27/2023	*	*	*	*	*	*	*	*
1/2/2024	*	*	*	*	*	*	*	*

[1] Control Location REMP Technical Specifications
[2] Sampler Malfunction, Insufficient sample collected
* All Non-Natural Gamma Emitters <MDA

Table B-6

Concentration of Beta Emitters in Air Particulates
(Results in units of 10^{-2} pCi/m^3 ± 2σ)

Stop Date	A1 Entrance to Camp Conoy		A2 Camp Conoy Siren		A3 Bay Breeze Rd		A4 Route 765 at Lusby		A5[1] EOF	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
1/9/2023	2.17E-02	1.48E-03	2.30E-02	1.52E-03	2.25E-02	1.51E-03	2.43E-02	1.59E-03	2.30E-02	1.51E-03
1/17/2023	2.19E-02	1.24E-03	2.28E-02	1.27E-03	2.28E-02	1.27E-03	2.72E-02	1.44E-03	2.50E-02	1.32E-03
1/23/2023	1.66E-02	1.35E-03	1.79E-02	1.37E-03	1.83E-02	1.38E-03	2.09E-02	1.46E-03	1.79E-02	1.36E-03
1/31/2023	1.89E-02	1.17E-03	2.10E-02	1.22E-03	1.88E-02	1.16E-03	2.14E-02	1.23E-03	2.01E-02	1.17E-03
2/6/2023	1.98E-02	1.48E-03	1.94E-02	1.47E-03	1.90E-02	1.46E-03	2.11E-02	1.60E-03	2.04E-02	1.49E-03
2/13/2023	2.64E-02	1.46E-03	2.75E-02	1.48E-03	2.76E-02	1.49E-03	2.98E-02	1.53E-03	2.94E-02	1.53E-03
2/20/2023	1.76E-02	1.25E-03	1.81E-02	1.27E-03	1.91E-02	1.29E-03	1.77E-02	1.26E-03	2.00E-02	1.32E-03
2/27/2023	2.08E-02	1.33E-03	2.18E-02	1.35E-03	2.20E-02	1.36E-03	2.23E-02	1.37E-03	2.27E-02	1.38E-03
3/6/2023	1.49E-02	1.20E-03	1.43E-02	1.18E-03	1.37E-02	1.16E-03	1.63E-02	1.23E-03	1.68E-02	1.25E-03
3/13/2023	1.22E-02	1.09E-03	1.42E-02	1.15E-03	1.29E-02	1.12E-03	1.46E-02	1.17E-03	1.53E-02	1.19E-03
3/20/2023	2.06E-02	1.32E-03	2.18E-02	1.35E-03	2.19E-02	1.36E-03	2.23E-02	1.37E-03	2.19E-02	1.36E-03
3/27/2023	2.23E-02	1.40E-03	2.30E-02	1.42E-03	2.67E-02	1.50E-03	2.42E-02	1.44E-03	2.33E-02	1.42E-03
4/3/2023	2.07E-02	1.33E-03	2.45E-02	1.44E-03	2.46E-02	1.41E-03	2.42E-02	1.43E-03	2.49E-02	1.46E-03
4/10/2023	2.13E-02	1.39E-03	2.17E-02	1.39E-03	2.31E-02	1.38E-03	2.20E-02	1.38E-03	[2]	
4/17/2023	1.83E-02	1.30E-03	1.81E-02	1.29E-03	2.23E-02	1.38E-03	2.16E-02	1.39E-03	2.15E-02	1.38E-03
4/24/2023	2.07E-02	1.32E-03	2.28E-02	1.37E-03	2.26E-02	1.27E-03	2.65E-02	1.46E-03	2.57E-02	1.44E-03
5/1/2023	1.34E-02	1.12E-03	1.55E-02	1.21E-03	1.46E-02	1.16E-03	1.49E-02	1.17E-03	1.49E-02	1.17E-03
5/8/2023	7.80E-03	9.90E-04	8.87E-03	1.02E-03	8.84E-03	1.02E-03	9.29E-03	1.04E-03	8.87E-03	1.02E-03
5/15/2023	1.96E-02	1.30E-03	2.11E-02	1.34E-03	2.31E-02	1.40E-03	2.19E-02	1.37E-03	2.25E-02	1.38E-03
5/22/2023	1.35E-02	1.15E-03	1.59E-02	1.24E-03	1.61E-02	1.20E-03	1.68E-02	1.24E-03	1.72E-02	1.25E-03
5/30/2023	1.08E-02	9.80E-04	9.75E-03	1.34E-03	1.24E-02	1.01E-03	1.22E-02	1.03E-03	1.25E-02	1.03E-03

Stop Date	A1 Entrance to Camp Conoy		A2 Camp Conoy Siren		A3 Bay Breeze Rd		A4 Route 765 at Lusby		A5[1] EOF	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
6/5/2023	9.35E-03	1.15E-03	1.09E-02	1.20E-03	1.03E-02	1.16E-03	1.03E-02	1.18E-03	1.19E-02	1.24E-03
6/12/2023	1.78E-02	1.30E-03	1.57E-02	1.16E-03	1.30E-02	1.16E-03	1.84E-02	1.19E-03	2.31E-02	1.85E-03
6/19/2023	1.75E-02	1.32E-03	1.88E-02	1.28E-03	1.77E-02	1.25E-03	1.97E-02	1.31E-03	1.96E-02	1.28E-03
6/26/2023	1.25E-02	1.11E-03	1.39E-02	1.15E-03	1.31E-02	1.13E-03	1.26E-02	1.11E-03	1.23E-02	1.13E-03
7/3/2023	2.03E-02	1.36E-03	2.13E-02	1.39E-03	2.08E-02	1.37E-03	2.28E-02	1.42E-03	2.15E-02	1.39E-03
7/10/2023	2.33E-02	1.42E-03	2.55E-02	1.47E-03	2.27E-02	1.41E-03	2.49E-02	1.46E-03	2.39E-02	1.43E-03
7/17/2023	2.07E-02	1.36E-03	2.31E-02	1.43E-03	2.30E-02	1.42E-03	2.33E-02	1.43E-03	2.21E-02	1.41E-03
7/24/2023	2.34E-02	1.38E-03	2.46E-02	1.43E-03	2.34E-02	1.40E-03	2.68E-02	1.48E-03	2.61E-02	1.47E-03
7/31/2023	2.57E-02	1.50E-03	3.00E-02	1.58E-03	2.72E-02	1.52E-03	2.86E-02	1.55E-03	2.71E-02	1.50E-03
8/7/2023	1.60E-02	1.25E-03	1.88E-02	1.32E-03	1.82E-02	1.30E-03	1.84E-02	1.31E-03	1.92E-02	1.33E-03
8/14/2023	2.60E-02	1.48E-03	2.63E-02	1.49E-03	2.53E-02	1.46E-03	2.76E-02	1.52E-03	2.77E-02	1.53E-03
8/21/2023	2.10E-02	1.33E-03	2.25E-02	1.38E-03	2.24E-02	1.37E-03	2.19E-02	1.36E-03	2.20E-02	1.36E-03
8/28/2023	2.40E-02	1.43E-03	2.47E-02	1.45E-03	2.39E-02	1.43E-03	2.66E-02	1.50E-03	2.61E-02	1.49E-03
9/5/2023	1.90E-02	1.24E-03	2.18E-02	1.30E-03	1.93E-02	1.24E-03	2.13E-02	1.29E-03	2.18E-02	1.32E-03
9/11/2023	3.68E-02	1.86E-03	4.10E-02	1.95E-03	4.15E-02	1.96E-03	4.32E-02	1.99E-03	3.99E-02	1.93E-03
9/18/2023	2.14E-02	1.38E-03	2.23E-02	1.39E-03	2.24E-02	1.39E-03	2.35E-02	1.44E-03	2.44E-02	1.47E-03
9/25/2023	1.67E-02	1.24E-03	1.89E-02	1.31E-03	1.85E-02	1.33E-03	1.84E-02	1.28E-03	1.85E-02	1.31E-03
10/2/2023	1.04E-02	1.03E-03	1.09E-02	1.06E-03	9.30E-03	1.01E-03	9.38E-03	1.01E-03	1.12E-02	1.08E-03
10/9/2023	2.23E-02	1.41E-03	2.55E-02	1.47E-03	2.52E-02	1.46E-03	2.51E-02	1.47E-03	2.68E-02	1.49E-03
10/16/2023	2.71E-02	1.50E-03	3.00E-02	1.57E-03	3.03E-02	1.57E-03	3.02E-02	1.57E-03	2.95E-02	1.55E-03
10/23/2023	1.21E-02	1.12E-03	1.50E-02	1.23E-03	1.36E-02	1.18E-03	1.34E-02	1.19E-03	1.45E-02	1.23E-03
10/30/2023	2.55E-02	1.49E-03	2.37E-02	1.48E-03	2.26E-02	1.42E-03	2.46E-02	1.50E-03	2.45E-02	1.50E-03
11/6/2023	3.19E-02	1.60E-03	3.21E-02	1.61E-03	2.81E-02	1.52E-03	3.30E-02	1.63E-03	3.43E-02	1.66E-03
11/13/2023	3.83E-02	1.74E-03	3.73E-02	1.73E-03	3.40E-02	1.66E-03	3.79E-02	1.74E-03	3.88E-02	1.76E-03

Stop Date	A1 Entrance to Camp Conoy		A2 Camp Conoy Siren		A3 Bay Breeze Rd		A4 Route 765 at Lusby		A5[1] EOF	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
11/20/2023	3.15E-02	1.61E-03	2.86E-02	1.54E-03	2.58E-02	1.47E-03	2.89E-02	1.55E-03	3.05E-02	1.58E-03
11/27/2023	1.95E-02	1.32E-03	2.21E-02	1.39E-03	2.07E-02	1.35E-03	2.08E-02	1.35E-03	2.06E-02	1.35E-03
12/4/2023	4.28E-02	1.85E-03	4.22E-02	1.84E-03	3.45E-02	1.69E-03	3.88E-02	1.78E-03	3.96E-02	1.79E-03
12/11/2023	3.72E-02	1.73E-03	3.61E-02	1.71E-03	3.42E-02	1.67E-03	3.43E-02	1.67E-03	3.64E-02	1.72E-03
12/19/2023	3.19E-02	1.51E-03	3.03E-02	1.47E-03	2.59E-02	1.37E-03	2.79E-02	1.42E-03	2.79E-02	1.42E-03
12/27/2023	2.22E-02	1.27E-03	2.22E-02	1.29E-03	2.05E-02	1.24E-03	2.26E-02	1.30E-03	2.46E-02	1.34E-03
1/2/2024	2.26E-02	1.47E-03	2.07E-02	1.42E-03	1.89E-02	1.42E-03	2.05E-02	1.47E-03	2.00E-02	1.43E-03

[1] Control Location
[2] Equipment Malfunction, insufficient sample for A5

Table B-6 - Continued

Concentration of Beta Emitters in Air Particulates
(Results in units of 10^{-2} pCi/m^3 +/- 2±)

