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

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

Subject: **Annual Radiological Environmental Operating Report**

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

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

There are no regulatory commitments contained in this correspondence.

Should you have questions regarding this matter, please contact me at (410) 495-5219 or Mr. Ron Thomas at (410) 495-6970.

Respectfully,

Larry D. Smith
Manager - Regulatory Assurance
LDS/lmd

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

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

ATTACHMENT (1)

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR THE

CALVERT CLIFFS NUCLEAR POWER PLANT

UNITS 1 AND 2

AND THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

Calvert Cliffs Nuclear Power Plant

May 14, 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, 2020

A. M. Barnett
R. V. Ihnacik

EXELON GENERATION, LLC

MAY 2021

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. SUMMARY

During 2020, Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 2229 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 946 radiochemical analyses were performed on 906 environmental samples; and 400 thermoluminescent dosimeters (TLDs) and Optically Stimulated Luminescent Dosimeters (OSLDs) were analyzed for ambient radiation exposure rates as part of the original REMP. These analyses were performed to satisfy the requirements of the ODCM (Ref. 6) and the Environmental Technical Specifications (Ref. 5).

For the ISFSI monitoring program, 320 radiochemical analyses were performed on 300 environmental samples, 224 of which were in common with the original REMP. In addition, 360 TLDs and OSLDs, 18 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, 349 radiochemical analyses were performed on 292 quality assurance samples and 120 quality assurance OSLDs 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 and OSLDs from forty-two locations surrounding CCNPP and the ISFSI.

Natural radioactivity was detected in essentially all 2229 radiological analyses performed. Low levels of man-made fission products were also observed in 5 of these analyses for the CCNPP REMP. These 5 observations were for Cs-137 and attributed to fallout from past atmospheric weapons testing. Detailed discussions about the results of these analyses are contained in the body of this report.

To assess the plant's contribution to the radiation levels of the ambient environment, dose calculations were performed by Murray and Trettel, Inc. using 2020 data from the plant's effluent releases, 2020 on-site meteorological data, and appropriate pathways. Details on these dose calculations and meteorological trends from 2020 are provided in the Annual Report on the Meteorological Monitoring Program at the Calvert Cliffs Nuclear Power Station 2020. The results of these dose calculations indicate:

a. a maximum thyroid dose of 2.00×10^{-4} mrem via liquid and gaseous pathways, which is about 0.0002% 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 3.92×10^{-4} mrem via liquid and gaseous pathways, which is about 0.002% 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 7.87×10^{-4} mrem. This dose is about 0.003% 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

In Q2 of 2020, the CCNPP REMP began using Optically Stimulated Luminescence Dosimeters (OSLD) for environmental dosimetry. These OSLDs are distributed and analyzed by Landauer, Inc.. OSLDs are optimized for environmental dosimetry due to their higher sensitivity, as compared to Thermoluminescent Dosimeters (TLD). Transitioning to OSLDs brings CCNPP into alignment with the rest of the Exelon fleet with regard to REMP environmental dosimetry systems. This streamlines the program across the fleet from both a technical and a business perspective.

Since the beginning of the CCNPP REMP, including the pre-operational studies, direct radiation measurements have been reported in milliroentgen (mR). However, 2020 Q2, Q3, and Q4 dosimetry data as reported by Landauer has expressed exposure in units of millirem (mrem).

NRC guidance has stated that the Roentgen can be used interchangeably with the rem. NUREG-1736 (page 3-26) addresses the Roentgen and its equivalency with the rad and the rem, stating that "… the R is numerically equal to the rad and to the rem." Charts in the 2020 AREOR report units in milliroentgen (mR), as ODCM attachment 14 specifies the unit of measure for Direct Radiation as the mR. CCNPP Issue Report 04422723 has been generated to document the transition to the use of mrem for environmental dosimetry reporting. Associated actions have been generated to update the ODCM.

There were three dosimetry program exceptions during this operating period.
In each case dosimeters and their housing were either damaged or completely missing in the field. New housing and dosimeters were deployed for the next quarter. DR22 in Quarter 1 dosimeters and housing were on the ground and damaged. DR19 in Quarter 2, dosimeters and housing were could not be found and DR15 in Quarter 4 dosimeters and housing also could not be found in the field. These losses were captured in the Nuclear Corrective Action Program to document the events and trend future events should they occur.

Garden vegetation was unavailable from multiple locations through the months of June, July, August, and September due to poor garden soil conditions and insect damage. Details are documented in Table B-8a. Alternative vegetation was collected from the vicinity of the sample

locations, as documented in station Issue Reports 04367487 and 04371223. Corrective actions have been implemented to improve garden conditions.

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) and Dosimetry analysis which was transitioned to Landauer OSLDs beginning Quarter 2 2020 (Ref. 17). The analytical results for this reporting period are presented in Appendix B and are also summarized in Table 2. For discussion, the analytical results are divided into four categories. The categories are Aquatic Environment, Atmospheric Environment, Terrestrial Environment, and Direct Radiation. These categories are further divided into subcategories according to sample type (e.g. Bay Water and Aquatic Organisms for Aquatic Environment).

II.C.1 Aquatic Environment

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

II.C.1.a Bay Water

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

The tritium analyses, performed on quarterly composites of the monthly bay water samples, revealed no detectable concentrations in any samples.

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

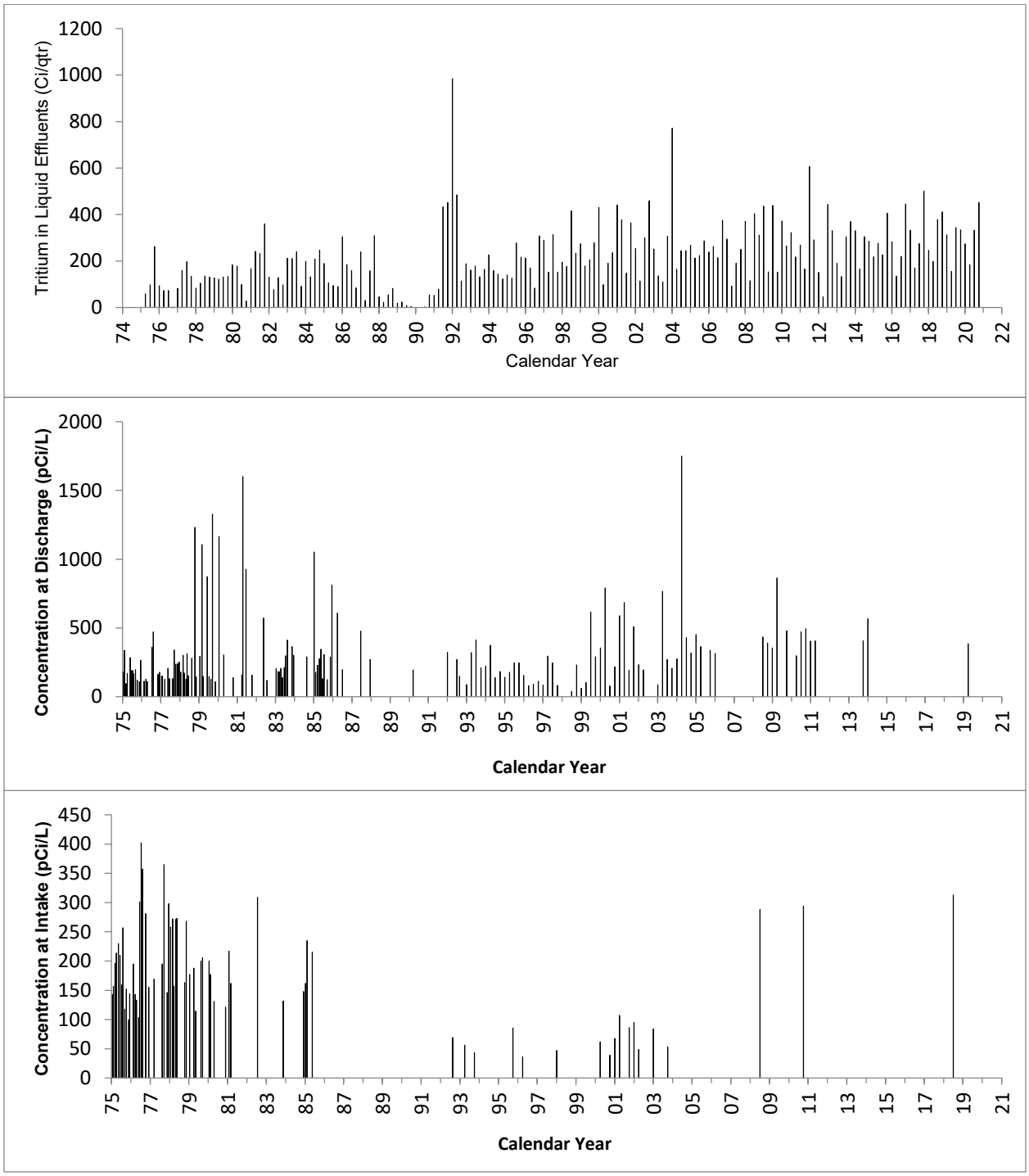
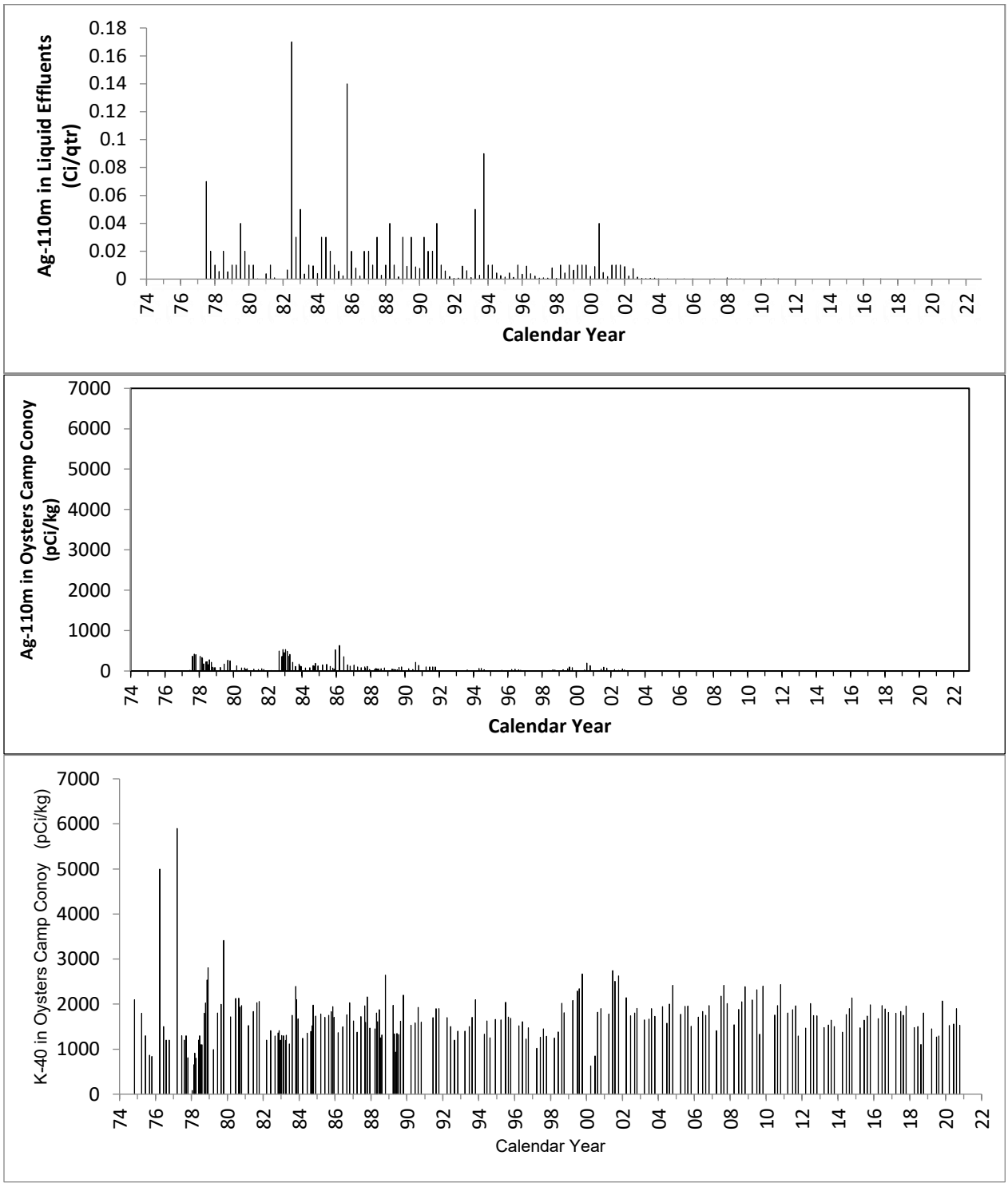


FIGURE 2
Silver-110m and Potassium-40 in Chesapeake Bay Oysters



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 0.7×10^{-2} to 4.4×10^{-2} pCi/m^3 for the indicator locations and 0.9×10^{-2} to 4.2×10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 1.9×10^{-2} pCi/m^3 was SFA4, SSE of the ISFSI.

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

Figure 3 depicts the historical trends of beta activity.

