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May 15, 2020

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 (410) 495-5219 or Mr. Ron Thomas at (410) 495-6970.

Respectfully,

Larry D. Smith
Manager - Regulatory Assurance
LDS/lmd

IE25
NMSS26
NRR
NMSS

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. Gray, 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, 2020

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, 2019

A. M. Barnett
M. Prosceo

EXELON GENERATION, LLC

MAY 2020

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I. SUMMARY

During 2019, Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 2447 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 906 environmental samples; and 546 thermoluminescent dosimeters (TLDs) 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, 480 TLDs, 24 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, 229 radiochemical analyses were performed on 183 quality assurance samples and 120 quality assurance TLDs were analyzed 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 TLDs from forty-two locations surrounding CCNPP and the ISFSI.

Natural radioactivity was detected in essentially all 2447 radiological analyses performed. Low levels of man-made fission products were also observed in 9 of these analyses for the CCNPP REMP. One of these observations was for low level Tritium and is attributed to normal plant operations. The other 8 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 using 2019 data from the plant's effluent releases, 2019 on-site meteorological data, and appropriate pathways. The results of these dose calculations indicate:

a. a maximum thyroid dose of 7.39×10^{-4} mrem via liquid and gaseous pathways, which is about 0.001% 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 7.78×10^{-4} mrem via liquid and gaseous pathways, which is about 0.003% 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 1.22×10^{-3} mrem. This dose is about 0.005% 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 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 Exelon Generation 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.

II.B.4 Program Exceptions

There were two program exceptions during this operating period.

A GFCI trip on the air sampler resulted in a lost Sample at A2 for air iodine and air particulate for the week ending May 28th, 2019. This event was entered into the site's corrective action program to prevent future occurrences.

DR19 data for Quarter 4 was rejected by the laboratory due to water damaged dosimeters. The plastic bag the dosimeters were in did not hold its seal and was wet at the time of retrieval. The dosimeter was dried, gave erroneous data and was rejected. The event was entered in the corrective action program to document the issue and trend future events should they occur.

Calvert Cliffs began adopting the requirements of ANSI/HPS N13.34, Environmental Dosimetry, as suggested in NRC Regulatory Guide 4.3, Rev 2, in June 2018. The mean 90-day ambient radiation was reported for the first quarter of 2018. Beginning in June 2018, ambient radiation was reported as a 91-day average. In early 2020, the calculation for Facility-related dose was finalized and the dosimetry results from 2018 were re-calculated to correct for Extraneous dose. This event was entered in the corrective action program to document the deviation and track re-calculation of the 2018 data.

After correction for Extraneous Dose, the 2018 mean 91-day ambient radiation measured at the indicator locations was 8.57 mR and ranged from 4.84 to 14.00 mR. The control locations showed a mean 91-day measurement of 9.99 mR with a range of 6.73 to 14.50 mR. The location with the highest overall mean of 12.08 mR was Taylors Island, Anderson's Property (sample code DR23) which ranged from 11.00 to 14.50 mR. A comparison of the 2018 non-corrected vs corrected results is shown in the table below. Facility-related dose was not detected at any of the monitoring locations in 2018.

2018 Ambient Radiation Quarterly (91-Day) Summary				
	Mean (mR)	**Range (mR)**	**Mean (mR) Corrected for Extraneous Dose**	**Range (mR) Corrected for Extraneous Dose**
Indicator Locations	11.75	9.29- 16.56	8.57	4.84- 14.00
Control Locations	13.19	11.11- 17.25	9.99	6.73- 14.50
Highest Overall Location (DR23)	15.38	14.40- 17.25	12.08	11.00- 14.50

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year were analyzed using Exelon Industrial Services laboratory procedures (Ref. 8), except Tritium which was analyzed by Teledyne Brown Engineering (Ref. 14). 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 one result for tritium at the Discharge Area (sample code WA2) in the first quarterly sample collected from 12/31/2018 to 03/29/2019 at 385 ± 201 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

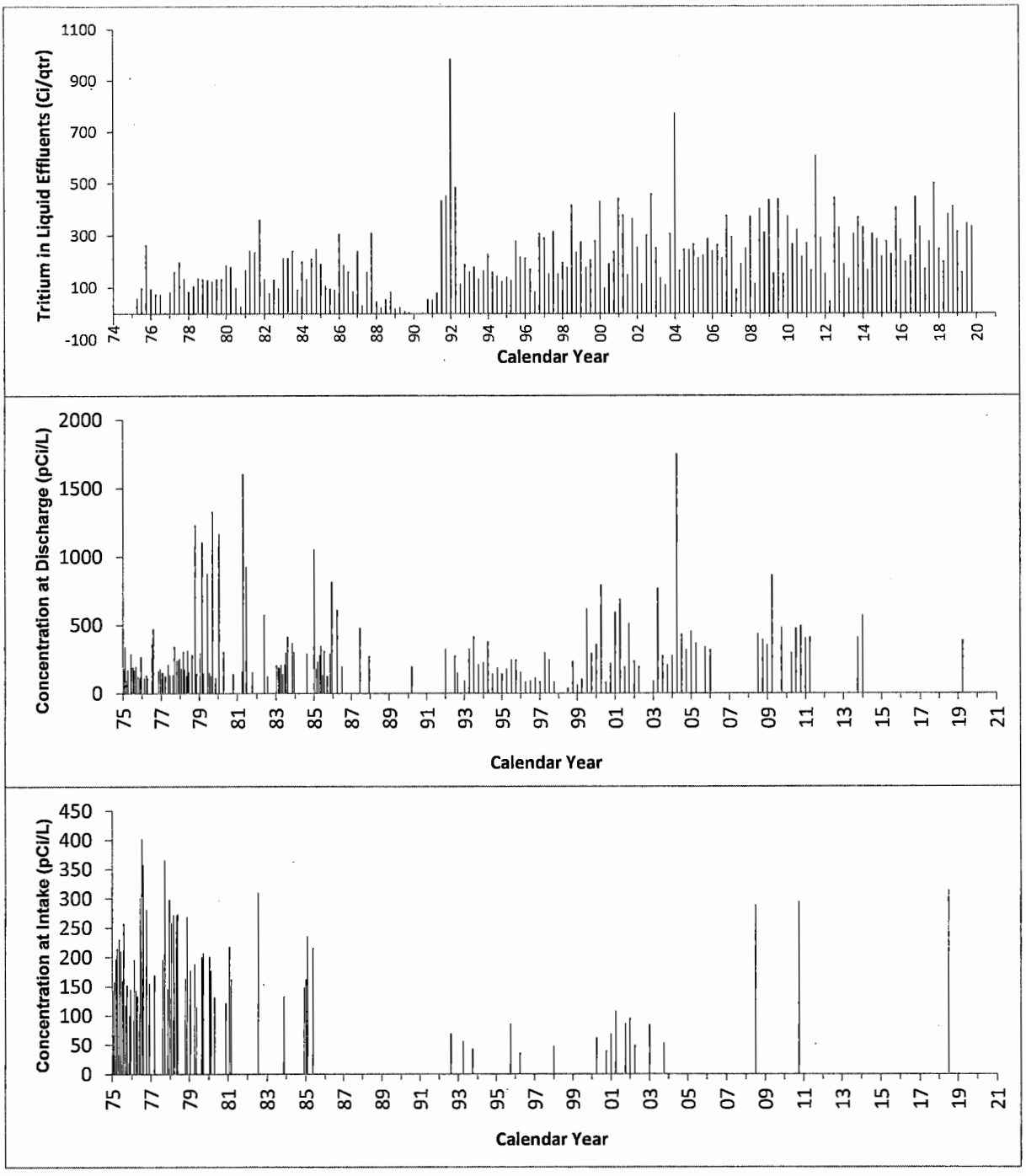
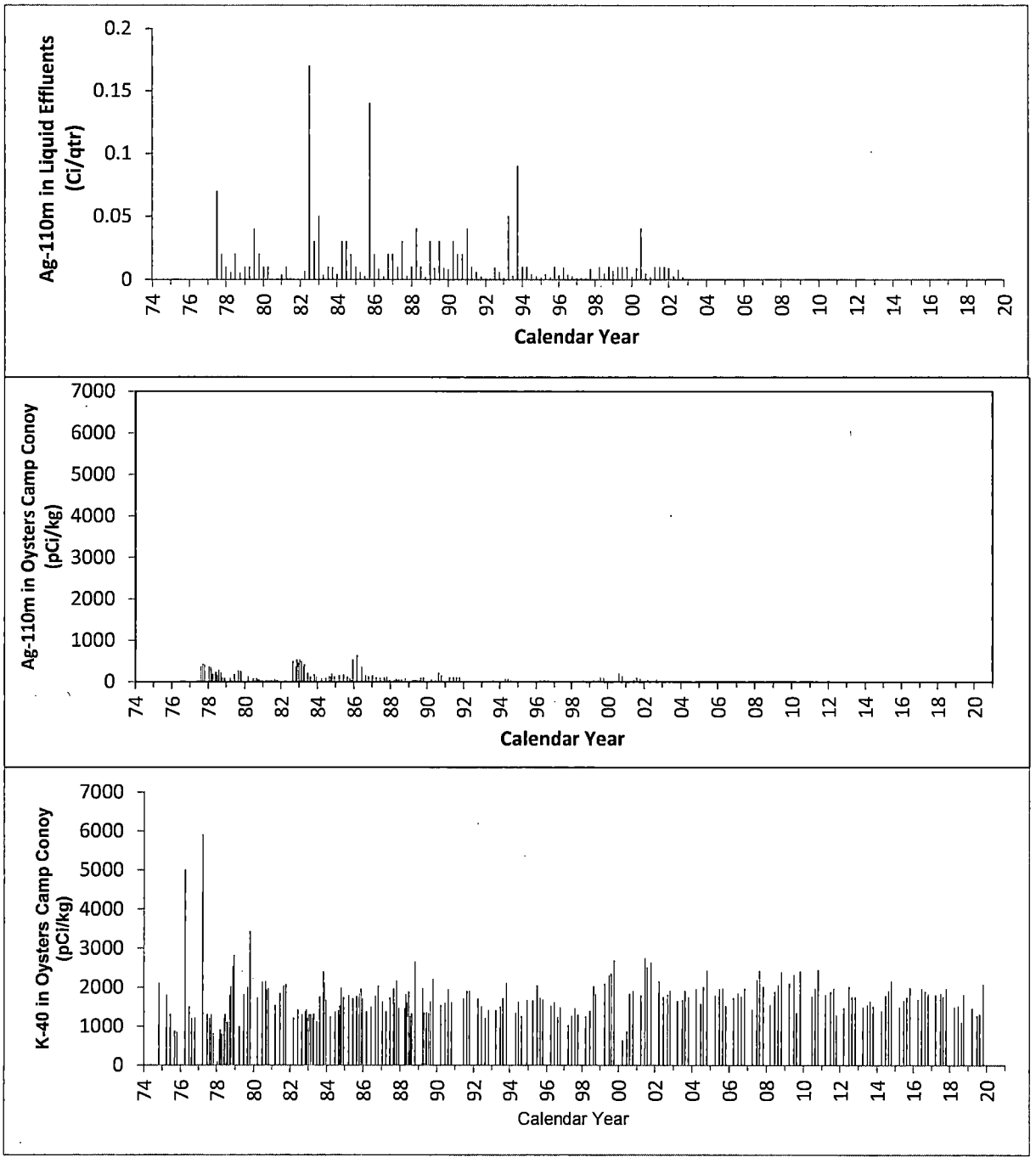


FIGURE 2
Silver-110m and Potassium-40 in Chesapeake Bay Oysters



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.

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 1.0×10^{-2} to 3.4×10^{-2} pCi/m^3 for the indicator locations and 1.1×10^{-2} to 3.7×10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 2.0×10^{-2} pCi/m^3 was A5, Emergency Operations Facility.

Gamma spectrometric analyses of monthly 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.

Figure 3 depicts the historical trends of beta activity.

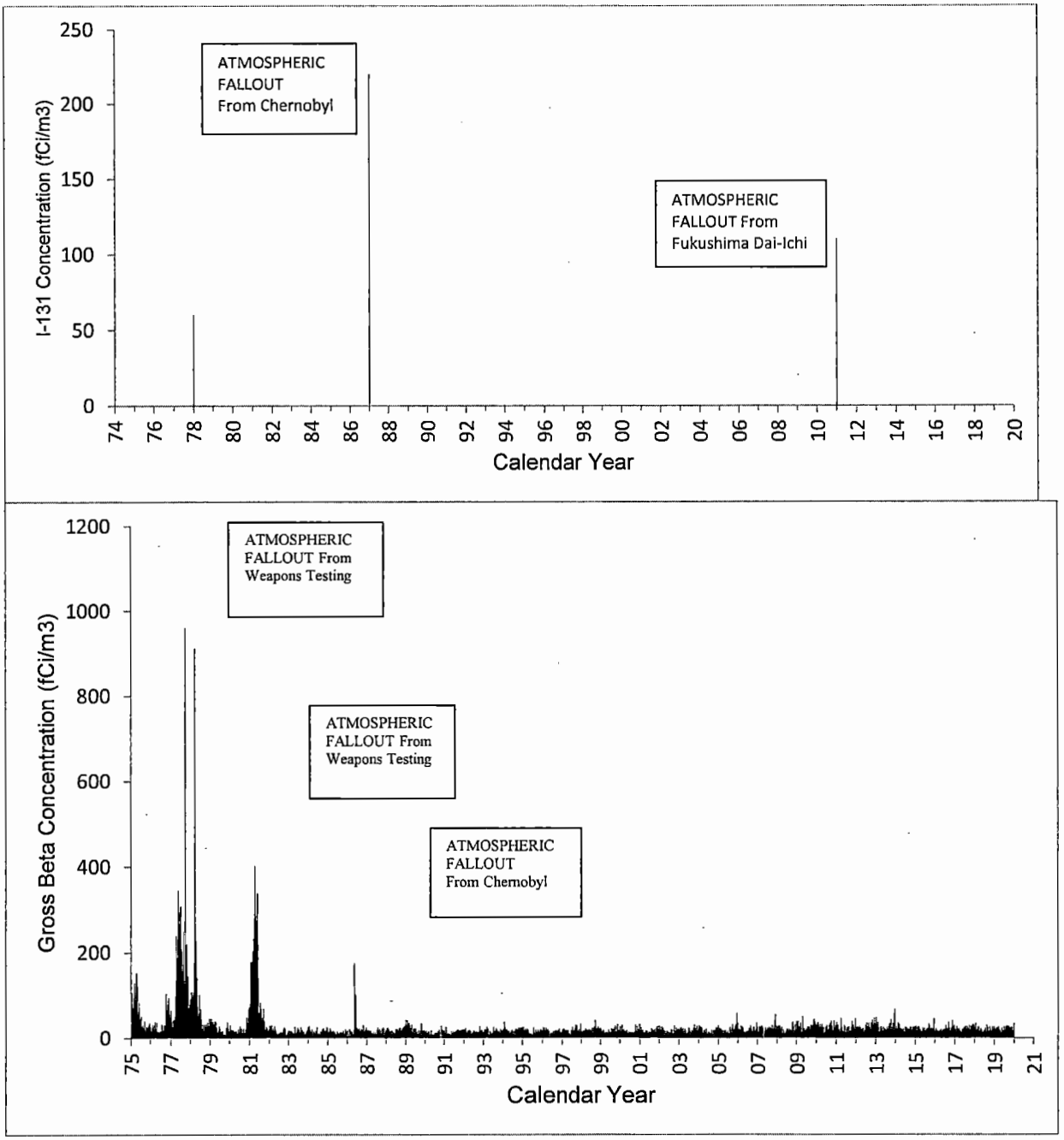
II.C.2.b Air Iodine

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.

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 TLDs in each overland sector surrounding the plant, both at the plant boundary and at 4 miles from the plant.