Stop Date	SFA1		SFA2 (Control)		SFA3		SFA4	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
1/9/2023	2.45E-02	1.56E-03	1.87E-02	1.43E-03	2.07E-02	1.46E-03	2.21E-02	1.49E-03
1/17/2023	2.45E-02	1.30E-03	1.93E-02	1.20E-03	2.11E-02	1.22E-03	2.18E-02	1.23E-03
1/23/2023	1.86E-02	1.40E-03	1.55E-02	1.35E-03	1.51E-02	1.30E-03	1.58E-02	1.33E-03
1/31/2023	2.09E-02	1.22E-03	1.71E-02	1.10E-03	1.81E-02	1.12E-03	1.84E-02	1.15E-03
2/6/2023	2.11E-02	1.51E-03	1.71E-02	1.37E-03	1.87E-02	1.45E-03	1.87E-02	1.45E-03
2/13/2023	3.04E-02	1.55E-03	2.44E-02	1.41E-03	2.51E-02	1.43E-03	2.68E-02	1.47E-03
2/20/2023	2.05E-02	1.33E-03	1.70E-02	1.24E-03	1.87E-02	1.34E-03	1.86E-02	1.31E-03
2/27/2023	2.31E-02	1.39E-03	1.85E-02	1.27E-03	2.18E-02	1.34E-03	2.39E-02	1.39E-03
3/6/2023	1.64E-02	1.24E-03	1.28E-02	1.13E-03	1.58E-02	1.21E-03	1.58E-02	1.19E-03
3/13/2023	1.59E-02	1.20E-03	1.20E-02	1.09E-03	1.55E-02	1.19E-03	1.44E-02	1.16E-03
3/20/2023	2.27E-02	1.36E-03	1.87E-02	1.27E-03	2.24E-02	1.35E-03	2.22E-02	1.36E-03
3/27/2023	2.59E-02	1.50E-03	1.96E-02	1.33E-03	2.26E-02	1.42E-03	2.41E-02	1.42E-03
4/3/2023	2.49E-02	1.44E-03	1.95E-02	1.31E-03	2.35E-02	1.39E-03	2.42E-02	1.32E-03
4/10/2023	2.42E-02	1.45E-03	1.70E-02	1.27E-03	2.04E-02	1.34E-03	2.22E-02	1.37E-03
4/17/2023	2.31E-02	1.44E-03	1.73E-02	1.31E-03	2.05E-02	1.36E-03	2.16E-02	1.35E-03
4/24/2023	2.59E-02	1.45E-03	1.99E-02	1.32E-03	2.32E-02	1.38E-03	2.46E-02	1.33E-03
5/1/2023	1.44E-02	1.17E-03	1.18E-02	1.14E-03	1.43E-02	1.15E-03	1.35E-02	1.13E-03
5/8/2023	9.41E-03	1.04E-03	7.73E-03	9.80E-04	9.20E-03	1.04E-03	9.01E-03	1.03E-03
5/15/2023	2.23E-02	1.36E-03	1.80E-02	1.26E-03	2.17E-02	1.35E-03	2.42E-02	1.41E-03
5/22/2023	1.63E-02	1.24E-03	1.35E-02	1.15E-03	1.62E-02	1.22E-03	1.59E-02	1.19E-03
5/30/2023	1.22E-02	1.02E-03	1.05E-02	9.70E-04	1.28E-02	1.04E-03	1.17E-02	9.30E-04

Stop Date	SFA1		SFA2 (Control)		SFA3		SFA4	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
6/5/2023	9.63E-03	1.16E-03	7.25E-03	1.08E-03	9.29E-03	1.15E-03	9.62E-03	1.16E-03
6/12/2023	1.98E-02	1.35E-03	1.72E-02	1.28E-03	1.61E-02	1.07E-03	3.63E-02	2.61E-03
6/19/2023	2.01E-02	1.32E-03	1.68E-02	1.26E-03	2.04E-02	1.33E-03	1.97E-02	1.33E-03
6/26/2023	1.29E-02	1.12E-03	1.14E-02	1.08E-03	1.35E-02	1.14E-03	1.32E-02	1.13E-03
7/3/2023	2.41E-02	1.45E-03	1.85E-02	1.32E-03	2.25E-02	1.41E-03	2.26E-02	1.42E-03
7/10/2023	2.63E-02	1.49E-03	1.93E-02	1.32E-03	2.47E-02	1.46E-03	2.51E-02	1.47E-03
7/17/2023	2.46E-02	1.46E-03	2.06E-02	1.36E-03	2.37E-02	1.44E-03	2.25E-02	1.41E-03
7/24/2023	2.57E-02	1.45E-03	2.15E-02	1.34E-03	2.65E-02	1.47E-03	2.65E-02	1.46E-03
7/31/2023	2.92E-02	1.56E-03	2.33E-02	1.43E-03	2.93E-02	1.57E-03	2.95E-02	1.58E-03
8/7/2023	1.87E-02	1.32E-03	1.50E-02	1.22E-03	1.87E-02	1.32E-03	1.87E-02	1.32E-03
8/14/2023	2.73E-02	1.51E-03	2.32E-02	1.41E-03	2.78E-02	1.52E-03	2.88E-02	1.51E-03
8/21/2023	2.29E-02	1.39E-03	2.10E-02	1.34E-03	2.14E-02	1.35E-03	2.23E-02	1.35E-03
8/28/2023	2.43E-02	1.43E-03	2.04E-02	1.34E-03	2.42E-02	1.43E-03	2.56E-02	1.40E-03
9/5/2023	2.16E-02	1.30E-03	1.66E-02	1.17E-03	2.11E-02	1.29E-03	2.26E-02	1.27E-03
9/11/2023	4.11E-02	1.95E-03	3.56E-02	1.83E-03	4.04E-02	1.92E-03	4.21E-02	1.87E-03
9/18/2023	2.50E-02	1.51E-03	1.99E-02	1.33E-03	2.38E-02	1.43E-03	2.52E-02	1.47E-03
9/25/2023	1.84E-02	1.31E-03	1.46E-02	1.18E-03	1.92E-02	1.31E-03	1.88E-02	1.30E-03
10/2/2023	9.96E-03	1.04E-03	9.36E-03	9.80E-04	1.06E-02	1.04E-03	9.75E-03	9.60E-04
10/9/2023	2.36E-02	1.43E-03	1.86E-02	1.28E-03	2.46E-02	1.46E-03	2.71E-02	1.52E-03
10/16/2023	2.90E-02	1.56E-03	2.59E-02	1.47E-03	2.85E-02	1.53E-03	3.31E-02	1.63E-03
10/23/2023	1.38E-02	1.24E-03	1.17E-02	1.11E-03	1.49E-02	1.22E-03	1.56E-02	1.23E-03
10/30/2023	2.36E-02	1.44E-03	1.96E-02	1.34E-03	2.33E-02	1.44E-03	2.52E-02	1.48E-03
11/6/2023	3.25E-02	1.60E-03	2.62E-02	1.47E-03	3.08E-02	1.57E-03	3.18E-02	1.67E-03
11/13/2023	3.64E-02	1.73E-03	2.88E-02	1.54E-03	3.41E-02	1.68E-03	3.75E-02	1.74E-03
11/20/2023	2.90E-02	1.55E-03	2.20E-02	1.38E-03	2.67E-02	1.49E-03	2.98E-02	1.57E-03
11/27/2023	1.92E-02	1.31E-03	1.54E-02	1.20E-03	1.78E-02	1.27E-03	1.89E-02	1.30E-03

Stop Date	SFA1		SFA2 (Control)		SFA3		SFA4	
	Activity	2σ	Activity	2σ	Activity	2σ	Activity	2σ
12/4/2023	3.72E-02	1.74E-03	2.94E-02	1.57E-03	3.80E-02	1.76E-03	3.69E-02	1.73E-03
12/11/2023	3.71E-02	1.73E-03	2.69E-02	1.50E-03	3.55E-02	1.70E-03	3.39E-02	1.66E-03
12/19/2023	3.04E-02	1.47E-03	2.35E-02	1.32E-03	3.03E-02	1.47E-03	2.83E-02	1.46E-03
12/27/2023	2.22E-02	1.29E-03	1.82E-02	1.18E-03	2.34E-02	1.32E-03	2.24E-02	1.36E-03
1/2/2024	2.18E-02	1.48E-03	2.24E-02	1.50E-03	2.20E-02	1.49E-03	2.05E-02	1.44E-03

Table B-7

Concentration of Gamma Emitters in Air Particulates
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
4/3/2023	*	*	*	*	*
7/3/2023	*	*	*	*	*
10/2/2023	*	*	*	*	*
1/2/2024	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
4/3/2023	*	*	*	*
7/3/2023	*	*	*	*
10/2/2023	*	*	*	*
1/2/2024	*	*	*	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-8a

Concentration of Gamma Emitters in Vegetation Samples
(Results in units of pCi/kg (wet) +/- 2 σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
IB4	6/19/2023	Kale	*
Camp Conoy	7/17/2023	Kale	*
Entrance	8/14/2023	Kale	*
	9/11/2023	Kale	*
IB5	6/19/2023	Cabbage	*
Camp Conoy	7/17/2023	Cabbage	*
Entrance	8/14/2023	Cabbage	*
	9/11/2023	Swiss Chard	*
IB6	6/19/2023	Collards	*
Camp Conoy	7/17/2023	Collards	*
Entrance	8/14/2023	Collards	*
	9/11/2023	Collards	*
IB7	6/19/2023	Kale	*
EOF	7/17/2023	Kale	*
	8/14/2023	Kale	*
	9/11/2023	Kale	*
IB8	6/19/2023	Cabbage	*
EOF	7/17/2023	Cabbage	*
	8/14/2023	Cabbage	*
	9/11/2023	Cabbage	*
IB9	6/19/2023	Collards	*
EOF	7/17/2023	Collards	*
	8/14/2023	Collards	*
	9/11/2023	Collards	*
IB10	6/19/2023	Kale	*
Met Station	7/17/2023	Kale	*
	8/14/2023	Kale	*
	9/11/2023	Kale	*
IB11	6/19/2023	Cabbage	*
Met Station	7/17/2023	Cabbage	*
	8/14/2023	Cabbage	*
	9/11/2023	Swiss Chard	*
IB12	6/19/2023	Collards	*
Met Station	7/17/2023	Collards	*
	8/14/2023	Collards	*
	9/11/2023	Collards	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-8b

Concentration of Gamma Emitters in Vegetation From Locations Around the ISFSI (Results in units of pCi/kg (wet) ± 2σ

Sample Code	Sample Date	Gamma Emitters
SFB1		
MET Station	3/20/2023	*
	5/15/2023	*
	8/28/2023	*
	11/6/2023	*
SFB2[1]		
Visitor's Center	3/20/2023	*
	5/15/2023	*
	8/28/2023	*
	11/6/2023	*
SFB3		
NNW of ISFSI	3/20/2023	*
	5/15/2023	*
	8/28/2023	*
	11/6/2023	*
SFB4		
SSE of ISFSI	3/20/2023	*
	5/15/2023	*
	8/28/2023	*
	11/6/2023	*
SFB5		
On Site Before Entrance to Camp Conoy	3/20/2023	*
	5/15/2023	*
	8/28/2023	*
	11/6/2023	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-9

Concentration of Gamma Emitters in Soil Samples From Locations Around the ISFSI (Results in units of pCi/kg (dry) ± 2σ)