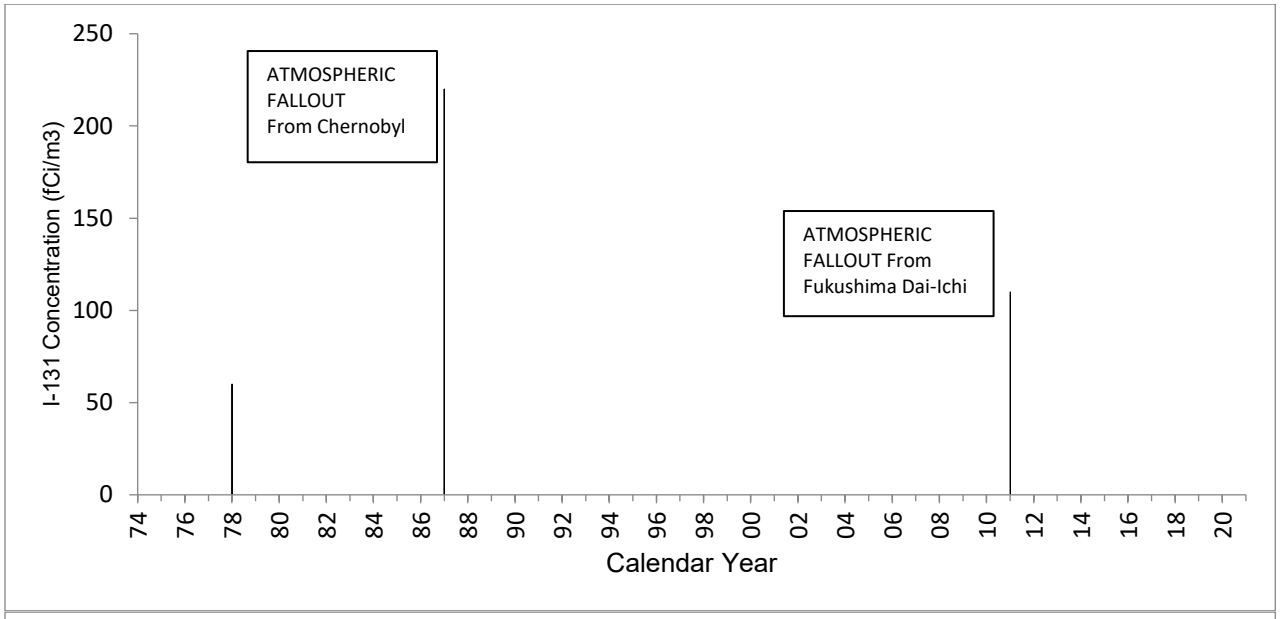
II.C.2.b Air Iodine

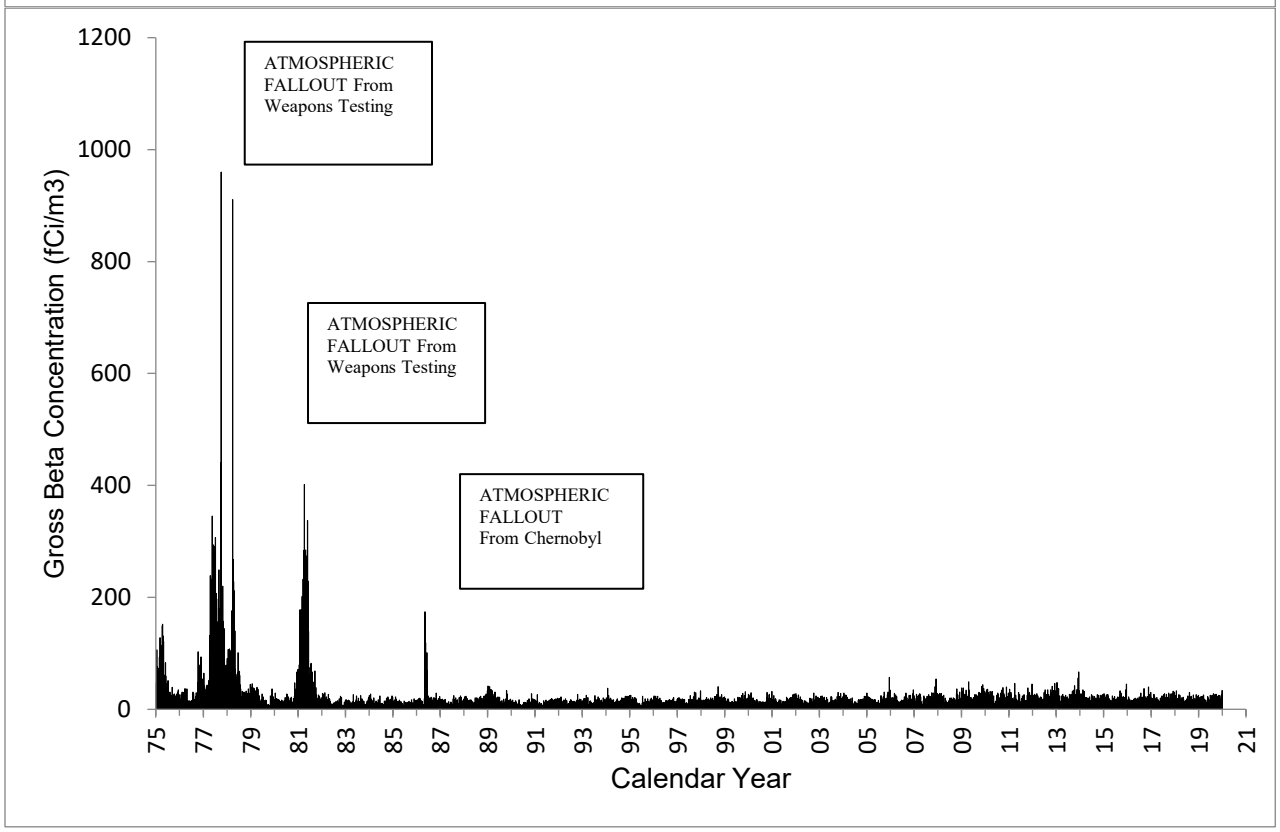
Weekly composited charcoal cartridges (for trapping radioiodine species) were collected from the eight locations, referenced above, during the year. These samples were analyzed for radioiodine species and exhibited no detectable concentrations of I-131 during the year.

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

FIGURE 3
Nuclear Fallout in the Calvert Cliffs Area

SURFACE AIR VAPORS, LUSBY, MD (A4)





II.C.3 Terrestrial Environment

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

II.C.3.a Vegetation

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

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

II.C.4 Direct Radiation

Direct radiation is measured by a network of environmental dosimeters in each overland sector surrounding the plant, both at the plant boundary and at 4 miles from the plant. Beginning with the second quarter TLDs were retired in favor of using OSLDs for this monitoring.

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

In April of 2020 the site transitioned from TLDs to OSLDs provided by and analyzed by Landauer, Inc. The 2020 mean 91-day ambient radiation measured at the indicator locations was 12.1 mR and ranged from 8.59 to 16.60 mR as reported in Table 2. The control locations showed a 91-day mean of 13.95 mR with ranges from 10.7 to 17.9 mR. The location with the highest overall mean of 16.7 was Taylors Island, Anderson’s Property (sample code DR23) which ranged from 15.8 to 17.9 mR.

Figure 4-a depicts the long-term trend of mean dosimeter exposure for the 4-mile, Control Location, and On-Site dosimeters. In June of 2018 the site adopted the requirements of the updated ANSI 13.34 standard.

Figure 4-b depicts quarterly exposure at each Dosimeter location in 2020, 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 due to higher natural background radiation at DR23 (Taylor's Island, 7.8 miles from CCNPP). This slight bias is due to normal variations in background radiation levels and is consistent with pre-operational data.

Note that in figure 4-b, the ranking of DR22 is diminished because Q1 data was not available for that dosimetry location. This is also the case for DR 19 and DR 15. These have been identified in the program exceptions section of this report.

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 2020.

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

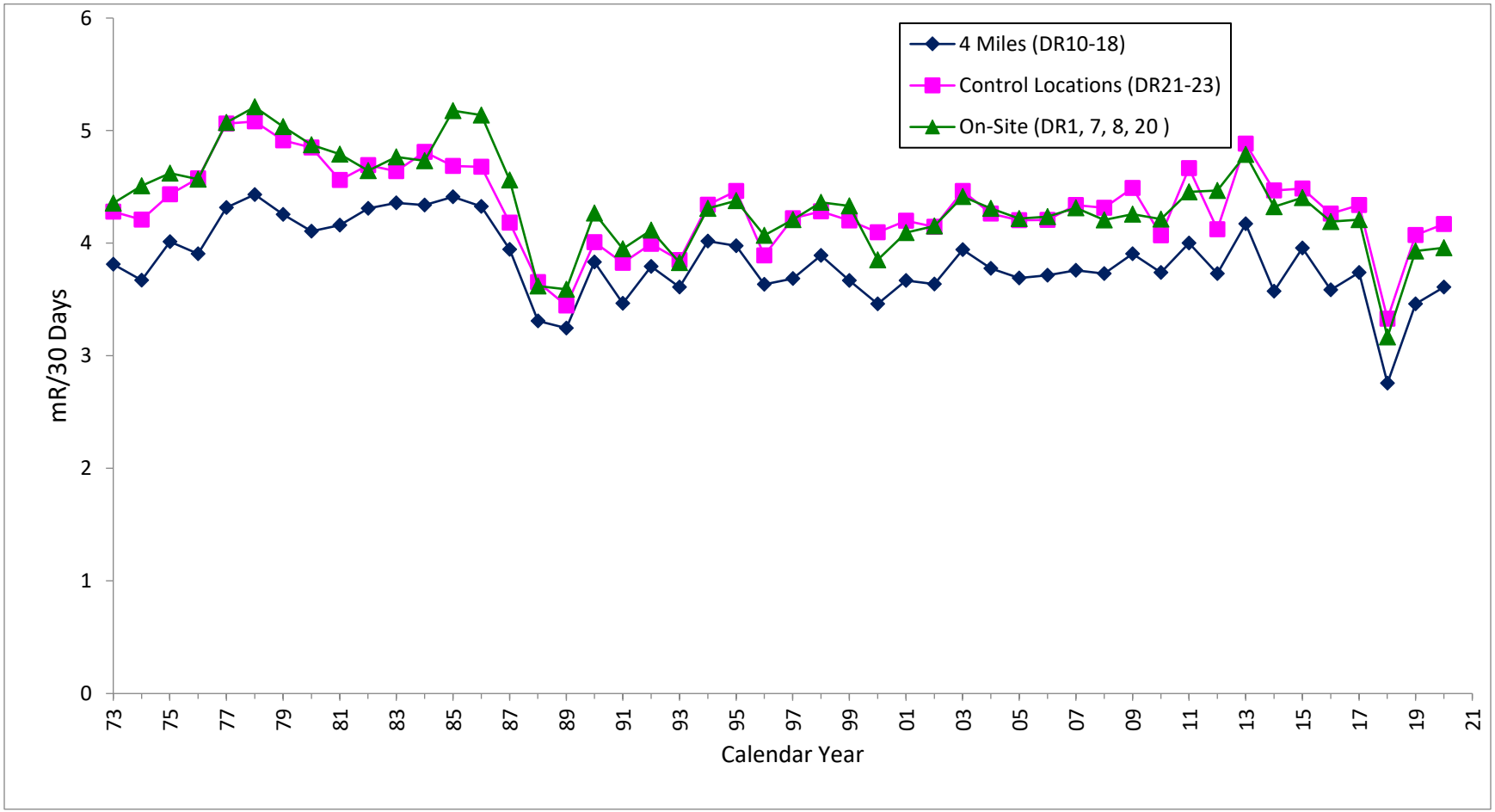
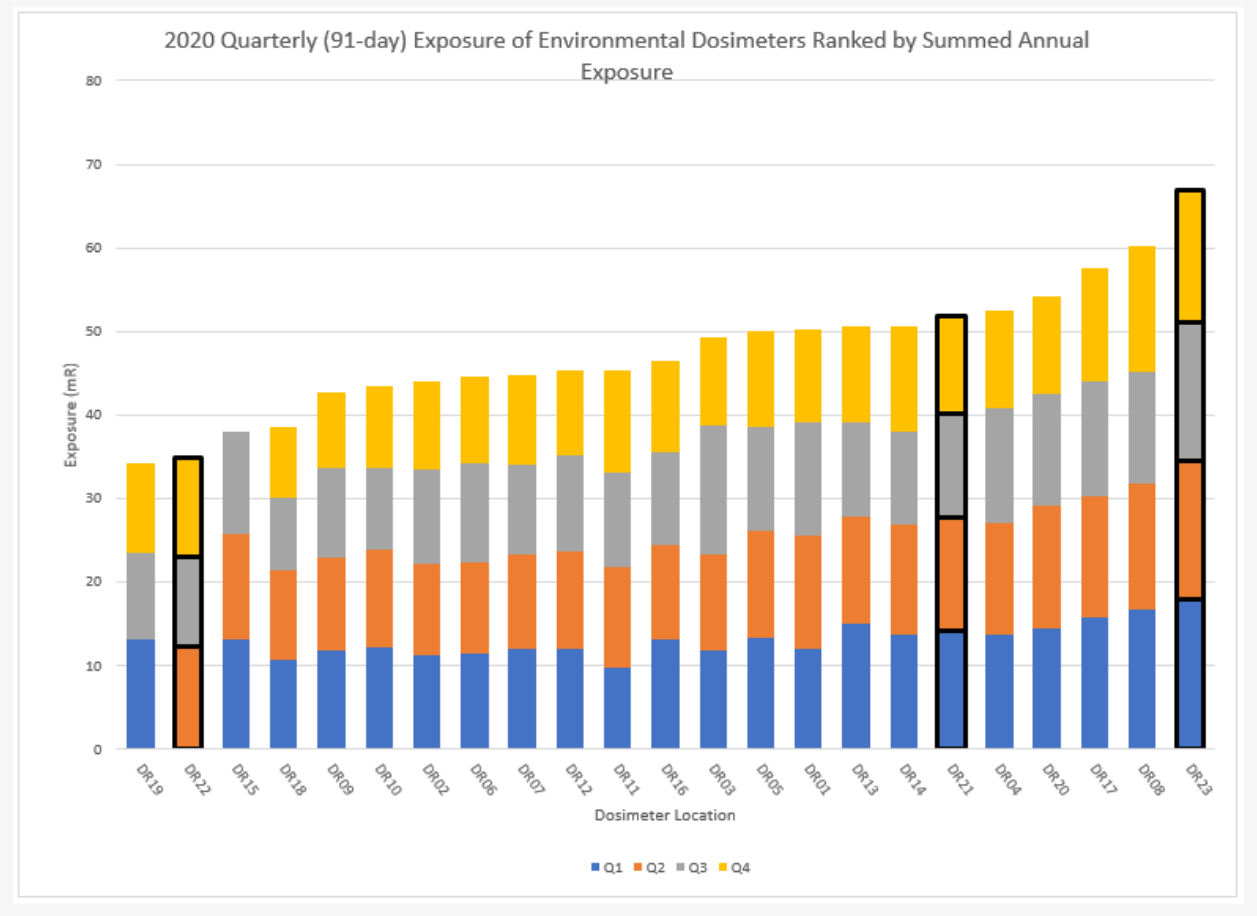


FIGURE 4b
2020 Quarterly Dosimeter Gamma Dose, per Location, Calvert Cliffs Nuclear Power Plant



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/OSLD data are depicted in Figures 1 through 4. As can be seen from these figures, the plant made no adverse radiological contributions to the surrounding environment.

To assess the plant's contribution to the ambient radiation levels of the surrounding environment, dose calculations were performed by Murray and Trettel, Inc. using the plant's 2020 effluent release data, on site meteorological data (see X/Q and D/Q values presented in Figures 5 and 6), and appropriate pathways. Details on these dose calculations and meteorological trends from 2020 are provided in the Annual Report on the Meteorological Monitoring Program at the Calvert Cliffs Nuclear Power Station 2020. The results of these dose calculations indicate:

Gaseous Pathways

A maximum thyroid dose of 3.39×10^{-5} 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 0.000045% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body gamma dose of 3.39×10^{-5} mrem to a child at 2.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0001% 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 3.41×10^{-5} mrem to a child at 2.7 miles WNW of the containments at Calvert Cliffs. This is about 0.0001% of the acceptable dose limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

Liquid Pathways

A maximum thyroid dose of 1.66×10^{-4} mrem to a teenager for all liquid pathways, which is about 0.0002% of the acceptable dose limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 3.58×10^{-4} mrem to an adult via all liquid pathways, which is about 0.0014 % of the acceptable dose limit of 25 mrem/yr as stated in 40CFR190 and 10CFR72.104.

A maximum dose to any other organ, in this case GI-Tract, of 7.53×10^{-4} mrem to a teenager for all pathways, which is 0.003% 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 2.00 x 10^{-4} mrem via liquid and gaseous pathways, which is about 0.0002% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole-body dose of 3.92 x 10^{-4} mrem via liquid and gaseous pathways, which is about 0.0016% 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 7.87 x 10^{-4} mrem. This dose was about 0.003% 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 2020.

