Exelon Generation®

Larry D. Smith
Manager-Regulatory Assurance

Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657

410-495-5219 Office
www.exeloncorp.com
Larry.smith2@exeloncorp.com

May 8, 2015

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

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. David Merryman at (410) 495-4913.

Respectfully,

Larry D. Smith
Manager-Regulatory Assurance

LDS/PSF/bjm

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

IE25
NMSS26

cc: NRC Project Manager, Calvert Cliffs
NRC Regional Administrator, Region I
NRC Resident Inspector, Calvert Cliffs
S. Gray, MD-DNR
R. Manley, MDE

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 8, 2015

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, 2014

A. M. Barnett
C. D. Merryman

EXELON GENERATION COMPANY, LLC

MAY 2014

TABLE OF CONTENTS

LIST OF FIGURES ii
LIST OF TABLES iii
I. SUMMARY 1
II. CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM 3
II.A. INTRODUCTION 3
II.B. PROGRAM 3
II.B.1 Objectives 3
II.B.2 Sample Collection 4
II.B.3 Data Interpretation 4
II.B.4 Program Exceptions 4
II.C. RESULTS AND DISCUSSIONS 4
II.C.1 Aquatic Environment 5
II.C.1.a Bay Water 5
II.C.1.b Aquatic Organisms 5
II.C.1.c Shoreline Sediment 6
II.C.2 Atmospheric Environment 9
II.C.2.a Air Particulate Filters 9
II.C.2.b Air Iodine 9
II.C.3 Terrestrial Environment 11
II.C.3.a Vegetation 11
II.C.4 Direct Radiation 11
II.D. CONCLUSION 13
III. INDEPENDENT SPENT FUEL STORAGE INSTALLATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM 19
III.A. INTRODUCTION 19
III.B. PROGRAM 19
III.B.1 Objectives 19
III.B.2 Sample Collection 20
III.B.3 Data Interpretation 20
III.B.4 Program Exceptions 20
III.C. RESULTS AND DISCUSSIONS 20
III.C.1 Atmospheric Environment 20
III.C.1.a Air Particulate Filters 20
III.C.2 Terrestrial Environment 21
III.C.2.a Vegetation 21
III.C.2.b Soils 21
III.C.3 Direct Radiation 22
III.D. CONCLUSION 22
IV. REFERENCES 26
APPENDIX A Sample Locations for the REMP and the ISFSI 27
APPENDIX B Analysis Results for the REMP and the ISFSI 36
APPENDIX C Quality Assurance Program 57
APPENDIX D Land Use Survey 71
APPENDIX E Additional Samples and Analysis Results 72

LIST OF FIGURES

Figure	Title	Page
1	Tritium in Chesapeake Bay Water	7
2	Silver-110m and Potassium-40 in Chesapeake Bay Oysters	8
3	Nuclear Fallout in the Calvert Cliffs Area	10
4	Mean TLD Gamma Dose, Calvert Cliffs Nuclear Power Plant	12
5	Atmospheric Dispersion Around CCNPP Average Relative Air Concentrations (X/Q)	15
6	Atmospheric Dispersion Around CCNPP Average Relative Ground Deposition (D/Q)	16
7	Mean TLD Gamma Dose, ISFSI	23
A-1	Map of Southern Maryland and Chesapeake Bay Showing Location of Calvert Cliffs Nuclear Power Plant	30
A-2	Calvert Cliffs Nuclear Power Plant Sampling Locations, 0-2 Miles	31
A-3	Calvert Cliffs Nuclear Power Plant Sampling Locations, 0-10 Miles	32
A-4	Independent Spent Fuel Storage Installation Sampling Locations	34
A-5	Enlarged Map of the Independent Spent Fuel Storage Installation Sampling Locations	35
E-1	Site Map Groundwater Monitoring Wells	88

LIST OF TABLES

Table	Title	Page
1	Synopsis of 2014 Calvert Cliffs Nuclear Power Plant Radiological Environmental Monitoring Program	17
2	Annual Summary of Radioactivity in the Environs of the Calvert Cliffs Nuclear Power Plant Units 1 and 2	18
3	Synopsis of 2014 Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Radiological Environmental Monitoring Program	24
4	Annual Summary of Radioactivity in the Environs of the Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation	25
A-1	Locations of Environmental Sampling Stations for the Calvert Cliffs Nuclear Power Plant	29
A-2	Locations of Environmental Sampling Stations for the Independent Spent Fuel Storage Installation at Calvert Cliffs	33
B-1	Concentration of Tritium and Gamma Emitters in Bay Water	38
B-2	Concentration of Gamma Emitters in the Flesh of Edible Fish	39
B-3	Concentration of Gamma Emitters in Oyster Samples	40
B-4	Concentration of Gamma Emitters in Shoreline Sediment	41
B-5	Concentration of Iodine-131 in Filtered Air	42
B-6	Concentration of Beta Emitters in Air Particulates	44
B-7	Concentration of Gamma Emitters in Air Particulates	48
B-8a	Concentration of Gamma Emitters in Vegetation Samples	49
B-8b	Concentration of Gamma Emitters in Vegetation From Locations Around the ISFSI	50
B-9	Concentration of Gamma Emitters in Soil Samples From Locations Around the ISFSI	51
B-10	Typical MDA Ranges for Gamma Spectrometry	52
B-11	Typical LLDs for Gamma Spectrometry	53
B-12	Direct Radiation	54
C-1	Results of Participation in Cross Check Programs	59
C-2	Results of Quality Assurance Program	62
C-3	Teledyne Brown Engineering's Typical MDAs for Gamma Spectrometry	70
D-1	Land Use Survey	71
E-1	Locations of Non-Tech Spec Environmental Sampling Stations for Calvert Cliffs Nuclear Power Plant	74
E-2	Synopsis of 2014 Calvert Cliffs Nuclear Power Plant Non-Tech Spec Radiological Environmental Monitoring Program	75
E-3	Annual Summary for Calvert Cliffs Nuclear Power Plant Units 1 & 2 Non-Tech Spec Radiological Environmental Monitoring Program	76
E-4	Concentration of Gamma Emitters in Bottom Sediment	77
E-5	Concentration of Iodine-131 in Filtered Air	78
E-6	Concentration of Beta Emitters in Air Particulates	80
E-7	Concentration of Gamma Emitters in Air Particulates	82
E-8	Concentration of Tritium and Gamma Emitters in TaylorsIsland Well Water	83