Sample Code	Sample Date	Cs-137	Gamma Emitters
SFS1			
MET station	3/20/2023	[1]	*
	5/15/2023	[1]	*
	8/28/2023	[1]	*
	11/6/2023	[1]	*
SFS2[2]			
Visitors Center	3/20/2023	[1]	*
	5/15/2023	[1]	*
	8/28/2023	[1]	*
	11/6/2023	[1]	*
SFS3			
NNW of ISFSI	3/20/2023	138 +/- 48.1	*
	5/15/2023	[1]	*
	8/28/2023	209 +/- 56.4	*
	11/6/2023	[1]	*
SFS4			
SSE of ISFSI	3/20/2023	[1]	*
	5/15/2023	[1]	*
	8/28/2023	[1]	*
	11/6/2023	[1]	*
SFS5			
Entrance to Camp Conoy	3/20/2023	[1]	*
	5/15/2023	[1]	*
	8/28/2023	[1]	*
	11/6/2023	[1]	*

[1] This isotope <MDA
[2] Control Location
* All Non-Natural Gamma Emitters <MDA except where Cs-137 is observed and reported

Table B-10

Typical MDA Ranges for Gamma Spectrometry

Selected Nuclides	Air Particulates (10^{-3} pCi/m^3)	Bay Water, Surface Water, Drinking Water (pCi/L)	Fish (pCi/kg) Wet	Ground water (pCi/L)	Milk (pCi/L)	Oysters (pCi/kg)	Shoreline Sediment (pCi/kg) Dry	Soil (pCi/kg) Dry	Vegetation (pCi/kg) Wet
K-40	5.65 - 24.6	16 - 182	2,747 - 4,505	21.5 -66.4	1,286 - 1,529	1,269 - 2,069	781 - 13,761	789 - 10,713	1,269 - 2,069
Mn-54	0.32 - 1.16	2.7 - 5.6	9.8 - 19.6	2.86 - 5.14	3.6 - 6.6	10.8 - 16.4	41.4 - 67.1	37.4 - 91.9	10.8 - 16.4
Fe-59	1.01 - 8.52	5.6 - 13.2	31.6 - 93.2	6.04 - 11.7	9.2 - 15.9	29.3 - 56.7	142 - 251	96.4 – 389	29.3 - 56.7
Co-58	0.38 - 2.07	2.7 - 5.6	10.9 - 28.3	2.86 - 5.27	3.7 - 6.3	10.5 - 19.3	53.7 - 82.9	44.6 – 133	10.5 - 19.3
Co-60	0.28 - 1.09	2.8 - 5.5	10.9 - 24.3	3.01 - 5.38	4.1 - 7.2	11.7 - 17.0	38.6 - 57.9	32.8 - 85.8	11.7 - 17.0
Zn-65	0.81 - 3.10	5.5 - 11.4	23.3 - 57.2	6.41 - 14.4	9.4 - 16.1	22.0 - 43.3	112 - 198	96.4 – 275	22.0 - 43.3
Ag-110m	0.33 – 1.06	2.42 - 4.96	8.2 – 18.1	2.79 - 5.06	3.26- 5.64	8.7 - 16.0	36.6 - 175	40.7 – 99.4	8.7 - 16.0
Zr-95	0.72 - 3.88	4.7 - 10.2	20.0 - 47.1	5.62 - 8.75	5.8 - 11.5	19.0 - 34.0	93.5 - 151	84.6 – 261	19.0 - 34.0
Nb-95	0.56 - 4.91	2.9 - 6.0	13.7 - 42.7	3.3 - 5.88	3.9 - 6.5	13.9 - 24.3	82.1 - 157	61.5 – 227	13.9 - 24.3
Ru-106	3.00 - 12.1	23.8 - 48.1	77.1 - 197	25.6 - 45.3	29.3 - 51.8	88.0 - 141	327.0 – 570	314.0 – 840	88.0 - 141
I-131[1]	2.73 - 914	0.52 - 11.7	21.4 - 2,340	4.87 - 9.04	0.5 - 7.03	22.4 - 107	470 - 2,040	139 - 8,060	22.4 - 107
Cs-134	0.47 - 0.88	3.2 - 5.7	7.8 - 16.0	2.92 - 5.48	4.09 - 4.82	9.7 - 16.5	43.3 - 82.4	33.4 - 109	9.7 - 16.5
Cs-137	0.46 - 0.88	3.7 - 5.9	3.8 - 17.5	2.97 - 5.43	4.08 - 5.29	10.0 - 16.7	38.4 - 65.4	39.1 - 135	10.0 - 16.7
La-140	2.01 – 116	5.05 - 11.5	15.9 - 444	4.87 - 10.3	4.89 - 6.28	24.1 - 80.4	368 - 773	136 - 1,820	24.1 - 80.4
Ba-140	2.01 - 116	5.05 - 11.5	15.9 - 444	5.86 - 26.0	4.89 - 6.28	24.1 - 80.4	368 – 773	136 - 1,820	24.1 - 80.4
Ce-144	1.12 - 3.27	16.8 - 36.7	38.1 - 70.9	17.8 - 32.0	20.5 - 31.0	42.6 - 72.6	208 - 279	191 - 414	42.6 - 72.6
Cr-51	4.90 - 45.0	23.2 - 50.6	93.0 - 395	26.7 - 42.1	30.4 - 46.8	97.0 - 199	711 - 1,110	489 - 1,810	97.0 - 199
Na-22	0.34 - 1.33	2.7 - 6.0	12.1 - 28.0	2.78 - 5.94	4.9 - 8.5	13.4 - 19.5	46.4 - 77.4	36.4 - 92.4	13.4 - 19.5

[1] This MDA range for I-131 on a charcoal cartridge is typically 5.22×10^{-3} to 1.37×10^{-2} pCi/m^3

Table B-11

Typical LLDs for Gamma Spectrometry

Selected Nuclides	Air Particulates 10-3 pCi/m3	Bay Water, Surface Water, Drinking Water pCi/L	Fish pCi/kg (wet)	Ground water pCi/L	Oysters pCi/kg (wet)	Milk pCi/L	Soil pCi/kg (dry)	Vegetation pCi/kg (wet)
Na-22	5	5.3	12	5.3	12	9.1	78	27
Cr-51	74	37	76	37	76	62	452	185
Mn-54	4.6	4.7	13	4.7	13	7.4	63	20
Co-58	6.7	4.3	12	4.3	12	8.2	78	31
Fe-59	20	11	27	11	27	18	123	73
Co-60	3.5	4.8	12	4.8	12	7.5	59	37
Zn-65	8.9	11	27	11	27	17	162	57
Nb-95	9.8	4.5	13	4.5	13	9.5	73	24
Zr-95	11	7.9	18	7.9	18	14	117	40
Ru-106	43	38	111	38	111	62	624	178
Ag-110m	4.2	4.3	11	4.3	11	6	65	24
Te-129m	101	56	118	56	118	90	833	370
I-131*	90	0.8	11	6.4	11	0.8	58	42
Cs-134	4.7	4.7	11	4.7	11	6.7	66	17
Cs-137	4.2	5.1	11	5.1	11	6.9	78	26
Ba-140	47	23	39	23	39	46	103	143
La-140	47	9.2	15	9.2	15	13	103	43
Ce-144	15	23	45	23	45	37	288	114

* The LLD for I-131 measured on a charcoal cartridge is 3.7 $x10^{-2}$ pCi/m^3

Table B-12
Direct Radiation
(Results in Units of mrem/91 days ± 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Mean +/- 2 Stdev
DR01	On Site, along Cliffs	14.5	13.4	11.8	15.2	13.7 ± 1.5
DR02	Route 765, Auto Dump	12.0	10.6	9.2	9.9	10.4 ± 1.2
DR03	Route 765, Giovanni's Tavern	12.0	11.0	10.1	10.5	10.9 ± 0.8
DR04	Route 765, across from Vera's Beach Club	13.7	13.4	10.4	12.1	12.4 ± 1.5
DR05	Route 765, John's Creek	13.2	12.0	8.5	12.7	11.6 ± 2.1
DR06	Route 765 at Lusby	11.9	10.7	8.5	9.5	10.1 ± 1.5
DR07 [2]	Entrance to Camp Conoy	12.9	11.7	9.6	10.5	11.2 ± 1.4
DR08	Camp Conoy Rd at Emergency Siren	15.4	14.7	12.0	14.8	14.2 ± 1.5
DR09	Bay Breeze Rd	10.7	9.9	6.7	9.8	9.3 ± 1.8
DR10	Calvert Beach Rd and Decatur Street	12.1	11.7	9.9	11.8	11.4 ± 1.0
DR11	Dirt road off Mackall & Parren Rd	12.4	10.7	10.7	11.2	11.3 ± 0.8
DR12	Mackall & Bowen Rds	11.3	9.8	10.0	11.2	10.6 ± 0.8
DR13	Mackall Rd, near Wallville	11.7	12.1	11.8	11.6	11.8 ± 0.2
DR14	Rodney Point	13.2	12.8	11.5	14.0	12.9 ± 1.0
DR15	Mill Bridge & Turner Rds	12.7	10.7	11.3	13.0	11.9 ± 1.1
DR16	Across from Appeal School	11.1	9.1	10.8	9.9	10.2 ± 0.9
DR17	Cove Point & Little Cove Point Rds	14.9	13.7	14.5	13.9	14.3 ± 0.6
DR18	Cove Point	10.2	9.5	8.6	10.4	9.7 ± 0.8
DR19	Long Beach	12.0	9.6	9.2	12.0	10.7 ± 1.5
DR20	On site, near shore	14.1	13.7	10.5	14.6	13.2 ± 1.9

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Mean +/- 2 Stdev
DR21 [1]	EOF	13.5	12.9	11.3	12.5	12.6 ± 0.9
DR22 [1]	Solomons Island	12.1	11.1	11.2	11.3	11.4 ± 0.5
DR23 [1]	Taylors Island	16.2	15.6	18.2	15.8	16.5 ± 1.2
DR30	MET Station	11.7	13.3	10.6	12.7	12.1 ± 1.2
SFDR01	SW of ISFSI	19.5	18.3	16.5	19.6	18.5 ± 1.4
SFDR02	NNW of ISFSI	19.6	17.4	19.8	17.2	18.5 ± 1.4
SFDR03	North of ISFSI	30.8	32.1	29.1	31.9	31.0 ± 1.4
SFDR04	NE of ISFSI	49.9	53.3	60.2	54.3	54.4 ± 4.3
SFDR05	East of ISFSI	48.3	47.6	43.2	46.3	46.4 ± 2.3
SFDR06	ESE of ISFSI	31.7	32.3	37.7	33.9	33.9 ± 2.7
SFDR07 [1]	Visitor's Center	15.8	16.3	14.4	13.6	15.0 ± 1.2
SFDR08	NNW of ISFSI	28	24.1	22.9	25.3	25.1 ± 2.2
SFDR09	SSE of ISFSI	72.3	46.7	81.7	93.9	73.7 ± 20.0
SFDR10	NW of ISFSI	27.6	21.7	21.6	25.8	24.2 ± 3.0
SFDR11	WNW ISFSI	26.8	23.8	26.5	24.7	25.5 ± 1.4
SFDR12	WSW of ISFSI	47.5	67.8	36.9	35.3	46.9 ± 15.0
SFDR13	South of ISFSI	144	84.2	132	143	126 ± 28.3
SFDR14	SE of ISFSI	90.6	78.1	95.2	96.9	90.2 ± 8.5
SFDR15	ENE of ISFSI	55.3	46.7	48	46.4	49.1 ± 4.2
SFDR16	SSW of ISFSI	94.5	121	91.7	103	103 ± 13.2
SFDR17	NNE of ISFSI	37.2	34.7	39.1	34.6	36.4 ± 2.2
SFDR18	NNE of ISFSI	38.7	43.6	36.7	42.1	40.3 ± 3.1

[1] Control Location

APPENDIX C

Quality Assurance Program

Appendix C is a summary of Constellation Generation Solutions (CGS) laboratory's quality assurance program. It consists of Table C-1 which is a compilation of the results of the CGS laboratory's participation in an interlaboratory comparison program with Environmental Resource Associates (ERA) located in Arvada, Colorado and Eckert and Ziegler Analytics, Inc. (EZA) located in Atlanta, Georgia.