FIGURE 5

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

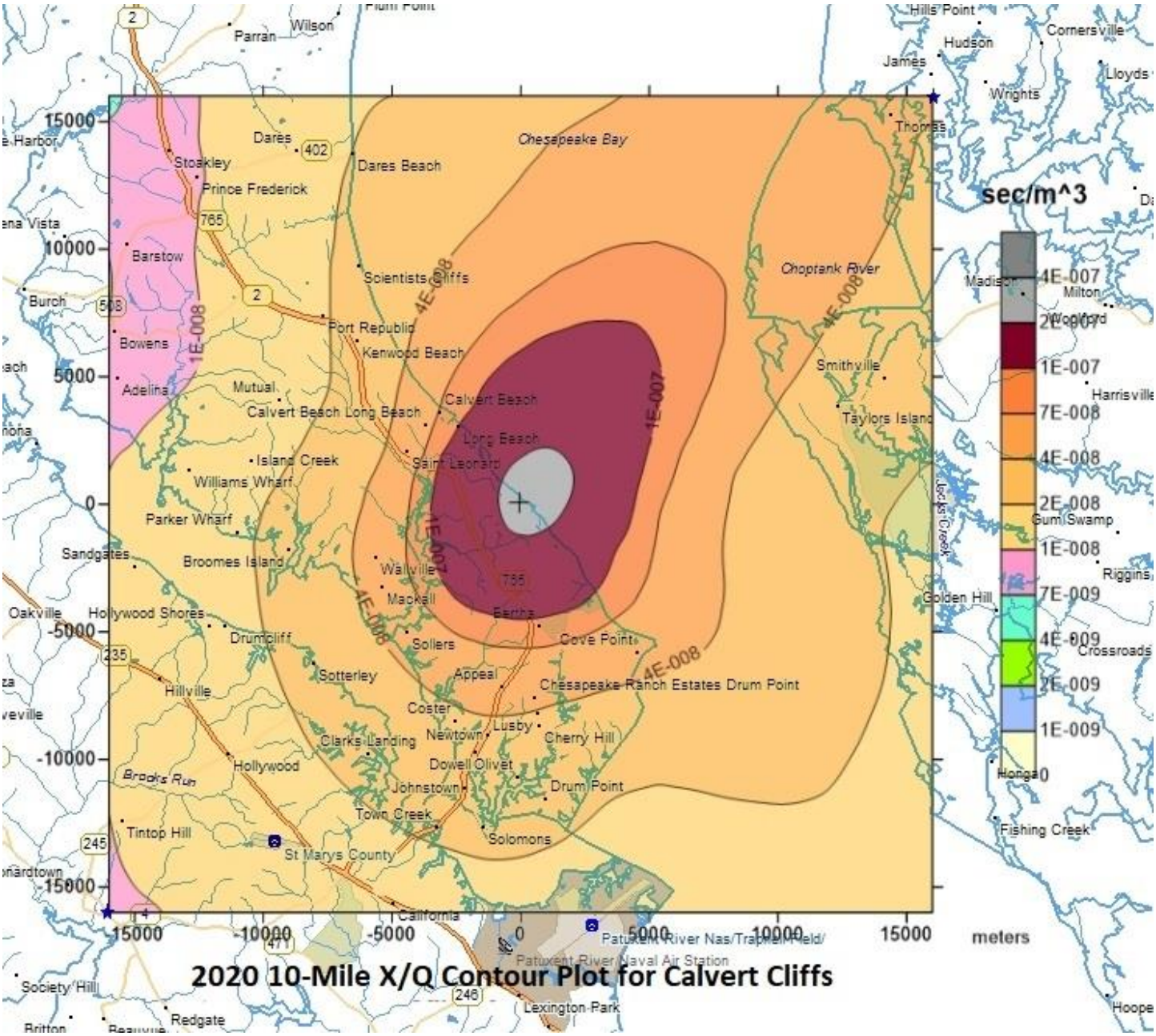


FIGURE 6

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

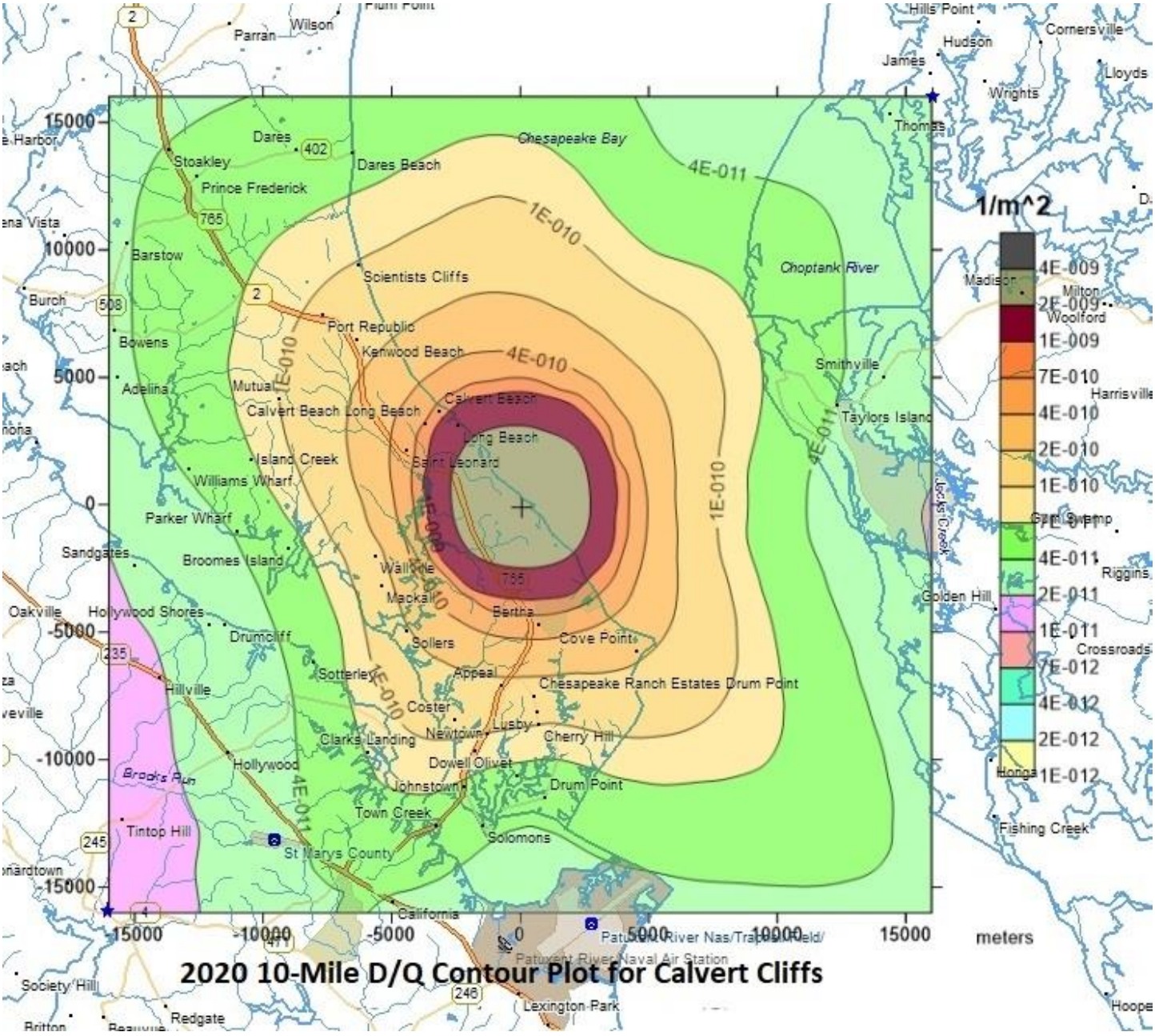


Table 1

Synopsis of 2020 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	416
Air Particulates[4]	W	8	416	Gross Beta	W	416
				Gamma	QC	32
Direct Radiation						
Ambient Radiation	Q	23	400	TLD/OSLD	Q	400
Terrestrial Environment						
Vegetation[5]	M	3	36	Gamma	M	36

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

Table 2

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

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (415)	0.5	1.8 (364/364) (0.7-4.4)	SSE of ISFSI SFA4 0.1 km SSE	1.9 (52/52) (0.9-4.4)	1.9 (52/52) (0.9-4.2)
Direct Radiation						
Ambient Radiation (mR/91 days)	TLD/OSLD (400)	0.1	12.09 (352/352) (8.59-16.60)	Taylors Island DR23 12.4 km ENE	16.7 (18/18) (15.8-17.9)	13.95 (48/48) (10.7-17.9)

[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 2020, there were no 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

In Q2 of 2020, the CCNPP REMP began using Optically Stimulated Luminescence Dosimeters (OSLD) for environmental dosimetry. These OSLDs are distributed and analyzed by Landauer, Inc.. OSLDs are optimized for environmental dosimetry due to their higher sensitivity, as compared to Thermoluminescent Dosimeters (TLD). Transitioning to OSLDs brings CCNPP into alignment with the rest of the Exelon fleet with regard to REMP environmental dosimetry systems. This streamlines the program across the fleet from both a technical and a business perspective.

Since the beginning of the CCNPP REMP, including the pre-operational studies, direct radiation measurements have been reported in milliroentgen (mR). However, 2020 Q2, Q3, and Q4 dosimetry data as reported by Landauer has expressed exposure in units of millirem (mrem).

NRC guidance has stated that the Roentgen can be used interchangeably with the rem. NUREG-1736 (page 3-26) addresses the Roentgen and its equivalency with the rad and the rem, stating that "… the R is numerically equal to the rad and to the rem." Charts in the 2020 AREOR report units in milliroentgen (mR), as ODCM attachment 14 specifies the unit of measure for Direct Radiation as the mR. CCNPP Issue Report 04422723 has been generated to document the transition to the use of mrem for environmental dosimetry reporting. Associated actions have been generated to update the ODCM.

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 0.7×10^{-2} to 4.4×10^{-2} pCi/m^3 for the indicator locations and 0.9×10^{-2} to 3.8×10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 1.9×10^{-2} pCi/m^3 was SFA4, SSE 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 five quarterly samples from indicator locations. The Cs-137 concentrations ranged from 64 ± 33 to

168 ± 58 pCi/kg. While the presence of Cs-137 in these samples may be plant-related, this range is consistent with that found to be due to the residual fallout from past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40CFR190 and 10CFR72.104. These are comparable to those observed in previous annual reporting periods for the CCNPP REMP and in the earlier pre-operational data for the ISFSI. No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were also detected in all these samples.

III.C.3 Direct Radiation-

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

The 2020 mean 91-day ambient radiation measured at the ISFSI indicator locations was 32.7 mR and ranged from 11.0 to 74.3 mR as reported in Table 4. The control location showed a 91-day mean of 14.7 mR and ranged from 13.7 to 15.6 mR. The location with the highest overall mean of 68.1 mR with a range of 62.2 to 74.3 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 dosimeter data from the indicator locations with the ISFSI control location at the Visitor's Center, SFDR7, can be seen in Figure 7.

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

The 2020 mean 91-day Facility-related dose measured at the indicator locations was 23.7 mR and ranged from 6.4 to 56.2 mR. Facility-related dose was not detected at the control location. The location with the highest overall mean of 50.0 mR was Southeast of ISFSI (sample code

SFDR14 which ranged from 44.2 to 56.2 mR. A summary of the 2020 results is shown in the table below.

2020 ISFSI Facility-related Dose Quarterly (91-Day) Summary		
	Exposure (mR)	**Range (mR)**
Indicator Locations	23.7	6.4-56.2
Control Location	Not Detected	N/A
Highest Overall Location (SFDR14)	50.0	44.2-56.2

III.D. CONCLUSION

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

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

FIGURE 7
Mean Dosimeter Gamma Dose, ISFSI

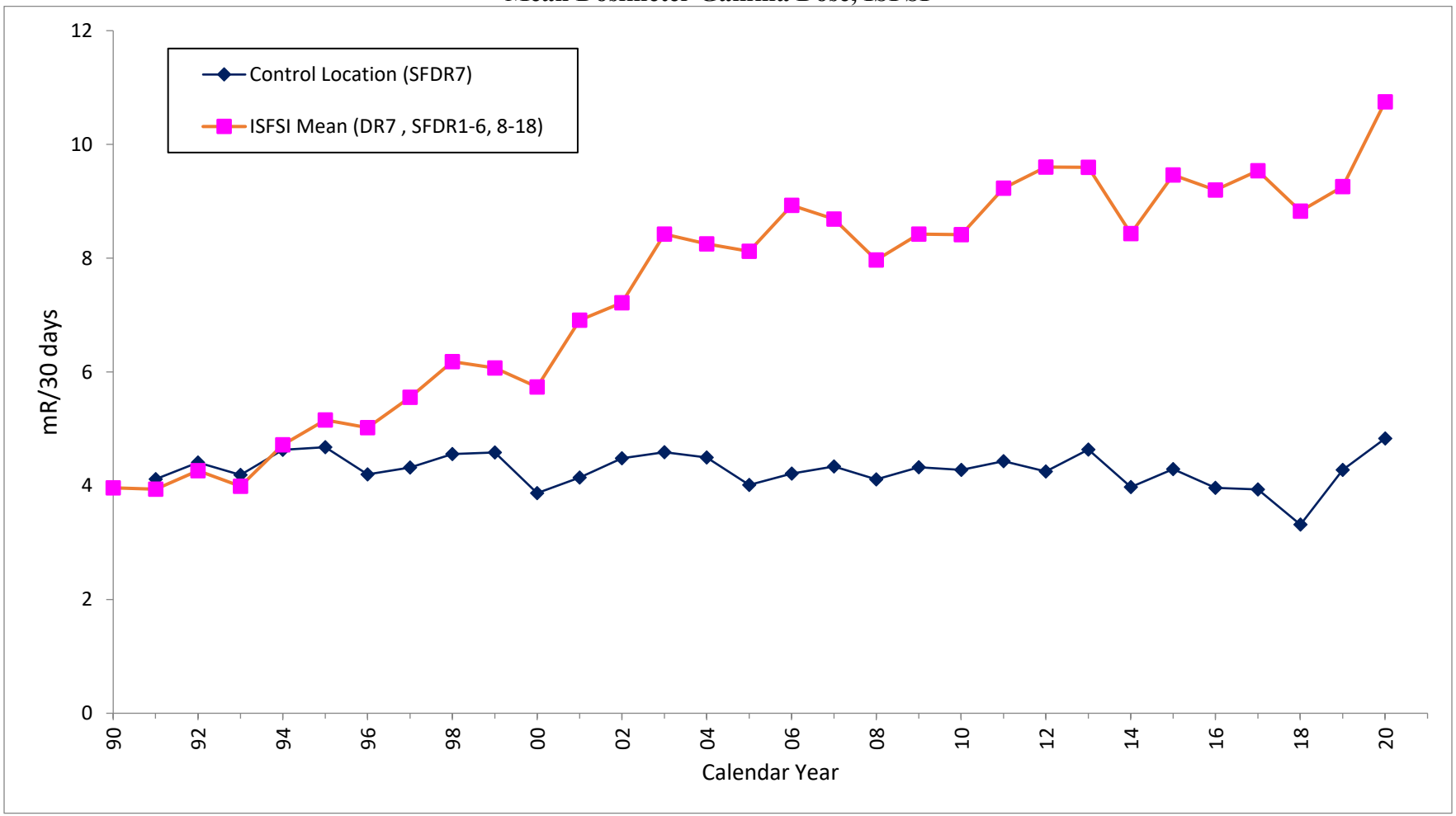


Table 3

Synopsis of 2020 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	360	TLD/OSLD	Q	360
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	1.8 (208/208) (0.7-4.4)	SSE of ISFSI SFA4 0.1 km SSE	1.9 (52/52) (0.9-4.4)	1.8 (52/52) (0.9-3.8)
Direct Radiation						
Ambient Radiation (mR/91 days)	TLD(120)/OSLDs (240)	0.1	32.7 (342/342) (11.0-74.3)	SE of ISFSI SFDR14 0.1 km SE	68.1 (18/18) (62.2-74.3)	14.7 (18/18) (13.7-15.6)
Terrestrial Environment						
Soil (pCi/kg)	Gamma (20) Cs-137	--	115 (5/16) (64-168)	NNW of ISFSI SFS3 0.1 km NNW	143 (3/4) (114-168)	-- --