TLDs 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 June of 2018 the site adopted the requirements of the updated ANSI 13.34 standard which measures mean 91-day ambient radiation. The 2019 mean 91-day ambient radiation measured at the indicator locations was 10.49 mR and ranged from 4.50 to 17.60 mR as reported in Table 2. The control locations showed a 91-day mean of 12.22 mR with ranges from 5.64 to 20.50 mR. The location with the highest overall mean of 15.06 was Taylors Island, Anderson's Property (sample code DR23) which ranged from 8.96 to 20.50 mR. Figure 4-a depicts the long-term trend of mean TLD exposure for the 4-mile, Control Location, and On-Site TLDs. The results for 2018 and 2019 were corrected for Extraneous Dose, which accounts for the slight downward shift in the baseline beginning in 2018. Figure 4-b depicts quarterly exposure at each TLD

location in 2019, 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 highlighted in bold. This is predominantly due to the higher 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 2019.

FIGURE 4a
Mean TLD Gamma Dose, Calvert Cliffs Nuclear Power Plant[BAP1][BAP2]

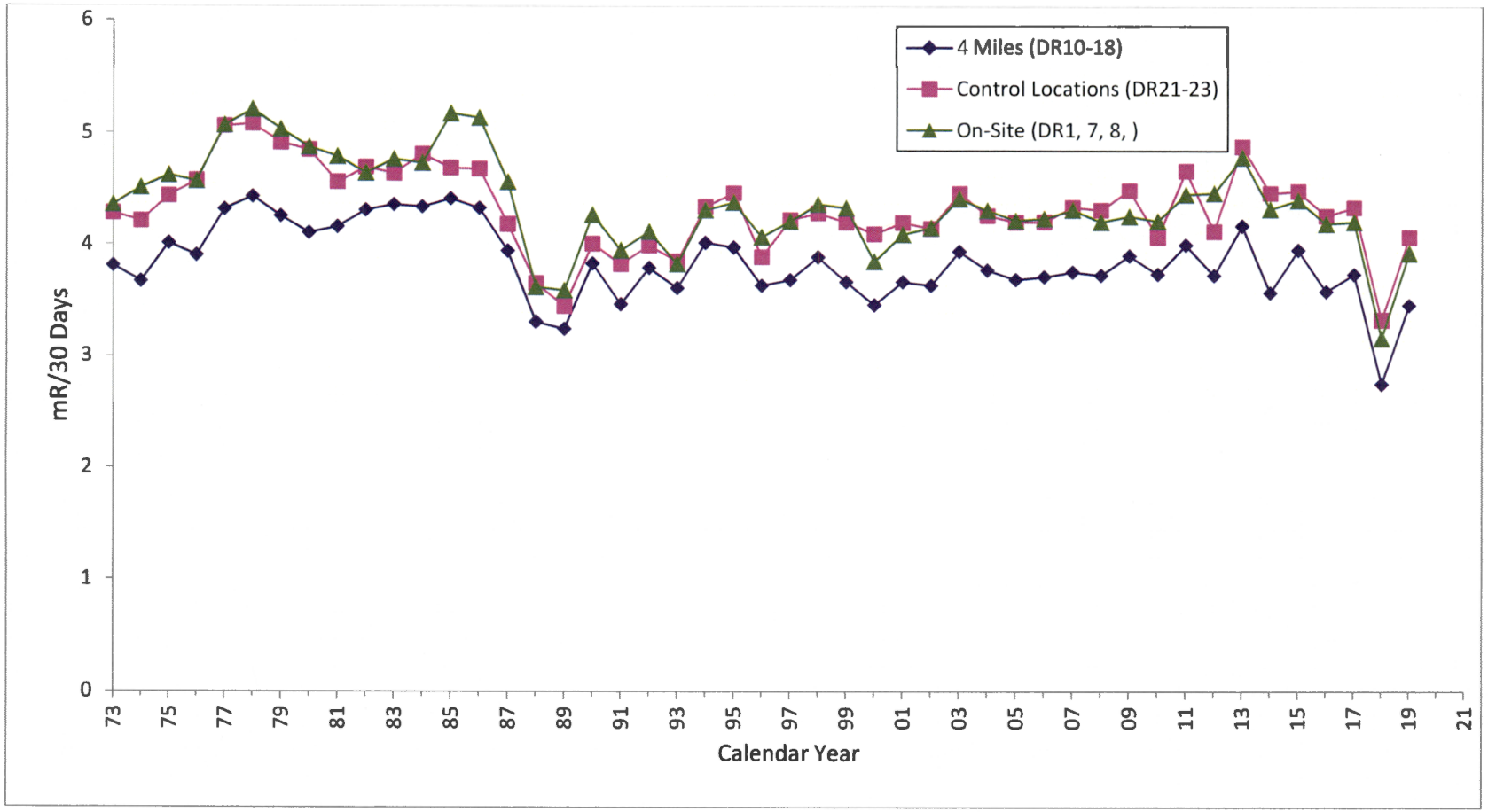
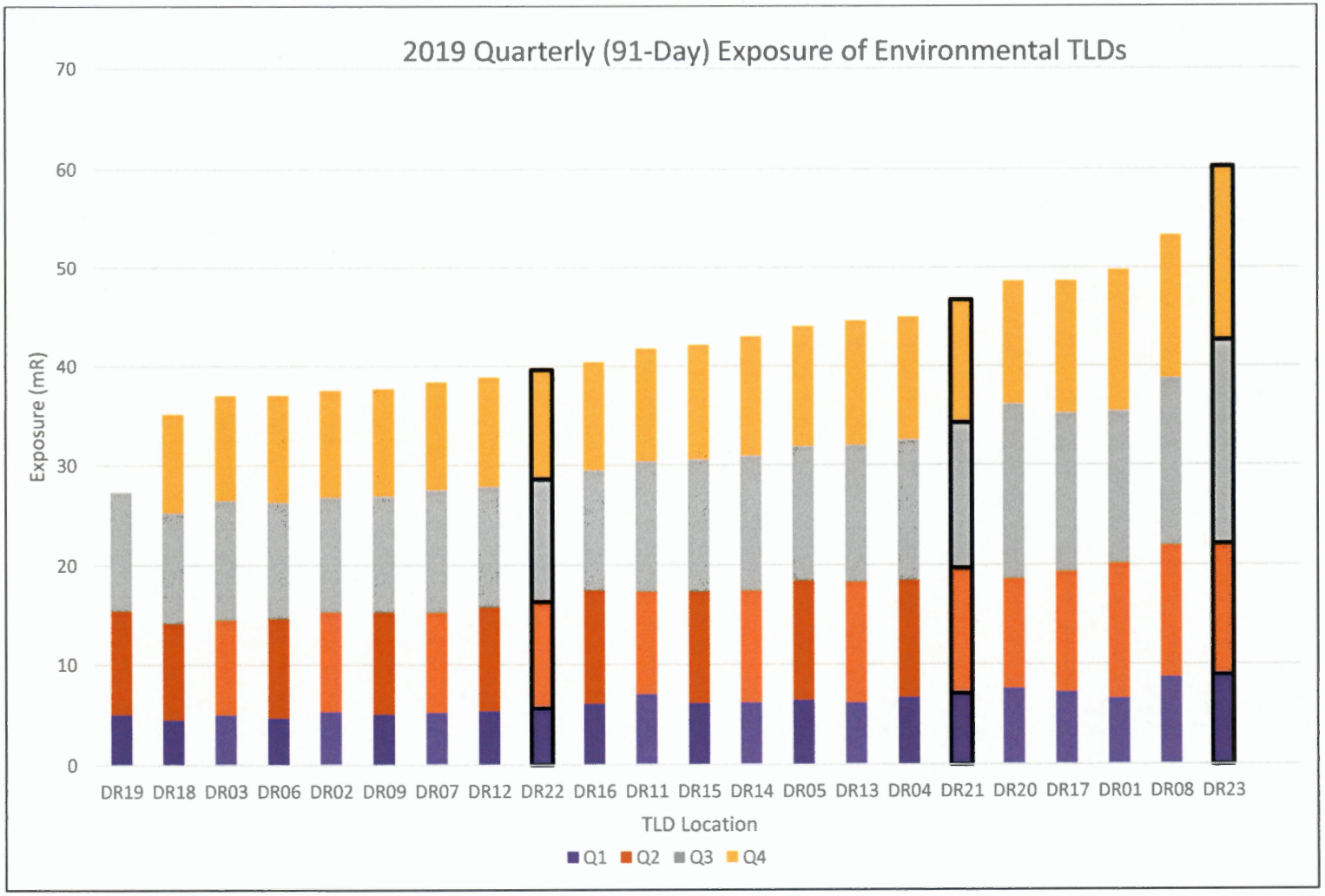


FIGURE 4b
2019 Quarterly TLD Gamma Dose, per Location, Calvert Cliffs Nuclear Power Plant



[BAP3]

II.D. CONCLUSION

No 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 TLD 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 using the plant's 2019 effluent release data, on site meteorological data (see X/Q and D/Q values presented in Figures 5 and 6), and appropriate pathways. The results of these dose calculations indicate:

Gaseous Pathways

A maximum thyroid dose of 1.77×10^{-4} mrem to a child via the plume, ground, vegetable, and inhalation pathways at 2.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0002% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body gamma dose of 4.36×10^{-5} mrem to a child at 2.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0002% 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 the skin, of 4.75×10^{-5} mrem to a child at 2.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0002% of the acceptable dose limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

Liquid Pathways

A maximum thyroid dose of 5.62×10^{-4} mrem to a teenager for all liquid pathways, which is about 0.001 % of the acceptable dose limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 7.34×10^{-4} mrem to a teenager via all liquid pathways, which is about 0.003 % 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 bone, of 1.17×10^{-3} mrem to a teenager for all pathways, which is 0.005% 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 7.39×10^{-4} mrem via liquid and gaseous pathways, which is about 0.001% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 7.78×10^{-4} mrem via liquid and gaseous pathways, which is about 0.003% 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 is equal to 1.22×10^{-3} mrem. This dose was about 0.005% 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 2019.

FIGURE 5

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

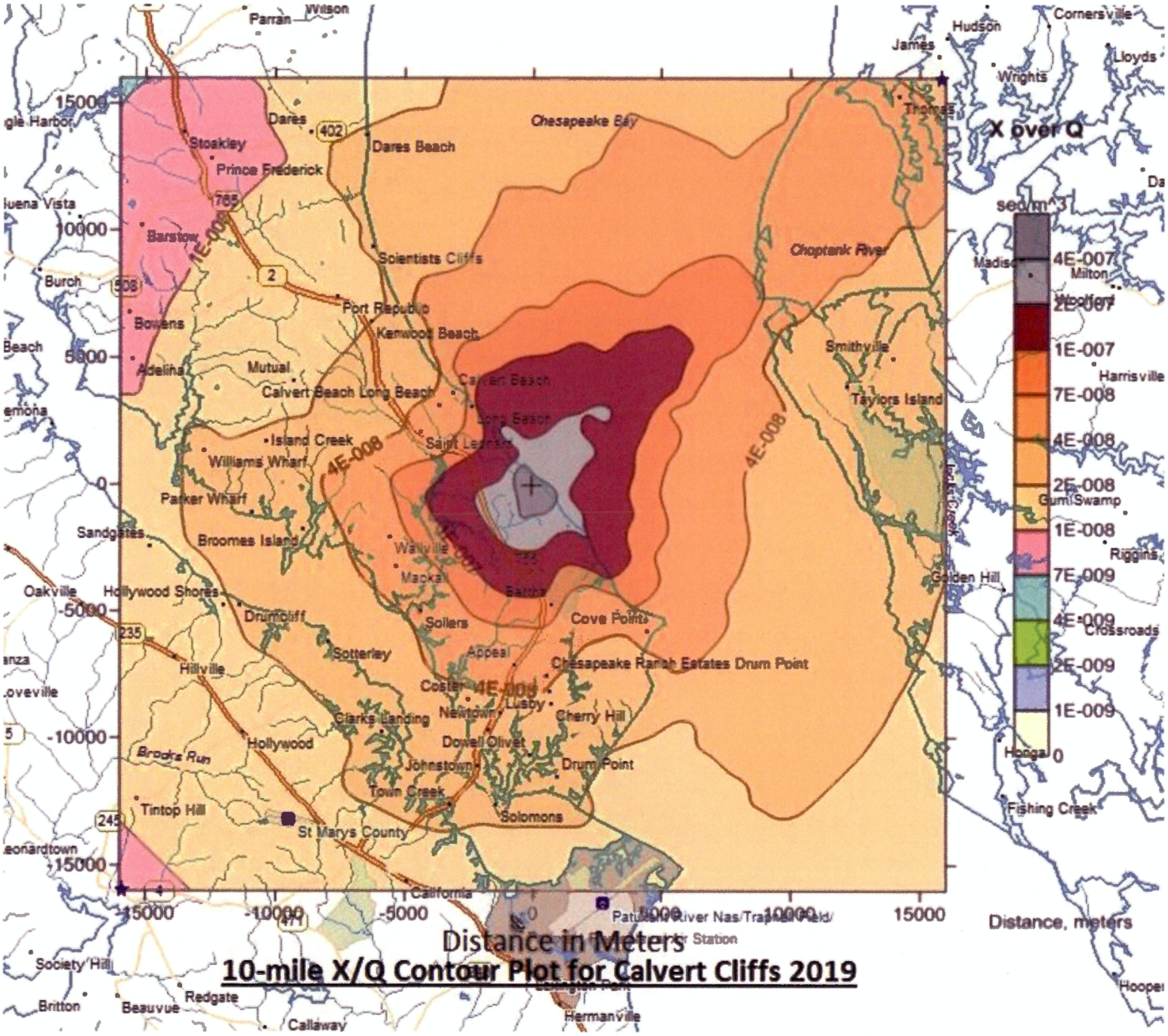


FIGURE 6

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

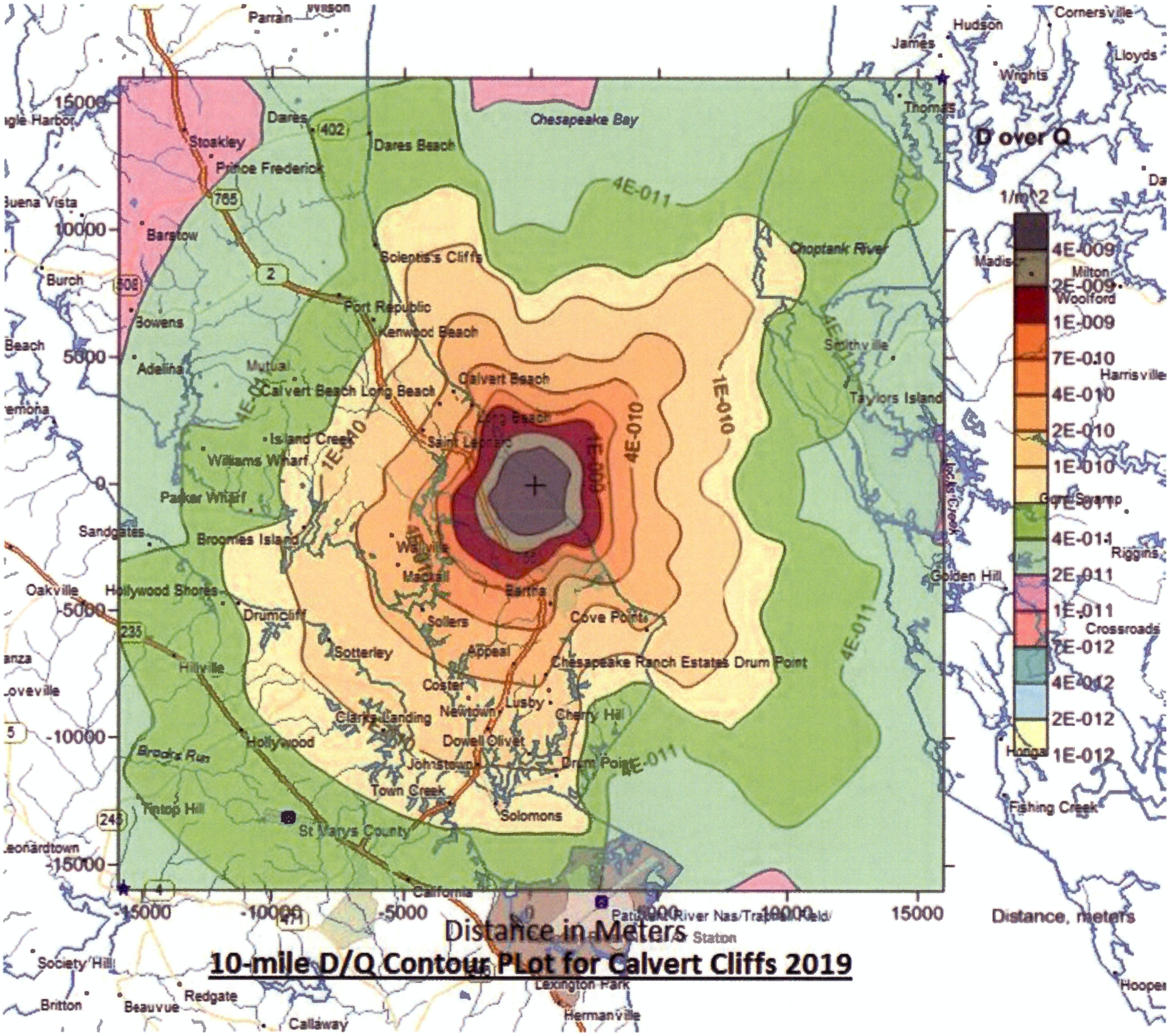


Table 1

Synopsis of 2019 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, Surface Water, Drinking 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	416	I-131	W	415
Air Particulates[4]	W	8	416	Gross Beta	W	415
				Gamma	QC	32
Direct Radiation						
Ambient Radiation	Q	23	552	TLD	Q	546
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 monthly 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, Surface Water, Drinking Water (pCi/L)	H-3 (8)	200pCi/L	385 (1/4) --	Discharge Vicinity WA2 0.3 km N	385 (1/4) --	-- --
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (415)	0.5	2.0 (363/364) (1.0-3.4)	EOF A5 19.3 km WNW	2.0 (52/52) (1.1-3.7)	2.0 (52/52) (1.1-3.7)
Direct Radiation						
Ambient Radiation (mR/91 days)	TLD (546)	--	10.49 (474/480) (4.50-17.60)	Taylors Island DR23 12.4 km ENE	15.07 (24/24) (8.96-20.5)	12.22 (72/72) (5.64-20.5)

[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.