E-9 Direct Radiation 84
E-10 Direct Radiation from Resin Storage Area 85
E-11 Concentration of Tritium in Groundwater 86
E-12 Gross Concentration of Gamma Emitters in Groundwater 87

I. SUMMARY

During this operating period for Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 3468 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 651 radiochemical analyses were performed on 583 environmental samples and 540 thermoluminescent dosimeters (TLDs) were analyzed for ambient radiation exposure rates as part of the original REMP. These analyses were performed to satisfy the requirements of the ODCM (Ref. 6) and the Environmental Technical Specifications (Ref. 5).

For the ISFSI monitoring program, 360 radiochemical analyses were performed on 300 environmental samples, 64 of which were in common with the original REMP. In addition, 480 TLDs, 24 in common with the original REMP, were analyzed for ambient radiation exposure rates. These analyses were performed to satisfy the requirements of the ODCM (Ref. 6) and the ISFSI Technical Specifications (Ref. 10).

In addition, 720 analyses were performed on 604 additional environmental samples, and 480 additional TLDs were analyzed for ambient radiation exposure rates.

And lastly, 194 radiochemical analyses were performed on 194 quality assurance samples and 132 quality assurance TLDs were analyzed as part of an internal and external quality assurance program associated with Teledyne Brown Engineering. Laboratory intercomparison samples obtained from Environmental Resource Associates (ERA) and Analytics' Inc. were also analyzed.

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

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

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

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

Natural radioactivity was detected in essentially all 3469 radiological analyses performed. Low levels of man-made fission products were also observed in 11 of these analyses for the CCNPP REMP. These observations were attributed to fallout from past atmospheric weapons testing. Detailed discussions about the results of these analyses are contained in the body of this report.

To assess the plant's contribution to the radiation levels of the ambient environment, dose calculations were performed using the plant's effluent release data, on-site meteorological data, and appropriate pathways. The results of these dose calculations indicate:

a. a maximum thyroid dose of 3.69×10^{-3} mrem via liquid and gaseous pathways, which is about 0.005% of the acceptable limit of 75 mrem/yr as specified in 40 CFR 190 "Environmental Radiation Protection Standards for Nuclear Power Operations" and 10 CFR 72.104, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste";

b. a maximum whole body dose of 1.86×10^{-3} mrem via liquid and gaseous pathways, which is about 0.007% of the acceptable limit of 25 mrem/yr as specified in both 40 CFR 190 and 10 CFR 72.104; and

c. a maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 3.29×10^{-3} mrem to the skin. This dose is about 0.013% of the allowable limit of 25 mrem/yr as specified in both 40 CFR 190 and 10 CFR 72.104.

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

Exelon Generation, formerly Constellation Energy Nuclear Generation (CENG), has been conducting a REMP in the environs of the 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 40 CFR 190,

b. To detect any measurable build-up 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 CCNPP and Exelon Industrial Services (EIS) Laboratory Procedures (Ref. 7, 8 and 12).

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

Sample A2 Camp Conoy Road, at the Emergency Siren had a malfunction and insufficient sample was collected due to low flow for the week of February 10th to February 17th. The pump was replaced on February 20th and no further loss of sample occurred. Troubleshooting revealed a wiring problem in the pump which was resolved and all other pumps were inspected and preemptive actions taken. This program exception has been entered into the site's Corrective Action Program to ensure it does not recur.

Two direct radiation dosimeters, both in the 4th quarter, were found missing from ODCM (Ref. 6) sampling locations during this operating period. A thorough search of each area did not find the dosimeters and thus, direct radiation dosimeters were not taken from Mackall Road near Wallville (sample code DR13) and at Cove Point and Little Cove Point Roads sampling location (sample code DR17) in the 4th quarter of this operating period. No substitute samples were collected in lieu of the samples not taken from these locations. Direct radiation dosimeters were replaced at these locations for the purposes of monitoring direct radiation per the ODCM (Ref. 6), and these program exceptions were entered into the site's Corrective Action Program.

Oysters collected at IA3 Camp Conoy and IA6 Kenwood Beach were collected on April 1, 2014, one day outside of the first quarter sampling period. Sample collection was delayed several times as a result of severe weather which created conditions adverse to safety for the watercraft and sample collectors. This program exception has been entered into the site's Corrective Action Program.

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year 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 in Table 2. For discussion, the analytical results are divided into four categories. The categories are the Aquatic Environment, the Atmospheric Environment, the Terrestrial Environment, and Direct Radiation. These categories

are further divided into subcategories according to sample type (e.g., Bay Water, Aquatic Organisms, etc., for the 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. These 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 evidence of tritium in any of the samples taken from either site throughout the year.