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

(8) 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 2020

(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

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

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

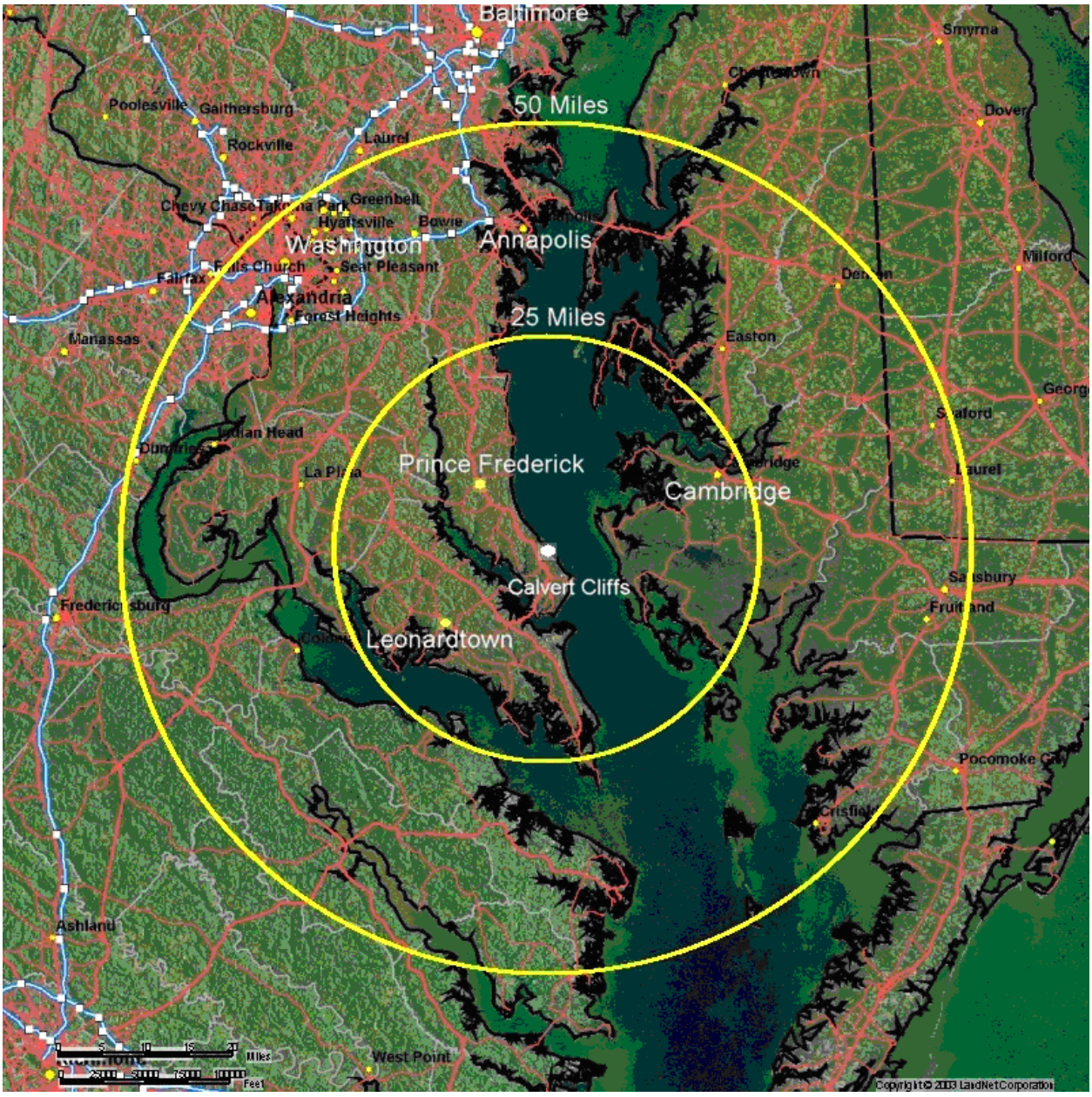


Figure A-2

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles

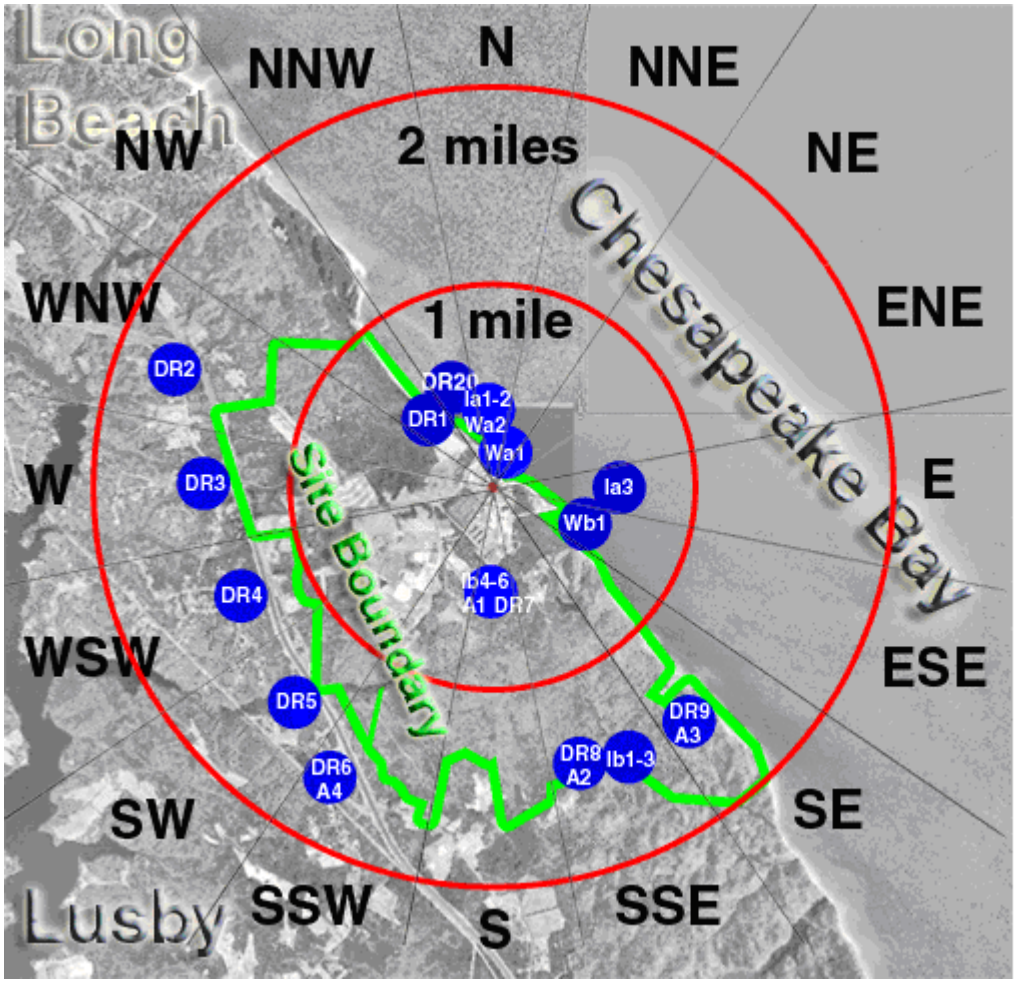


Figure A-3

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-10 Miles

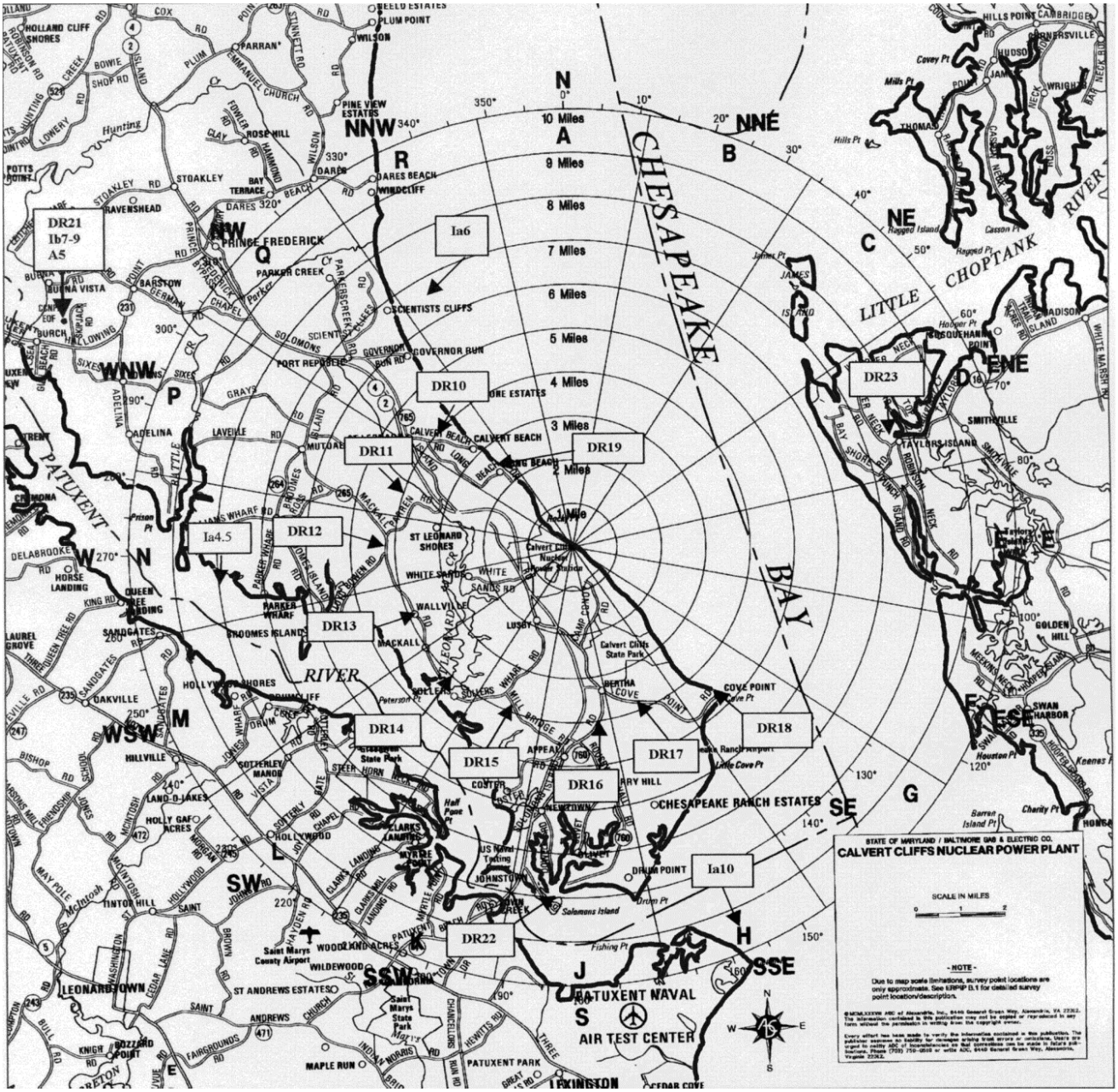


Table A-2

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

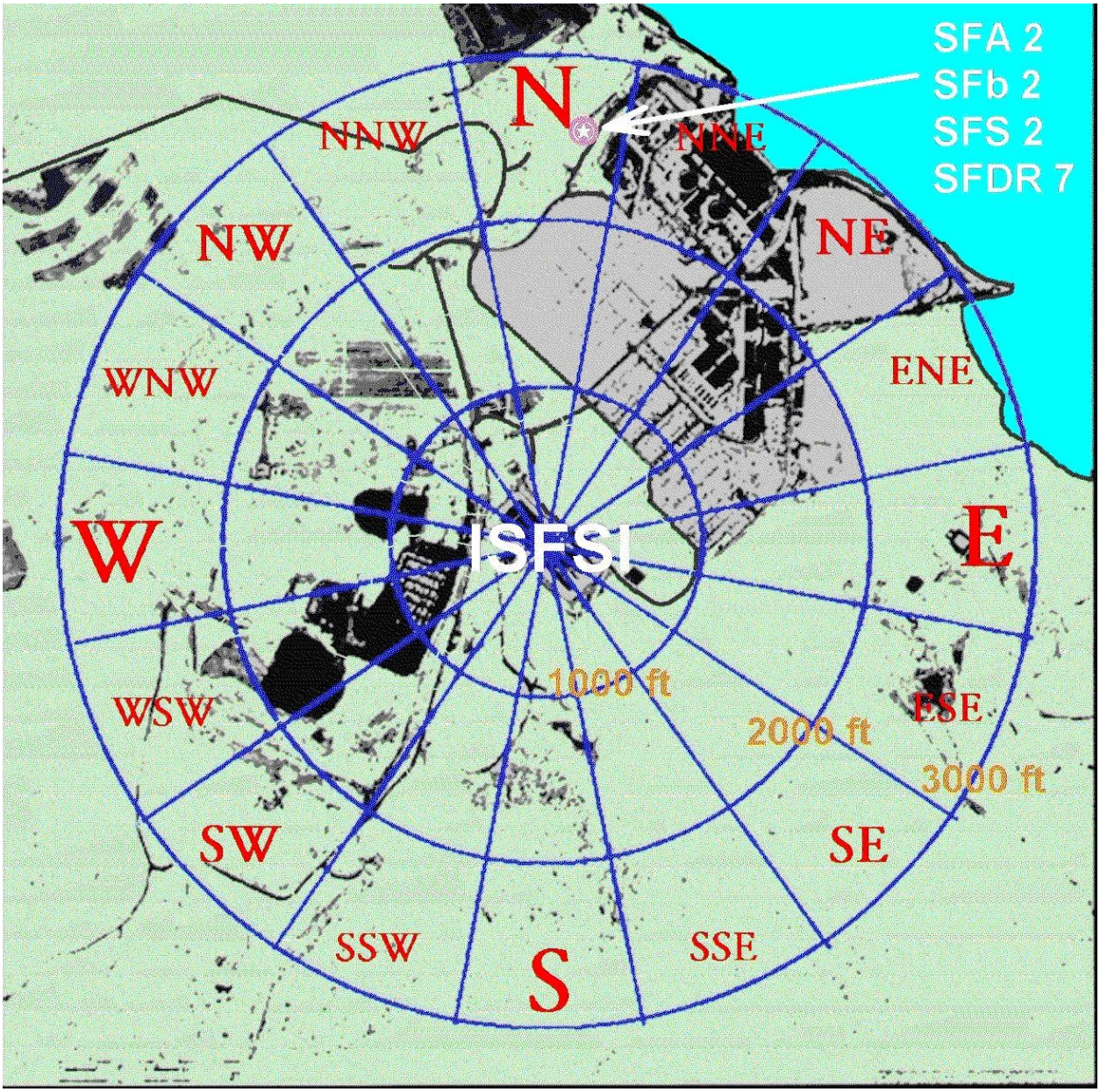
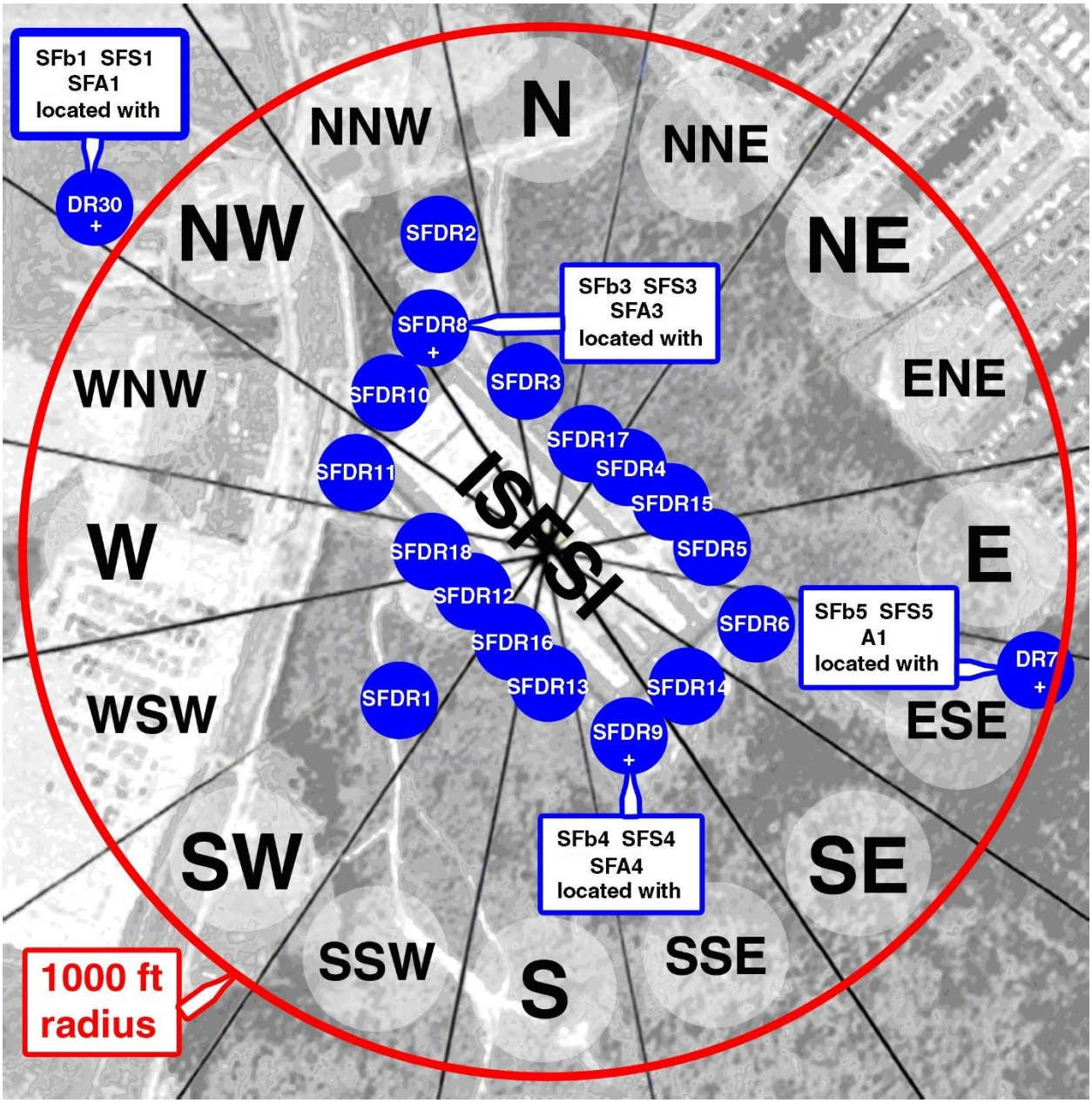