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. During 2019, five additional canisters of spent fuel were 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, Exelon Industrial Services personnel according to Exelon Industrial Services 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.

III.B.4 Program Exceptions

There were no program exceptions to the ISFSI Program in 2019.

Calvert Cliffs began adopting the requirements of ANSI/HPS N13.34, Environmental Dosimetry, as suggested in NRC Regulatory Guide 4.3, Rev 2, in June 2018. The mean 90-day ambient radiation was reported for the first quarter of 2018. Beginning in June 2018, ambient radiation was reported as a 91-day average. In early 2020, the calculation for Facility-related dose was finalized and the dosimetry results from 2018 were re-calculated to correct for Extraneous dose. This event was entered in the corrective action program to document the deviation and track re-calculation of the 2018 data.

After correction for Extraneous Dose, the 2018 mean 91-day ambient radiation measured at the indicator locations was 27.24 mR and ranged from 6.12 to 70.60 mR. The control location shows a mean 91-day measurement of 9.95 mR with a range of 8.09 to 12.5 mR. The location with the highest overall mean of 59.63 mR was Southeast of ISFSI (sample code SFDR-14) which ranged from 50.00 to 70.60 mR. A comparison of the 2018 corrected vs non-corrected results is shown in the table below.

2018 ISFSI Ambient Radiation Quarterly (91-Day) Summary

	Exposure (mR)	Range (mR)	Exposure (mR) Corrected for Extraneous Dose	Range (mR) Corrected for Extraneous Dose
Indicator Locations	30.45	10.01 - 69.51	27.24	6.12 - 70.60
Control Location	13.23	12.47 - 14.00	9.95	8.09 - 12.5
Highest Overall Location (SFDR14)	62.32	51.1 7- 69.51	59.63	50.00- 70.60

Facility-related dose was detected 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 installed at the ISFSI each year. The ISFSI TLDs are located directly around the perimeter of the ISFSI. Due to the proximity of these TLDs 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 TLDs

(on-site, 4 miles, and beyond) show no observable increase in exposure when compared to control TLDs.

The 2018 mean 91-day Facility-related dose measured at the indicator locations was 18.04 mR and ranged from 5.33 to 52.50 mR. Facility-related dose was not detected at the indicator location. The location with the highest overall mean of 41.58 mR was Southeast of ISFSI (sample code SFDR14 which ranged from 31.90 to 52.50 mR. A summary of the 2018 results is shown in the table below.

2018 ISFSI Facility-related Dose Quarterly (91-Day) Summary		
	Exposure (mR)	**Range (mR)**
Indicator Locations	18.04	5.33- 52.50
Control Location	Not Detected	N/A
Highest Overall Location (SFDR14)	41.58	31.90- 52.50

III.C. RESULTS AND DISCUSSIONS

All the environmental samples collected were analyzed using Exelon Industrial Services 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 1.0×10^{-2} to 3.1×10^{-2} pCi/m^3 for the indicator locations and 1.1×10^{-2} to 3.2×10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 2.0×10^{-2} pCi/m^3 was SFA3, NNW of the ISFSI.

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 eight quarterly samples from indicator locations. The Cs-137 concentrations ranged from 58 ± 28 to 135 ± 50 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 TLDs surrounding the ISFSI. These TLDs are collected quarterly from nineteen locations surrounding the ISFSI, plus one control TLD 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 2019 mean 91-day ambient radiation measured at the ISFSI indicator locations was 28.30 mR and ranged from 5.22 to 63.70 mR as reported in Table 4. The control location showed a 91-day mean of 12.83 mR and ranged from 8.02 to 16.40 mR. The location with the highest overall mean of 54.10 mR with a range of 43.90 to 63.7 mR was SFDR14, SE 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 TLD 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 N of ISFSI (sample code SFDR2); 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 installed at the ISFSI each year. The ISFSI TLDs are located directly around the perimeter of the ISFSI. Due to the proximity of these TLDs 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 TLDs (on-site, 4 miles, and beyond) show no observable increase in exposure when compared to control TLDs.

The 2019 mean 91-day Facility-related dose measured at the indicator locations was 13.92 mR and ranged from 5.24 to 45.70 mR. Facility-related dose was not detected at the indicator location. The location with the highest overall mean of 36.08 mR was Southeast of ISFSI (sample code SFDR14 which ranged from 25.90 to 45.70 mR. A summary of the 2019 results is shown in the table below.

2019 ISFSI Facility-related Dose Quarterly (91-Day) Summary		
	Exposure (mR)	**Range (mR)**
Indicator Locations	13.92	5.24- 45.70
Control Location	Not Detected	N/A
Highest Overall Location (SFDR14)	36.08	25.90- 45.70

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 TLD Gamma Dose, ISFSI[BAP4][BAP5]

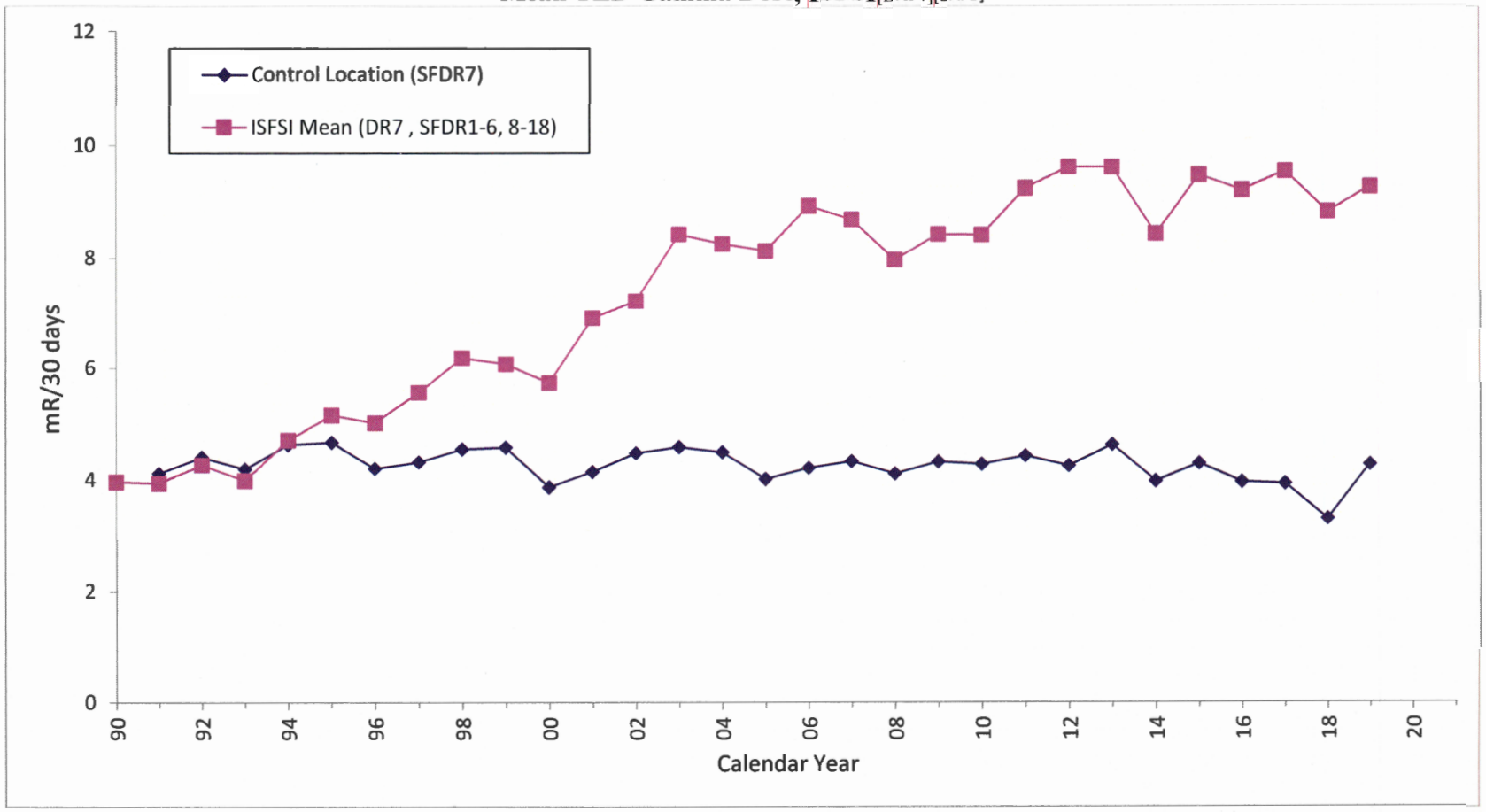


Table 3

Synopsis of 2019 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	480	TLD	Q	480
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	2.0 (208/208) (1.0-3.1)	NNW of ISFSI SFA3 0.1 km NNW	2.0 (52/52) (1.1-3.1)	1.9 (52/52) (1.1-3.2)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (480)	--	28.30 (456/456) (5.22-63.70)	SE of ISFSI SFDR14 0.1 km SE	54.10 (24/24) (43.90-63.70)	12.83 (24/24) (8.02-16.40)
Terrestrial Environment						
Soil (pCi/kg)	Gamma (20) Cs-137	--	91 (8/16) (58-135)	NNW of ISFSI SFS3 0.1 km NNW	102 (4/4) (87-135)	-- --

[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) Exelon Industrial Services 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 Analysis
b. CY-ES-239, EIS Collection Exchange of Field Dosimeters for Radiological Analysis
c. CY-ES-241, Vegetation Sample Collection for Radiological Analysis
d. CY-ES-242, Soil and Sediment Sample Collection for Radiological Analysis
e. CY-ES-247, Precipitation Sampling and Collection for Radiological Analysis

(8) Exelon Industrial Services Analytical Procedures
a. CY-ES-200, Operation of the Panasonic UD-716AGL Automatic Reader
b. CY-ES-204, Sample Preparation for Gamma Analysis
c. CY-ES-205, Operation of HPGe Detectors with the Genie PC Counting System
d. CY-ES-206, Operation of the Tennelec S5E Proportional Counter
e. CY-ES-246, Sample Preparation for Gross Beta Analysis

(9) Land Use Census Around Calvert Cliffs Nuclear Power Plant, August 2019

(10) Calvert Cliffs Independent Spent Fuel Storage Installation Technical Specifications, Appendix A to Materials License SNM-2505

(11) Baltimore Gas and Electric Company, Radiological Environmental Monitoring Program Pre-Operational Report for the Calvert Cliffs Independent Spent Fuel Storage Installation, August 1990 - November 1993, February 1994.