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

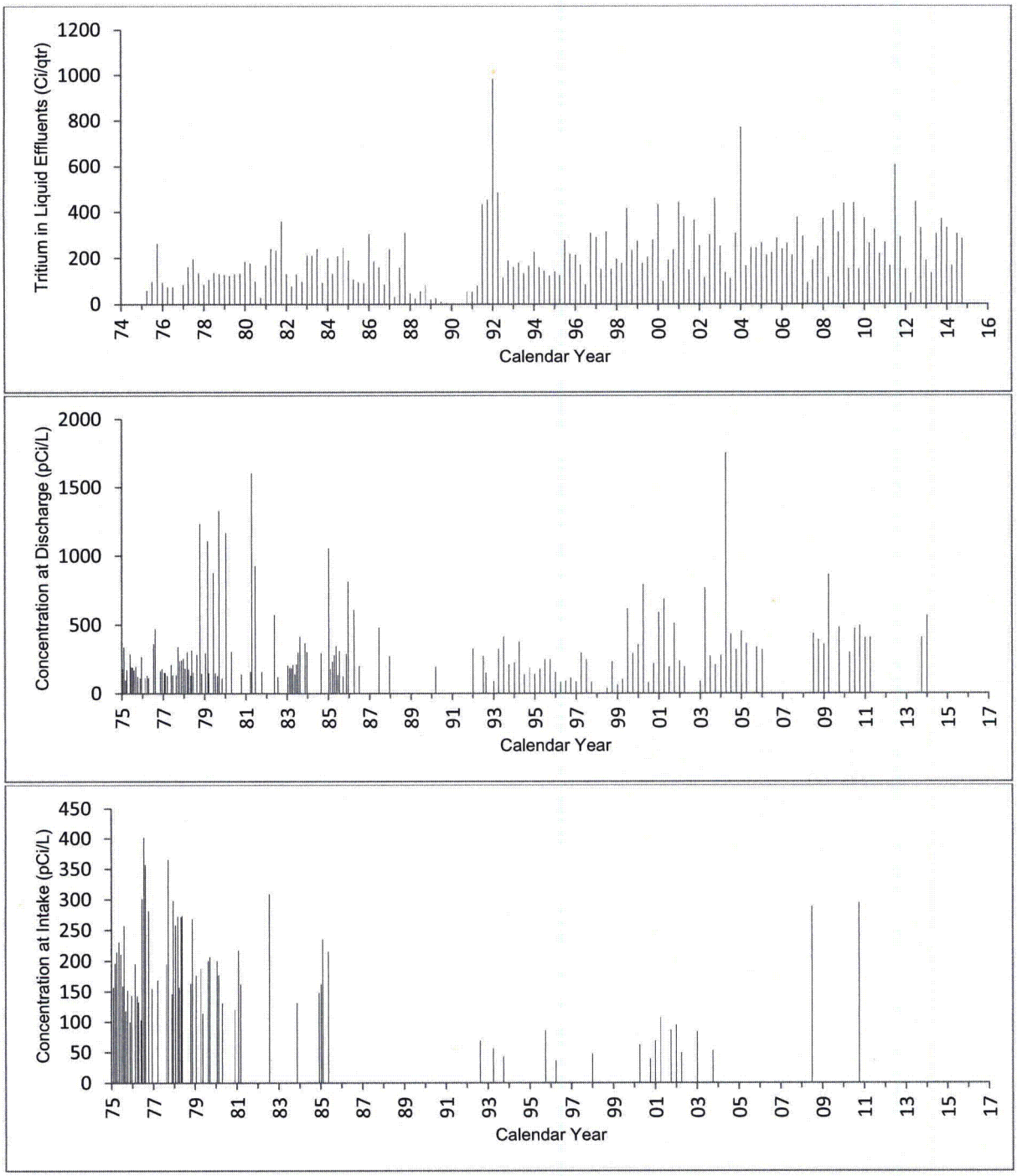
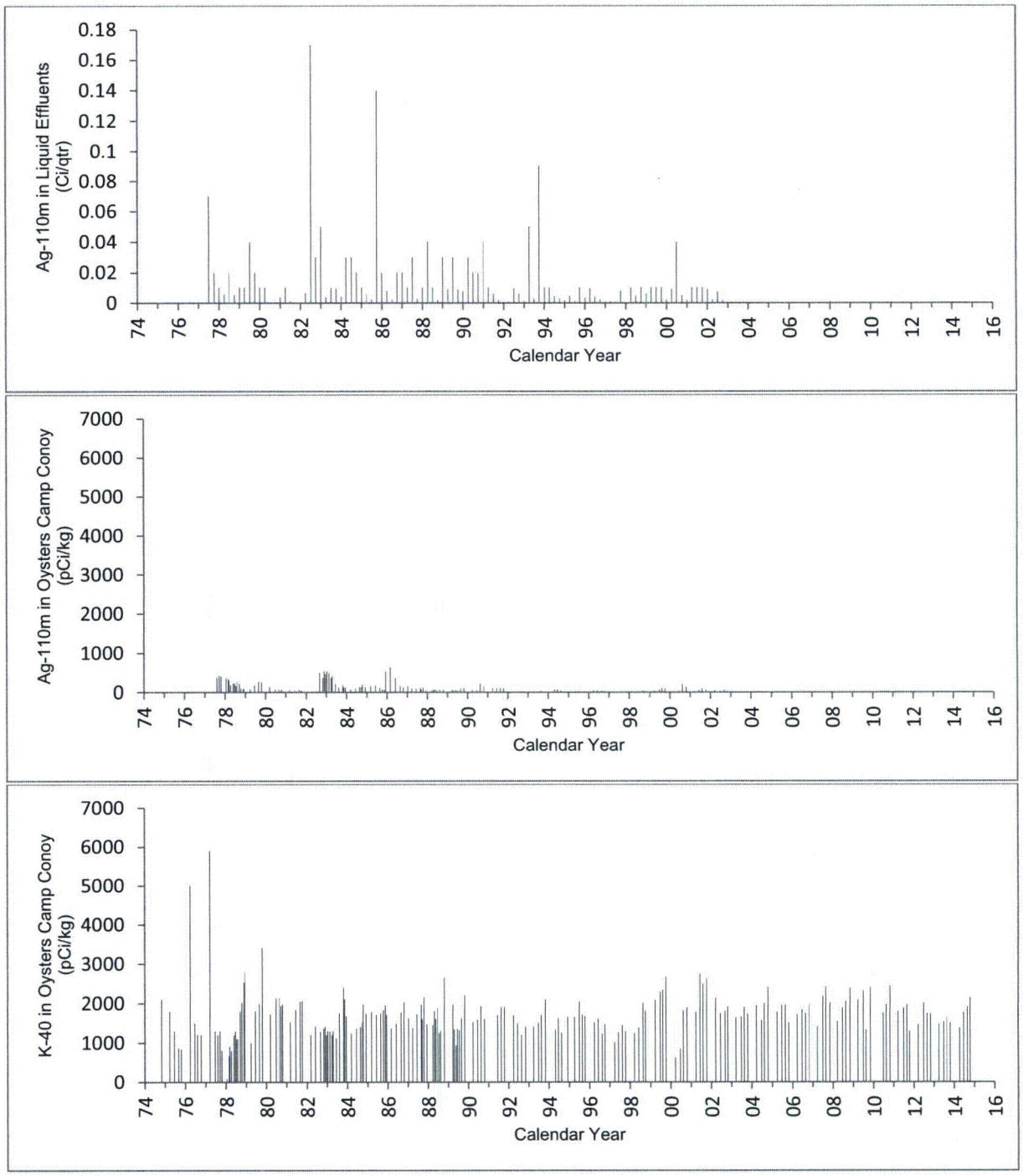