Figure A-5

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	1/31/2020	*	
	2/28/2020	*	
	4/3/2020	*	<196
	4/30/2020	*	
	5/28/2020	*	
	6/30/2020	*	<177
	7/30/2020	*	
	8/28/2020	*	
	10/2/2020	*	<177
	10/30/2020	*	
	11/27/2020	*	
	12/31/2020	*	<183
WA2			
Discharge Vicinity	1/31/2020	*	
	2/28/2020	*	
	4/3/2020	*	<193
	4/30/2020	*	
	5/28/2020	*	
	6/30/2020	*	<185
	7/30/2020	*	
	8/28/2020	*	
	10/2/2020	*	<181
	10/30/2020	*	
	11/27/2020	*	
	12/31/2020	*	<179

[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	8/05/2020	Perch	*
IA2 Discharge Area	8/05/2020	Spot	*
IA4[1] Patuxent River	8/05/2020	Perch	*
IA5[1] Patuxent River	8/05/2020	Spot	*

[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	3/10/2020	*
	6/8/2020	*
	8/5/2020	*
	10/13/2020	*
IA6[1]		
Kenwood Beach	3/10/2020	*
	6/8/2020	*
	8/5/2020	*
	10/13/2020	*

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

Table B-4

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

Sample Code	Sample Date	Gamma Emitters
WB1		
Shoreline at Barge Rd.	3/23/2020	*
	10/13/2020	*

* 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
12/30/2019	1/6/2020	*	*	*	*	*	*	*	*
1/6/2020	1/13/2020	*	*	*	*	*	*	*	*
1/13/2020	1/21/2020	*	*	*	*	*	*	*	*
1/21/2020	1/27/2020	*	*	*	*	*	*	*	*
1/27/2020	2/3/2020	*	*	*	*	*	*	*	*
2/3/2020	2/10/2020	*	*	*	*	*	*	*	*
2/10/2020	2/17/2020	*	*	*	*	*	*	*	*
2/17/2020	2/24/2020	*	*	*	*	*	*	*	*
2/24/2020	3/2/2020	*	*	*	*	*	*	*	*
3/2/2020	3/9/2020	*	*	*	*	*	*	*	*
3/9/2020	3/16/2020	*	*	*	*	*	*	*	*
3/16/2020	3/23/2020	*	*	*	*	*	*	*	*
3/23/2020	3/30/2020	*	*	*	*	*	*	*	*
3/30/2020	4/6/2020	*	*	*	*	*	*	*	*
4/6/2020	4/13/2020	*	*	*	*	*	*	*	*
4/13/2020	4/20/2020	*	*	*	*	*	*	*	*
4/20/2020	4/27/2020	*	*	*	*	*	*	*	*
4/27/2020	5/4/2020	*	*	*	*	*	*	*	*
5/4/2020	5/11/2020	*	*	*	*	*	*	*	*
5/11/2020	5/18/2020	*	*	*	*	*	*	*	*
5/18/2020	5/26/2020	*	*	*	*	*	*	*	*
5/26/2020	6/1/2020	*	*	*	*	*	*	*	*
6/1/2020	6/8/2020	*	*	*	*	*	*	*	*
6/8/2020	6/15/2020	*	*	*	*	*	*	*	*
6/15/2020	6/22/2020	*	*	*	*	*	*	*	*
6/22/2020	6/29/2020	*	*	*	*	*	*	*	*

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
6/29/2020	7/6/2020	*	*	*	*	*	*	*	*
7/6/2020	7/13/2020	*	*	*	*	*	*	*	*
7/13/2020	7/20/2020	*	*	*	*	*	*	*	*
7/20/2020	7/27/2020	*	*	*	*	*	*	*	*
7/27/2020	8/3/2020	*	*	*	*	*	*	*	*
8/3/2020	8/10/2020	*	*	*	*	*	*	*	*
8/10/2020	8/17/2020	*	*	*	*	*	*	*	*
8/17/2020	8/24/2020	*	*	*	*	*	*	*	*
8/24/2020	8/31/2020	*	*	*	*	*	*	*	*
8/31/2020	9/8/2020	*	*	*	*	*	*	*	*
9/8/2020	9/14/2020	*	*	*	*	*	*	*	*
9/14/2020	9/21/2020	*	*	*	*	*	*	*	*
9/21/2020	9/28/2020	*	*	*	*	*	*	*	*
9/28/2020	10/6/2020	*	*	*	*	*	*	*	*
10/6/2020	10/13/2020	*	*	*	*	*	*	*	*
10/13/2020	10/19/2020	*	*	*	*	*	*	*	*
10/19/2020	10/27/2020	*	*	*	*	*	*	*	*
10/27/2020	11/2/2020	*	*	*	*	*	*	*	*
11/2/2020	11/10/2020	*	*	*	*	*	*	*	*
11/10/2020	11/16/2020	*	*	*	*	*	*	*	*
11/16/2020	11/23/2020	*	*	*	*	*	*	*	*
11/23/2020	12/1/2020	*	*	*	*	*	*	*	*
12/1/2020	12/7/2020	*	*	*	*	*	*	*	*
12/7/2020	12/14/2020	*	*	*	*	*	*	*	*
12/14/2020	12/21/2020	*	*	*	*	*	*	*	*
12/21/2020	12/28/2020	*	*	*	*	*	*	*	*

[1] Control Location REMP Technical Specifications
[2] Control Location ISFSI REMP Program
* 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
12/30/2019	1/6/2020	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1
1/6/2020	1/13/2020	1.1 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1	1.2 +/- 0.1	1.2 +/- 0.1
1/13/2020	1/21/2020	2.3 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.2 +/- 0.1
1/21/2020	1/27/2020	1.4 +/- 0.1	1.5 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.2 +/- 0.1
1/27/2020	2/3/2020	1.3 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
2/3/2020	2/10/2020	1.5 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
2/10/2020	2/17/2020	1.8 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1
2/17/2020	2/24/2020	2.5 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
2/24/2020	3/2/2020	1.6 +/- 0.1	1.3 +/- 0.1	1.7 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
3/2/2020	3/9/2020	1.6 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.7 +/- 0.1	1.3 +/- 0.1
3/9/2020	3/16/2020	1.5 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
3/16/2020	3/23/2020	1.9 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
3/23/2020	3/30/2020	0.8 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1
3/30/2020	4/6/2020	1.0 +/- 0.1	1.2 +/- 0.1	1.1 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1
4/6/2020	4/13/2020	1.9 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1
4/13/2020	4/20/2020	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	1.8 +/- 0.1
4/20/2020	4/27/2020	1.2 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1
4/27/2020	5/4/2020	1.2 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1	1.1 +/- 0.1
5/4/2020	5/11/2020	1.2 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1
5/11/2020	5/18/2020	0.8 +/- 0.1	0.9 +/- 0.1	0.9 +/- 0.1	0.9 +/- 0.1	0.9 +/- 0.1
5/18/2020	5/26/2020	0.7 +/- 0.1	0.9 +/- 0.1	0.9 +/- 0.1	0.9 +/- 0.1	1.0 +/- 0.1
5/26/2020	6/1/2020	1.7 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	2.0 +/- 0.1
6/1/2020	6/8/2020	1.8 +/- 0.1	2.0 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1
6/8/2020	6/15/2020	1.2 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.2 +/- 0.1	1.4 +/- 0.1
6/15/2020	6/22/2020	0.8 +/- 0.1	1.0 +/- 0.1	0.8 +/- 0.1	0.9 +/- 0.1	1.0 +/- 0.1
6/22/2020	6/29/2020	1.9 +/- 0.1	2.3 +/- 0.1	2.0 +/- 0.1	2.4 +/- 0.1	2.2 +/- 0.1
6/29/2020	7/6/2020	1.6 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1
7/6/2020	7/13/2020	1.4 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1
7/13/2020	7/20/2020	2.1 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1	2.4 +/- 0.1
7/20/2020	7/27/2020	1.7 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1
7/27/2020	8/3/2020	1.8 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
8/3/2020	8/10/2020	1.3 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
8/10/2020	8/17/2020	2.0 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
8/17/2020	8/24/2020	2.2 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.2	2.3 +/- 0.1	2.2 +/- 0.1
8/24/2020	8/31/2020	2.0 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.2	2.5 +/- 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
8/31/2020	9/8/2020	1.9 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
9/8/2020	9/14/2020	1.3 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1
9/14/2020	9/21/2020	1.5 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1
9/21/2020	9/28/2020	2.5 +/- 0.2	2.8 +/- 0.2	2.9 +/- 0.2	2.9 +/- 0.2	3.0 +/- 0.2
9/28/2020	10/6/2020	1.6 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	2.1 +/- 0.1
10/6/2020	10/13/2020	2.2 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.8 +/- 0.2
10/13/2020	10/19/2020	1.6 +/- 0.1	2.0 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1	2.2 +/- 0.2
10/19/2020	10/27/2020	1.1 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1
10/27/2020	11/2/2020	1.7 +/- 0.1	1.4 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
11/2/2020	11/10/2020	2.7 +/- 0.1	2.7 +/- 0.2	2.6 +/- 0.1	2.8 +/- 0.1	3.2 +/- 0.2
11/10/2020	11/16/2020	2.1 +/- 0.2	2.1 +/- 0.2	2.3 +/- 0.2	2.5 +/- 0.2	2.3 +/- 0.2
11/16/2020	11/23/2020	2.0 +/- 0.1	2.2 +/- 0.1	1.9 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1
11/23/2020	12/1/2020	2.3 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.1	2.7 +/- 0.1	2.6 +/- 0.1
12/1/2020	12/7/2020	1.9 +/- 0.2	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
12/7/2020	12/14/2020	3.8 +/- 0.2	3.4 +/- 0.2	4.0 +/- 0.2	4.4 +/- 0.2	4.2 +/- 0.2
12/14/2020	12/21/2020	1.5 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
12/21/2020	12/28/2020	2.3 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1

[1] Control Location

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
12/30/2019	1/6/2020	1.5 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1
1/6/2020	1/13/2020	1.2 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1
1/13/2020	1/21/2020	2.2 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
1/21/2020	1/27/2020	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1
1/27/2020	2/3/2020	1.4 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1
2/3/2020	2/10/2020	1.6 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1
2/10/2020	2/17/2020	1.8 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
2/17/2020	2/24/2020	2.5 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.2	2.4 +/- 0.1
2/24/2020	3/2/2020	1.4 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
3/2/2020	3/9/2020	1.6 +/- 0.1	1.6 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
3/9/2020	3/16/2020	1.7 +/- 0.1	1.9 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1
3/16/2020	3/23/2020	2.1 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1
3/23/2020	3/30/2020	1.1 +/- 0.1	1.1 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1
3/30/2020	4/6/2020	1.2 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1
4/6/2020	4/13/2020	2.1 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1
4/13/2020	4/20/2020	2.0 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
4/20/2020	4/27/2020	1.4 +/- 0.1	1.4 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1
4/27/2020	5/4/2020	1.2 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
5/4/2020	5/11/2020	1.3 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
5/11/2020	5/18/2020	1.0 +/- 0.1	1.0 +/- 0.1	0.8 +/- 0.1	0.9 +/- 0.1
5/18/2020	5/26/2020	0.9 +/- 0.1	0.9 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1
5/26/2020	6/1/2020	1.9 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1
6/1/2020	6/8/2020	2.2 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
6/8/2020	6/15/2020	1.4 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
6/15/2020	6/22/2020	1.0 +/- 0.1	0.9 +/- 0.1	0.8 +/- 0.1	1.0 +/- 0.1
6/22/2020	6/29/2020	2.3 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
6/29/2020	7/6/2020	2.0 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
7/6/2020	7/13/2020	1.8 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1
7/13/2020	7/20/2020	2.6 +/- 0.1	2.5 +/- 0.1	2.5 +/- 0.1	2.2 +/- 0.1
7/20/2020	7/27/2020	2.3 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1	2.0 +/- 0.1
7/27/2020	8/3/2020	2.3 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1
8/3/2020	8/10/2020	1.6 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.1
8/10/2020	8/17/2020	2.3 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1
8/17/2020	8/24/2020	2.4 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1
8/24/2020	8/31/2020	2.5 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.1
8/31/2020	9/8/2020	2.2 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1
9/8/2020	9/14/2020	1.4 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.1
9/14/2020	9/21/2020	1.6 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1
9/21/2020	9/28/2020	3.0 +/- 0.2	2.6 +/- 0.1	2.9 +/- 0.2	2.9 +/- 0.2