(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

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

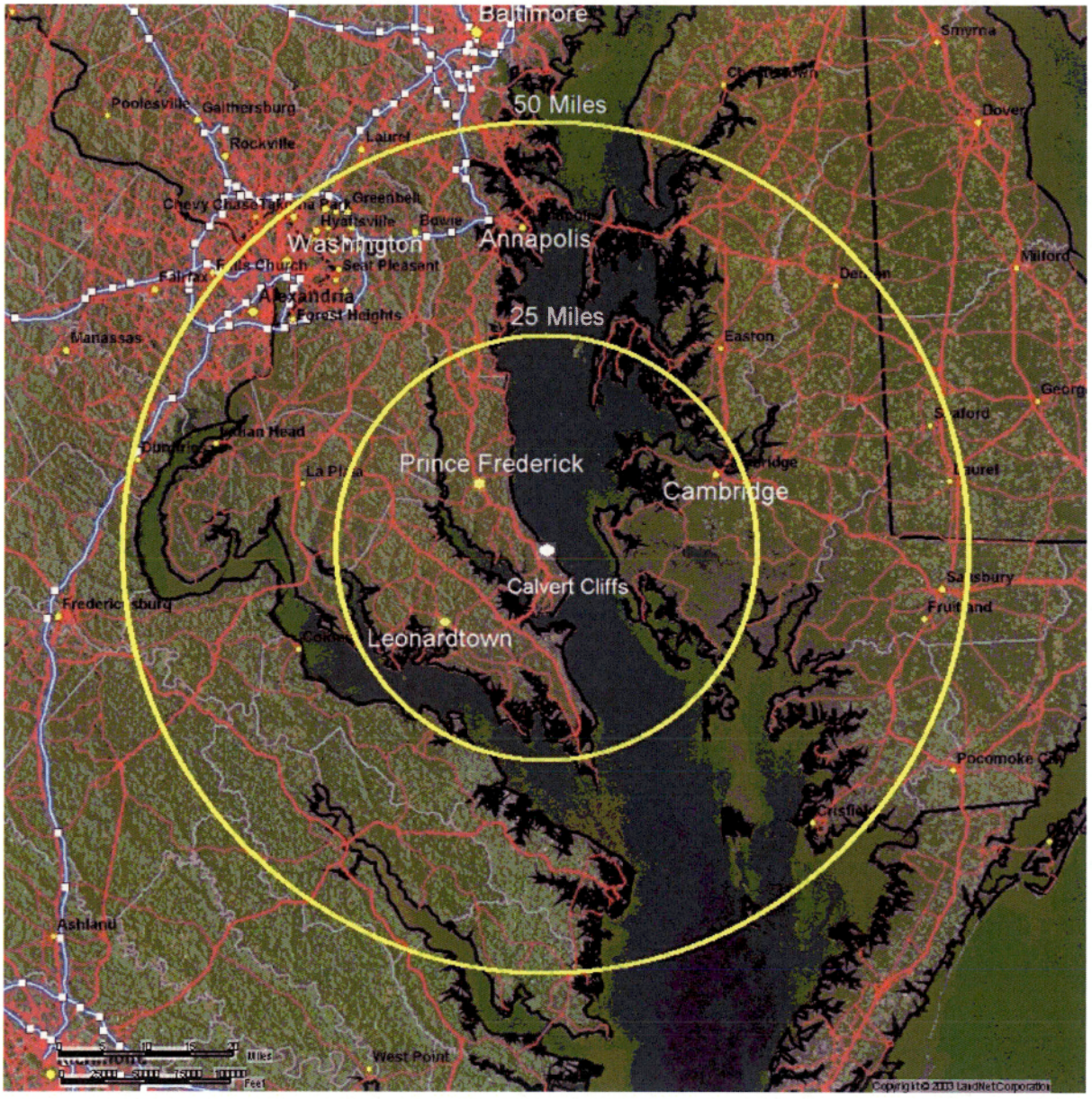


Figure A-2

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles

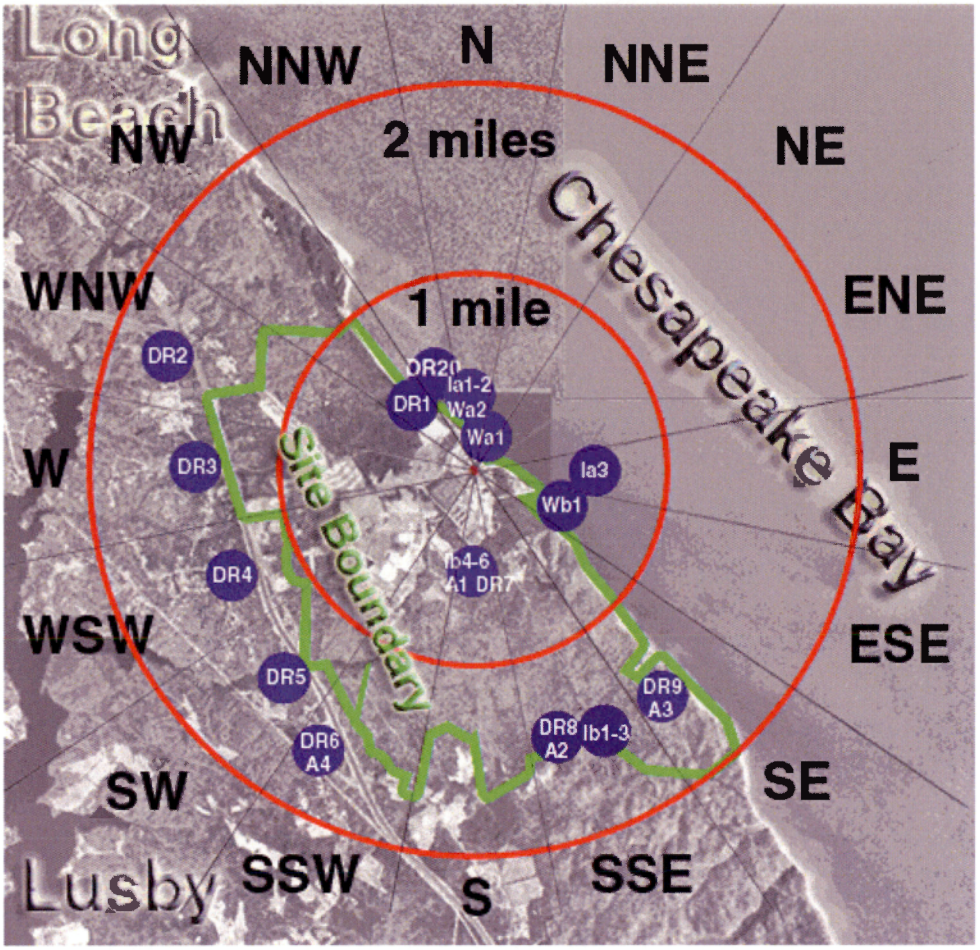


Figure A-3

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

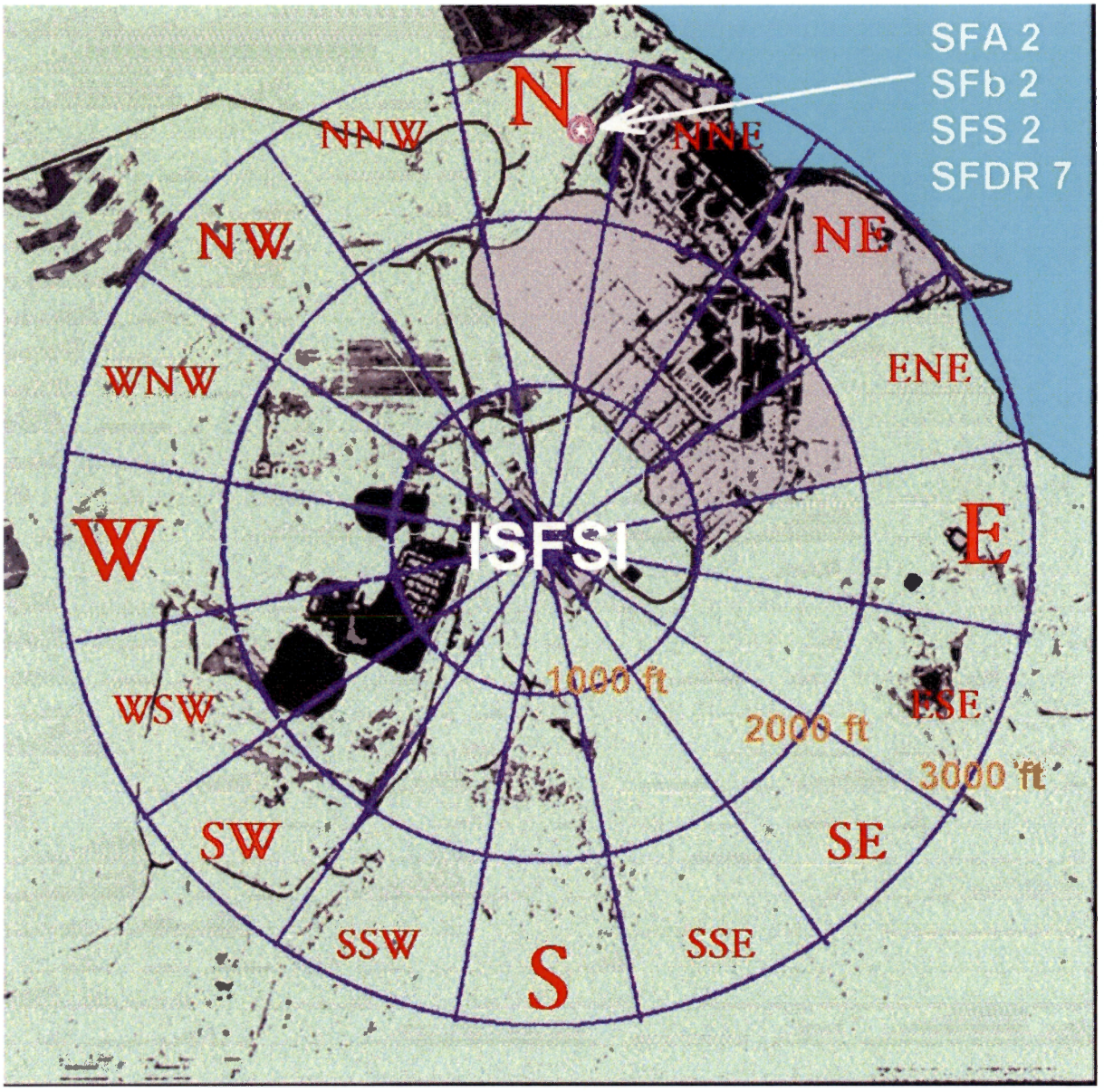
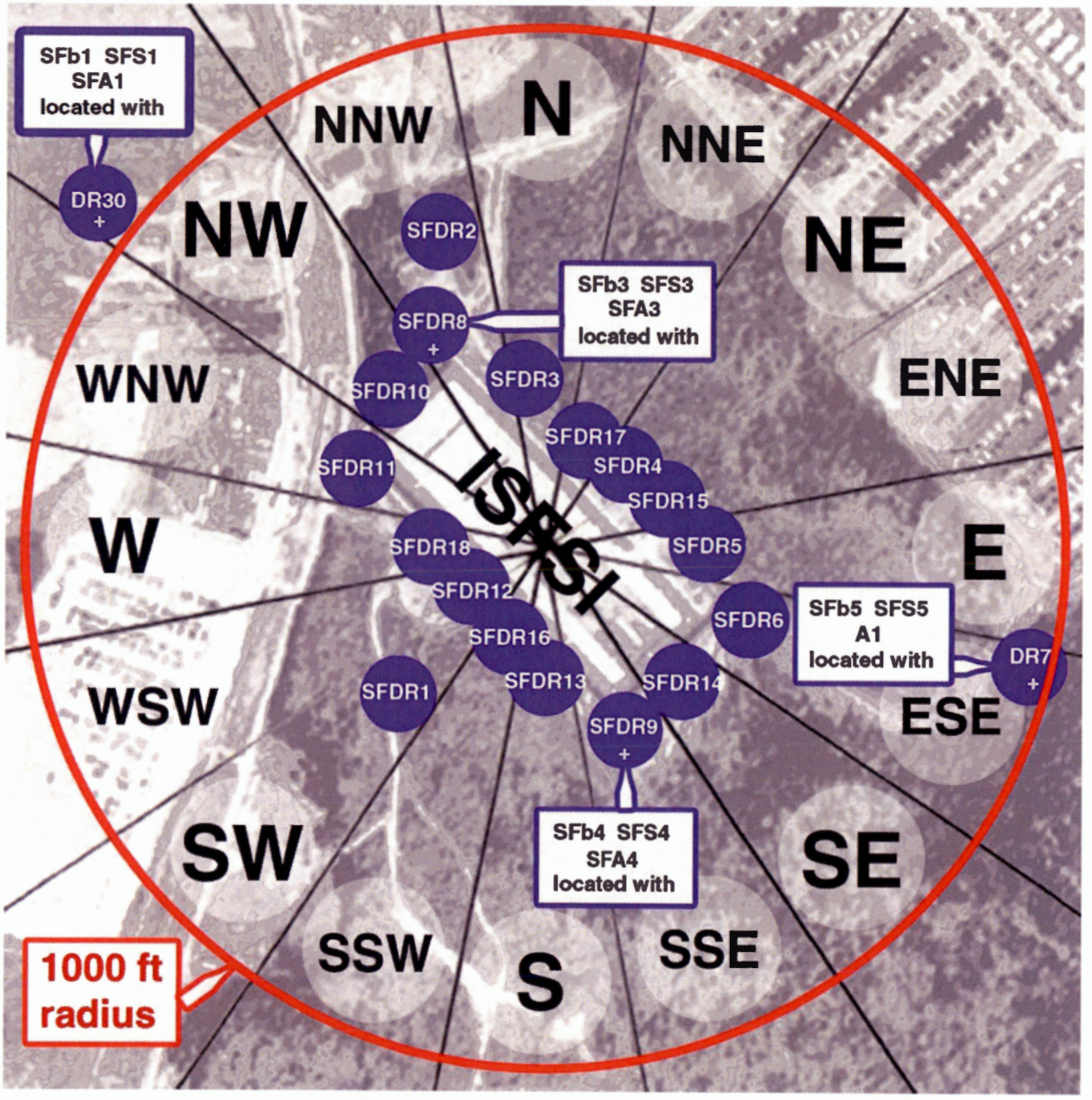


Figure A-5

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]
WA1			
Intake Vicinity	1/29/2019	*	
	2/27/2019	*	
	3/29/2019	*	<196
	4/26/2019	*	
	5/31/2019	*	
	7/1/2019	*	<185
	7/31/2019	*	
	8/30/2019	*	
	9/27/2019	*	<180
	11/1/2019	*	
	12/2/2019	*	
	12/31/2019	*	<184
WA2			
Discharge Vicinity	1/29/2019	*	
	2/27/2019	*	
	3/29/2019	*	385 ± 201
	5/1/2019	*	
	5/31/2019	*	
	7/1/2019	*	<184
	7/31/2019	*	
	8/30/2019	*	
	9/27/2019	*	<182
	11/1/2019	*	
	12/2/2019	*	
	12/31/2019	*	<187

[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	8/12/2019	Spot	*
IA2 Discharge Area	8/12/2019	Spanish Mackerel	*
IA4[1] Patuxent River	8/12/2019	Spot	*
IA5[1] Patuxent River	8/12/2019	Spanish Mackerel	*

[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	3/19/2019	*
	6/25/2019	*
	8/12/2019	*
	10/23/2019	*
IA6[1]		
Kenwood Beach	3/19/2019	*
	6/25/2019	*
	8/12/2019	*
	10/23/2019	*

[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.	4/29/2019	*
	10/1/2019	*

* 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)

Start Date	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
12/31/2018	1/7/2019	*	*	*	*	*	*	*	*
1/7/2019	1/14/2019	*	*	*	*	*	*	*	*
1/14/2019	1/22/2019	*	*	*	*	*	*	*	*
1/22/2019	1/28/2019	*	*	*	*	*	*	*	*
1/28/2019	2/4/2019	*	*	*	*	*	*	*	*
2/4/2019	2/11/2019	*	*	*	*	*	*	*	*
2/11/2019	2/18/2019	*	*	*	*	*	*	*	*
2/18/2019	2/26/2019	*	*	*	*	*	*	*	*
2/26/2019	3/4/2019	*	*	*	*	*	*	*	*
3/4/2019	3/12/2019	*	*	*	*	*	*	*	*
3/12/2019	3/19/2019	*	*	*	*	*	*	*	*
3/19/2019	3/26/2019	*	*	*	*	*	*	*	*
3/26/2019	4/2/2019	*	*	*	*	*	*	*	*
4/2/2019	4/8/2019	*	*	*	*	*	*	*	*
4/8/2019	4/15/2019	*	*	*	*	*	*	*	*
4/15/2019	4/23/2019	*	*	*	*	*	*	*	*
4/23/2019	4/29/2019	*	*	*	*	*	*	*	*
4/29/2019	5/7/2019	*	*	*	*	*	*	*	*
5/7/2019	5/13/2019	*	*	*	*	*	*	*	*
5/13/2019	5/20/2019	*	*	*	*	*	*	*	*
5/20/2019	5/28/2019	*	[3]	*	*	*	*	*	*
5/28/2019	6/3/2019	*	*	*	*	*	*	*	*
6/3/2019	6/10/2019	*	*	*	*	*	*	*	*
6/10/2019	6/17/2019	*	*	*	*	*	*	*	*
6/17/2019	6/24/2019	*	*	*	*	*	*	*	*
6/24/2019	7/1/2019	*	*	*	*	*	*	*	*
7/1/2019	7/8/2019	*	*	*	*	*	*	*	*
7/8/2019	7/15/2019	*	*	*	*	*	*	*	*
7/15/2019	7/22/2019	*	*	*	*	*	*	*	*
7/22/2019	7/30/2019	*	*	*	*	*	*	*	*
7/30/2019	8/5/2019	*	*	*	*	*	*	*	*
8/5/2019	8/12/2019	*	*	*	*	*	*	*	*
8/12/2019	8/19/2019	*	*	*	*	*	*	*	*
8/19/2019	8/26/2019	*	*	*	*	*	*	*	*
8/26/2019	9/3/2019	*	*	*	*	*	*	*	*

Table B-5

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

Start Date	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
9/3/2019	9/9/2019	*	*	*	*	*	*	*	*
9/9/2019	9/16/2019	*	*	*	*	*	*	*	*
9/16/2019	9/23/2019	*	*	*	*	*	*	*	*
9/23/2019	10/1/2019	*	*	*	*	*	*	*	*
10/1/2019	10/7/2019	*	*	*	*	*	*	*	*
10/7/2019	10/14/2019	*	*	*	*	*	*	*	*
10/14/2019	10/21/2019	*	*	*	*	*	*	*	*
10/21/2019	10/28/2019	*	*	*	*	*	*	*	*
10/28/2019	11/4/2019	*	*	*	*	*	*	*	*
11/4/2019	11/11/2019	*	*	*	*	*	*	*	*
11/11/2019	11/18/2019	*	*	*	*	*	*	*	*
11/18/2019	11/25/2019	*	*	*	*	*	*	*	*
11/25/2019	12/2/2019	*	*	*	*	*	*	*	*
12/2/2019	12/9/2019	*	*	*	*	*	*	*	*
12/9/2019	12/16/2019	*	*	*	*	*	*	*	*
12/16/2019	12/23/2019	*	*	*	*	*	*	*	*
12/23/2019	12/30/2019	*	*	*	*	*	*	*	*

[1] Control Location REMP Technical Specifications
[2] Control Location ISFSI REMP Program
[3] Lost Sample Due to Power Outage
* 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)