FIGURE 2
Silver-110m and Potassium-40 in Chesapeake Bay Oysters



II.C.2 Atmospheric Environment

The atmospheric environment was monitored by analyzing air particulate filters and charcoal cartridges (for trapping radioiodine species). These samples were collected from five locations surrounding the plant. These locations are On Site before the 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 Emergency Operations Facility (sample code A5).

II.C.2.a Air Particulate Filters

Weekly composite air particulate filter samples were collected from the five locations 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 five locations showed values characteristic of background levels. The values ranged from 1.2×10^{-2} to 3.7×10^{-2} pCi/m^3 for the indicator locations and 1.2×10^{-2} to 3.6×10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 2.1×10^{-2} pCi/m^3 was A5, Emergency Offsite Facility.

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

Figure 3 depicts the historical trends of beta activity.

II.C.2.b Air Iodine

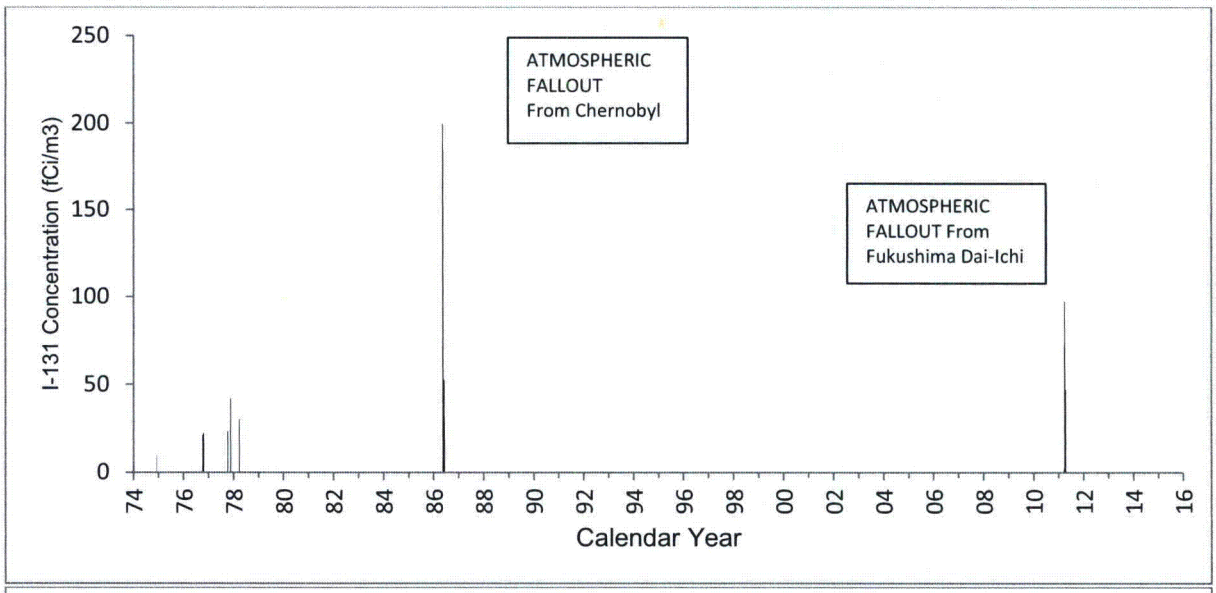
Weekly composited charcoal cartridges (for trapping radioiodine species) were collected from the five locations during the year. These samples were analyzed for radioiodine species.