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
9/28/2020	10/6/2020	1.7 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1
10/6/2020	10/13/2020	2.6 +/- 0.2	2.1 +/- 0.1	2.2 +/- 0.1	2.5 +/- 0.2
10/13/2020	10/19/2020	1.8 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.9 +/- 0.1
10/19/2020	10/27/2020	1.2 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1	1.1 +/- 0.1
10/27/2020	11/2/2020	1.9 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1
11/2/2020	11/10/2020	2.6 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	3.0 +/- 0.1
11/10/2020	11/16/2020	2.3 +/- 0.2	2.3 +/- 0.2	2.0 +/- 0.1	2.7 +/- 0.2
11/16/2020	11/23/2020	2.0 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1
11/23/2020	12/1/2020	2.5 +/- 0.1	2.2 +/- 0.1	2.5 +/- 0.1	2.8 +/- 0.1

[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
3/30/2020	*	*	*	*	*
6/29/2020	*	*	*	*	*
9/28/2020	*	*	*	*	*
12/28/2020	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
3/30/2020	*	*	*	*
6/29/2020	*	*	*	*
9/28/2020	*	*	*	*
12/28/2020	*	*	*	*

[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	6/29/2020	Kale	*
	7/27/2020	Kale	*
	8/24/2020	Tree Leaves	*
	9/21/2020	Collards	*
IB5			
Camp Conoy Entrance	6/29/2020	Cabbage	*
	7/27/2020	Collards	*
	8/24/2020	Collards	*
	9/21/2020	Kale	*
IB6			
Camp Conoy Entrance	6/29/2020	Collards	*
	7/27/2020	Cabbage	*
	8/24/2020	Kale	*
	9/21/2020	Tree Leaves	*
IB7[1]			
EOF	6/29/2020	Cabbage	*
	7/27/2020	Kale	*
	8/24/2020	Tree Leaves	*
	9/21/2020	Tree Leaves	*
			*
IB8[1]			
EOF	6/29/2020	Kale	*
	7/27/2020	Collards	*
	8/24/2020	Tree Leaves	*
	9/21/2020	Tree Leaves	
IB9[1]			
EOF	6/29/2020	Collards	*
	7/27/2020	Tree Leaves	*
	8/24/2020	Tree Leaves	*
	9/21/2020	Tree Leaves	*

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
IB10			
Meteorological Station	6/29/2020	Kale	*
	7/27/2020	Kale	*
	8/24/2020	Cabbage	*
	9/21/2020	Collards	*
IB11			
Meteorological Station	6/29/2020	Cabbage	*
	7/27/2020	Cabbage	*
	8/24/2020	Collards	*
	9/21/2020	Kale	*
IB12			
Meteorological Station	6/29/2020	Tree Leaves	*
	7/27/2020	Tree Leaves	*
	8/24/2020	Kale	*
	9/21/2020	Cabbage	*

* 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	2/17/2020	*
	5/26/2020	*
	9/8/2020	*
	12/7/2020	*
SFB2[1]		
Visitor's Center	2/17/2020	*
	5/26/2020	*
	9/8/2020	*
	12/7/2020	*
SFB3		
NNW of ISFSI	2/17/2020	*
	5/26/2020	*
	9/8/2020	*
	12/7/2020	*
SFB4		
SSE of ISFSI	2/17/2020	*
	5/26/2020	*
	9/8/2020	*
	12/7/2020	*
SFB5		
On Site Before Entrance		
to Camp Conoy	2/17/2020	*
	5/26/2020	*
	9/8/2020	*
	12/7/2020	*

[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	2/17/2020	[1]	*
	5/26/2020	[1]	*
	9/8/2020	[1]	*
	12/7/2020	[1]	*
SFS2[2] Visitors Center	2/17/2020	[1]	*
	5/26/2020	[1]	*
	9/8/2020	[1]	*
	12/7/2020	[1]	*
SFS3 NNW of ISFSI	2/17/2020	146 +/- 41	*
	5/26/2020	168 +/- 58	*
	9/8/2020	114 +/- 52	*
	12/7/2020	[1]	*
SFS4 SSE of ISFSI	2/17/2020	[1]	*
	5/26/2020	[1]	*
	9/8/2020	[1]	*
	12/7/2020	[1]	*
SFS5 Entrance to Camp Conoy	2/17/2020	82 +/- 26	*
	5/26/2020	[1]	*
	9/8/2020	64 +/- 33	*
	12/7/2020	[1]	*

[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	5.65 - 24.6	16 - 182	2,747 - 4,505	21.5 -66.4	1,286 - 1,529	1,269 - 2,069	781 - 13,761	789 - 10,713	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	0.52 - 11.7	21.4 - 2,340	4.87 - 9.04	0.5 - 7.03	22.4 - 107	470 - 2,040	139 - 8,060	13.4 - 854
Cs-134	0.47 - 0.88	3.2 - 5.7	7.8 - 16.0	2.92 - 5.48	4.09 - 4.82	9.7 - 16.5	43.3 - 82.4	33.4 - 109	11.1 - 58.1
Cs-137	0.46 - 0.88	3.7 - 5.9	3.8 - 17.5	2.97 - 5.43	4.08 - 5.29	10.0 - 16.7	38.4 - 65.4	39.1 - 135	11.1 - 62.3
La-140	2.01 – 116	5.05 - 11.5	15.9 - 444	4.87 - 10.3	4.89 - 6.28	24.1 - 80.4	368 - 773	136 - 1,820	9.1 - 388
Ba-140	2.01 - 116	5.05 - 11.5	15.9 - 444	5.86 - 26.0	4.89 - 6.28	24.1 - 80.4	368 – 773	136 - 1,820	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 5.22 x 10^{-3} to 1.37 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	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	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 3.7 $x10^{-2}$ 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	Mean ± 2 σ
DR01	On Site, along Cliffs	12.0	13.6	13.5	11.2	12.6 ± 2.3
DR02	Route 765, Auto Dump	11.2	11.0	11.3	10.5	11.0 ± 0.7
DR03	Route 765, Giovanni's Tavern	11.8	11.5	15.5	10.4	12.3 ± 4.4
DR04	Route 765, across from Vera's Beach Club	13.7	13.3	13.8	11.7	13.1 ±1.9
DR05	Route 765, John's Creek	13.3	12.7	12.5	11.5	12.5 ±1.5
DR06	Route 765 at Lusby	11.3	11.0	11.8	10.5	11.2 ± 1.1
DR07	Entrance to Camp Conoy	11.9	11.3	10.8	10.7	11.2 ± 1.1
DR08	Camp Conoy Rd at Emergency Siren	16.6	15.2	13.3	15.1	15.1 ± 2.7
DR09	Bay Breeze Rd	11.7	11.2	10.8	9.06	10.7 ± 2.3
DR10	Calvert Beach Rd and Decatur Street	12.1	11.8	9.63	9.91	10.9 ± 2.5
DR11	Dirt road off Mackall & Parren Rd	9.6	12.1	11.3	12.4	11.4 ± 2.5
DR12	Mackall & Bowen Rds	12.0	11.7	11.4	10.2	11.3 ± 1.6
DR13	Mackall Rd, near Wallville	14.9	12.9	11.2	11.5	12.6 ± 3.4
DR14	Rodney Point	13.7	13.1	11.2	12.5	12.6 ± 2.1

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

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Mean ± 2 σ
DR15	Mill Bridge & Turner Rds	13.1	12.6	12.3	*	12.7 ± 0.8
DR16	Across from Appeal School	13.0	11.3	11.2	10.9	11.6 ± 1.9
DR17	Cove Point & Little Cove Point Rds	15.7	14.6	13.7	13.6	14.4 ± 2.0
DR18	Cove Point	10.7	10.7	8.59	8.61	9.7 ± 2.4
DR19	Long Beach	13.0	*	10.5	10.6	11.4 ± 2.8
DR20	On site, near shore	14.4	14.7	13.3	11.7	13.5 ± 2.7
DR21[1]	EOF	14.1	13.5	12.5	11.8	13.0 ± 2.0
DR22[1]	Solomons Island	*	12.3	10.7	11.8	11.6 ± 1.6
DR23[1]	Taylors Island	17.9	16.5	16.6	15.8	16.7 ± 1.8
DR30	MET Station	12.1	12.4	11.0	12.0	11.9 ± 1.2
SFDR01	SW of ISFSI	18.0	18.3	16.0	20.1	18.1 ± 3.4
SFDR02	NNW of ISFSI	20.4	19.6	17.9	15.7	18.4 ± 4.2
SFDR03	North of ISFSI	40.1	32.8	33.1	31.2	34.3 ± 7.9
SFDR04	NE of ISFSI	42.0	34.7	36.6	32.2	36.4 ± 8.3
SFDR05	East of ISFSI	30.0	23.1	20.0	23.5	24.2 ± 8.4
SFDR06	ESE of ISFSI	21.4	19.0	18.6	19.1	19.5 ± 2.5

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

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Mean ± 2 σ
SFDR07[1]	Visitor's Center	15.6	14.3	13.7	15.0	14.7 ± 1.7
SFDR08	NNW of ISFSI	30.1	24.7	24.4	21.8	25.3 ± 7.0
SFDR09	SSE of ISFSI	46.2	54.1	53.0	50.5	51.0 ± 7.0
SFDR10	NW of ISFSI	25.7	26.3	25.0	21.5	24.6 ± 4.3
SFDR11	WNW ISFSI	31.6	25.9	23.8	23.3	26.2 ± 7.6
SFDR12	WSW of ISFSI	42.8	43.0	41.6	38.2	41.4 ± 4.4
SFDR13	South of ISFSI	33.6	30.9	32.2	30.3	31.8 ± 2.9
SFDR14	SE of ISFSI	62.2	68.5	74.3	67.4	68.1 ± 9.9
SFDR15	ENE of ISFSI	34.7	26.9	26.7	26.2	28.6 ± 8.1
SFDR16	SSW of ISFSI	59.2	47.5	45.9	47.7	50.1 ± 12.3
SFDR17	NNE of ISFSI	42.8	36.7	37.1	36.4	38.3 ± 6.1
SFDR18	West of ISFSI	47.2	37.8	38.5	37.5	40.3 ± 9.3

1 Control Location
- Missing Dosimeters, No data

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 Gross Beta result for ERA Study Rad 121, reference date 4/3/2020 passed the low end of vendor acceptance criteria but failed NRC Resolution Test Criteria. Low recovery of activity in sample preparation is the likely cause of the low result reported and NRC Resolution Test Criteria Failure. It was determined that glassware used in preparation is cleaned with Nitric acid except the volumetric pipets which are rinsed with DI water only. The glass is potentially not as clean and could retain microdroplets of activity on the glass. Going forward volumetric pipets are rinsed with Nitric acid to remove mineral deposit and activity that might be retained on the glass during use and preventing a clean delivery of the sample. This event has been entered into the Corrective Action Program for tracking and to prevent future occurrence.

Two of the EZA crosscheck studies, reference date 12/3/2020 reported values for Zn-65 that failed NRC acceptance criteria for Filter E13067 and Milk, E13070. The cause for the failure in both studies was that the evaluation spreadsheet that was used contained an error in mapping the raw data cell to the calculated data cell. The spreadsheet was not properly peer reviewed and verified. The cell was mapped to the Co-60 raw data and not the Zn-65 raw data. Had this cell been mapped to the correct raw data, the result and uncertainty would have passed NRC acceptance criteria with less than 10% difference from the True value. This event has been entered into the Corrective Action Program and the spreadsheet tool has been corrected and validated to prevent recurrence of this error.

The Inter and Intra 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. In addition, statistical analysis of replicate OSLDs from Landauer are also evaluated using NRC Resolution Test Criteria[1]. Replicate OSLDs were deployed at the same locations previously evaluated with replicate TLDs for historical continuity. The comparison of the gross ambient radiation detected on original and replicate dosimeters is included

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

at the end of Table C-2 and all these Landauer results agree with their respective original and replicate dosimeters.

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. The original, replicate and split analysis of soil collected on May 26, 2020 at SFS3 indicated Non Plant related Cs-137 at low levels and these results Pass the NRC Resolution Test Criteria[1]. The Cs-137 detected is consistent with weapons related fallout previously identified in the environs around Calvert Cliffs Nuclear Power Plant.

The replicate and split analysis of soil collected on May 26, 2020 at SFS5 indicated low level, Non Plant related Cs-137 and these results Pass the NRC Resolution Test Critiera[1]. The original sample did not indicate Cs-137 above the Minimum Detectable Activity, MDA, of the analysis. In this case the replicate and split results also Pass the NRC Resolution Test Criteria[1], as specified in the rule. When compared to the MDA of the original analysis, the positive result is less than five times the MDA value. The low level Cs-137 observed in these soil analyses is consistent with weapons related fallout previously identified in the environs around Calvert Cliffs Nuclear Power Plant.

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.