Start Date	Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
12/31/2018	1/7/2019	2.2 ± 0.1	2.3 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.1 ± 0.1
1/7/2019	1/14/2019	1.6 ± 0.1	1.6 ± 0.1	1.4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1
1/14/2019	1/22/2019	1.7 ± 0.1	1.5 ± 0.1	1.4 ± 0.1	1.7 ± 0.1	1.7 ± 0.1
1/22/2019	1/28/2019	2.0 ± 0.1	2.0 ± 0.1	2.1 ± 0.1	1.9 ± 0.1	2.0 ± 0.1
1/28/2019	2/4/2019	2.5 ± 0.1	2.6 ± 0.1	2.5 ± 0.1	2.3 ± 0.1	2.4 ± 0.1
2/4/2019	2/11/2019	2.3 ± 0.1	2.4 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.4 ± 0.1
2/11/2019	2/18/2019	1.7 ± 0.1	1.9 ± 0.1	1.7 ± 0.1	1.9 ± 0.1	1.8 ± 0.1
2/18/2019	2/26/2019	2.3 ± 0.1	2.5 ± 0.1	2.1 ± 0.1	2.3 ± 0.1	2.1 ± 0.1
2/26/2019	3/4/2019	1.7 ± 0.1	1.8 ± 0.1	1.6 ± 0.1	1.6 ± 0.1	1.8 ± 0.1
3/4/2019	3/12/2019	2.0 ± 0.1	2.0 ± 0.1	2.0 ± 0.1	2.0 ± 0.1	1.9 ± 0.1
3/12/2019	3/19/2019	2.6 ± 0.1	2.7 ± 0.1	2.7 ± 0.1	2.6 ± 0.1	2.5 ± 0.1
3/19/2019	3/26/2019	1.4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.4 ± 0.1
3/26/2019	4/2/2019	1.3 ± 0.1	1.2 ± 0.1	1.3 ± 0.1	1.3 ± 0.1	1.4 ± 0.1
4/2/2019	4/8/2019	2.1 ± 0.1	1.9 ± 0.1	2.0 ± 0.1	1.8 ± 0.1	2.0 ± 0.1
4/8/2019	4/15/2019	1.2 ± 0.1	1.1 ± 0.1	1.1 ± 0.1	1.2 ± 0.1	1.2 ± 0.1
4/15/2019	4/23/2019	1.1 ± 0.1	1.0 ± 0.1	1.1 ± 0.1	1.1 ± 0.1	1.1 ± 0.1
4/23/2019	4/29/2019	1.4 ± 0.1	1.4 ± 0.1	1.6 ± 0.1	1.7 ± 0.1	1.5 ± 0.1
4/29/2019	5/7/2019	1.2 ± 0.1	1.2 ± 0.1	1.3 ± 0.1	1.2 ± 0.1	1.3 ± 0.1
5/7/2019	5/13/2019	1.1 ± 0.1	1.2 ± 0.1	1.2 ± 0.1	1.2 ± 0.1	1.2 ± 0.1
5/13/2019	5/20/2019	2.0 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.3 ± 0.1	2.2 ± 0.1
5/20/2019	5/28/2019	1.4 ± 0.1	[2]	1.4 ± 0.1	1.5 ± 0.1	1.4 ± 0.1
5/28/2019	6/3/2019	2.0 ± 0.1	2.0 ± 0.1	1.8 ± 0.1	2.0 ± 0.1	1.9 ± 0.1
6/3/2019	6/10/2019	1.8 ± 0.1	1.6 ± 0.4	1.7 ± 0.1	1.7 ± 0.1	1.8 ± 0.1
6/10/2019	6/17/2019	1.4 ± 0.1	1.3 ± 0.1	1.3 ± 0.1	1.5 ± 0.1	1.4 ± 0.1
6/17/2019	6/24/2019	1.3 ± 0.1	1.1 ± 0.1	1.1 ± 0.1	1.3 ± 0.1	1.2 ± 0.1
6/24/2019	7/1/2019	2.4 ± 0.1	2.3 ± 0.1	2.2 ± 0.1	2.5 ± 0.1	2.4 ± 0.1
7/1/2019	7/8/2019	1.9 ± 0.1	1.8 ± 0.1	1.8 ± 0.1	1.9 ± 0.1	1.7 ± 0.1
7/8/2019	7/15/2019	1.5 ± 0.1	1.6 ± 0.1	1.8 ± 0.1	1.7 ± 0.1	1.8 ± 0.1
7/15/2019	7/22/2019	2.2 ± 0.1	2.3 ± 0.1	2.1 ± 0.1	2.4 ± 0.1	2.3 ± 0.1
7/22/2019	7/30/2019	1.8 ± 0.1	1.9 ± 0.1	1.8 ± 0.1	1.9 ± 0.1	2.0 ± 0.1
7/30/2019	8/5/2019	2.7 ± 0.2	2.8 ± 0.2	2.6 ± 0.2	2.5 ± 0.2	2.4 ± 0.2
8/5/2019	8/12/2019	2.2 ± 0.1	2.4 ± 0.1	2.5 ± 0.1	2.5 ± 0.1	2.3 ± 0.1
8/12/2019	8/19/2019	2.7 ± 0.1	2.6 ± 0.1	2.7 ± 0.2	2.8 ± 0.2	3.0 ± 0.2
8/19/2019	8/26/2019	1.8 ± 0.1	1.9 ± 0.1	1.9 ± 0.1	1.9 ± 0.1	2.0 ± 0.1
8/26/2019	9/3/2019	2.1 ± 0.1	2.2 ± 0.1	2.2 ± 0.1	2.2 ± 0.1	2.3 ± 0.1

Table B-6

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

Start Date	Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
9/3/2019	9/9/2019	2.7 ± 0.2	2.5 ± 0.2	2.6 ± 0.2	2.5 ± 0.2	2.6 ± 0.2
9/9/2019	9/16/2019	2.5 ± 0.1	2.6 ± 0.1	2.7 ± 0.1	2.7 ± 0.1	2.8 ± 0.2
9/16/2019	9/23/2019	2.3 ± 0.1	2.3 ± 0.1	2.5 ± 0.1	2.3 ± 0.1	2.6 ± 0.1
9/23/2019	10/1/2019	2.6 ± 0.1	2.5 ± 0.1	2.7 ± 0.1	2.7 ± 0.1	2.6 ± 0.1
10/1/2019	10/7/2019	2.0 ± 0.1	1.9 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.1 ± 0.1
10/7/2019	10/14/2019	1.9 ± 0.1	1.8 ± 0.1	1.9 ± 0.1	2.0 ± 0.1	1.9 ± 0.1
10/14/2019	10/21/2019	2.3 ± 0.1	2.4 ± 0.2	2.4 ± 0.1	2.3 ± 0.1	2.2 ± 0.1
10/21/2019	10/28/2019	1.9 ± 0.1	1.6 ± 0.1	1.5 ± 0.1	1.7 ± 0.1	1.7 ± 0.1
10/28/2019	11/4/2019	1.6 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.5 ± 0.1
11/4/2019	11/11/2019	2.7 ± 0.2	2.3 ± 0.1	1.9 ± 0.1	2.5 ± 0.1	2.6 ± 0.1
11/11/2019	11/18/2019	2.1 ± 0.1	2.1 ± 0.1	2.3 ± 0.1	2.0 ± 0.1	2.3 ± 0.1
11/18/2019	11/25/2019	2.5 ± 0.1	2.3 ± 0.1	2.3 ± 0.1	2.4 ± 0.1	2.6 ± 0.1
11/25/2019	12/2/2019	1.6 ± 0.1	1.4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.6 ± 0.1
12/2/2019	12/9/2019	1.6 ± 0.1	1.3 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.6 ± 0.1
12/9/2019	12/16/2019	1.6 ± 0.1	1.5 ± 0.1	1.6 ± 0.1	1.7 ± 0.1	1.8 ± 0.1
12/16/2019	12/23/2019	2.5 ± 0.1	2.7 ± 0.1	2.6 ± 0.1	2.6 ± 0.1	2.7 ± 0.1
12/23/2019	12/30/2019	3.0 ± 0.2	3.1 ± 0.2	2.8 ± 0.2	3.4 ± 0.2	3.7 ± 0.2

[1] Control Location
[2] Lost Sample Due to Power Outage

Table B-6 - Continued

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

Start Date	Stop Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
12/31/2018	1/7/2019	1.9 ± 0.1	2.2 ± 0.1	2.0 ± 0.1	2.1 ± 0.1
1/7/2019	1/14/2019	1.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.1
1/14/2019	1/22/2019	1.5 ± 0.1	1.6 ± 0.1	1.7 ± 0.1	1.7 ± 0.1
1/22/2019	1/28/2019	2.1 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.2 ± 0.1
1/28/2019	2/4/2019	2.3 ± 0.1	2.4 ± 0.1	2.4 ± 0.1	2.3 ± 0.1
2/4/2019	2/11/2019	2.2 ± 0.1	2.3 ± 0.1	2.5 ± 0.1	2.2 ± 0.1
2/11/2019	2/18/2019	1.8 ± 0.1	1.8 ± 0.1	2.0 ± 0.1	1.8 ± 0.1
2/18/2019	2/26/2019	2.4 ± 0.1	2.3 ± 0.1	2.4 ± 0.1	2.5 ± 0.1
2/26/2019	3/4/2019	1.7 ± 0.1	1.5 ± 0.1	1.7 ± 0.1	1.7 ± 0.1
3/4/2019	3/12/2019	2.0 ± 0.1	2.1 ± 0.1	2.1 ± 0.1	2.0 ± 0.1
3/12/2019	3/19/2019	2.5 ± 0.1	2.6 ± 0.1	2.6 ± 0.1	2.5 ± 0.1
3/19/2019	3/26/2019	1.5 ± 0.1	1.5 ± 0.1	1.4 ± 0.1	1.3 ± 0.1
3/26/2019	4/2/2019	1.3 ± 0.1	1.4 ± 0.1	1.3 ± 0.1	1.2 ± 0.1
4/2/2019	4/8/2019	1.7 ± 0.1	1.6 ± 0.1	1.9 ± 0.1	1.9 ± 0.1
4/8/2019	4/15/2019	1.1 ± 0.1	1.2 ± 0.1	1.1 ± 0.1	1.1 ± 0.1
4/15/2019	4/23/2019	1.1 ± 0.1	1.1 ± 0.1	1.1 ± 0.1	1.1 ± 0.1
4/23/2019	4/29/2019	1.7 ± 0.1	1.5 ± 0.1	1.6 ± 0.1	1.4 ± 0.1
4/29/2019	5/7/2019	1.2 ± 0.1	1.1 ± 0.1	1.2 ± 0.1	1.0 ± 0.1
5/7/2019	5/13/2019	1.2 ± 0.1	1.1 ± 0.1	1.2 ± 0.1	1.1 ± 0.1
5/13/2019	5/20/2019	2.3 ± 0.1	2.1 ± 0.1	2.2 ± 0.1	2.1 ± 0.1
5/20/2019	5/28/2019	1.5 ± 0.1	1.3 ± 0.1	1.5 ± 0.1	1.4 ± 0.1
5/28/2019	6/3/2019	2.0 ± 0.1	1.9 ± 0.1	2.0 ± 0.1	1.9 ± 0.1
6/3/2019	6/10/2019	1.8 ± 0.1	1.6 ± 0.1	1.7 ± 0.1	1.6 ± 0.1
6/10/2019	6/17/2019	1.5 ± 0.1	1.3 ± 0.1	1.5 ± 0.1	1.3 ± 0.1
6/17/2019	6/24/2019	1.3 ± 0.1	1.2 ± 0.1	1.3 ± 0.1	1.2 ± 0.1
6/24/2019	7/1/2019	2.5 ± 0.1	2.3 ± 0.1	2.6 ± 0.1	2.4 ± 0.1
7/1/2019	7/8/2019	1.9 ± 0.1	1.7 ± 0.1	1.8 ± 0.1	1.7 ± 0.1
7/8/2019	7/15/2019	1.8 ± 0.1	1.6 ± 0.1	1.5 ± 0.1	1.5 ± 0.1
7/15/2019	7/22/2019	2.3 ± 0.1	2.3 ± 0.1	2.5 ± 0.1	2.3 ± 0.1
7/22/2019	7/30/2019	2.0 ± 0.1	1.8 ± 0.1	1.9 ± 0.1	1.7 ± 0.1
7/30/2019	8/5/2019	2.7 ± 0.2	2.5 ± 0.2	2.6 ± 0.2	2.4 ± 0.2
8/5/2019	8/12/2019	2.6 ± 0.1	2.4 ± 0.1	2.5 ± 0.1	2.2 ± 0.1
8/12/2019	8/19/2019	2.8 ± 0.2	2.5 ± 0.1	2.8 ± 0.2	2.4 ± 0.1
8/19/2019	8/26/2019	1.9 ± 0.1	1.7 ± 0.1	1.9 ± 0.1	1.9 ± 0.1
8/26/2019	9/3/2019	2.0 ± 0.1	1.9 ± 0.1	2.2 ± 0.1	2.0 ± 0.1

Table B-6 - Continued

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

Start Date	Stop Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
9/3/2019	9/9/2019	2.7 ± 0.2	2.5 ± 0.2	2.4 ± 0.2	2.5 ± 0.2
9/9/2019	9/16/2019	2.6 ± 0.1	2.4 ± 0.1	2.5 ± 0.1	2.6 ± 0.1
9/16/2019	9/23/2019	2.3 ± 0.1	2.2 ± 0.1	2.4 ± 0.1	2.3 ± 0.1
9/23/2019	10/1/2019	2.6 ± 0.1	2.5 ± 0.1	2.6 ± 0.1	2.5 ± 0.1
10/1/2019	10/7/2019	2.2 ± 0.2	1.9 ± 0.1	2.0 ± 0.1	2.0 ± 0.1
10/7/2019	10/14/2019	2.1 ± 0.1	1.8 ± 0.1	1.9 ± 0.1	1.9 ± 0.1
10/14/2019	10/21/2019	2.3 ± 0.1	2.2 ± 0.1	2.4 ± 0.1	2.1 ± 0.1
10/21/2019	10/28/2019	1.8 ± 0.1	1.7 ± 0.1	1.9 ± 0.1	1.6 ± 0.1
10/28/2019	11/4/2019	1.5 ± 0.1	1.5 ± 0.1	1.4 ± 0.1	1.6 ± 0.1
11/4/2019	11/11/2019	2.6 ± 0.1	2.5 ± 0.1	2.6 ± 0.1	2.4 ± 0.1
11/11/2019	11/18/2019	2.1 ± 0.1	2.0 ± 0.1	2.0 ± 0.1	2.1 ± 0.1
11/18/2019	11/25/2019	2.5 ± 0.1	2.2 ± 0.1	2.7 ± 0.2	2.3 ± 0.1
11/25/2019	12/2/2019	1.6 ± 0.1	1.8 ± 0.1	1.6 ± 0.1	1.5 ± 0.1
12/2/2019	12/9/2019	1.5 ± 0.1	1.4 ± 0.1	1.4 ± 0.1	1.4 ± 0.1
12/9/2019	12/16/2019	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	1.5 ± 0.1
12/16/2019	12/23/2019	2.5 ± 0.1	2.6 ± 0.1	2.6 ± 0.1	2.4 ± 0.1
12/23/2019	12/30/2019	2.8 ± 0.2	3.2 ± 0.2	3.1 ± 0.2	3.0 ± 0.2

[1] Control Location

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
4/2/2019	*	*	*	*	*
7/1/2019	*	*	*	*	*
10/1/2019	*	*	*	*	*
12/30/2019	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
4/2/2019	*	*	*	*
7/1/2019	*	*	*	*
10/1/2019	*	*	*	*
12/30/2019	*	*	*	*

[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) ± 2σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
IB4			
Camp Conoy Entrance	6/24/2019	Kale	*
	7/22/2019	Cabbage	*
	8/19/2019	Collards	*
	9/23/2019	Chard	*
IB5			
Camp Conoy Entrance	6/24/2019	Collards	*
	7/22/2019	Chard	*
	8/19/2019	Chard	*
	9/23/2019	Cabbage	*
IB6			
Camp Conoy Entrance	6/24/2019	Cabbage	*
	7/22/2019	Kale	*
	8/19/2019	Kale	*
	9/23/2019	Collards	*
IB7[1]			
EOF	6/24/2019	Collards	*
	7/22/2019	Eggplant Leaves	*
	8/19/2019	Kale	*
	9/23/2019	Chard	*
IB8[1]			
EOF	6/24/2019	Chard	*
	7/22/2019	Chard	*
	8/19/2019	Chard	*
	9/23/2019	Eggplant Leaves	*
IB9[1]			
EOF	6/24/2019	Eggplant Leaves	*
	7/22/2019	Kale	*
	8/19/2019	Eggplant Leaves	*
	9/23/2019	Cabbage	*