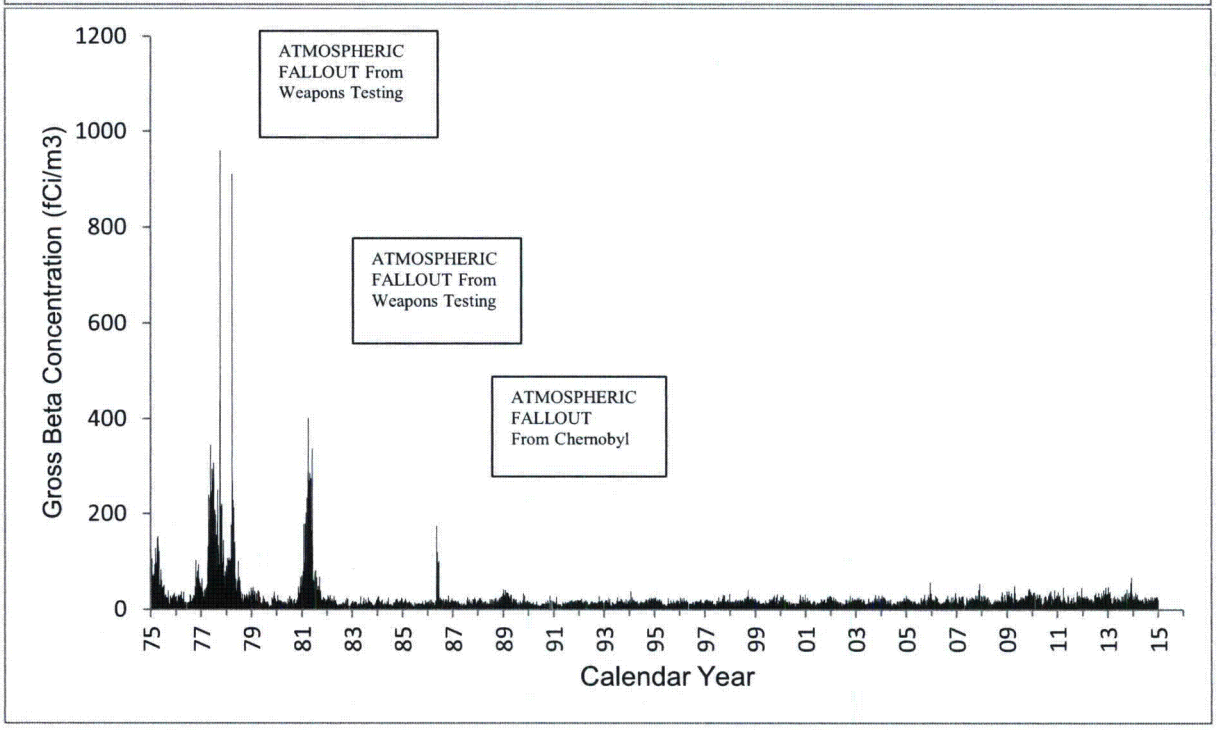
Weekly radioiodine analyses of charcoal cartridges collected from all five locations exhibited no detectable concentrations of I-131.

Figure 3 depicts the historical trends of radioiodine.

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 Garden Plot off Bay Breeze Road (sample codes IB1, IB2, and IB3), On Site before the Entrance to Camp Conoy (sample codes IB4, IB5, and IB6), and the Emergency Operations Facility (sample codes IB7, IB8, and IB9). These samples were analyzed for gamma emitters, including analyses for I-131.