It also includes Table C-2, which is a compilation of the results of the Constellation Generation Solutions (CGS) Laboratory's participation in a split sample program with Teledyne Brown Engineering located in Knoxville, Tennessee and Table C-3, which is a list of the Site Specific LLDs required by the ODCM.

The CGS laboratory's results contained in Table C-1, intercomparison results, are in full agreement when they were evaluated using the NRC Resolution Test Criteria [1] except as noted in the Pass/Fail column and described below. The CGS laboratory's results are provided with their analytical uncertainties of 2 sigma. When evaluating with the NRC Resolution Test a one sigma uncertainty is used to determine Pass or Fail and noted accordingly.

All results reported passed their respective vendor acceptance ranges and NRC Resolution Test Criteria [1] with one exception for the Water Study ERA RAD 133, reference date 4/10/2023. The CGS lab reported a result of 26.6pCi/L for Ba-133 which passed the NRC Resolution Test Criteria but failed the Vendor Acceptance Range of 17.1-25.8 pCi/L. This high result is for a low concentration of an isotope with low statistics that historically is observed at the lower end of acceptable data ranges. In this case however, the result was an outlier and should have been flagged out of trend and not passed internal QA review. This event has been entered into the Corrective Action Program for tracking and to prevent future occurrence.

The vendor laboratories used by CGS for subcontracting and interlaboratory comparison samples, GEL Laboratories and Teledyne Brown Engineering, also participate in the ERA and EZA interlaboratory comparison program. A presentation of their full data report is provided in their Annual Environmental Quality Assurance Program Reports, (Ref 18,19). In summary Gel and TBE reported results met vendor and laboratory acceptance ranges with the following exceptions discussed here:

For the TBE laboratory, 110 out of 115 analyses performed met the specified acceptance criteria. Five analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. A summary is found below:

1. TBE result for ERA RAD April 2023 water Ba-133 result was evaluated as Not Acceptable. The reported value was 26.0 pCi/L and the known was 22.3 (acceptance range 17.1 – 25.8 pCi) or 117% of the known (acceptable for TBE QC). The sample was used as the workgroup duplicate with a result of 25.4 (114%). The sample had also been counted on a different detector with a result of 21.9 (98%). This was TBE's first failure for Ba-133.
   (NCR 23-10)

2. The ERA RAD October 2023 water Gross Alpha result was evaluated as *Not Acceptable*. The reported result was 53.2 pCi/L and the known result was 70.6 (acceptable range of 54.0 – 87.2 pCi/L). The reported result was the workgroup duplicate and was within 75% of the known value (within TBE QC range). The original result was 63.3 pCi/L (90% of the known). Because the LCS result was biased slightly high, the decision was made to report the lower value. (NCR 23-20)
3. The ERA RAD October 2023 water I-131 result was evaluated as *Not Acceptable*. The reported value was 23.5 pCi/L and the known result was 29.7 (acceptable range of 25.8 – 33.6) The reported result was 79% of the known, which is within the acceptable TBE QC range. The workgroup was reviewed with no anomalies found. The LCS/LCSD results were 109% and 86.1%. The sample was not processed in a timely manner as per the ERA instructions which stated to analyze shortly after receipt due to the short half-life. Going forward, the QA &/or Lab Mgr. will ensure that this analysis is started sooner. (NCR 23-21)
4. The MAPEP February 2023 vegetation Sr-90 result was evaluated as *Not Acceptable*. The reported value was 0.05 Bq (not detected) and the known result was a “false positive”. This was considered to be a statistical failure because TBE’s reported result with 3 times the uncertainty resulted in a slightly positive net result (0.03194 Bq/kg). The reported result was significantly below TBE’s average detection limit for vegetation samples. (NCR 23-09)
5. The Analytics September 2023 milk Sr-90 result was evaluated as Not Acceptable. The reported result was 7.28 pCi/L and the known result was 12.8 (57% of known). This sample was used as the workgroup duplicate and the carrier yields for both samples were 107% and 75%. The LCS recovery for the workgroup was at 106%. The ERA drinking water Sr-90 cross check that was analyzed around the same time was acceptable at 108%. There was no explanation for the failure. This is the first low biased failure for Sr-90 milk. The last failure (high) was in 2016. (NCR 23-24)

For the GEL Laboratory, nine analyses from four performance evaluation studies did not meet the specified acceptance criteria and were addressed through the GEL’s internal nonconformance system. A summary is found below:

1. RAD-132 Water failed three parameters. All data and laboratory processes were evaluated and no errors were found. The investigation determined that the laboratory met all quality control criteria specified in the methods and failures were tracked through GEL's internal nonconformance system.

Zinc-65 was reported at 126pCi/L with a Reference Value of 105pCi/L and acceptance range of (94.5 - 125 pCi/l). The unacceptable error is due to an un known error.

Tritium was reported at 18,000pCi/L with a Reference Value of 21,600pCi/L and acceptance range of (18,900-23,800pCi/L). The laboratory has concluded that this low bias was an isolated occurrence and that the overall process is within control.

Iodine-131 was reported at 16.8pCi/L with a Reference Value of 27pCi/L and acceptance range of (22.4 - 31.8 pCi/l). Having found no errors the laboratory continues to investigate all steps of the analytical process including the standardization of the carrier reagent as a possible contributor to the low bias.

2. E13890 Milk failed Strontium-90. All data and laboratory processes were evaluated and no errors were found. The investigation determined that the laboratory met all quality control criteria specified in the method and failures were tracked through GEL's internal nonconformance system. Strontium-90 was reported at 6.21pCi/L with a Reference Value of 12.7pCi/L and acceptance range of (7.62 - 15.88 pCi/l). The laboratory reviewed the data for this analysis and no errors were found. It was noted that both the Strontium and Yttrium carriers recovered greater than is typically seen for this method which could cause a potential low bias in the results. Due to the Sr-89 result being with acceptance limits, it is also suspected that an undetermined error occurred during the second separation resulting in a low Y-90 recovery.

3. RAD-134 Water failed three parameters. The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. Thes failures were tracked through GEL's internal non-conformance system.

Barium-133 was reported at 75.7pCi/L with a Reference Value of 66pCi/L and acceptance range of (55.4 - 73.2 pCi/l). The data was reviewed and no errors were found. The result recovered at 114% of the reference value which is within the laboratory's acceptance criteria for LCS recovery. The batch Duplicate result was within the acceptance range of the study and met batch replication criteria with the sample result. Historical performance evaluation results do not indicate a high bias for this parameter. Additionally, a contributing factor is how long the samples were counted. The laboratory's SOP indicates drinking water samples are typically counted for 4 hrs. This results in an uncertainty associated with the result that approaches the acceptable range.

Strontium 89 was reported at 61.8pCi/L and 59.6pCi/l with a Reference Value of 51.2pCi/L and acceptance range of (40.4 - 58.7pCi/l).Strontium 90 was reported at 58.2pCi/L with a Reference Value of 45.0pCi/L and acceptance range of (33.2 - 51.6pCi/L). The data for the drinking water PT analysis has been reviewed and no anomalies were noted. The Strontium-89 result recovered at 118% (905.0 Mod) and 116% (905.0) which is within the laboratory's acceptance criteria for LCS recovery. The sample was analyzed in duplicate for each method, and the duplicate results were within the acceptance range of the study. While the Stontium-90 LCS for the batch met recovery requirements, the recovery was higher than is typically recovered for these methods. The two gravimetrical yields that are determined in the drinking water method were reviewed. It was noted that the yields were closer to the lower end of the acceptance range. It is possible that the yield recoveries contributed to bias in the results. For the failed Strontium-90, it was noted also that the first prep of the sample needed to be reanalyzed due to low yields. A smaller sample volume was used in the reanalysis, and this may have contributed to variation in the results and greater uncertainty in the measurement.

Iodine-131 was reported at 29.1pCi/L with a Reference Value of 24.4pCi/L and acceptance range of (20.2 - 28.9 pCi/l). The data for the drinking water PT analysis has been reviewed and no anomalies were noted. The laboratory has reviewed the data for this analysis and no errors were found. The result recovered at 119% of the reference value which is within the laboratory's acceptance criteria for LCS recovery. The Duplicate in the analysis batch was within the acceptance range of the study and met replication criteria with the sample result. Review of historical results for I-131 performance evaluation samples by this method does not indicate a high bias.

4. MRAD-39 Soil failed two parameters. The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal nonconformance system.

Cesium-137 was reported at 1290pCi/Kg with a Reference Value of 1780pCi/Kg and acceptance range of (1350 - 2250pCi/Kg).
Cobalt-60 was reported at 5760 pCi/Kg with a Reference Value of 7960pCi/Kg and acceptance range of (6270 - 9830 pCi/Kg).

The Interlaboratory results contained in Table C-2 are intercomparison results for routine samples split for analyses between CGS and its subcontractor, GEL, as the primary REMP Laboratory and TBE as the QA laboratory. Analysis evaluated were Tritium, Strontium 90, Beta and non-natural gamma emitters. The CGS laboratory's results are provided with their analytical uncertainties of 2 sigma. When evaluating with the NRC Resolution Test a one sigma uncertainty is used to determine Pass or Fail and noted accordingly. In the event there are no non-natural isotopes detected, the samples are reported <MDA and designated as Pass.

The results contained in Table C-2 generally agree with their respective CGS laboratory original, and Teledyne Brown Engineering's split laboratory sample according to NRC Resolution Test Criteria[1]. The results for separate air samplers collocated E1-2 and E1-2Q analyzed by CGS and TBE respectively for Air Iodine and the Beta particulate are generally in trend. Colocated air samplers are not required to meet NRC Resolution test Criteria for Gross Beta analysis due to the statistical differences between equipment and laboratories. CGS laboratory counts samples generally an order of magnitude below required MDAs thus achieving very low uncertainties resulting in a very tight range of acceptance. When comparing to TBE's results, samples are counted to meet required MDAs resulting in greater uncertainties. When comparing the two laboratories' results, the average difference between weekly results was less than 0.0074 pCi/m3 which is statistically comparable at these very low ranges.