Table B-8a

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

Sample Code	Sample Date	Sample Type	Gamma Emitters
IB10			
Meteorological Station	6/24/2019	Kale	*
	7/22/2019	Collards	*
	8/19/2019	Chard	*
	9/23/2019	Chard	*
IB11			
Meteorological Station	6/24/2019	Chard	*
	7/22/2019	Chard	*
	8/19/2019	Collards	*
	9/23/2019	Cabbage	*
IB12			
Meteorological Station	6/24/2019	Cabbage	*
	7/22/2019	Cabbage	*
	8/19/2019	Cabbage	*
	9/23/2019	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	2/26/2019	*
	6/12/2019	*
	9/16/2019	*
	11/18/2019	*
SFB2[1]		
Visitor's Center	2/26/2019	*
	6/12/2019	*
	9/16/2019	*
	11/18/2019	*
SFB3		
NNW of ISFSI	2/26/2019	*
	6/12/2019	*
	9/16/2019	*
	11/18/2019	*
SFB4		
SSE of ISFSI	2/26/2019	*
	6/12/2019	*
	9/16/2019	*
	11/18/2019	*
SFB5		
On Site Before Entrance		
to Camp Conoy	2/26/2019	*
	6/12/2019	*
	9/16/2019	*
	11/18/2019	*

[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	2/26/2019	[1]	*
	6/12/2019	[1]	*
	9/16/2019	[1]	*
	11/18/2019	[1]	*
SFS2[2]			
Visitors Center	2/26/2019	[1]	*
	6/12/2019	[1]	*
	9/16/2019	[1]	*
	11/18/2019	[1]	*
SFS3			
NNW of ISFSI	2/26/2019	99 ± 44	*
	6/12/2019	87 ± 49	*
	9/16/2019	88 ± 39	*
	11/18/2019	135 ± 50	*
SFS4			
SSE of ISFSI	2/26/2019	[1]	*
	6/12/2019	[1]	*
	9/16/2019	[1]	*
	11/18/2019	[1]	*
SFS5			
Entrance to Camp Conoy	2/26/2019	86 ± 32	*
	6/12/2019	96 ± 25	*
	9/16/2019	81 ± 32	*
	11/18/2019	58 ± 28	*

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

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	4.03 - 16.6	16 - 182	2,747 - 4,505	21.5 -66.4	1,286 - 1,529	1,269 - 2,069	781 - 13,761	789 - 10,713	671 - 11,829
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	10.3 - 53.0
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	22.0 - 151
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	10.9 - 59.8
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	12.9 - 55.0
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	24.7 - 116
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	10.1 - 61.4
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	19.3 - 116
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	10.9 - 90.5
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	92.9 - 541
I-131[1]	2.73 - 914	0.4 - 14.9	21.4 - 2,340	4.87 - 9.04	0.4 - 11.6	22.4 - 107	470 - 2,040	139 - 8,060	13.4 - 854
Cs-134	0.31 - 1.08	2.8 - 5.3	7.8 - 16.0	2.92 - 5.48	3.2 - 5.9	9.7 - 16.5	43.3 - 82.4	33.4 - 109	11.1 - 58.1
Cs-137	0.27 - 1.03	2.0 - 5.4	3.8 - 17.5	2.97 - 5.43	3.4 - 6.0	10.0 - 16.7	38.4 - 65.4	39.1 - 135	11.1 - 62.3
La-140	2.01 – 116	3.6 - 14.6	15.9 - 444	4.87 - 10.3	4.5 - 11.4	24.1 - 80.4	368 - 773	136 - 1,820	9.1 - 388
Ba-140	2.01 - 116	3.6 - 14.6	15.9 - 444	5.86 - 26.0	4.5 - 11.4	24.1 - 80.4	368 – 773	136 - 1,820	9.1 - 388
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	46.6 - 289
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	93.9 - 850
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	8.9 - 54.1

[1] This MDA range for I-131 on a charcoal cartridge is typically 2.82 x 10^{-3} to 5.53 x 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	5.0	5.3	12	5.3	12	9.1	78	27
Cr-51	74	37	76	37	76	62	452	174
Mn-54	4.6	4.7	13	4.7	13	7.4	63	19
Co-58	6.7	4.3	12	4.3	12	8.2	78	23
Fe-59	20	11	27	11	27	18	123	57
Co-60	3.5	4.8	12	4.8	12	7.5	59	24
Zn-65	8.9	11	27	11	27	17	162	55
Nb-95	9.8	4.5	13	4.5	13	9.5	73	25
Zr-95	11	7.9	18	7.9	18	14	117	34
Ru-106	43	38	111	38	111	62	624	174
Ag-110m	4.2	4.3	11	4.3	11	6.0	65	20
Te-129m	101	56	118	56	118	90	833	263
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	18
Cs-137	4.2	5.1	11	5.1	11	6.9	78	21
Ba-140	47	23	39	23	39	46	103	111
La-140	47	9.2	15	9.2	15	13	103	30
Ce-144	15	23	45	23	45	37	288	70

* The LLD for I-131 measured on a charcoal cartridge is 5.3 $x10^{-2}$ pCi/m^3

Table B-12

Direct Radiation
(Results in Units of mR/91 days ± 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR01	On Site, along Cliffs	6.58 ± 0.94	13.60 ± 1.02	15.30 ± 1.13	14.30 ± 1.71
DR02	Route 765, Auto Dump	5.29 ± 0.49	10.00 ± 1.07	11.50 ± 0.64	10.80 ± 0.41
DR03	Route 765, Giovanni's Tavern	4.99 ± 0.39	9.51 ± 0.74	12.00 ± 0.84	10.60 ± 0.61
DR04	Route 765, across from Vera's Beach Club	6.69 ± 0.58	11.80 ± 0.65	14.00 ± 1.14	12.50 ± 0.53
DR05	Route 765, John's Creek	6.45 ± 0.80	12.00 ± 0.78	13.40 ± 0.67	12.20 ± 0.72
DR06	Route 765 at Lusby	4.68 ± 0.52	9.95 ± 0.68	11.70 ± 0.64	10.80 ± 0.47
DR07	Entrance to Camp Conoy	5.22 ± 0.79	10.00 ± 0.69	12.30 ± 0.39	10.90 ± 0.55
DR08	Camp Conoy Rd at Emergency Siren	8.70 ± 0.88	13.30 ± 0.84	16.80 ± 0.88	14.50 ± 0.55
DR09	Bay Breeze Rd	5.04 ± 0.58	10.20 ± 0.76	11.70 ± 0.49	10.80 ± 0.66
DR10	Calvert Beach Rd and Decatur Street	5.41 ± 0.49	10.50 ± 0.83	12.50 ± 0.82	10.90 ± 0.46
DR11	Dirt road off Mackall & Parren Rd	7.05 ± 1.46	10.30 ± 0.66	13.00 ± 0.62	11.40 ± 0.55
DR12	Mackall & Bowen Rds	5.36 ± 0.64	10.40 ± 0.68	12.10 ± 0.77	11.00 ± 0.71
DR13	Mackall Rd, near Wallville	6.18 ± 0.57	12.10 ± 0.76	13.70 ± 0.50	12.60 ± 0.59
DR14	Rodney Point	6.22 ± 0.58	11.20 ± 0.76	13.50 ± 0.61	12.10 ± 3.24
DR15	Mill Bridge & Turner Rds	6.15 ± 0.41	11.20 ± 0.65	13.20 ± 1.01	11.60 ± 0.47

Table B-12

Direct Radiation
(Results in Units of mR/91 days ± 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR16	Across from Appeal School	6.08 ± 0.56	11.40 ± 1.04	12.00 ± 0.53	10.90 ± 0.53
DR17	Cove Point & Little Cove Point Rds	7.24 ± 0.70	12.10 ± 0.89	15.90 ± 0.53	13.40 ± 0.69
DR18	Cove Point	4.50 ± 0.65	9.65 ± 0.87	11.10 ± 0.41	9.92 ± 0.45
DR19	Long Beach	5.02 ± 0.50	10.40 ± 1.00	11.90 ± 1.08	*
DR20	On site, near shore	7.61 ± 0.71	11.00 ± 0.59	17.60 ± 1.22	12.40 ± 0.70
DR21[1]	EOF	7.12 ± 0.53	12.60 ± 1.07	14.60 ± 1.15	12.40 ± 0.38
DR22[1]	Solomons Island	5.64 ± 0.78	10.70 ± 0.81	12.30 ± 0.34	11.00 ± 0.57
DR23[1]	Taylors Island	8.96 ± 0.91	13.20 ± 0.63	20.50 ± 0.71	17.60 ± 0.89
DR30	MET Station	6.25 ± 0.57	10.30 ± 0.71	12.00 ± 0.79	10.90 ± 0.55
SFDR01	SW of ISFSI	10.80 ± 1.02	14.50 ± 0.82	20.10 ± 1.63	17.00 ± 0.90
SFDR02	NNW of ISFSI	11.60 ± 0.75	15.90 ± 0.97	25.50 ± 4.77	18.20 ± 1.28
SFDR03	North of ISFSI	25.00 ± 3.08	27.40 ± 1.52	40.60 ± 3.97	37.60 ± 2.89
SFDR04	NE of ISFSI	23.30 ± 1.21	26.20 ± 1.09	41.70 ± 3.12	35.60 ± 2.09
SFDR05	East of ISFSI	15.00 ± 1.01	18.80 ± 0.65	28.50 ± 5.15	23.40 ± 0.99
SFDR06	ESE of ISFSI	12.60 ± 1.29	16.50 ± 1.01	23.60 ± 2.06	19.90 ± 1.11
SFDR07[1]	Visitor's Center	8.02 ± 0.58	12.80 ± 0.86	16.40 ± 0.83	14.10 ± 0.74

Table B-12

Direct Radiation
(Results in Units of mR/91 days ± 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
SFDR08	NNW of ISFSI	17.60 ± 1.75	21.50 ± 1.76	26.30 ± 1.95	24.20 ± 1.75
SFDR09	SSE of ISFSI	29.70 ± 2.15	39.40 ± 12.11	47.50 ± 4.34	47.60 ± 15.33
SFDR10	NW of ISFSI	17.70 ± 1.47	21.40 ± 1.41	36.40 ± 4.56	26.80 ± 1.68
SFDR11	WNW ISFSI	16.10 ± 1.17	23.50 ± 1.72	31.60 ± 2.19	27.30 ± 4.32
SFDR12	WSW of ISFSI	35.30 ± 5.48	33.60 ± 3.58	49.10 ± 7.10	40.60 ± 2.27
SFDR13	South of ISFSI	19.80 ± 3.02	24.40 ± 2.40	42.60 ± 9.38	33.40 ± 3.45
SFDR14	SE of ISFSI	47.20 ± 6.83	43.90 ± 2.42	63.70 ± 8.96	61.60 ± 16.34
SFDR15	ENE of ISFSI	18.20 ± 1.50	20.60 ± 1.06	31.20 ± 2.18	25.50 ± 2.48
SFDR16	SSW of ISFSI	37.10 ± 4.06	38.80 ± 3.50	58.90 ± 7.95	47.60 ± 3.56
SFDR17	NNE of ISFSI	30.60 ± 3.78	31.30 ± 1.39	44.00 ± 4.09	40.30 ± 1.98
SFDR18	West of ISFSI	29.80 ± 0.98	31.80 ± 1.58	46.90 ± 2.62	41.20 ± 1.92

[1] Control Location
* Damaged TLDs, data rejected

APPENDIX C

Quality Assurance Program

Appendix C is a summary of Exelon Industrial Services (EIS) laboratory's quality assurance program. It consists of Table C-1 which is a compilation of the results of the EIS 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 EIS laboratory's participation in a split sample program with Teledyne Brown Engineering located in Knoxville, Tennessee. Finally, Table C-3, is a list of the power plant's ODCM required LLDs, all of which are achieved by both EIS laboratory and Teledyne Brown Engineering for the analyses reported.

All the EIS 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]. The EIS 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.

The EIS laboratory results contained in Table C-2 are intercomparison results for routine samples analyzed for replicate and split analyses and evaluated for beta and non-natural gamma emitters. The EIS 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.

All the results contained in Table C-2 agree with their respective EIS laboratory original, replicate and/or Teledyne Brown Engineering's split laboratory samples, except for the comparisons of Beta emitters in a particulate sample with poor resolution at A2 collected on 06/10/19 and one sample involving the Cs-137 results for a bottom sediment sample at WBS4 collected on 6/25/19. The original and replicate analysis of the air particulate sample from A2 collected on 06/10/19 failed the NRC Resolution test criteria due to low volume collected resulting from a power outage to the air sampler. Poor resolution of these results is attributed to the low volume collected resulting in insufficient counting statistics. A nonconformance was issued on this event and recorded in the corrective action program.

In the bottom sediment sample, WBS2 collected on 6/25/19, the original and replicate analysis do pass NRC Resolution test criteria however the result does not agree within the required resolution for the split lab result. These minor discrepancies, which have been observed in previous reporting periods, are most probably due to counting statistics and/or the non-homogeneous nature of this type of sample.

All air particulate samples contain Beta emitters and are reported with a 2sigma uncertainty. The original and replicate analyses are evaluated for agreement using the NRC Resolution Test Criteria[1]. These samples must be composited for further analysis and this precludes them from being split for analysis of beta emitters. Filters and other samples whose nature generally preclude sample splitting are marked "**" in the Split Analysis column.