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

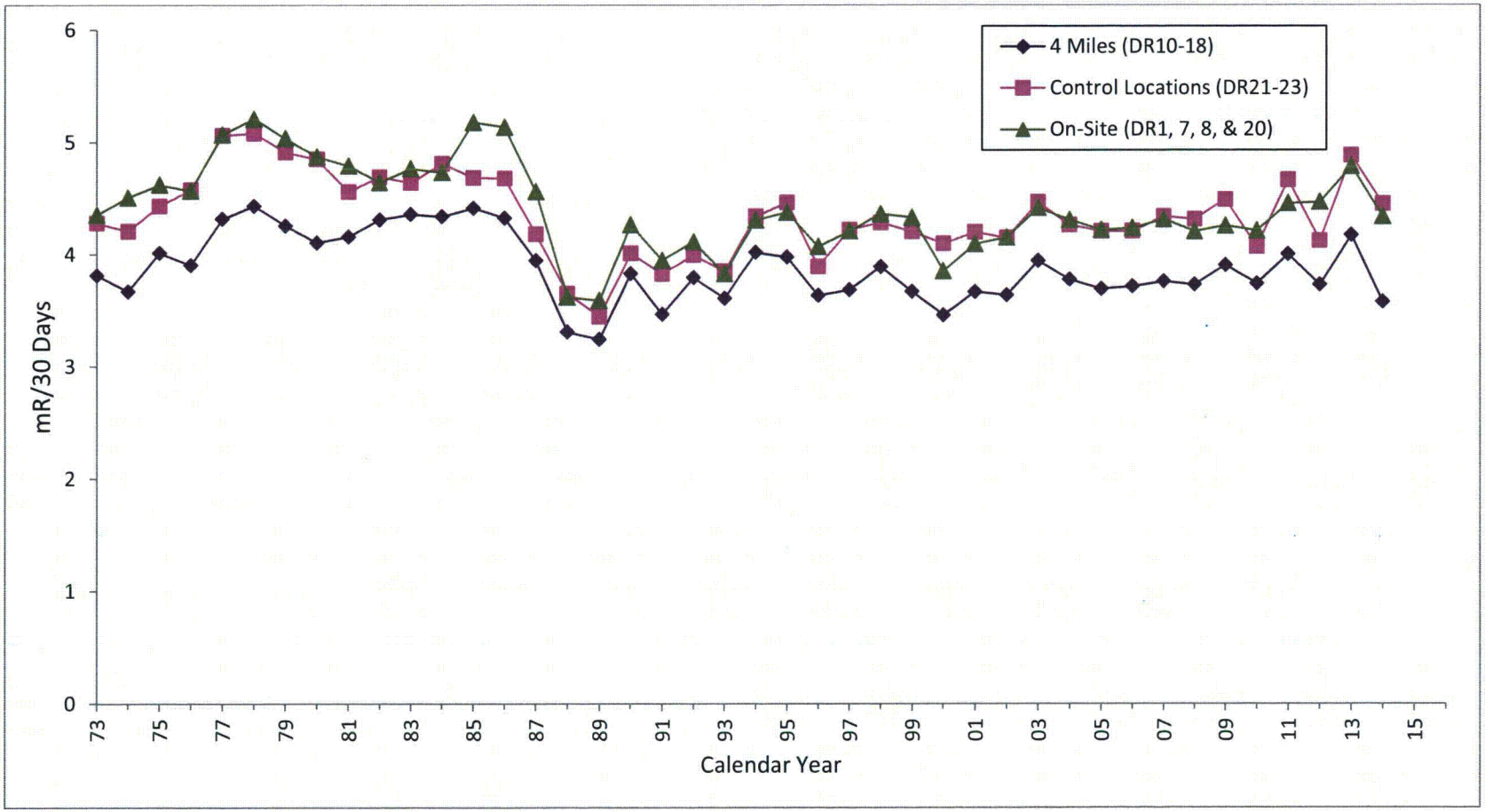
II.C.4 Direct Radiation

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

TLDs were collected quarterly from twenty-three locations surrounding the plant. The twenty indicator locations are On Site Along the Cliffs (sample code DR1), Route 765 Auto Dump (sample code DR2), Giovanni's Tavern (sample code DR3), Route 765 across from White Sands (sample code DR4), 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), Decatur and Calvert Beach Roads (sample code DR10), Dirt Road off Mackall and Parran Roads (sample code DR11), Mackall and Bowen Roads (sample code DR12), Wallville (sample code DR13), Rodney Point (sample code DR14), Mill Bridge and Turner Roads (sample code DR15), Appeal School (sample code DR16), Cove Point and Little Cove Point Roads (sample code DR17), Cove Point (sample code DR18), Long Beach (sample code DR19), and On Site 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).

The mean 90 day ambient radiation measured at the indicator locations was 11.69 mR and ranged from 9.57 to 15.98 mR as reported in Table 2. The control locations showed a 90 day mean of 13.36 mR with ranges from 10.90 to 16.46 mR. The location with the highest overall mean of 16.10 was Taylors Island, Anderson's Property (sample code DR23) which ranged from 15.59 to 16.46 mR. Figure 4 shows the historical comparison of the average monthly radiation levels per calendar year for TLDs on site, at four miles, and at the control locations. A comparison of the means and ranges of the current TLD data with those of both the historical data and the regional data shows no plant-related contribution to the measured direct radiation exposure.

FIGURE 4
Mean TLD Gamma Dose, 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 data are depicted in Figures 1 through 4. As can be seen from these figures, the plant made no adverse radiological contributions to the surrounding environment.

To assess the plant's contribution to the ambient radiation levels of the surrounding environment, dose calculations were performed using the plant's effluent release data, on-site meteorological data (see X/Q and D/Q values presented in Figures 5 and 6), and appropriate pathways. The results of these dose calculations indicate:

Gaseous Pathways

A maximum thyroid dose of 2.35×10^{-3} mrem to a child via the plume, ground, vegetable, and inhalation pathways at 1.1 km SW of the containments at Calvert Cliffs. This is about 0.003% of the acceptable limit of 75 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

A maximum whole body gamma dose of 3.19×10^{-4} mrem to a child at 1.1 km SW of the containments at Calvert Cliffs. This is about 0.001% of the acceptable dose limit of 25 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

A maximum dose to any other organ, in this case the skin, of 3.67×10^{-4} mrem to a child at 1.1 km SW of the containments at Calvert Cliffs. This is about 0.002% of the acceptable dose limit of 25 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

Liquid Pathways

A maximum thyroid dose of 1.34×10^{-3} mrem to an adult for all liquid pathways, which is about 0.002 % of the acceptable dose limit of 75 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

A maximum whole body dose of 1.80×10^{-3} mrem to an adult via all liquid pathways, which is about 0.007 % of the acceptable dose limit of 25 mrem/yr as stated in 40 CFR 190 and 10 CFR 72.104.

A maximum dose to any other organ, in this case bone, of 2.92×10^{-3} mrem to a teen for all pathways, which is 0.012% of the acceptable dose limit of 25 mrem/yr specified in 40 CFR 190 and 10 CFR 72.104.

Gaseous and Liquid Pathways Combined

A maximum thyroid dose of 3.69×10^{-3} mrem via liquid and gaseous pathways, which is about 0.005% of the acceptable limit of 75 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

A maximum whole body dose of 1.86×10^{-3} mrem via liquid and gaseous pathways, which is about 0.007% of the acceptable limit of 25 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

A maximum calculated dose to all other organs via liquid and gaseous pathways is equal to 3.29×10^{-3}mrem to the skin. This dose was about 0.013% of the allowable limit of 25 mrem/yr as specified in 40 CFR 190 and 10 CFR 72.104.

In all cases, the calculated doses are a small fraction of the applicable limits specified in 40 CFR 190 and 10 CFR 72.104.

Therefore, it is concluded that the radioactivity produced by the operation of Calvert Cliffs Units 1 and 2 combined with ambient radiation levels were significantly below the limits of the ODCM, 40 CFR 190, and 10 CFR 72.104. Furthermore, there was no significant build-up of plant-related radionuclides in the environment due to the operation of the CCNPP in 2014.