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[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
04/06/20	Water-pCi/L	Co-60	50.7 +/- 3.4	50.3	Pass
		Zn-65	87.8 +/- 9.4	86.8	Pass
		Cs-134	46.5 +/- 2.5	46.3	Pass
		Cs-137	225 +/- 8.5	234	Pass
		Ba-133	40.1 +/- 3.5	41.8	Pass
		I-131	29.7 +/- 4.0	28.9	Pass
04/06/20	Water - pCi/L	Gross Beta	43.3 +/- 2.05	60.5	Pass
06/04/20	Air Filter-pCi	Co-60	125 +/- 8.6	127	Pass
		Zn-65	153 +/- 20.0	146	Pass
		Cs-134	75.8 +/- 5.6	95.2	Pass
		Cs-137	64.2 +/- 6.9	67.5	Pass
		Ce-141	82.8 +/- 7.7	75.5	Pass
		Cr-51	160 +/- 41.2	167	Pass
		Mn-54	94.1 +/- 7.5	87.0	Pass
		Fe-59	71.7 +/- 8.8	65.7	Pass
		Co-58	62.1 +/- 7.3	65.4	Pass
06/04/20	Air Filter-pCi	Co-60	136 +/- 6.9	127	Pass
		Zn-65	153 +/- 16.2	146	Pass
		Cs-134	81.4 +/- 4.3	95.2	Pass
		Cs-137	71.8 +/- 6.5	67.5	Pass
		Ce-141	79.4 +/- 6.2	75.5	Pass
		Cr-51	179 +/- 36.5	167	Pass
		Mn-54	87.3 +/- 7.2	87	Pass
		Fe-59	65.8 +/- 7.9	65.7	Pass
		Co-58	60.7 +/- 6.7	65.4	Pass
06/04/20	Air Filter-pCi	Co-60	125 +/- 6.5	127	Pass
		Zn-65	136 +/- 16.6	146	Pass
		Cs-134	82.9 +/- 4.3	95.2	Pass
		Cs-137	64.0 +/- 6.5	67.5	Pass
		Ce-141	71.5 +/- 5.1	75.5	Pass
		Cr-51	115 +/- 23.7	167	Pass
		Mn-54	91.8 +/- 10.6	87.0	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
		Fe-59	72.4 +/- 13.3	65.7	Pass
		Co-58	67.3 +/- 9.0	65.4	Pass
06/04/20	Air Filter-pCi	Co-60	125 +/- 9.4	127	Pass
		Zn-65	154 +/- 22.0	146	Pass
		Cs-134	83.9 +/- 6.7	95.2	Pass
		Cs-137	70.9 +/- 9.0	67.5	Pass
		Ce-141	68.0 +/- 7.9	75.5	Pass
		Cr-51	135 +/- 45.2	167	Pass
		Mn-54	88.3 +/- 8.6	87.0	Pass
		Fe-59	82.9 +/- 12.3	65.7	Pass
		Co-58	55.0 +/- 7.3	65.4	Pass
06/04/20	Air Iodine-pCi	I-131	88.1 +/- 21.8	91.7	Pass
		I-131	87.6 +/- 20.0	91.7	Pass
		I-131	82.5 +/- 10.5	91.7	Pass
		I-131	86.2 +/- 15.2	91.7	Pass
06/04/20	Milk-pCi/L	Cs-134	131 +/- 8.3	146	Pass
		Cs-137	102 +/- 14.0	104	Pass
		Ce-141	106 +/- 20.2	81.2	Pass
		Cr-51	250 +/- 96.6	256	Pass
		Mn-54	124 +/- 18.6	134	Pass
		Fe-59	104 +/- 20.0	101	Pass
		Co-58	99.2 +/- 13.9	100	Pass
		Co-60	199 +/- 15.0	195	Pass
		Zn-65	211 +/- 33.7	225	Pass
		I-131	71.4 +/- 26.3	81.5	Pass
06/04/20	Milk-pCi/L	Cs-134	125 +/- 10.3	146	Pass
		Cs-137	98.9 +/- 14.2	104	Pass
		Ce-141	114 +/- 22.8	81.2	Pass
		Cr-51	251 +/- 101.1	256	Pass
		Mn-54	154 +/- 19.1	134	Pass
		Fe-59	96.0 +/- 20.8	101	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
		Co-58	107 +/- 17.5	100	Pass
		Co-60	200 +/- 16.5	195	Pass
		Zn-65	225 +/- 41.4	225	Pass
		I-131	80.8 +/- 19.9	81.5	Pass
06/04/20	Milk-pCi/L	Cs-134	142 +/- 12.4	146	Pass
		Cs-137	97.9 +/- 18.3	104	Pass
		Ce-141	107 +/- 15.8	81.2	Pass
		Cr-51	223 +/- 69.0	256	Pass
		Mn-54	131 +/- 13.9	134	Pass
		Fe-59	106 +/- 16.5	101	Pass
		Co-58	94.9 +/- 12.0	100	Pass
		Co-60	181 +/- 11.9	195	Pass
		Zn-65	200 +/- 223	225	Pass
		I-131	87.3 +/- 29.3	81.5	Pass
06/04/20	Milk-pCi/L	Cs-134	128 +/- 8.6	146	Pass
		Cs-137	101 +/- 12.5	104	Pass
		Ce-141	118 +/- 17.5	81.2	Pass
		Cr-51	231 +/- 94.6	256	Pass
		I-131	81.2 +/- 24.2	81.5	Pass
		Zn-65	189 +/- 32.1	225	Pass
		Co-58	101 +/- 14.8	100	Pass
		Mn-54	133 +/- 0.0	134	Pass
		Fe-59	99.1 +/- 17.7	101	Pass
06/04/20	Water-pCi/L	Mn-54	129 +/- 17.4	135	Pass
		Fe-59	116 +/- 24.6	102	Pass
		Co-58	91.4 +/- 18.3	102	Pass
		Co-60	201 +/- 16.2	198	Pass
		Zn-65	218 +/- 41.6	227	Pass
		I-131	63.9 +/- 26.5	80.5	Pass
		Cs-134	150 +/- 12.3	148	Pass
		Cs-137	109 +/- 15.6	105	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
		Ce-141	116 +/- 18.0	117	Pass
		Cr-51	208 +/- 91.6	259	Pass
06/04/20	Water-pCi/L	Mn-54	159 +/- 15.7	135	Pass
		Fe-59	119 +/- 17.3	102	Pass
		Co-58	100 +/- 14.5	102	Pass
		Co-60	204 +/- 12.4	198	Pass
		Zn-65	211 +/- 27.9	227	Pass
		I-131	67.4 +/- 22.0	80.5	Pass
		Cs-134	151 +/- 9.1	148	Pass
		Cs-137	106 +/- 13.5	105	Pass
		Ce-141	126 +/- 17.5	117	Pass
		Cr-51	216 +/- 71.1	259	Pass
06/04/20	Water-pCi/L	Mn-54	150 +/- 15.4	135	Pass
		Fe-59	106 +/- 16.8	102	Pass
		Co-58	110 +/- 12.7	102	Pass
		Co-60	188 +/- 12.4	198	Pass
		Zn-65	221 +/- 28.1	227	Pass
		I-131	90.2 +/- 20.4	80.5	Pass
		Cs-134	141 +/- 9.6	148	Pass
		Cs-137	105 +/- 13.5	105	Pass
		Ce-141	119 +/- 17.5	117	Pass
		Cr-51	229 +/- 75.1	259	Pass
06/04/20	Water - pCi/L	Gross Beta	273 +/- 4.88	272	Pass
09/10/20	Air Filter - pCi/m^3	Gross Beta	174 +/- 2.76	162	Pass
		Gross Beta	175 +/- 2.77	162	Pass
09/14/20	Air Filter	Cs-134	271 +/- 7.9	296	Pass
		Cs-137	439 +/- 17.1	413	Pass
		Co-60	528 +/- 14.7	497	Pass
		Zn-65	528 +/- 31.9	500	Pass
10/02/20	Water	Cs-134	53.7 +/- 4.6	52.7	Pass
		Zn-65	150 +/- 17.1	162	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
		Co-60	68.6 +/- 5.6	60.5	Pass
		Ba-133	33.3 +/- 5.1	37.0	Pass
		Cs-137	136 +/- 9.6	131	Pass
		I-131	28.7 +/- 6.9	28.2	Pass
12/03/20	Air Filter	Ce-141	77.1 +/- 5.7	78.4	Pass
		Cs-137	92.3 +/- 8.3	99.9	Pass
		Cs-134	79.3 +/- 4.6	84.5	Pass
		Zn-65	105 +/- 7.5	149	Pass
		Co-60	117 +/- 7.5	119	Pass
		Co-58	64.3 +/- 7.5	66.1	Pass
		Fe-59	101 +/- 10.7	87.9	Pass
		Mn-54	110 +/- 9.1	112	Pass
		Cr-51	184 +/- 30.4	199	Pass
12/03/20	Air Filter	Cr-51	197 +/- 26.2	199	Pass
		Ce-141	83.9 +/- 4.8	78.4	Pass
		Cs-137	95.0 +/- 5.8	99.9	Pass
		Cs-134	72.3 +/- 3.8	84.5	Pass
		Zn-65	111 +/- 4.8	149	Pass
		Co-60	124 +/- 4.8	119	Pass
		Co-58	63.0 +/- 5.1	66.1	Pass
		Fe-59	111 +/- 7.8	87.9	Pass
		Mn-54	125 +/- 7.0	112	Pass
12/03/20	Air Iodine	I-131	79.4 +/- 6.6	78.3	Pass
		I-131	73.4 +/- 7.6	78.3	Pass
12/03/20	Milk	Ce-141	106 +/- 14.0	100	Pass
		Cs-137	120 +/- 10.4	127	Pass
		Cr-51	231 +/- 52.2	253	Pass
		Mn-54	146 +/- 12.4	143	Pass
		Cs-134	89.6 +/- 5.6	108	Pass
		I-131	83.3 +/- 12.2	91.9	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
		Zn-65	135 +/- 8.9	190	Pass
		Co-60	150 +/- 8.9	152	Pass
		Co-58	72.7 +/- 9.5	84.3	Pass
		Fe-59	116 +/- 14.2	112	Pass
12/03/20	Water - pCi/L	Gross Beta	300 +/- 5.11	277	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 Filter - A1	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A2	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A3	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A4	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A5	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA1	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA2	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA3	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA4	01/06/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Iodine - A1	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	01/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - A1	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A2	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - A3	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.6 +/- 0.1	**	PASS	NA
Air Filter - A4	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.3 +/- 0.1	**	PASS	NA
Air Filter - A5	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA1	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.6 +/- 0.1	1.5 +/- 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	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - SFA3	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.2 +/- 0.1	**	PASS	NA
Air Filter - SFA4	02/10/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Iodine - A1	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	02/24/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Water – WA2	4/3/2020	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Water – WA1	4/3/2020	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	04/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	04/06/20	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 - A1	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	05/04/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Soil - SFS3[1]	05/26/20	Cs-137	pCi/kg	168 +/- 58.3	215 +/- 67.2	209 +/- 34.0	PASS	PASS
Soil - SFS5[1]	05/26/20	Cs-137	pCi/kg	<MDA	76.0 ± 34.8	81.2 ± 24.8	PASS	PASS
Air Filter - A1	06/08/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - A2	06/08/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - A3	06/08/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - A4	06/08/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - A5	06/08/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - SFA1	06/08/20	Gross Beta	10^{-2} pCi/m^3	2.2 +/- 0.1	2.1 +/- 0.1	**	PASS	NA
Air Filter - SFA2	06/08/20	Gross Beta	10^{-2} pCi/m^3	2.1 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - SFA3	06/08/20	Gross Beta	10^{-2} pCi/m^3	2.2 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - SFA4	06/08/20	Gross Beta	10^{-2} pCi/m^3	2.2 +/- 0.1	2.0 +/- 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)
Oysters – IA3	06/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Oysters – IA6	06/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Bottom sediment - WBS4	06/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Bottom sediment - WBS2	06/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	06/15/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - A1	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A2	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A3	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A4	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A5	6/29/20	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 - SFA1	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA2	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA3	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA4	6/29/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.6 +/- 0.1	1.6 +/- 0.1	**	PASS	NA
Air Filter - A2	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - A3	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - A4	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - A5	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - SFA1	07/06/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - SFA2	07/06/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - SFA3	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	2.0 +/- 0.1	**	PASS	NA
Air Filter - SFA4	07/06/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	1.7 +/- 0.1	**	PASS	NA
Air Iodine - A1	07/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	07/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	07/06/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	07/06/20	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)
Kale - IB4	7/27/2020	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Kale - IB7	7/27/2020	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Kale - IB10	7/27/2020	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Shoreline Sediment -East	7/31/2020	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Spot – IA2	08/05/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Spot – IA5	08/05/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Oysters – IA3	08/05/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Oysters – IA6	08/05/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A1	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.3 +/- 0.1	1.2 +/- 0.1	**	PASS	NA
Air Filter - A2	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.5 +/- 0.1	**	PASS	NA
Air Filter - A3	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.3 +/- 0.1	**	PASS	NA
Air Filter - A4	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.3 +/- 0.1	**	PASS	NA
Air Filter - A5	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - SFA1	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.6 +/- 0.1	1.6 +/- 0.1	**	PASS	NA
Air Filter - SFA2	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - SFA3	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.3 +/- 0.1	1.4 +/- 0.1	**	PASS	NA
Air Filter - SFA4	08/10/20	Gross Beta	10^{-2} pCi/m^3	1.5 +/- 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 Iodine - A1	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	08/10/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Grapes - East	09/04/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Vegetation – SFB3	09/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Vegetation – SFB3	09/08/20	Gamma	pCi/kg	<MDA	<MDA	<MDA	PASS	NA
Milk – Farm A	09/08/20	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Milk – Farm B	09/08/20	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	09/08/20	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 - SFA1	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	09/08/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - 11S2	10/05/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.2	1.8 +/- 0.2	**	PASS	NA
Air Filter - 1A	10/08/20	Gross Beta	10^{-2} pCi/m^3	2.5 +/- 0.2	2.5 +/- 0.2	**	PASS	NA
Air Filter - E1-2Q	10/08/20	Gross Beta	10^{-2} pCi/m^3	2.4 +/- 0.2	2.4 +/- 0.2	**	PASS	NA
Air Filter - 11S2	10/12/20	Gross Beta	10^{-2} pCi/m^3	2.9 +/- 0.2	3.2 +/- 0.2	**	PASS	NA
Drinking Water - MCWA	10/12/20	Gross Beta	pCi/L	1.68 +/- 0.65	1.55 +/- 0.65	**	PASS	NA
Drinking Water – OWD	10/12/20	Gross Beta	pCi/L	2.02 +/- 0.67	1.82 +/- 0.67	**	PASS	NA
Drinking Water – Webster	10/12/20	Gross Beta	pCi/L	1.32 +/- 0.62	1.84 +/- 0.67	**	PASS	NA
Surface Water – CIRC-IN	10/12/20	Gross Beta	pCi/L	2.11 +/- 0.67	205 +/- 0.68	**	PASS	NA
Surface Water – CIRC-OUT	10/12/20	Gross Beta	pCi/L	2.58 +/- 0.71	2.20 +/- 0.70	**	PASS	NA
Air Filter - 1A	10/14/20	Gross Beta	10^{-2} pCi/m^3	2.2 +/- 0.2	2.3 +/- 0.2	**	PASS	NA
Air Filter - E1-2Q	10/15/20	Gross Beta	10^{-2} pCi/m^3	2.3 +/- 0.2	2.3 +/- 0.2	**	PASS	NA
Air Filter - 11S2	10/19/20	Gross Beta	10^{-2} pCi/m^3	1.6 +/- 0.2	1.9 +/- 0.2	**	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	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	10/19/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Filter - 1A	10/21/20	Gross Beta	10^{-2} pCi/m^3	2.6 +/- 0.2	2.4 +/- 0.2	**	PASS	NA
Surface Water - DC	10/21/20	Gross Beta	pCi/L	<MDA	<MDA	**	PASS	NA
Surface Water - ML	10/21/20	Gross Beta	pCi/L	8.31 +/- 2.3	5.71 +/- 2.2	**	PASS	NA
Air Filter - E1-2Q	10/22/20	Gross Beta	10^{-2} pCi/m^3	2.2 +/- 0.2	2.1 +/- 0.2	**	PASS	NA
Air Filter - 11S2	10/26/20	Gross Beta	10^{-2} pCi/m^3	1.4 +/- 0.2	1.3 +/- 0.2	**	PASS	NA
Air Filter – STATION-02	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	1.9 +/- 0.1	**	PASS	NA
Air Filter – STATION-03	10/27/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.2	1.9 +/- 0.1	**	PASS	NA
Air Filter –	10/27/20	Gross Beta		1.6 +/- 0.3	1.6 +/- 0.3	**	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)
STATION-04			10^{-2} pCi/m^3					
Air Filter – STATION-05	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.7 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter – STATION-06	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	1.9 +/- 0.1	**	PASS	NA
Air Filter – STATION-07	10/27/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.2	2.0 +/- 0.2	**	PASS	NA
Air Filter – STATION-08	10/27/20	Gross Beta	10^{-2} pCi/m^3	2.5 +/- 0.2	2.6 +/- 0.2	**	PASS	NA
Air Filter – STATION-09	10/27/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.2	2.1 +/- 0.2	**	PASS	NA
Air Filter – STATION-10	10/27/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter – STATION-11	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	1.7 +/- 0.1	**	PASS	NA
Air Filter – STATION-12	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter – STATION-13	10/27/20	Gross Beta	10^{-2} pCi/m^3	1.9 +/- 0.1	1.8 +/- 0.1	**	PASS	NA
Air Filter - 1A	10/29/20	Gross Beta	10^{-2} pCi/m^3	2.0 +/- 0.2	2.0 +/- 0.2	**	PASS	NA
Air Filter -E1-2Q	10/29/20	Gross Beta	10^{-2} pCi/m^3	1.6 +/- 0.2	1.5 +/- 0.2	**	PASS	NA
Water – WA2	10/30/20	Gamma	pCi/L	<MDA	<MDA	NA	PASS	NA
Water – WA1	10/30/20	Gamma	pCi/L	<MDA	<MDA	NA	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 - 11S2	11/03/20	Gross Beta	10^{-2} pCi/m^3	1.8 +/- 0.2	1.7 +/- 0.2	**	PASS	NA
Water – WA2	11/27/20	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Water – WA1	11/27/20	Gamma	pCi/L	<MDA	<MDA	<MDA	PASS	PASS
Air Iodine - A1	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A2	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A3	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A4	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - A5	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA1	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA2	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA3	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Air Iodine - SFA4	12/14/20	I-131	pCi/m^3	<MDA	<MDA	**	PASS	NA
Milk – Farm A	12/28/20	I-131	pCi/L	<MDA	**	<MDA	NA	PASS
Air Filter - A1	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A2	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A3	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A4	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - A5	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA1	12/28/20	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 - SFA2	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA3	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
Air Filter - SFA4	12/28/20	Gamma	pCi/m^3	<MDA	<MDA	<MDA	PASS	PASS
DR05[1]	07/06/20	Ambient Radiation	mR	12.6	12.4	**	PASS	**
DR06[1]	07/06/20	Ambient Radiation	mR	11.3	11.5	**	PASS	**
DR07[1]	07/06/20	Ambient Radiation	mR	11.5	11.4	**	PASS	**
DR08[1]	07/06/20	Ambient Radiation	mR	14.2	14.3	**	PASS	**
DR09[1]	07/06/20	Ambient Radiation	mR	11.5	11.4	**	PASS	**
DR10[1]	07/06/20	Ambient Radiation	mR	11.9	11.8	**	PASS	**
DR11[1]	07/06/20	Ambient Radiation	mR	12.1	11.9	**	PASS	**
SFDR14[1]	07/06/20	Ambient Radiation	mR	52.6	57.2	**	PASS	**
SFDR15[1]	07/06/20	Ambient Radiation	mR	23.8	24.3	**	PASS	**
DR23[1]	07/06/20	Ambient Radiation	mR	15.2	15.2	**	PASS	**
DR05[1]	10/06/20	Ambient Radiation	mR	17.0	15.5	**	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)
DR06[1]	10/06/20	Ambient Radiation	mR	16.5	14.6	**	PASS	**
DR07[1]	10/06/20	Ambient Radiation	mR	15.6	15.0	**	PASS	**
DR08[1]	10/06/20	Ambient Radiation	mR	17.7	17.0	**	PASS	**
DR09[1]	10/06/20	Ambient Radiation	mR	15.6	14.7	**	PASS	**
DR10[1]	10/06/20	Ambient Radiation	mR	14.7	15.3	**	PASS	**
DR11[1]	10/06/20	Ambient Radiation	mR	16.1	16.4	**	PASS	**
SFDR14[1]	10/06/20	Ambient Radiation	mR	68.3	67.4	**	PASS	**
SFDR15[1]	10/06/20	Ambient Radiation	mR	30.6	30.3	**	PASS	**
DR23[1]	10/06/20	Ambient Radiation	mR	19.2	18.9	**	PASS	**
DR05[1]	01/15/2021	Ambient Radiation	mR	16.6	16.2	**	PASS	**
DR06[1]	01/15/2021	Ambient Radiation	mR	15.8	14.9	**	PASS	**
DR07[1]	01/15/2021	Ambient Radiation	mR	16.0	15.3	**	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)
DR08[1]	01/15/2021	Ambient Radiation	mR	19.5	19.6	**	PASS	**
DR09[1]	01/15/2021	Ambient Radiation	mR	14.6	14.8	**	PASS	**
DR10[1]	01/15/2021	Ambient Radiation	mR	15.3	15.5	**	PASS	**
DR11[1]	01/15/2021	Ambient Radiation	mR	17.3	16.8	**	PASS	**
SFDR14[1]	01/15/2021	Ambient Radiation	mR	64.1	59.7	**	PASS	**
SFDR15[1]	01/15/2021	Ambient Radiation	mR	30.4	29.4	**	PASS	**
DR23[1]	01/15/2021	Ambient Radiation	mR	19.7	20.2	**	PASS	**