[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	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results	Pass / Fail [1]
03/14/19	Air Iodine - pCi	I-131	73.0 ± 11.0	75.6	Pass
03/14/19	Milk - pCi/L	Fe-59	149 ± 25.0	159	Pass
		Mn-54	141 ± 16.0	143	Pass
		Co-60	262 ± 16.0	299	Pass
		Co-58	128 ± 17.0	143	Pass
		Cr-51	227 ± 101.0	293	Pass
		Ce-141	101 ± 20.0	117	Pass
		Cs-137	184 ± 18.0	196	Pass
		Cs-134	138 ± 10.0	160	Pass
		I-131	92.0 ± 36.0	89.5	Pass
		Zn-65	177 ± 32.0	220	Pass
03/14/19	Water - pCi/L	Gross Beta	264 ± 4.84	28.8	Pass
04/08/19	Water - pCi/L	I-131	25.3 ± 8.0	28.4	Pass
		Ba-133	23.0 ± 2.7	24.1	Pass
		Cs-137	34.4 ± 3.4	33.1	Pass
		Cs-134	10.8 ± 1.7	12.1	Pass
		Zn-65	88.0 ± 9.3	89.2	Pass
		Co-60	11.3 ± 1.8	11.5	Pass
04/08/19	Water - pCi/L	Gross Beta	28.8 ± 2.09	299	Pass
06/06/19	Air Iodine - pCi	Cs-134	80.9 ± 4.4	93.0	Pass
		Zn-65	185 ± 18.0	164	Pass
		Co-60	139 ± 7.0	131	Pass
		Co-58	77.7 ± 7.4	74.1	Pass
		Fe-59	121 ± 13.0	93.5	Pass
		Mn-54	142 ± 8.9	126	Pass
		Cs-137	119 ± 7.7	111	Pass
		Cr-51	222 ± 50.6	223	Pass
		Ce-141	97.7 ± 7.7	88.3	Pass

Table C-1

Results of Participation in Cross Check Programs

Sample Date	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results	Pass / Fail [1]
06/06/19	Water	Mn-54	214 ± 17.6	207	Pass
		Fe-59	154 ± 22.5	154	Pass
		Co-58	115 ± 15.6	122	Pass
		Co-60	216 ± 12.8	216	Pass
		Zn-65	257 ± 31.6	270	Pass
		I-131	115 ± 77.0	89.1	Pass
		Cs-134	139 ± 8.8	153	Pass
		Cs-137	186 ± 15.7	184	Pass
		Ce-141	142 ± 22.7	145	Pass
		Cr-51	327 ± 117	368	Pass
06/06/19	Water - pCi/L	Gross Beta	199 ± 4.2	199	Pass
09/12/19	Air Filter - pCi/m^3	Gross Beta	271 ± 3.42	221	Pass
09/16/19	Air Iodine - pCi	Am-241	28.4 ± 9.9	32.0	Pass
		Cs-137	440 ± 20.0	437	Pass
		Cs-134	60.7 ± 5.2	59.0	Pass
		Zn-65	381 ± 31.0	364	Pass
		Co-60	57.5 ± 6.1	58.4	Pass
10/04/19	Water - pCi/L	Cs-137	80.3 ± 7.2	78.7	Pass
		Ba-133	37.2 ± 5.4	43.8	Pass
		Cs-134	52.2 ± 4.2	55.9	Pass
		Zn-65	39.3 ± 10.0	34.0	Pass
		I-131	25.4 ± 8.3	23.9	Pass
		Co-60	54.8 ± 5.1	53.4	Pass

Table C-1

Results of Participation in Cross Check Programs

Sample Date	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results	Pass / Fail [1]
12/05/19	Air Filter – pCi (Det 2)	Mn-54	170 ± 13.0	155	Pass
		Fe-59	124 ± 14.3	104	Pass
		Co-58	117 ± 11.7	107	Pass
		Co-60	139 ± 9.1	138	Pass
		Zn-65	194 ± 24.8	190	Pass
		Cs-134	123 ± 7.4	135	Pass
		Cs-137	128 ± 11.6	121	Pass
		Ce-141	98.5 ± 6.4	99.1	Pass
		Cr-51	246 ± 46.6	288	Pass
12/05/19	Air Filter – pCi (Det 3)	Mn-54	173 ± 11.3	155	Pass
		Fe-59	122 ± 10.8	104	Pass
		Co-58	111 ± 8.9	107	Pass
		Co-60	148 ± 7.9	138	Pass
		Zn-65	203 ± 20.9	190	Pass
		Cs-134	128 ± 5.7	135	Pass
		Cs-137	128 ± 8.9	121	Pass
		Ce-141	95.7 ± 7.0	99.1	Pass
		Cr-51	257 ± 40.6	288	Pass
12/05/19	Air Filter – pCi (Det 4)	Mn-54	167 ± 9.1	155	Pass
		Fe-59	132 ± 10.3	104	Pass
		Co-58	102 ± 7.3	107	Pass
		Co-60	146 ± 7.2	138	Pass
		Zn-65	195 ± 17.3	190	Pass
		Cs-134	122 ± 4.9	135	Pass
		Cs-137	122 ± 7.6	121	Pass
		Ce-141	102 ± 6.1	99.1	Pass
		Cr-51	299 ± 29.9	288	Pass

Table C-1

Results of Participation in Cross Check Programs

Sample Date	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results	Pass / Fail [1]
12/05/19	Air Iodine – pCi (Det 4)	I-131	79.2 ± 5.7	88.2	Pass
	(Det 2)	I-131	79.0 ± 6.3	88.2	Pass
	(Det 3)	I-131	79.1 ± 6.0	88.2	Pass
12/05/19	Milk pCi/L (DET 2)	I-131	100 ± 16.9	94.5	Pass
		Ce-141	82.4 ± 15.9	83.0	Pass
		Cr-51	271 ± 76.7	241	Pass
		Cs-134	112 ± 11.9	113	Pass
		Cs-137	123 ± 17.9	102	Pass
		Co-58	84.9 ± 14.6	89.9	Pass
		Mn-54	128 ± 17.4	130	Pass
		Fe-59	95.5 ± 20.2	87.1	Pass
		Zn-65	148 ± 34.3	159	Pass
		Co-60	119 ± 13.3	115	Pass
12/05/19	Milk pCi/L (DET 3)	I-131	99.3 ± 15.0	94.5	Pass
		Ce-141	80.7 ± 12.5	83.0	Pass
		Cr-51	228 ± 63.0	241	Pass
		Cs-134	103 ± 9.6	113	Pass
		Cs-137	109 ± 12.2	102	Pass
		Co-58	102 ± 12.2	89.9	Pass
		Mn-54	141 ± 15.2	130	Pass
		Fe-59	102 ± 15.7	87.1	Pass
		Zn-65	166 ± 28.4	159	Pass
		Co-60	111 ± 10.8	115	Pass

Table C-1

Results of Participation in Cross Check Programs

Sample Date	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results	Pass / Fail [1]
12/05/19	Milk pCi/L (DET 4)	I-131	104 ± 13.5	94.5	Pass
		Ce-141	78.3 ± 12.7	83.0	Pass
		Cr-51	235 ± 68.0	241	Pass
		Cs-134	114 ± 8.3	113	Pass
		Cs-137	105 ± 13.2	102	Pass
		Co-58	92.0 ± 11.4	89.9	Pass
		Mn-54	143 ± 13.8	130	Pass
		Fe-59	104 ± 14.9	87.1	Pass
		Zn-65	164 ± 27.2	159	Pass
		Co-60	123 ± 10.2	115	Pass
12/05/19	Water - pCi/L	Gross Beta	260 ± 4.76	269	Pass

[1] See discussion at the beginning of the Appendix describes Acceptance Criteria

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Iodine - A1	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	01/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - A1	02/11/19	Gross Beta	pCi/m^3	2.3 ± 0.1	2.3 ± 0.1	**	PASS	NA
Air Filter - A2	02/11/19	Gross Beta	pCi/m^3	2.4 ± 0.1	2.3 ± 0.1	**	PASS	NA
Air Filter - A3	02/11/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.1 ± 0.1	**	PASS	NA
Air Filter - A4	02/11/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.2 ± 0.1	**	PASS	NA
Air Filter - A5	02/11/19	Gross Beta	pCi/m^3	2.4 ± 0.1	2.3 ± 0.1	**	PASS	NA
Air Filter - SFA1	02/11/19	Gross Beta	pCi/m^3	2.2 ± 0.1	2.2 ± 0.1	**	PASS	NA
Air Filter - SFA2	02/11/19	Gross Beta	pCi/m^3	2.3 ± 0.1	2.2 ± 0.1	**	PASS	NA
Air Filter - SFA3	02/11/19	Gross Beta	pCi/m^3	2.5 ± 0.1	2.2 ± 0.1	**	PASS	NA
Air Filter - SFA4	02/11/19	Gross Beta	pCi/m^3	2.2 ± 0.1	2.4 ± 0.1	**	PASS	NA
Air Iodine - A1	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	02/11/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Filter - A1	03/04/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - A2	03/04/19	Gross Beta	pCi/m^3	1.8 ± 0.1	2.0 ± 0.1	**	PASS	NA
Air Filter - A3	03/04/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - A4	03/04/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - A5	03/04/19	Gross Beta	pCi/m^3	1.8 ± 0.1	1.9 ± 0.1	**	PASS	NA
Air Filter - SFA1	03/04/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Filter - SFA2	03/04/19	Gross Beta	pCi/m^3	1.5 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Filter - SFA3	03/04/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - SFA4	03/04/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Iodine - A1	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	03/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - A1	04/08/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.1 ± 0.1	**	PASS	NA
Air Filter - A2	04/08/19	Gross Beta	pCi/m^3	1.9 ± 0.1	1.9 ± 0.1	**	PASS	NA
Air Filter - A3	04/08/19	Gross Beta	pCi/m^3	2.0 ± 0.1	2.0 ± 0.1	**	PASS	NA
Air Filter - A4	04/08/19	Gross Beta	pCi/m^3	1.8 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - A5	04/08/19	Gross Beta	pCi/m^3	2.0 ± 0.1	2.0 ± 0.1	**	PASS	NA
Air Filter - SFA1	04/08/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.9 ± 0.1	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Filter - SFA2	04/08/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Filter - SFA3	04/08/19	Gross Beta	pCi/m^3	1.9 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - SFA4	04/08/19	Gross Beta	pCi/m^3	1.9 ± 0.1	1.9 ± 0.1	**	PASS	NA
Air Iodine - A1	04/15/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	04/15/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Shoreline Sediment – WB1	4/29/19	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	05/07/19	Gross Beta	pCi/m^3	1.2 ± 0.1	1.1 ± 0.1	**	PASS	NA
Air Filter - A2	05/07/19	Gross Beta	pCi/m^3	1.2 ± 0.1	1.2 ± 0.1	**	PASS	NA
Air Filter - A3	05/07/19	Gross Beta	pCi/m^3	1.3 ± 0.1	1.2 ± 0.1	**	PASS	NA
Air Filter - A4	05/07/19	Gross Beta	pCi/m^3	1.2 ± 0.1	1.3 ± 0.1	**	PASS	NA
Air Filter - A5	05/07/19	Gross Beta	pCi/m^3	1.3 ± 0.1	1.2 ± 0.1	**	PASS	NA
Air Filter - SFA1	05/07/19	Gross Beta	pCi/m^3	1.2 ± 0.1	1.3 ± 0.1	**	PASS	NA
Air Filter - SFA2	05/07/19	Gross Beta	pCi/m^3	1.1 ± 0.1	1.1 ± 0.1	**	PASS	NA
Air Filter - SFA3	05/07/19	Gross Beta	pCi/m^3	1.2 ± 0.1	1.1 ± 0.1	**	PASS	NA
Air Filter - SFA4	05/07/19	Gross Beta	pCi/m^3	1.0 ± 0.1	1.0 ± 0.1	**	PASS	NA
Air Iodine - A1	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Iodine - A5	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	06/03/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - A1	06/10/19	Gross Beta	pCi/m^3	1.8 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - A2	06/10/19	Gross Beta	pCi/m^3	1.6 ± 0.4	0.9 ± 0.3	**	FAIL [1]	NA
Air Filter - A3	06/10/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - A4	06/10/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - A5	06/10/19	Gross Beta	pCi/m^3	1.8 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - SFA1	06/10/19	Gross Beta	pCi/m^3	1.8 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - SFA2	06/10/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Filter - SFA3	06/10/19	Gross Beta	pCi/m^3	1.7 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - SFA4	06/10/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.5 ± 0.1	**	PASS	NA
Soil – SFS2	06/12/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Soil - SFS5	06/12/19	Cs-137	pCi/kg	96.3 ± 25.1	75.2 ± 21.3	<MDA	PASS	PASS
Oysters – IA3	06/25/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Oysters – IA6	06/25/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Bottom sediment - WBS2	06/25/19	Cs-137	pCi/kg	91.4 ± 79.2	149 ± 72.3	341 ± 189	PASS	FAIL [1]
Bottom sediment - WBS4	06/25/19	Cs-137	pCi/kg	113 ± 73.8	<MDA	<MDA	PASS	PASS
Air Filter - A1	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A2	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A3	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A4	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A5	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA1	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA2	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA3	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA4	07/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Gamma field – DR05	07/01/19	TLD	mR/Qtr	12.1 ± 0.7	10.8 ± 1.3	**	PASS	NA
Gamma field – DR06	07/01/19	TLD	mR/Qtr	10.3 ± 0.7	10.0 ± 0.9	**	PASS	NA
Gamma field – DR07	07/01/19	TLD	mR/Qtr	10.2 ± 0.6	10.0 ± 1.1	**	PASS	NA
Gamma field – DR08	07/01/19	TLD	mR/Qtr	13.3 ± 1.2	12.8 ± 1.2	**	PASS	NA
Gamma field – DR09	07/01/19	TLD	mR/Qtr	10.3 ± 0.9	10.4 ± 0.7	**	PASS	NA
Gamma field - DR10	07/01/19	TLD	mR/Qtr	10.6 ± 1.1	10.7 ± 1.7	**	PASS	NA
Gamma field - DR11	07/01/19	TLD	mR/Qtr	10.6 ± 0.4	10.4 ± 0.6	**	PASS	NA
Gamma field - SFDR14	07/01/19	TLD	mR/Qtr	40.9 ± 2.8	46.4 ± 5.1	**	PASS	NA
Gamma field - SFDR15	07/01/19	TLD	mR/Qtr	20.1 ± 2.8	24.0 ± 6.8	**	PASS	NA
Gamma field – DR23	07/01/19	TLD	mR/Qtr	14.6 ± 1.1	13.5 ± 1.1	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Iodine - A1	07/15/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	07/15/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	07/15/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Chard - IB5	07/22/19	Cs-137	pCi/kg	18.6 ± 13.9	<MDA	18.2 ± 5.6	PASS	PASS
Cabbage – IB4	07/22/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Collards – IB10	07/22/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Cabbage – IB12	07/22/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	08/05/19	Gross Beta	pCi/m^3	2.7 ± 0.2	2.4 ± 0.2	**	PASS	NA
Air Filter - A2	08/05/19	Gross Beta	pCi/m^3	2.8 ± 0.2	2.6 ± 0.2	**	PASS	NA
Air Filter - A3	08/05/19	Gross Beta	pCi/m^3	2.6 ± 0.2	2.6 ± 0.2	**	PASS	NA
Air Filter - A4	08/05/19	Gross Beta	pCi/m^3	2.5 ± 0.2	2.5 ± 0.2	**	PASS	NA
Air Filter - A5	08/05/19	Gross Beta	pCi/m^3	2.4 ± 0.2	2.4 ± 0.2	**	PASS	NA
Air Filter - SFA1	08/05/19	Gross Beta	pCi/m^3	2.7 ± 0.2	2.6 ± 0.2	**	PASS	NA
Air Filter - SFA2	08/05/19	Gross Beta	pCi/m^3	2.5 ± 0.2	2.4 ± 0.2	**	PASS	NA
Air Filter - SFA3	08/05/19	Gross Beta	pCi/m^3	2.6 ± 0.2	2.5 ± 0.2	**	PASS	NA
Air Filter - SFA4	08/05/19	Gross Beta	pCi/m^3	2.4 ± 0.2	2.5 ± 0.2	**	PASS	NA
Air Iodine - A1	08/12/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	08/12/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Iodine - A3	08/12/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Spanish Mackerel - IA5	8/12/19	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Spot - IA1	8/12/19	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Spanish Mackerel -IA2	8/12/19	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	09/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Water – WA2	9/27/19	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Water – WA1	9/27/19	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A2	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A3	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A4	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A5	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA1	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA2	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA3	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Filter - SFA4	10/01/19	GAMMA	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	10/07/19	Gross Beta	pCi/m^3	2.0 ± 0.1	2.1 ± 0.2	**	PASS	NA
Air Filter - A2	10/07/19	Gross Beta	pCi/m^3	1.9 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Filter - A3	10/07/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.1 ± 0.2	**	PASS	NA
Air Filter - A4	10/07/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.0 ± 0.1	**	PASS	NA
Air Filter - A5	10/07/19	Gross Beta	pCi/m^3	2.1 ± 0.1	2.1 ± 0.2	**	PASS	NA
Air Filter - SFA1	10/07/19	Gross Beta	pCi/m^3	2.2 ± 0.2	1.9 ± 0.1	**	PASS	NA
Air Filter - SFA2	10/07/19	Gross Beta	pCi/m^3	1.9 ± 0.1	1.9 ± 0.1	**	PASS	NA
Air Filter - SFA3	10/07/19	Gross Beta	pCi/m^3	2.0 ± 0.1	2.0 ± 0.2	**	PASS	NA
Air Filter - SFA4	10/07/19	Gross Beta	pCi/m^3	2.0 ± 0.1	1.8 ± 0.1	**	PASS	NA
Air Iodine - A1	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	10/07/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Oysters – IA3	10/23/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Oysters – IA6	10/23/19	GAMMA	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	11/04/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.6 ± 0.1	**	PASS	NA
Air Filter - A2	11/04/19	Gross Beta	pCi/m^3	1.4 ± 0.1	1.4 ± 0.1	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Filter - A3	11/04/19	Gross Beta	pCi/m^3	1.4 ± 0.1	1.3 ± 0.1	**	PASS	NA
Air Filter - A4	11/04/19	Gross Beta	pCi/m^3	1.4 ± 0.1	1.4 ± 0.1	**	PASS	NA
Air Filter - A5	11/04/19	Gross Beta	pCi/m^3	1.5 ± 0.1	1.7 ± 0.1	**	PASS	NA
Air Filter - SFA1	11/04/19	Gross Beta	pCi/m^3	1.5 ± 0.1	1.5 ± 0.1	**	PASS	NA
Air Filter - SFA2	11/04/19	Gross Beta	pCi/m^3	1.5 ± 0.1	1.4 ± 0.1	**	PASS	NA
Air Filter - SFA3	11/04/19	Gross Beta	pCi/m^3	1.4 ± 0.1	1.4 ± 0.1	**	PASS	NA
Air Filter - SFA4	11/04/19	Gross Beta	pCi/m^3	1.6 ± 0.1	1.3 ± 0.1	**	PASS	NA
Air Iodine - A1	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	11/04/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Vegetation– SFB2	11/18/19	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Vegetation - SFB5	11/18/19	Cs-137	pCi/kg	<MDA	<MDA	19.5 ± 8.9	PASS	PASS
Water – WA1	12/2/2019	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Water – WA2	12/2/2019	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/ Fail (Replicate)	Pass/ Fail (Split)
Air Iodine - A3	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	12/09/19	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Gamma field – DR05	01/21/20	TLD	mR/Qtr	15.3 ± 1.6	15.1 ± 1.0	**	PASS	NA
Gamma field – DR06	01/21/20	TLD	mR/Qtr	13.6 ± 0.8	13.2 ± 0.5	**	PASS	NA
Gamma field – DR07	01/21/20	TLD	mR/Qtr	13.6 ± 1.0	13.9 ± 1.2	**	PASS	NA
Gamma field – DR08	01/21/20	TLD	mR/Qtr	18.2 ± 1.0	18.2 ± 1.8	**	PASS	NA
Gamma field – DR09	01/21/20	TLD	mR/Qtr	13.6 ± 1.4	13.5 ± 1.1	**	PASS	NA
Gamma field - DR10	01/21/20	TLD	mR/Qtr	13.7 ± 0.7	14.6 ± 3.7	**	PASS	NA
Gamma field - DR11	01/21/20	TLD	mR/Qtr	14.3 ± 1.0	14.1 ± 0.9	**	PASS	NA
Gamma field - SFDR14	01/21/20	TLD	mR/Qtr	76.1 ± 40.2	83.0 ± 55.5	**	PASS	NA
Gamma field - SFDR15	01/21/20	TLD	mR/Qtr	31.7 ± 6.0	33.9 ± 5.8	**	PASS	NA
Gamma field – DR23	01/21/20	TLD	mR/Qtr	21.9 ± 2.1	20.3 ± 1.0	**	PASS	NA