FIGURE 5

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

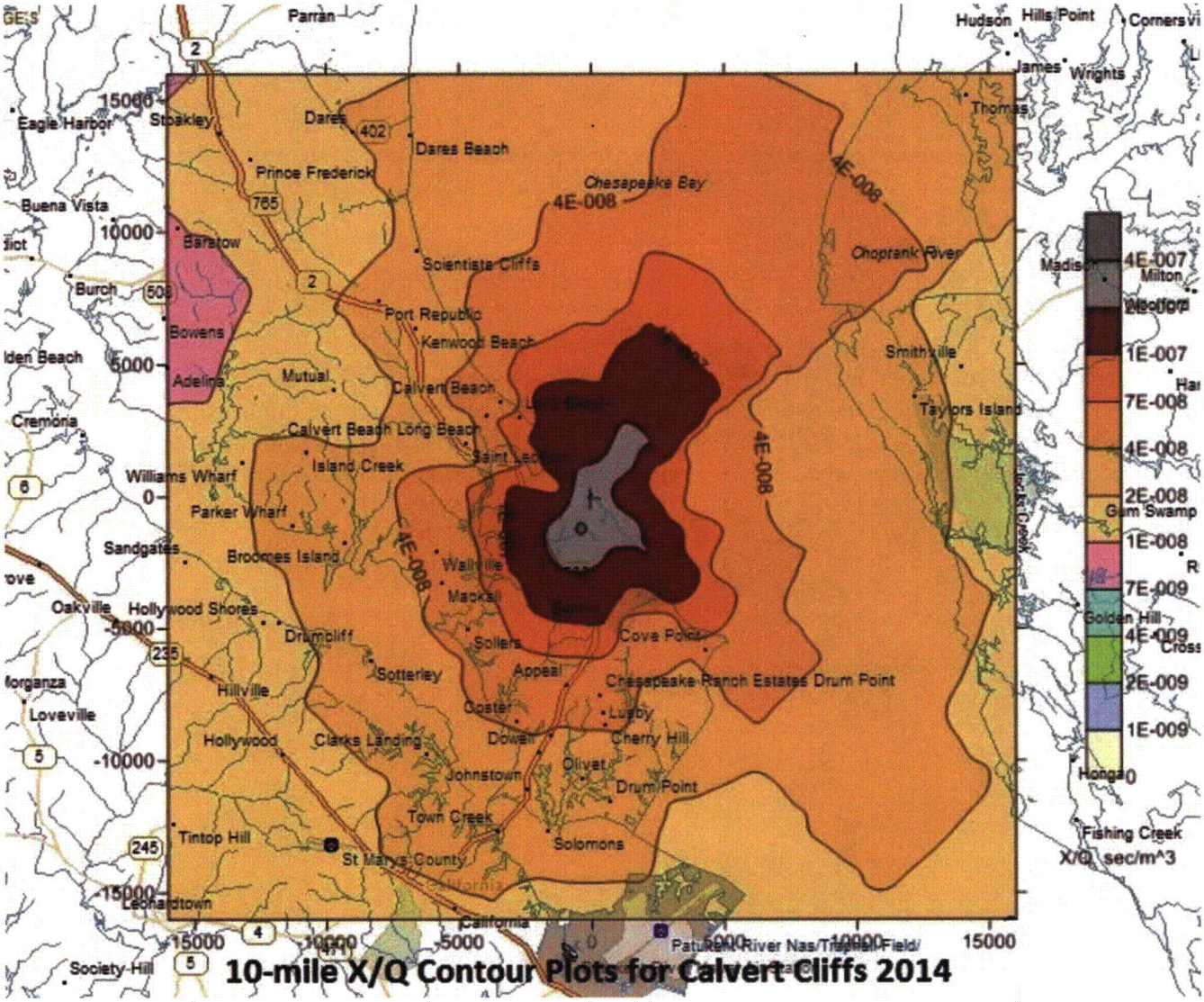


FIGURE 6

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

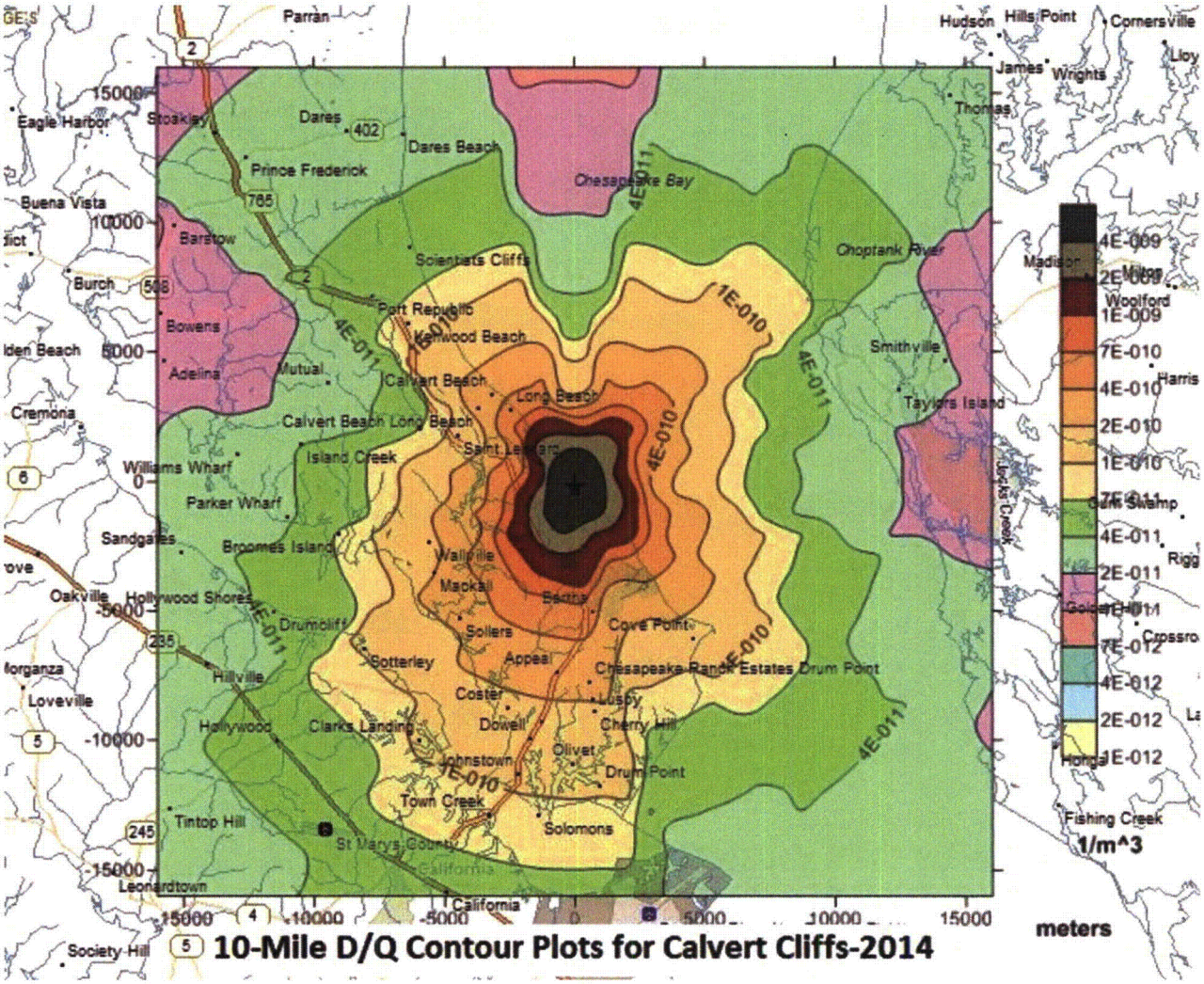


Table 1

Synopsis of 2014 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	5	259	I-131	W	259
Air Particulates[4]	W	5	259	Gross Beta	W	259
				Gamma	MC	60
Direct Radiation						
Ambient Radiation	Q	23	540	TLD	Q	540
Terrestrial Environment						
Vegetation[5]	M	3	27	Gamma	M	27

[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 silver Zeolite
[4] Beta counting is performed after >72 hour decay, Gamma spectroscopy performed on monthly composites of weekly samples
[5] Monthly during growing season when available

Table 2

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

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (259)	0.5	2.0 (207/208) (1.2-3.7)	EOF A5 19.3 km WNW	2.1 (52/52) (1.2-3.6)	2.1 (52/52) (1.2-3.6)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (540)	--	11.69 (480/480) (9.57-15.98)	Taylors Island DR23 12.6 km ENE	16.10 (24/24) (15.59-16.46)	13.36 (72/72) (10.90-16.46)

[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 this operating period, four additional canisters of spent fuel were transferred to the ISFSI. This area was also used as a temporary storage area for additional radioactive material.

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 40 CFR 190 and 10 CFR 72.104,

c. To detect any measurable build-up 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 according to EIS Laboratory Procedures (Ref. 7, 8, and 12).

III.B.3 Data Interpretation

Many results in environmental monitoring occur at or below the minimum detectable activity (MDA). In this report, all results at or below the relevant MDA are reported as being "less than" the MDA value.

III.B.4 Program Exceptions

There were no program exceptions during this operating period.

III.C. RESULTS AND DISCUSSIONS

All the environmental samples collected were analyzed using EIS 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 the Atmospheric Environment, the 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; in common with the CCNPP REMP), Meteorological Station (SFA1), CCNPP Visitor's Center (SFA2), NNW of the ISFSI (SFA3), and SSE of the ISFSI (SFA4). These samples were analyzed for beta radioactivity and gamma emitting radionuclides.

Weekly analyses for beta activity on air particulate filters collected from all five locations showed values characteristic of levels routinely observed in the REMP. These values ranged from 1.2×10^{-2} to 3.9×10^{-2} pCi/m^3 for the indicator locations and 1.1×10^{-2} to 3.8×10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 2.1×10^{-2} pCi/m^3 was SFA2, Visitors Center.