[1] NRC Inspection Manual, Inspection Procedure 84750, March 15, 1994

TABLE OF CONTENTS - ANALYTICAL RESULTS

Table C-1
Results of Participation in Cross Check Programs

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
3/16/2023	ANA	E13841	Cartridge	Gamma	pCi	D2	I-131	84.0	±	9.3	90.1	Pass
3/16/2023	ANA	E13841	Cartridge	Gamma	pCi	D3	I-131	88.6	±	10.4	90.1	Pass
3/16/2023	ANA	E13841	Cartridge	Gamma	pCi	D4	I-131	86.6	±	10.0	90.1	Pass
3/16/2023	ANA	E13841	Cartridge	Gamma	pCi	D5	I-131	83.2	±	10.6	90.1	Pass
3/16/2023	ANA	E13840	Water	Beta	pCi/L	S5E	Cs137	228	±	4.4	229	Pass
3/16/2023	ANA	E13839	Milk	Gamma	pCi/L	D4	I-131	69.1	±	19.0	82.0	Pass
							Cs-134	177	±	9.9	200	Pass
							Cs-137	133	±	12.9	140	Pass
							Ce-141	150	±	14.6	139	Pass
							Cr-51	307	±	82.4	302	Pass
							Mn-54	172	±	15.1	180	Pass
							Co-58	125	±	13.7	131	Pass
							Fe-59	118	±	17.7	122	Pass
							Co-60	267	±	14.6	279	Pass
							Zn-65	284	±	33.5	306	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
3/16/2023	ANA	E13839	Milk	Gamma	pCi/L	D5	I-131	71.7	±	21.6	82.0	Pass
							Cs-134	179	±	9.1	200	Pass
							Cs-137	138	±	14.2	140	Pass
							Ce-141	143	±	16.9	139	Pass
							Cr-51	272	±	91.2	302	Pass
							Mn-54	184	±	15.9	180	Pass
							Co-58	126	±	14.5	131	Pass
							Fe-59	116	±	19.1	122	Pass
							Co-60	258	±	14.1	279	Pass
3/16/2023	ANA	E13839	Milk	Gamma	pCi/L	D5	Zn-65	276	±	33.2	306	Pass
4/10/2023	ERA	Rad-133	Water	Gamma	pCi/L	D3	Ba-133	26.3	±	2.9	22.3	Fail [1]
							Cs-134	75.6	±	3.0	77.6	Pass
							Cs-137	61.0	±	4.6	61.0	Pass
							Co-60	31.8	±	2.7	30.3	Pass
							Zn-65	230	±	14.1	242	Pass
4/10/2023	ERA	Rad-133	Water	Beta	pCi/L	S5E	Cs-137	50.7	±	2.2	60.7	Pass
4/10/2023	ERA	Rad-133	Water	Gamma	pCi/L	D5	I-131	28.1	±	4.5	28.7	Pass
6/15/2023	ANA	E13771	Soil	Gamma	pCi/g	D4	Cs-134	0.285	±	0.02	0.292	Pass
							Cs-137	0.423	±	0.05	0.441	Pass
6/15/2023	ANA	E13842	Water	Beta	pCi/L	S5E	Cs-137	205	±	4.2	205	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
6/15/2023	ANA	E13843	Water	Gamma	pCi/L	D4	Ce-141	91.0	±	12.4	82.5	Pass
							Co-58	102	±	11.9	94.7	Pass
							Co-60	237	±	12.0	252	Pass
							Cr-51	175	±	81.2	201	Pass
							Cs-134	121	±	7.7	126	Pass
							Cs-137	162	±	12.8	158	Pass
							Fe-59	127	±	17.4	118	Pass
							Mn-54	113	±	11.8	112	Pass
							Zn-65	152	±	24.2	170	Pass
6/15/2023	ANA	E13843	Water	Gamma	pCi/L	D3	Ce-141	93.8	±	16.4	82.5	Pass
							Co-58	92.9	±	14.4	94.7	Pass
							Co-60	267	±	15.1	252	Pass
							Cr-51	237	±	86.7	201	Pass
							Cs-134	118	±	9.4	126	Pass
							Cs-137	160	±	16.1	158	Pass
							Fe-59	138	±	20.4	118	Pass
							Mn-54	119	±	14.8	112	Pass
							Zn-65	161	±	29.1	170	Pass
6/15/2023	ANA	E13844	Filter	Gamma	pCi	D4	Ce-141	77.0	±	3.3	76.7	Pass
							Co-58	84.8	±	5.0	88.1	Pass
							Co-60	227	±	2.9	235	Pass
							Cr-51	184	±	24.8	187	Pass
							Cs-134	97.3	±	2.8	117	Pass
							Cs-137	139	±	5.5	147	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
6/15/2023	ANA	E13844	Filter	Gamma	pCi	D4	Fe-59	129	±	7.6	110	Pass
							Mn-54	111	±	5.3	104	Pass
							Zn-65	171	±	11.3	159	Pass
6/15/2023	ANA	E13844	Filter	Gamma	pCi	D5	Ce-141	80.3	±	5.8	76.7	Pass
							Co-58	83.9	±	7.1	88.1	Pass
							Co-60	237	±	8.4	235	Pass
							Cr-51	180	±	36.9	187	Pass
							Cs-134	101	±	3.9	117	Pass
							Cs-137	147	±	7.7	147	Pass
							Fe-59	131	±	10.9	110	Pass
							Mn-54	113	±	7.1	104	Pass
							Zn-65	167	±	15.3	159	Pass
6/15/2023	ANA	E13845	Filter	Beta	pCi	S5E	Cs-137	201	±	2.9	185	Pass
9/14/2023	ANA	E13846	Filter	Beta	pCi	S5E	Cs-137	260	±	3.4	237	Pass
9/14/2023	ANA	E13772	Soil	Gamma	pCi/g	D2	Cs-134	0.221	±	0.027	0.202	Pass
							Cs-137	0.326	±	0.054	0.315	Pass
9/14/2023	ANA	E13772	Soil	Gamma	pCi/g	D3	Cs-134	0.213	±	0.022	0.202	Pass
							Cs-137	0.268	±	0.041	0.315	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
9/18/2023	ERA	MRAD-39	Filter	Gamma	pCi	D5	Cs-134	1188	±	17.0	1350	Pass
							Cs-137	1010	±	26.1	932	Pass
							Co-60	113	±	5.7	96	Pass
							Zn-65	175	±	16.6	161	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D2	Cs-134	43.3	±	4.2	41.2	Pass
							Cs-137	215	±	12.6	199	Pass
							Co-60	48.1	±	5.3	47.8	Pass
							Zn-65	62.1	±	13.6	57.0	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D2	I-131	28.9	±	6.1	29.7	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D3	I-131	28.3	±	5.0	29.7	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D2	Cs-134	43.3	±	4.2	41.2	Pass
							Cs-137	215	±	12.6	199	Pass
							Co-60	48.1	±	5.3	47.8	Pass
							Zn-65	62.1	±	13.6	57.0	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D2	I-131	28.9	±	6.1	29.7	Pass
10/6/2023	ERA	RAD-135	Water	Gamma	pCi/L	D3	I-131	28.3	±	5.0	29.7	Pass
11/30/2023	ANA	E13847	Filter	Gamma	pCi	D4	Cs-134	161	±	5.3	189	Pass
							Cs-137	156	±	8.5	160	Pass
							Ce-141	119	±	6.6	117	Pass
							Cr-51	176	±	34.7	201	Pass
							Mn-54	138	±	8.5	130	Pass
							Fe-59	163	±	11.2	142	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
11/30/2023	ANA	E13847	Filter	Gamma	pCi	D4	Co-60	123	±	6.6	123	Pass
							Zn-65	163	±	16.2	168	Pass
11/30/2023	ANA	E13847	Filter	Gamma	pCi	D5	Cs-134	163	±	5.0	189	Pass
							Cs-137	163	±	8.2	160	Pass
							Ce-141	119	±	6.1	117	Pass
							Cr-51	179	±	32.4	201	Pass
							Mn-54	134	±	7.8	130	Pass
							Fe-59	169	±	10.2	142	Pass
							Co-60	122	±	5.9	123	Pass
							Zn-65	174	±	15.0	168	Pass
11/30/2023	ANA	E13848	Water	Beta	pCi/L	S5e	Cs-137	229	±	4.5	189	Pass
11/30/2023	ANA	E13849	Cartridge	Gamma	pCi	D3	I-131	72.9	±	5.5	79.9	Pass
11/30/2023	ANA	E13849	Cartridge	Gamma	pCi	D4	I-131	72.1	±	8.7	79.9	Pass
11/30/2023	ANA	E13849	Cartridge	Gamma	pCi	D5	I-131	73.3	±	7.7	79.9	Pass
11/30/2023	ANA	E13850	Milk	Gamma	pCi/L	D4	I-131	38.4	±	15.5	40.0	Pass
							Cs-134	129	±	6.1	143	Pass
							Cs-137	123	±	9.9	121	Pass
							Ce-141	88.5	±	10.4	88.7	Pass
							Cr-51	155	±	63.9	152	Pass
							Mn-54	99.8	±	9.5	98.3	Pass
							Fe-59	107	±	13.7	108	Pass
							Co-60	94.3	±	6.8	92.9	Pass
							Zn-65	121	±	17.1	127	Pass

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
11/30/2023	ANA	E13850	Milk	Gamma	pCi/L	D5	I-131	32.2	±	12.5	40.0	Pass
							Cs-134	138	±	8.1	143	Pass
							Cs-137	116	±	12.6	121	Pass
							Ce-141	79.1	±	14.0	88.7	Pass
							Cr-51	146	±	78.3	152	Pass
							Mn-54	103	±	11.7	98.3	Pass
							Fe-59	119	±	17.4	108	Pass
							Co-60	95.5	±	8.9	92.9	Pass
							Zn-65	113	±	23.2	127	Pass

[1] See discussion at the beginning of the Appendix

Table C-2

Results of Quality Assurance Program

Sample Type	Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Split Analysis	Pass/Fail (Split)
Vegetation	IB10	6/19/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Vegetation	31G1	6/13/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Fish (Mud Flapper)	G-Control	7/11/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Fish (Bowfin)	G-Control	7/11/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Fish (Carp)	G-Control	7/11/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Fish (Bottom Feeder)	PB-6	6/12/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Bottom Sediment	CC-WBS4	6/28/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Bottom Sediment	CC-WBS2	6/28/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Oysters	CC-IA3	8/23/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Oysters	CC-IA6	8/23/2023	Gamma	pCi/kg	<MDA	<MDA	Pass
Bay Water	CC-WA1	8/29/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Bay Water	CC-WA2	8/29/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Filter Composite	CC-A1	10/2/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter Composite	CC-A2	10/2/2023	Gamma	pCi/m3	<MDA	<MDA	Pass

Filter Composite	CC-A3	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-A4	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-A5	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-SFA1	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-SFA2	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-SFA3	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Filter Composite	CC-SFA4	10/2/2023	Gamma	pCi/m3		<MDA		<MDA	Pass
Water -	Q9-1	2/2/2023	Gross Beta	pCi/L	1.4	±	0.7	<1.96	Pass
Water -	Q9-1	2/2/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	2/2/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	2/2/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/2/2023	Gross Beta	pCi/L	1.7	±	0.7	<2.09	Pass
Water -	Q9-1	3/2/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/2/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/2/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/30/2023	Gross Beta	pCi/L	1.2	±	0.7	<2.03	Pass
Water -	Q9-1	3/30/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/30/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	3/30/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	4/26/2023	Gross Beta	pCi/L	1.1	±	0.6	<1.89	Pass
Water -	Q9-1	4/26/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	4/26/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	4/26/2023	Tritium	pCi/L		<MDA		<MDA	Pass

Water -	Q9-1	6/1/2023	Gross Beta	pCi/L	2.8	±	0.7	2.3 ± 1.4	Pass
Water -	Q9-1	6/1/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	6/1/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	6/1/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	6/29/2023	Gross Beta	pCi/L	1.6	±	0.8	<2.39	Pass
Water -	Q9-1	6/29/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	6/29/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	6/29/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	7/27/2023	Gross Beta	pCi/L	2.0	±	0.7	2.9 ± 1.6	Pass
Water -	Q9-1	7/27/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	7/27/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	7/27/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	8/31/2023	Gross Beta	pCi/L	2.0	±	0.7	2.8 ±1.5	Pass
Water -	Q9-1	8/31/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	8/31/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	8/31/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	10/3/2023	Gross Beta	pCi/L	2.1	±	0.8	<2.13	Pass
Water -	Q9-1	10/3/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	10/3/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	10/3/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	11/2/2023	Gross Beta	pCi/L	2.1	±	0.7	3.1 ± 1.3	Pass
Water -	Q9-1	11/2/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	11/2/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	11/2/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	12/9/2023	Gross Beta	pCi/L	1.4	±	0.7	<2.05	Pass
Water -	Q9-1	12/9/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	12/9/2023	Gamma	pCi/L		<MDA		<MDA	Pass