[1] See discussion at the beginning of the Appendix
** The nature of these samples precluded splitting them with an independent laboratory.

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 2018 Land Use Census.

Table D-1
Land Use Survey

	Distance from Plant (miles)	
Sector	Residence	Garden
SE	1.5	4.5*
SSE	1.6	3.8*
S	1.6	1.9*
SSW	1.5	1.6
SW	1.1	2.4
WSW	1.2	1.5*
W	1.3	1.6*
WNW	2.7	2.7
NW	2.0	2.1

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

There are no animals producing milk for human consumption within the 5-mile radius. The closest beef cattle for meat consumption are 1.6 miles in the South Sector.

Discussion with a local waterman indicate that oysters 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 samples taken from aquatic and atmospheric radiological pathways surrounding the plant. In general, these results continue the historical trends previously observed in the official sites of the CCNPP REMP and ISFSI.

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 and maps have been updated accordingly.

Groundwater samples were collected from 16 of 17 on-site piezometer tubes and three subsurface manholes in 2019. 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 and 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]		Direction[1]
		(KM)	(Miles)	(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
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
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 2019 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
Aquatic Environment						
Bottom Sediment (pCi/kg)	Gamma (4) Cs-137	--	111 (2/2) (91-130)	Camp Conoy/ Rocky Point WBS4 3.0 km SE	120 (2/2) (113-128)	120 (2/2) (113-128)

[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	Cs-137	Gamma Emitters
WBS2			
Discharge Area	6/25/2019	91 ± 79	*
	10/23/2019	130 ± 71	*
WBS4[1]			
Camp Conoy/ Rocky Point	6/25/2019	113 ± 74	*
	10/23/2019	128 ± 63	*

[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)

Start Date	Stop Date	SFA2[1] Visitors Center
12/31/2018	1/7/2019	*
1/7/2019	1/14/2019	*
1/14/2019	1/22/2019	*
1/22/2019	1/28/2019	*
1/28/2019	2/4/2019	*
2/4/2019	2/11/2019	*
2/11/2019	2/18/2019	*
2/18/2019	2/26/2019	*
2/26/2019	3/4/2019	*
3/4/2019	3/12/2019	*
3/12/2019	3/19/2019	*
3/19/2019	3/26/2019	*
3/26/2019	4/2/2019	*
4/2/2019	4/8/2019	*
4/8/2019	4/15/2019	*
4/15/2019	4/23/2019	*
4/23/2019	4/29/2019	*
4/29/2019	5/7/2019	*
5/7/2019	5/13/2019	*
5/13/2019	5/20/2019	*
5/20/2019	5/28/2019	*
5/28/2019	6/3/2019	*
6/3/2019	6/10/2019	*
6/10/2019	6/17/2019	*
6/17/2019	6/24/2019	*
6/24/2019	7/1/2019	*
7/1/2019	7/8/2019	*
7/8/2019	7/15/2019	*
7/15/2019	7/22/2019	*
7/22/2019	7/30/2019	*
7/30/2019	8/5/2019	*
8/5/2019	8/12/2019	*
8/12/2019	8/19/2019	*
8/19/2019	8/26/2019	*
8/26/2019	9/3/2019	*
9/3/2019	9/9/2019	*
9/9/2019	9/16/2019	*
9/16/2019	9/23/2019	*
9/23/2019	10/1/2019	*

Table E-5

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

Start Date	Stop Date	SFA2[1] Visitors Center
10/1/2019	10/7/2019	*
10/7/2019	10/14/2019	*
10/14/2019	10/21/2019	*
10/21/2019	10/28/2019	*
10/28/2019	11/4/2019	*
11/4/2019	11/11/2019	*
11/11/2019	11/18/2019	*
11/18/2019	11/25/2019	*
11/25/2019	12/2/2019	*
12/2/2019	12/9/2019	*
12/9/2019	12/16/2019	*
12/16/2019	12/23/2019	*
12/23/2019	12/30/2019	*

[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)	PU-239/240 (AS)
PZ11	9/11/2019	<0.08083	<0.04002	<0.1058	<0.1412	<0.07059
		U-233/234 (AS)	U-235 (AS)	U-238 (AS)	Fe-55	Ni-63
		<0.06137	<0.04381	<0.01902	<54.49	<4.47

Table E-7

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

Station	Sample Date	GR-A (DIS) (pCi/L)	GR-A (SUS) (pCi/L)	GR-B (DIS) (pCi/L)	GR-B (SUS) (pCi/L)
MH66/SSD3	2/13/2019	<2.03	<0.503	ND	ND
PZ19	6/11/2019	<0.514	<0.518	<0.854	<1.45
PZ20	6/11/2019	<6.3	<2.37	15.9 ± 6.44	<7.37
PZ21	6/11/2019	<1.36	<0.901	4.26 ± 1.15	<1.52
PZ22	6/11/2019	<0.966	<0.944	3.39 ± 1.03	<1.55
PZ25	6/12/2019	<1.13	<1.14	3.5 ± 1.09	<1.67
PZ15	6/12/2019	<1.12	<0.363	3.07 ± 1.05	<1.49
PZ13	6/12/2019	<1.05	<0.931	4.5 ± 1.11	<1.54
PZ12	6/12/2019	<1.01	<1.53	6.65 ± 1.19	<2.31
PZ29	6/12/2019	<1.81	<1.34	4.91 ± 1.27	<2.21
PZ30	6/12/2019	2.21 ± 1.19	<1.36	11.5 ± 1.43	<2.22
PZ24	6/12/2019	<2.26	1.36 ± 0.72	4.55 ± 2.22	<1.88
MH28	8/14/2019	<0.901	<1.04	ND	ND
MH30	8/14/2019	<0.932	<1.03	ND	ND
PZ11	9/11/2019	<0.751	<0.507	ND	ND

* All Non-Natural Gamma Emitters <MDA
ND No Data samples obtained as required.

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	2/13/2019	<3.21	<0.539
PZ19	6/11/2019	<7.19	<0.671
PZ20	6/11/2019	<7.16	<0.443
PZ21	6/11/2019	<7.34	<0.318
PZ22	6/11/2019	<9.76	<0.48
PZ25	6/12/2019	<5.73	<0.609
PZ15	6/12/2019	<6.76	<0.816
PZ13	6/12/2019	<8.08	<0.454
PZ12	6/12/2019	<6.57	<0.575
PZ29	6/12/2019	<5.82	<0.7
PZ30	6/12/2019	<6.81	<0.745
PZ24	6/12/2019	<8.92	<0.593
MH28	8/14/2019	<6.01	<0.992
MH30	8/14/2019	<7.6	<0.743
PZ11	9/11/2019	<9.69	<0.839

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
3/12/2019	ND	ND	ND	ND	<175	<171	<175	<176	ND	ND	ND	ND	ND	ND	ND	ND
3/13/2019	1070 ± 185	<175	<176	<175	ND	ND	ND	ND	ND	<177	<173	ND	ND	ND	<173	<179
6/11/2019	ND	ND	ND	ND	<195	<196	<196	<195	<192	ND	ND	<193	<198	ND	ND	ND
6/12/2019	219 ± 133	<196	<193	<195	ND	ND	ND	ND	ND	<196	<193	ND	ND	<193	<193	<194
9/10/2019	ND	ND	ND	ND	<177	<180	<189	<181	ND	ND	ND	ND	ND	ND	ND	ND
9/11/2019	198 ±125	<178	<180	<181	ND	ND	ND	ND	ND	<180	<181	ND	ND	ND	<191	<181
(repeat)	<187	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12/18/2019	ND	<181	<182	<190	ND	ND	ND	ND	ND	<187	<184	ND	ND	ND	<188	ND
12/20/2019	448 ± 133	ND	ND	ND	<188	<189	<188	<188	ND	ND	ND	ND	ND	ND	ND	<192

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
1/31/2019	ND	2430 ±304	1400 ± 210	ND	ND	ND	ND	ND	ND
2/12/2019	ND	ND	ND	<191	<188	ND	ND	ND	ND
2/13/2019	<187	ND	ND	ND	ND	ND	ND	ND	ND
3/29/2019	ND	ND	ND	ND	ND	<195	<196	<195	<195
5/7/2019	ND	1840 ± 256	2070 ± 278	<195	<196	ND	ND	ND	ND
8/14/2019	ND	1830 ± 252	1710 ± 241	ND	ND	ND	ND	ND	ND
9/27/2019 (Confirmation / Repeat)	ND	ND	ND	252 ± 126 (214±127/ 246± 127)	<190	<193	<188	<189	<191
9/27/2019 (Confirmation / Repeat)	ND	ND	ND	218 ± 128 (<193/ 288± 127)	214 ±127 (<192/ 298±128)	ND	ND	ND	ND
9/30/2019	<192	ND	ND	ND	ND	ND	ND	ND	ND
11/19/2019	ND	2150 ± 282	1690 ± 239	ND	ND	ND	ND	ND	ND
12/31/2019	ND	ND	ND	<181	<186	<189	<188	<184	<188

* MH24 Renamed MH-66/SSD3

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
6/11/2019	ND	ND	ND	ND	ND	ND	ND	ND	#	ND	ND	#	#	ND	ND	ND
6/12/2019	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	ND	ND
9/10/2019	ND	ND	ND	ND	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
9/11/2019	#	#	#	#	ND	ND	ND	ND	ND	#	#	ND	ND	ND	#	#
12/20/2019	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[#] Tritium Less than minimum Detectable Activity(<MDA)
[ND] No Data - Quarterly sample obtained as required.

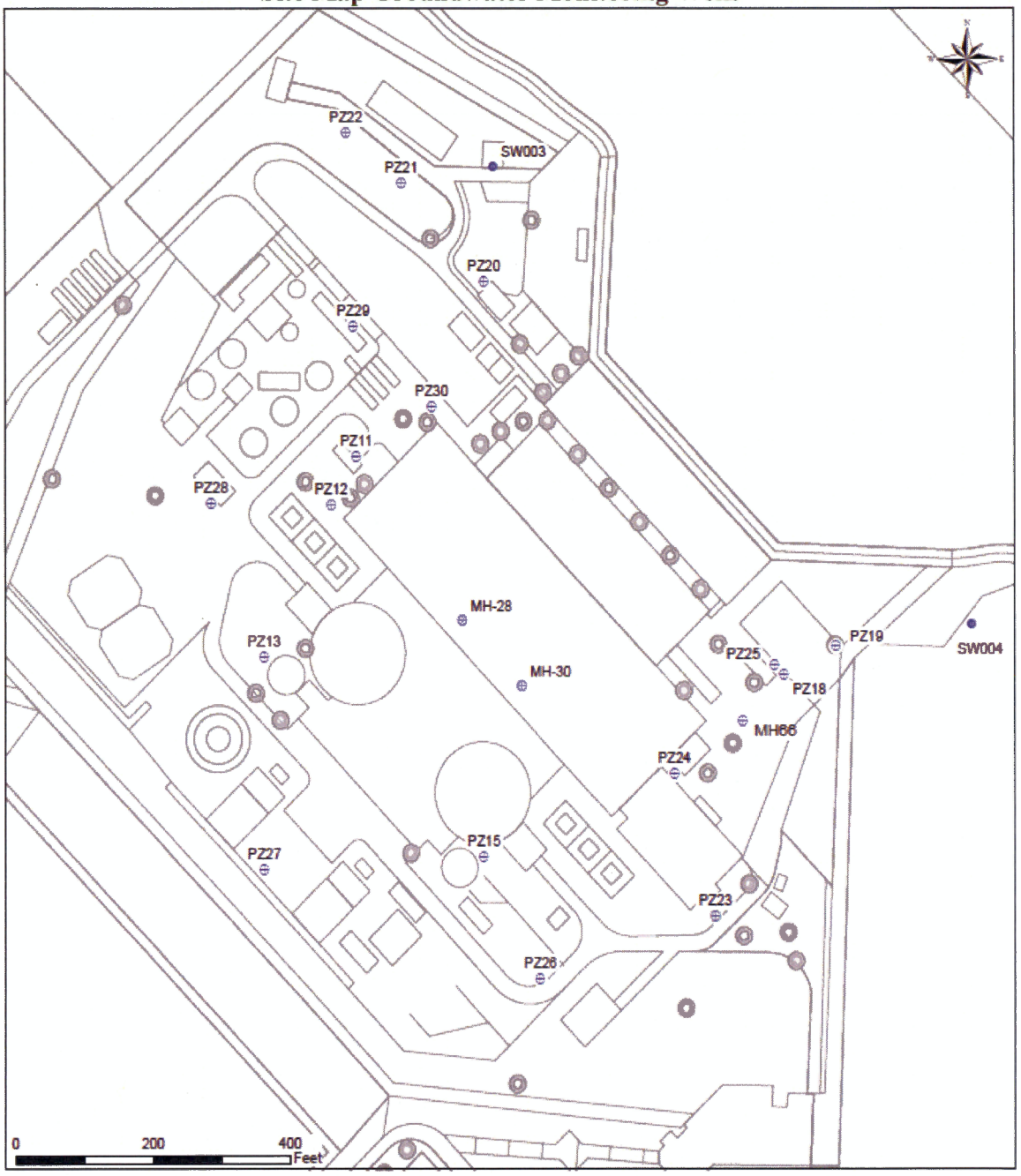
Table E-12

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
2/12/2019	ND	ND	ND	#	#	ND	ND	ND	ND
2/13/2019	#	ND	ND	ND	ND	ND	ND	ND	ND
8/14/2019	ND	#	#	ND	ND	ND	ND	ND	ND

*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



Explanation:
- Surface Water Monitoring Location
- Groundwater Monitoring Location

Figure E-2

Site Map Rainwater Locations