[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 2019 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	1.4*
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 West sector.

There are no animals producing milk for public consumption within the 5-mile radius. In the WNW Sector, goats were identified as being used for milk and cheese production for consumption by the owners and employees only. At this time there is no plan to sell these items to the public. The closest beef cattle for meat consumption are 1.6 miles in the South Sector.

Discussion with a local waterman indicate that oysters 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 2020. 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, MH30 and RW6 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
RW5	Open Grass Area outside NSF PA exit
RW6	U2 Turbine Building roll up door
RW7	Open area north of Outfall 004
RW8	Open area on north wing wall
MH28	12'- Unit1 next to Feed Water Heater
MH30	12'- Unit 2 next to elevator
MH66/SSD3	45'- East of SSB and South of Turbine Bldg
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 2020 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

No Positive Results in 2020 Non Tech Spec samples of air and bottom sediment reported in Tables E-4 and E-5.

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

Table E-4

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

Sample Code	Sample Date	Gamma Emitters
WBS2		
Discharge Area	6/8/2020	*
	10/13/2020	*
WBS4[1]		
Camp Conoy/ Rocky Point	6/8/2020	*
	10/13/2020	*

[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
12/30/2019	1/6/2020	*
1/6/2020	1/13/2020	*
1/13/2020	1/21/2020	*
1/21/2020	1/27/2020	*
1/27/2020	2/3/2020	*
2/3/2020	2/10/2020	*
2/10/2020	2/17/2020	*
2/17/2020	2/24/2020	*
2/24/2020	3/2/2020	*
3/2/2020	3/9/2020	*
3/9/2020	3/16/2020	*
3/16/2020	3/23/2020	*
3/23/2020	3/30/2020	*
3/30/2020	4/6/2020	*
4/6/2020	4/13/2020	*
4/13/2020	4/20/2020	*
4/20/2020	4/27/2020	*
4/27/2020	5/4/2020	*
5/4/2020	5/11/2020	*
5/11/2020	5/18/2020	*
5/18/2020	5/26/2020	*
5/26/2020	6/1/2020	*
6/1/2020	6/8/2020	*
6/8/2020	6/15/2020	*
6/15/2020	6/22/2020	*
6/22/2020	6/29/2020	*
6/29/2020	7/6/2020	*
7/6/2020	7/13/2020	*
7/13/2020	7/20/2020	*
7/20/2020	7/27/2020	*
7/27/2020	8/3/2020	*
8/3/2020	8/10/2020	*
8/10/2020	8/17/2020	*
8/17/2020	8/24/2020	*
8/24/2020	8/31/2020	*
8/31/2020	9/8/2020	*
9/8/2020	9/14/2020	*
9/14/2020	9/21/2020	*
9/21/2020	9/28/2020	*

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
9/28/2020	10/6/2020	*
10/6/2020	10/13/2020	*
10/13/2020	10/19/2020	*
10/19/2020	10/27/2020	*
10/27/2020	11/2/2020	*
11/2/2020	11/10/2020	*
11/10/2020	11/16/2020	*
11/16/2020	11/23/2020	*
11/23/2020	12/1/2020	*
12/1/2020	12/7/2020	*
12/7/2020	12/14/2020	*
12/14/2020	12/21/2020	*
12/21/2020	12/28/2020	*

[1] Control Location
* <MDA

Table E-6

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

Station	Sample Date	AM-241 (AS)	CM-242 (AS)	CM-243/244 (AS)	PU-238 (AS)
PZ11	7/22/2020	<.05536	<.03876	<.1096	<.02871

U-233/234 (AS)	U-235 (AS)	U-238 (AS)	PU-239/240 (AS)
<.08071	<.04989	<.0699	<.09262

Station	Sample Date	Fe-55	Ni-63
PZ11	7/22/2020	<18.2	<4.45
PZ24	7/21/2020	<63.8	<4.68
PZ25	7/21/2020	<106	<4.95
PZ29	7/22/2020	<66.3	<4.99
PZ30	7/22/2020	<130	<4.78
PZ12	7/21/2020	<123	<4.95
PZ13	7/21/2020	<59.0	<4.51
PZ15	7/21/2020	<123	<4.99
MH30	5/8/2020	<99.2	<4.28
MH28	5/8/2020	<90.9	<3.63

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)
MH28	5/8/2020	<0.615	<0.966
MH30	5/8/2020	<0.342	<0.969
PZ11	7/22/2020	<.472	<.613
PZ25	7/21/2020	<2.95	<1.63
PZ15	7/21/2020	<1.42	<0.642
PZ13	7/21/2020	<1.08	<0.638
PZ12	7/21/2020	<0.966	<0.672
PZ29	7/22/2020	<4.46	<1.66
PZ30	7/22/2020	<1.08	<0.661
PZ24	7/21/2020	<2.11	<1.59

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)
MH28	5/8/2020	<7.64	<0.738
MH30	5/8/2020	<5.33	<0.647
PZ11	7/22/2020	<7.63	<.785
PZ12	7/21/2020	<4.85	<0.937
PZ13	7/21/2020	<7.83	<0.681
PZ15	7/21/2020	<8	<0.69
PZ24	7/21/2020	<7.37	<0.945
PZ25	7/21/2020	<6.89	<0.946
PZ29	7/22/2020	<4.17	<0.781
PZ30	7/22/2020	<5.75	<0.77

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
1/28/2020	ND	<189	<182	<183	ND	ND	ND	ND	ND	<191	<175	ND	ND	ND	<173	<173
1/29/2020	377 ± 135	ND	ND	ND	<186	<187	<183	<189	ND	ND	ND	ND	ND	ND	ND	ND
7/21/2020	ND	<195	<192	<192	ND	ND	ND	ND	<147	<149	<150	<195	ND	ND	ND	ND
7/22/2020	192 ± 122	ND	ND	ND	<196	<195	<196	<146	ND	ND	ND	ND	ND	<153	<151	<153
11/4/2020	ND	ND	ND	ND	ND	ND	ND	ND	ND	<158	<157	ND	ND	ND	<173	<158
11/5/2020	394 ± 126	<159	<155	<173	ND	ND	ND	ND	ND	ND	ND	ND	<158	ND	ND	ND

[ND] No Data – Sample obtained as required

Table E-10

Concentration of Tritium in Surface Water, Precipitation, and Subsurface Drainage
(Results in units of pCi/L ± 2σ)

SAMPLE DATE	*MH-66 /SSD3	MH28	MH30	SW003	SW004	RW1	RW2	RW3	RW4	RW5	RW6	RW7	RW8
1/13/2020	<185	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1/16/2020	ND	ND	ND	<184	<186	ND	ND	ND	ND	ND	ND	ND	ND
2/1/2020	ND	ND	ND	ND	ND	<188	<187	<185	<187	<187	<184	<187	<188
2/4/2020	ND	2240 ± 288	1270 ± 197	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5/8/2020	ND	1800 ± 238	1020 ± 170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/8/2020	ND	1540 ± 223	1400 ± 207	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/17/2020	<182	<184	<173	<178	<183	<185	348 ± 128	<184	<178	<184	<173	<178	<183
9/23/2020	<184	<173	<178	<183	<185	<184	<173	<178	<183	<185	348 ± 128	<184	<178
9/23/2020 (Confirmation Repeat)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	(340±124 /<169)	ND	ND
10/8/2020	ND	2310 ± 302	786 ± 160	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10/13/2020	<179	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* 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
7/21/2020	ND	#	#	#	ND	ND	ND	ND	#	#	#	#	ND	ND	ND	ND
7/22/2020	#	ND	ND	ND	#	#	#	#	ND	ND	ND	ND	ND	#	#	#
11/5/2020	#	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	ND	ND	ND

[#] Non-Natural Gamma Emitters Less than minimum Detectable Activity(<MDA)
[ND] No Data - Annual sample obtained as required.

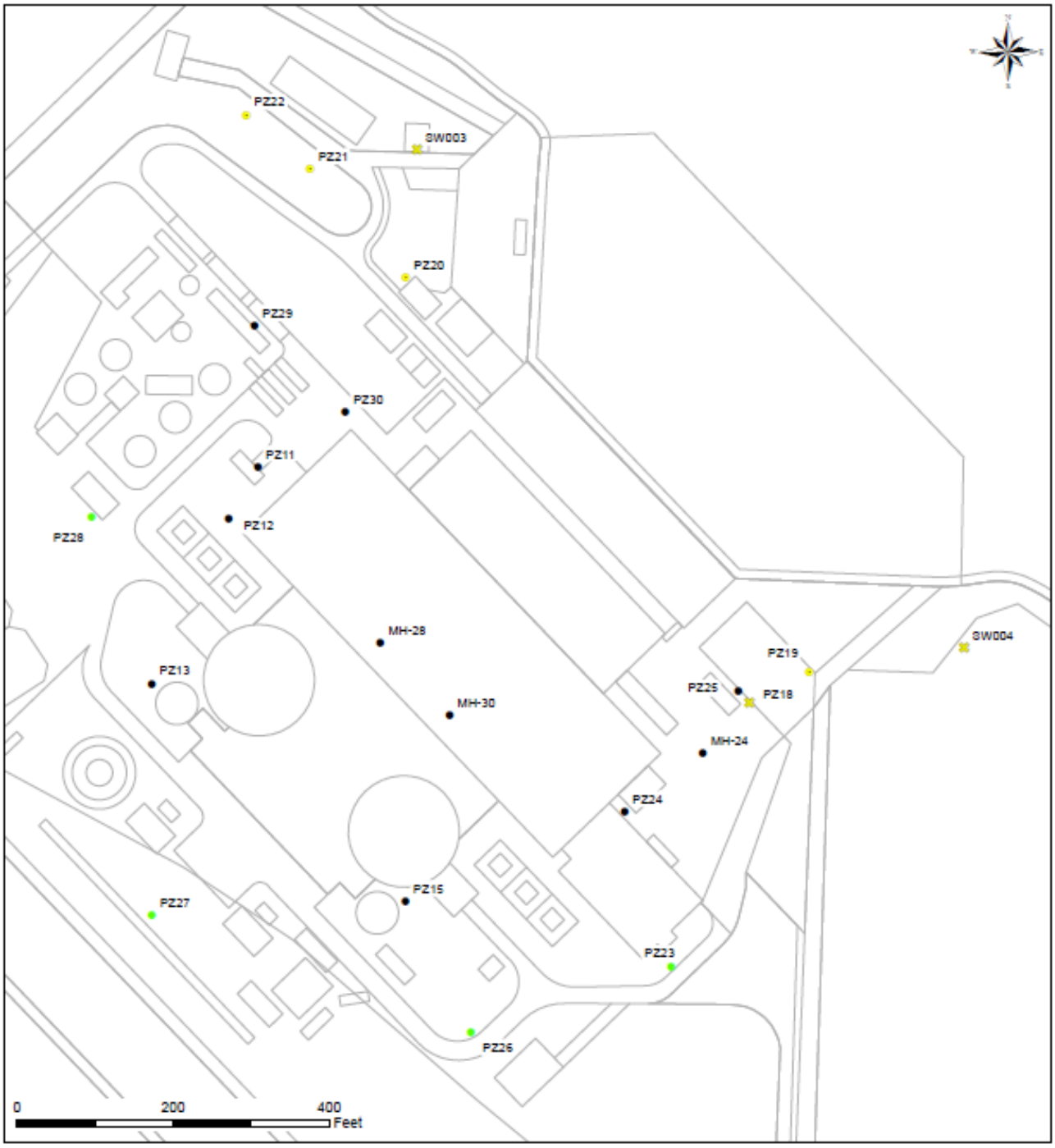
Table E-12

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
5/8/2020	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:
Modified RGPP Sample Locations

- Background
- Idle
- Perimeter
- Source

RGPP Sample Locations
Surface Water and Overburden
Exelon Corporation
Calvert Cliffs Generating Station

Figure E-2

Site Map Rainwater Locations