Water -	Q9-1	12/9/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	12/28/2023	Gross Beta	pCi/L	1.6	±	0.8	2.2 ± 1.5	Pass
Water -	Q9-1	12/28/2023	LLI	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	12/28/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Water -	Q9-1	12/28/2023	Tritium	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	1/11/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	1/11/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	2/15/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	2/15/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	3/8/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	3/8/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	3/22/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	3/22/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	4/6/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	4/6/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	4/20/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	4/20/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/3/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/3/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/17/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/17/2023	LLI	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/31/2023	Gamma	pCi/L		<MDA		<MDA	Pass
Milk-	G2-1	5/31/2023	LLI	pCi/L		<MDA		<MDA	Pass

Milk-	G2-1	6/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	6/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	6/28/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	6/28/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	7/12/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	7/12/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	7/26/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	7/26/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	8/9/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	8/9/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	8/23/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	8/23/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/6/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/6/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/20/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/20/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	10/4/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	10/4/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	10/18/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	10/18/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	11/1/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	11/1/2023	LLI	pCi/L	<MDA	<MDA	Pass

Milk-	G2-1	11/15/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	11/15/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	11/29/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	11/29/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	12/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	12/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	3/22/2023	Strontium 89	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	3/22/2023	Strontium 90	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	6/28/2023	Strontium 89	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	6/28/2023	Strontium 90	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/21/2023	Strontium 89	pCi/L	<MDA	<MDA	Pass
Milk-	G2-1	9/21/2023	Strontium 90	pCi/L	<MDA	<MDA	Pass
Filter	E1-2	3/30/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	E1-2	6/29/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	E1-2	9/28/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	E1-2	12/28/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Vegetation	H1-2	6/14/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	7/12/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	8/16/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	9/20/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	6/14/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	7/12/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	8/16/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Vegetation	H1-2	9/20/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass

Vegetation	B10-2	8/16/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Fish	INDP	10/4/2023	Gamma	pCi/Kg	<MDA	<MDA	Pass
Fish	INDP	10/4/2023	Strontium 90	pCi/Kg	<MDA	<MDA	Pass
Water -	16C2	1/31/2023	Gross Beta	pCi/L	3.16 ± 0.82	<2.58	Pass
Water -	16C2	1/31/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	1/31/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	2/27/2023	Gross Beta	pCi/L	2.51 ± 0.82	3.26 ± 1.65	Pass
Water -	16C2	2/27/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	2/27/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	4/3/2023	Gross Beta	pCi/L	2.21 ± 0.80	3.26 ± 1.66	Pass
Water -	16C2	4/3/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	4/3/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	4/3/2023	Tritium Qtr 1	pCi/L	<MDA	<MDA	Pass
Water -	16C2	5/1/2023	Gross Beta	pCi/L	3.18 ± 0.84	<2.39	Pass
Water -	16C2	5/1/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	5/1/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	5/30/2023	Gross Beta	pCi/L	2.34 ± 0.72	3.00 ± 1.58	Pass
Water -	16C2	5/30/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	5/30/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	7/3/2023	Gross Beta	pCi/L	2.80 ± 0.82	3.95 ± 1.95	Pass
Water -	16C2	7/3/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	7/3/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	7/3/2023	Tritium Qtr 2	pCi/L	<MDA	<MDA	Pass

Water -	16C2	7/31/2023	Gross Beta	pCi/L	1.80 ± 0.74	<2.51	Pass
Water -	16C2	7/31/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	7/31/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	8/28/2023	Gross Beta	pCi/L	1.60 ± 0.77	2.92 ± 1.90	Pass
Water -	16C2	8/28/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	8/28/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	10/2/2023	Gross Beta	pCi/L	2.25 ± 0.79	<2.97	Pass
Water -	16C2	10/2/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	10/2/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	10/2/2023	Tritium Qtr 3	pCi/L	<MDA	<MDA	Pass
Water -	16C2	10/30/2023	Gross Beta	pCi/L	2.66 ± 0.82	3.23 ± 1.73	Pass
Water -	16C2	10/30/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	10/30/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	11/27/2023	Gross Beta	pCi/L	2.93 ± 0.84	<2.50	Pass
Water -	16C2	11/27/2023	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	11/27/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	1/2/2024	Gross Beta	pCi/L	2.31 ± 0.80	<2.66	Pass
Water -	16C2	1/2/2024	LLI	pCi/L	<MDA	<MDA	Pass
Water -	16C2	1/2/2024	Gamma	pCi/L	<MDA	<MDA	Pass
Water -	16C2	1/2/2024	Tritium Qtr 4	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	1/10/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	1/10/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	1/10/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	1/10/2023	Gamma	pCi/L	<MDA	<MDA	Pass

Milk-	19B1	2/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	2/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	2/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	2/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	3/7/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	3/7/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	3/7/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	3/7/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	4/4/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	4/4/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	4/4/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	4/4/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	4/17/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	4/17/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	4/17/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	4/17/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/2/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/2/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	5/2/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	5/2/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/16/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/16/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	5/16/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	5/16/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/30/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	5/30/2023	Gamma	pCi/L	<MDA	<MDA	Pass

Milk-	22B1	5/30/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	5/30/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	6/13/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	6/13/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	6/13/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	6/13/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	6/27/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	6/27/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	6/27/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	6/27/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	7/11/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	7/11/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	7/11/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	7/11/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	7/25/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	7/25/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	7/25/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	7/25/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	8/7/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	8/7/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	8/7/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	8/7/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	8/22/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	8/22/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	8/22/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1		Gamma	pCi/L	<MDA	<MDA	Pass

Milk-	19B1	9/5/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	9/5/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	9/5/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	9/5/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	9/19/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	9/19/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	9/19/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	9/19/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/3/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/3/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/3/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/3/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/16/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/16/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/16/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/16/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/31/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	10/31/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/31/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	10/31/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	11/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	11/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	11/14/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	11/14/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	11/28/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	11/28/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	11/28/2023	LLI	pCi/L	<MDA	<MDA	Pass

Milk-	22B1	11/28/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	12/12/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	19B1	12/12/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	12/12/2023	LLI	pCi/L	<MDA	<MDA	Pass
Milk-	22B1	12/12/2023	Gamma	pCi/L	<MDA	<MDA	Pass
Filter	11S1 / 11S2	3/30/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	11S1 / 11S2	6/29/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	11S1 / 11S2	9/28/2023	Gamma	pCi/m3	<MDA	<MDA	Pass
Filter	11S1 / 11S2	12/28/2023	Gamma	pCi/m3	<MDA	<MDA	Pass

Weekly Air Samples - Colocated Samplers for Split Comparisons

Date	Media - Analysis	E1-2	E1-2Q
1/4/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
1/11/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
1/18/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
1/26/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
2/2/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
2/8/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
2/15/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
2/23/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
3/2/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
3/9/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
3/16/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
3/23/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
3/30/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
4/6/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
4/13/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
4/20/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
4/26/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
5/4/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
5/11/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA

5/18/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
5/25/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
6/1/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
6/8/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
6/15/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
6/22/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
6/29/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
7/5/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
7/13/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
7/20/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
7/27/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
8/3/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
8/9/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
8/17/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
8/24/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
8/31/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
9/7/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
9/14/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
9/21/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
9/28/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
10/4/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
10/12/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
10/18/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
10/25/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
11/2/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
11/9/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
11/16/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
11/22/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
11/29/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
12/7/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
12/14/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
12/21/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA
12/28/2023	Charcoal - Iodine-131 pCi/m^3	<MDA	<MDA

Sample Type	Split Locations	Sample Date	Analysis	10^{-2} pCi/m^3	E1-2 [1]	±2σ	E1-2Q [1]	±2σ
Filter	E1-2 / E1-2Q	1/4/2023	Beta	10^{-2} pCi/m^3	3.3	0.3	2.1	0.5
Filter	E1-2 / E1-2Q	1/11/2023	Beta	10^{-2} pCi/m^3	2.4	0.2	1.7	0.4
Filter	E1-2 / E1-2Q	1/18/2023	Beta	10^{-2} pCi/m^3	2.1	0.2	1.5	0.4
Filter	E1-2 / E1-2Q	1/26/2023	Beta	10^{-2} pCi/m^3	1.6	0.2	1.0	0.3
Filter	E1-2 / E1-2Q	2/2/2023	Beta	10^{-2} pCi/m^3	2.5	0.2	1.9	0.4
Filter	E1-2 / E1-2Q	2/8/2023	Beta	10^{-2} pCi/m^3	2.8	0.3	2.1	0.5
Filter	E1-2 / E1-2Q	2/15/2023	Beta	10^{-2} pCi/m^3	2.8	0.2	2.1	0.4
Filter	E1-2 / E1-2Q	2/23/2023	Beta	10^{-2} pCi/m^3	2.3	0.2	1.7	0.4
Filter	E1-2 / E1-2Q	3/2/2023	Beta	10^{-2} pCi/m^3	1.8	0.2	1.3	0.4
Filter	E1-2 / E1-2Q	3/9/2023	Beta	10^{-2} pCi/m^3	1.7	0.2	1.2	0.4
Filter	E1-2 / E1-2Q	3/16/2023	Beta	10^{-2} pCi/m^3	1.1	0.2	1.1	0.4
Filter	E1-2 / E1-2Q	3/23/2023	Beta	10^{-2} pCi/m^3	2.4	0.2	1.7	0.4
Filter	E1-2 / E1-2Q	3/30/2023	Beta	10^{-2} pCi/m^3	2.5	0.2	1.6	0.4
Filter	E1-2 / E1-2Q	4/6/2023	Beta	10^{-2} pCi/m^3	2.3	0.2	1.4	0.4
Filter	E1-2 / E1-2Q	4/13/2023	Beta	10^{-2} pCi/m^3	2.8	0.3	2.2	0.4
Filter	E1-2 / E1-2Q	4/20/2023	Beta	10^{-2} pCi/m^3	2.0	0.2	2.0	0.4
Filter	E1-2 / E1-2Q	4/26/2023	Beta	10^{-2} pCi/m^3	1.9	0.2	1.6	0.5
Filter	E1-2 / E1-2Q	5/4/2023	Beta	10^{-2} pCi/m^3	0.9	0.2	0.6	0.3
Filter	E1-2 / E1-2Q	5/11/2023	Beta	10^{-2} pCi/m^3	1.4	0.2	1.0	0.3
Filter	E1-2 / E1-2Q	5/18/2023	Beta	10^{-2} pCi/m^3	2.7	0.2	1.8	0.5
Filter	E1-2 / E1-2Q	5/25/2023	Beta	10^{-2} pCi/m^3	1.7	0.2	1.2	0.4
Filter	E1-2 / E1-2Q	6/1/2023	Beta	10^{-2} pCi/m^3	1.6	0.2	1.5	0.4
Filter	E1-2 / E1-2Q	6/8/2023	Beta	10^{-2} pCi/m^3	2.2	0.2	1.3	0.4
Filter	E1-2 / E1-2Q	6/15/2023	Beta	10^{-2} pCi/m^3	1.6	0.2	1.1	0.4
Filter	E1-2 / E1-2Q	6/22/2023	Beta	10^{-2} pCi/m^3	1.6	0.2	1.5	0.4
Filter	E1-2 / E1-2Q	6/29/2023	Beta	10^{-2} pCi/m^3	1.4	0.2	0.9	0.3
Filter	E1-2 / E1-2Q	7/5/2023	Beta	10^{-2} pCi/m^3	2.5	0.3	1.7	0.5
Filter	E1-2 / E1-2Q	7/13/2023	Beta	10^{-2} pCi/m^3	3.3	0.2	2.1	0.4
Filter	E1-2 / E1-2Q	7/20/2023	Beta	10^{-2} pCi/m^3	2.8	0.3	2.3	0.5
Filter	E1-2 / E1-2Q	7/27/2023	Beta	10^{-2} pCi/m^3	2.4	0.2	1.3	0.4
Filter	E1-2 / E1-2Q	8/3/2023	Beta	10^{-2} pCi/m^3	2.6	0.2	1.5	0.4
Filter	E1-2 / E1-2Q	8/9/2023	Beta	10^{-2} pCi/m^3	2.4	0.3	1.1	0.5
Filter	E1-2 / E1-2Q	8/17/2023	Beta	10^{-2} pCi/m^3	2.4	0.2	1.6	0.4
Filter	E1-2 / E1-2Q	8/24/2023	Beta	10^{-2} pCi/m^3	2.3	0.2	1.3	0.4
Filter	E1-2 / E1-2Q	8/31/2023	Beta	10^{-2} pCi/m^3	2.3	0.2	1.6	0.4
Filter	E1-2 / E1-2Q	9/7/2023	Beta	10^{-2} pCi/m^3	3.7	0.3	2.4	0.5
Filter	E1-2 / E1-2Q	9/14/2023	Beta	10^{-2} pCi/m^3	2.9	0.2	2.2	0.5
Filter	E1-2 / E1-2Q	9/21/2023	Beta	10^{-2} pCi/m^3	2.4	0.2	1.6	0.4

Filter	**E1-2 / E1-2Q**	9/28/2023	Beta	10^{-2} pCi/m^3	1.5	0.2	1.5	0.4
Filter	**E1-2 / E1-2Q**	10/4/2023	Beta	10^{-2} pCi/m^3	2.4	0.3	2.1	0.5
Filter	**E1-2 / E1-2Q**	10/12/2023	Beta	10^{-2} pCi/m^3	3.0	0.2	1.9	0.4
Filter	**E1-2 / E1-2Q**	10/18/2023	Beta	10^{-2} pCi/m^3	1.4	0.2	0.9	0.5
Filter	**E1-2 / E1-2Q**	10/25/2023	Beta	10^{-2} pCi/m^3	2.1	0.2	1.5	0.4
Filter	**E1-2 / E1-2Q**	11/2/2023	Beta	10^{-2} pCi/m^3	2.8	0.2	1.9	0.4
Filter	**E1-2 / E1-2Q**	11/9/2023	Beta	10^{-2} pCi/m^3	4.2	0.3	3.3	0.5
Filter	**E1-2 / E1-2Q**	11/16/2023	Beta	10^{-2} pCi/m^3	3.0	0.3	2.0	0.5
Filter	**E1-2 / E1-2Q**	11/22/2023	Beta	10^{-2} pCi/m^3	3.1	0.3	1.9	0.5
Filter	**E1-2 / E1-2Q**	11/29/2023	Beta	10^{-2} pCi/m^3	2.3	0.2	1.4	0.4
Filter	**E1-2 / E1-2Q**	12/7/2023	Beta	10^{-2} pCi/m^3	3.8	0.3	2.3	0.4
Filter	**E1-2 / E1-2Q**	12/14/2023	Beta	10^{-2} pCi/m^3	2.9	0.3	2.0	0.4
Filter	**E1-2 / E1-2Q**	12/21/2023	Beta	10^{-2} pCi/m^3	3.1	0.3	2.1	0.4
Filter	**E1-2 / E1-2Q**	12/28/2023	Beta	10^{-2} pCi/m^3	2.2	0.2	1.5	0.4

[1] See discussion at the beginning of the Appendix

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TABLE C-3

Calvert Cliffs Nuclear Power Plant ODCM Required LLDs

Selected Nuclides	Water pCi/l	Fish/Shellfish pCi/kg	Milk pCi/L	Sediment pCi/kg	Vegetation pCi/kg	Particulates[1] pCi/m^3
H-3	2000	--	--	--	--	--
Mn-54	15	130	--	--	--	--
Co-58	15	130	--	--	--	--
Fe-59	30	260	--	--	--	--
Co-60	15	130	--	--	--	--
Zn-65	30	260	--	--	--	--
Zr-95/Nb-95	15	--	--	--	--	--
I-131	15[2]	--	1	--	60	0.07[3]
Cs-134	15	130	15	150	60	0.05
Cs-137	18	150	18	180	80	0.06
BaLa-140	15	--	15	--	--	--

[1]Gross Beta activity LLD = 0.01pCi/m^3
[2] In accordance with the ODCM no drinking water pathway exists so the Gamma Isotopic LLD is used.
[3] Air samples for I-131 are collected separately on a charcoal radioiodine cannister

APPENDIX D
Land Use Survey

Appendix D contains the results of a Land Use Survey conducted around Calvert Cliffs Nuclear Power Plant during this operating period. A table listing the raw data of this survey and a discussion of the results are included in this appendix.

Discussion

A Land Use Survey was conducted to identify, within a distance of 5 miles, the location of the nearest milk animal, the nearest residence, and the nearest garden greater than 50 m^2 in each of the nine sectors over land. A detailed description of the Land Use Survey is given in a separate document (Ref. 9). The position of the nearest residence and garden in each sector out to 5 miles is given in the adjacent table. An "*" denotes a change in this sector since the 2022 Land Use Census.

Table D-1
Land Use Survey

	Distance from Plant (miles)	
Sector	Residence	Garden
SE	1.5	4.5
SSE	1.6	3.9*
S	1.6	1.8*
SSW	1.6*	2.2*
SW	1.1	2.4
WSW	1.2	1.5
W	1.3	1.4*
WNW	1.7*	1.7*
NW	2.0	2.1

The closest residence is situated in the SW sector and the nearest garden is in the West sector.

There are no animals producing milk for public consumption within the 5-mile radius. At a farm that spans the W to WNW Sectors, goats were identified as being used occasionally for meat consumption by the owners and not for milk or dairy. At this time there is no plan to sell these items to the public. The closest beef cattle for meat consumption are 1.6 miles in the South Sector.

Discussion with a local waterman indicate that oysters and fish are still harvested in the vicinity of CCNPP.

APPENDIX E

Additional Samples and Analysis Results

Appendix E is a presentation of the analytical results for additional samples collected in the environs of CCNPP. These extra samples are not required by the ODCM (Ref. 6). Table E-1 lists the locations of all the additional samples and groundwater samples discussed below. The remaining tables in this appendix provide the results. Some of these samples were collected and analyzed to maintain the historical continuity for samples and sampling pathways discontinued when the Environmental Technical Specifications were changed in March,1985.

Table E-4 through E-5 contain analytical results for additional samples taken from aquatic and atmospheric radiological pathways surrounding the plant. There were no positive detects for any non-natural Gamma emitters

The NEI Industry Groundwater Protection Initiative was established to determine the potential impact nuclear power plants may have on the surrounding environment due to unplanned releases of radioactive liquids. Under the Groundwater Protection Initiative, groundwater monitoring is accomplished through routine sampling of the water table around the plant (Ref. 16). Analysis is performed for gamma, tritium, alpha, beta, and various other radiological isotopes. Tables E-6 through E-12 contain the analytical results for samples taken from the various groundwater monitoring wells, subsurface drains, and rainwater.
In 2019 MH24 was renamed to MH66/SSD3.

Groundwater samples were collected from 16 of 17 on-site piezometer tubes and three subsurface manholes in 2023. These locations are listed in Table E-1 and on Figure E-1, Site Map Groundwater Monitoring Wells. Figure E-2, Site Map RW Locations, shows precipitation collection sites. A piezometer tube is a shallow monitoring well which allows access to groundwater at a depth of approximately 40 feet beneath the site. Of the piezometer tubes sampled, only #11 piezometer, MH28 and MH30 showed any results greater than MDAs. This activity was previously identified and evaluated in December of 2005. The activity consists of tritium originating from normal radiological waste discharges and was previously reported in the Annual Radioactive Release Reports. The tritium contamination is contained on site. No drinking water has been affected; the groundwater at this location does not impact any drinking water pathway.

TABLE OF CONTENTS - ANALYTICAL RESULTS

TABLE E-1

Locations of Non-Tech Spec and Radiological Groundwater Environmental Sampling Stations for Calvert Cliffs Nuclear Power Plant

Non-Tech Spec Station	Description	Distance[1] (KM)	Distance[1] (Miles)	Direction[1] (Sector)
WBS2	Discharge Area	0.3	0.2	N
WBS4	Camp Conoy/Rocky Point	3.0	1.9	SE
SFA2	Visitors Center	0.8 [2]	0.5 [2]	N [2]

RGPP Station	Description
PZ11	45' - North side of Unit 1 near roll-up door
PZ12	NW corner of Unit 1
PZ13	Unit 1 RWT
PZ15	Unit 2 RWT
PZ18	45' - South side near stairwell to waterfront (idle)
PZ19	10' - Southside near traveling screen trough
PZ20	10' -Northside of MMD Shop
PZ21	10' - In grass West of STP
PZ22	10’ - In grass West of STP
PZ23	45’ – S of SSB doors
PZ24	45' - East of SSB near Unit 2 roll-up door
PZ25	45' - South side near stairwell to waterfront
PZ26	45' -SW of Spare Transformer
PZ27	45' -SW of Spare Transformer
PZ28	45’ – SW corner of NRC Bldg
PZ29	45' - East of Nitrogen Tank in road
PZ30	45' -NE Corner of Turbine Bldg
RW1	Met Tower
RW2	Lower Lay Down Area
RW3	Visitor’s Center Overlook
RW4	Waterfront
RW5	Open Grass Area outside NSF PA exit
RW6	U2 Turbine Building roll up door
RW7	Open area north of Outfall 004
RW8	Open area on north wing wall
MH28	12'- Unit1 next to Feed Water Heater
MH30	12'- Unit 2 next to elevator
MH66/SSD3	45'- East of SSB and South of Turbine Bldg (formerly named MH-24)
SW003	Waterfront south of Sewage Treatment Plant
SW004	Waterfront Barge Dock Rd

[1] Distance and direction from the central point between the two containment buildings

[2.] Distance and direction from the central point of the ISFSI

Table E-2

**Synopsis of 2023 Calvert Cliffs Nuclear Power Plant
Non-Tech Spec Radiological Environmental Monitoring Program**

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Aquatic Environment						
Bottom Sediment	SA	2	4	Gamma	SA	4
Atmospheric Environment						
Air Iodine[2]	W	1	52	I-131	W	52

[1] W=weekly, M=monthly, Q=quarterly, SA=semiannual, A=annual, C=composite
[2] The collection device contains Charcoal

Table E-3

**Annual Summary for Calvert Cliffs Nuclear Power Plant Units 1 & 2
Non-Tech Spec Radiological Environmental Monitoring Program**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range

There were No Positive Results in 2023 Non-Tech Spec samples of air and bottom sediment reported in Tables E-4 and E-5.

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] Distance and direction from the central point between the two containment buildings.

Table E-4

Concentration of Gamma Emitters in Bottom Sediment
(Results in units of pCi/kg (dry) ± 2σ)

Sample Code	Sample Date	Gamma Emitters
WBS2		
Discharge Area	6/28/2023	*
	10/10/2023	*
WBS4[1]		
Camp Conoy/ Rocky Point	6/28/2023	*
	10/10/2023	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table E-5

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Collection Stop Date	SFA2[1] Visitors Center
1/9/2023	*
1/17/2023	*
1/23/2023	*
1/31/2023	*
2/6/2023	*
2/13/2023	*
2/20/2023	*
2/27/2023	*
3/6/2023	*
3/13/2023	*
3/20/2023	*
3/27/2023	*
4/3/2023	*
4/10/2023	*
4/17/2023	*
4/24/2023	*
5/1/2023	*
5/8/2023	*
5/15/2023	*
5/22/2023	*
5/30/2023	*
6/5/2023	*
6/12/2023	*
6/19/2023	*
6/26/2023	*
7/3/2023	*
7/10/2023	*
7/17/2023	*
7/24/2023	*
7/31/2023	*
8/7/2023	*
8/14/2023	*
8/21/2023	*
8/28/2023	*

Table E-5 - Continued

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Collection Stop Date	SFA2[1] Visitors Center
9/5/2023	*
9/11/2023	*
9/18/2023	*
9/25/2023	*
10/2/2023	*
10/9/2023	*
10/16/2023	*
10/23/2023	*
10/30/2023	*
11/6/2023	*
11/13/2023	*
11/20/2023	*
11/27/2023	*
12/4/2023	*
12/11/2023	*
12/19/2023	*
12/27/2023	*
1/2/2024	*

[1] Control Location
* <MDA

Table E-6

Alpha Isotopic and Pu-241 in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	AM-241 (AS)	CM-242 (AS)	CM-243/244 (AS)	PU-238 (AS)
PZ11	5/9/2023	<0.0568	<0.0562	<0.126	<0.1362
PZ24	8/15/2023	<0.0235	<0.0232	<0.0232	<0.0890

Station	Sample Date	U-233/234 (AS)	U-235 (AS)	U-238 (AS)	PU-239/240 (AS)
PZ11	5/9/2023	<0.0704	<0.1450	<0.1173	<0.0472
PZ24	8/15/2023	1.100 ± 0.494	<0.0711	0.7611 ± 0.419	<0.1999

Station	Sample Date	Fe-55	Ni-63
PZ11	5/9/2023	<63.5	<4.67

Table E-7

Gross Alpha Activity in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	GR-A (DIS) (pCi/L)	GR-A (SUS) (pCi/L)
PZ11	5/9/2023	<1.13	<0.597
PZ24	8/15/2023	<1.58	1.32 ± 0.74
MH66/SSD3*	12/20/2023	<2.03	<1.11
MH-28	12/12/2023	<1.25	<1.1
MH-30	12/13/2023	<0.879	<1.1

*Renamed from MH-24

Table E-8

Concentration of Radiostrontium in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	SR-89 (pCi/L)	SR-90 (pCi/L)
MH66/SSD3*	12/20/2023	<3.34	<0.779
MH28	12/12/2023	<8.15	<0.975
MH30	4/13/2023	<7.83	<0.865
	12/13/2023	<8.42	<0.858
PZ11	5/09/2023	<7.87	<0.844
PZ12	5/09/2023	<6.66	<0.88
PZ13	5/09/2023	<5.85	<0.78
PZ15	5/09/2023	<4.68	<0.94
PZ24	5/09/2023	<2.95	<0.814
PZ25	5/09/2023	<3.88	<0.924
PZ29	5/09/2023	<3.13	<0.926
PZ30	5/09/2023	<4.2	<0.874

*Renamed from MH-24

Table E-9

Concentration of Tritium in Groundwater
(Results in units of pCi/L ± 2σ)
By Piezometer Tube Locations

SAMPLE DATE	11	12	13	15	19	20	21	22	23	24	25	26	27	28	29	30
02/28/2023	<183	<181	<181	<182	ND	ND	ND	ND	ND	<184	<184	ND	ND	ND	<178	<179
05/09/2023	<193	<197	<188	<198	<194	<188	<190	<190	<192	<199	<194	<189	<193	<192	<192	<188
08/15/2023	ND	<194	<193	<194	ND	ND	ND	ND	ND	<198	<199	ND	ND	ND	<197	ND
08/16/2023	<195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<193
10/23/2023	ND	ND	ND	ND	ND	ND	ND	ND	ND	<196	<196	ND	ND	ND	ND	ND
10/24/2023	ND	<196	<193	<198	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<194	<195
12/22/2023	<185	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[ND] No Data – Sample obtained as required

Table E-10

Concentration of Tritium in Surface Water, Precipitation, and Subsurface Drainage

(Results in units of pCi/L ± 2σ)

SAMPLE DATE	*MH-66 /SSD3	MH28	MH30	SW003	SW004	RW1	RW2	RW3	RW4	RW5	RW6	RW7	RW8
01/06/2023	ND	1150 ± 189	1570 ± 227	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
01/13/2023	<180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
02/27/2023	ND	ND	ND	ND	ND	<179	<180	<182	<181	<185	<181	<182	<179
04/13/2023	ND	860 ± 162	1210 ± 196	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4/14/2023	<187	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
05/09/2023	ND	ND	ND	ND	ND	<179	<185	<182	<182	<184	<182	<187	<182
7/25/2023	ND	1020 ± 183	1350 ± 213	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/16/2023	ND	ND	ND	ND	ND	<194	<190	<192	<198	<199	<194	<195	<197
10/24//2023	ND	ND	ND	ND	ND	<196	<188	<195	<188	<189	<191	<193	<197
12/12/2023	ND	832 ± 164	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12/13/2023	ND	ND	1070 ± 184	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12/20/2023	<197	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* MH24 Renamed MH-66/SSD3
[ND] No Data – sample obtained as required

Table E-11

Gross Concentration of Gamma Emitters in Groundwater
(Results in units of pCi/L ± 2σ)

By Piezometer Tube Locations

SAMPLE DATE	11	12	13	15	19	20	21	22	23	24	25	26	27	28	29	30
5/9/2023	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/16/2023	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12/22/2023	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

RGPP samples for gamma-radionuclide analysis are scheduled to be collected in 2024 according to the biennial sampling requirement.

[#] Non-Natural Gamma Emitters Less than Minimum Detectable Activity (MDA)
[ND] No Data – Biennial sample obtained as required.

Table E-12

Gross Concentration of Gamma Emitters in Surface Water, Precipitation and MH (subsurface drains)
(Results in units of pCi/L ± 2σ)

SAMPLE DATE	*MH66/SSD3	MH28	MH30	SW003	SW004	RW1	RW2	RW3	RW4
12/12/2023	ND	#	ND	ND	ND	ND	ND	ND	ND
12/13/2023	ND	ND	#	ND	ND	ND	ND	ND	ND
12/20/2023	#	ND	ND	ND	ND	ND	ND	ND	ND

RGPP samples for gamma-radionuclide analysis are scheduled to be collected in 2024 according to the biennial sampling requirement.

*MH24 Renamed as MH66/SSD3
All Non-Natural Gamma Emitters <MDA
[ND] No Data - Sample obtained as required.

Figure E-1
Site Map Groundwater Monitoring Wells

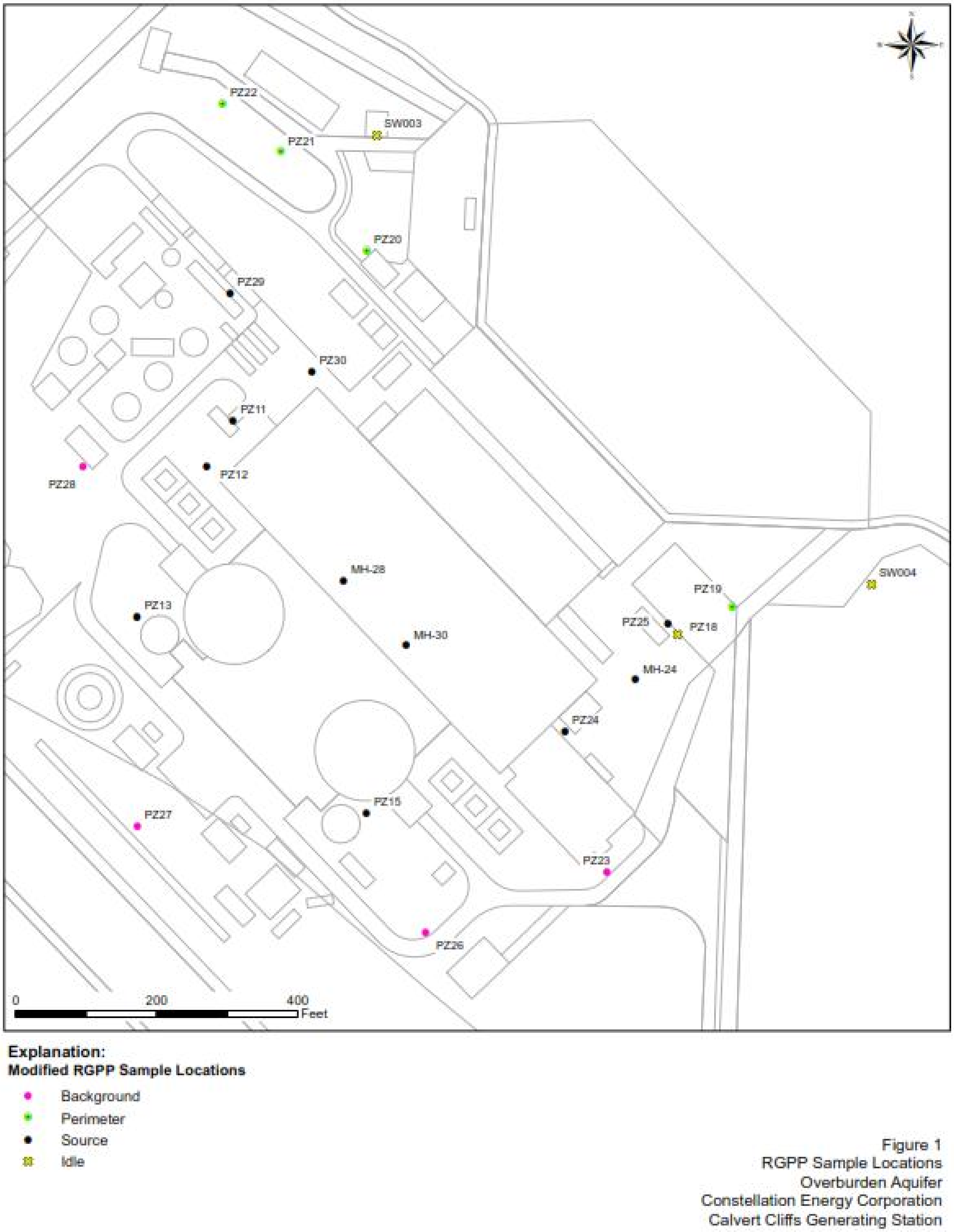

Figure E-2

Site Map Rainwater Locations