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

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).

Vegetation samples were analyzed for gamma emitting radionuclides. Cesium-137 was detected in one sample at an indicator location. The Cs-137 concentration was 68 ± 24 pCi/kg. While the presence of Cs-137 in this sample may be plant-related, this range is consistent with that found from residual fallout of past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40 CFR 190 and 10 CFR 72.104. 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 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 six quarterly samples from both indicator and control locations. The Cs-137 concentrations ranged from 56 ± 21 to 221 ± 32 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 40 CFR 190 and 10 CFR 72.104. These are comparable to those observed in previous annual reporting periods for the CCNPP REMP and in the earlier pre-operational data for the ISFSI. No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were also detected in all these samples.

III.C.3 Direct Radiation

Direct radiation is measured by a network of TLDs surrounding the ISFSI. These TLDs are collected quarterly from nineteen locations surrounding the ISFSI, plus one control TLD location at the Visitor's Center (sample code SFDR7). The locations include On Site before the Entrance to Camp Conoy (sample code DR7, common to both the CCNPP Program and the ISFSI Program) and the Meteorological Station (sample code DR30, previously a location maintained for historical continuity.) The other sampling locations are: SW of ISFSI, (sample code SFDR1); NNW 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); SSW 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 mean 90 day ambient radiation measured at the ISFSI indicator locations was 25.19 mR and ranged from 9.69 to 47.20 mR as reported in Table 4. The control location showed a 90 day mean of 11.88 mR and ranged from 10.34 to 12.71 mR. The location with the highest overall mean of 42.84 mR with a range of 39.83 to 47.20 mR was SFDR12, WSW of ISFSI. These readings are consistent with those expected from the storage of spent fuel in the ISFSI. A comparison of the average monthly radiation levels per calendar year of the ISFSI TLD data from the indicator locations with the ISFSI control location at the Visitor's Center, SFDR7, can be seen in Figure 7.

III.D. CONCLUSION

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

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

FIGURE 7
Mean TLD Gamma Dose, ISFSI

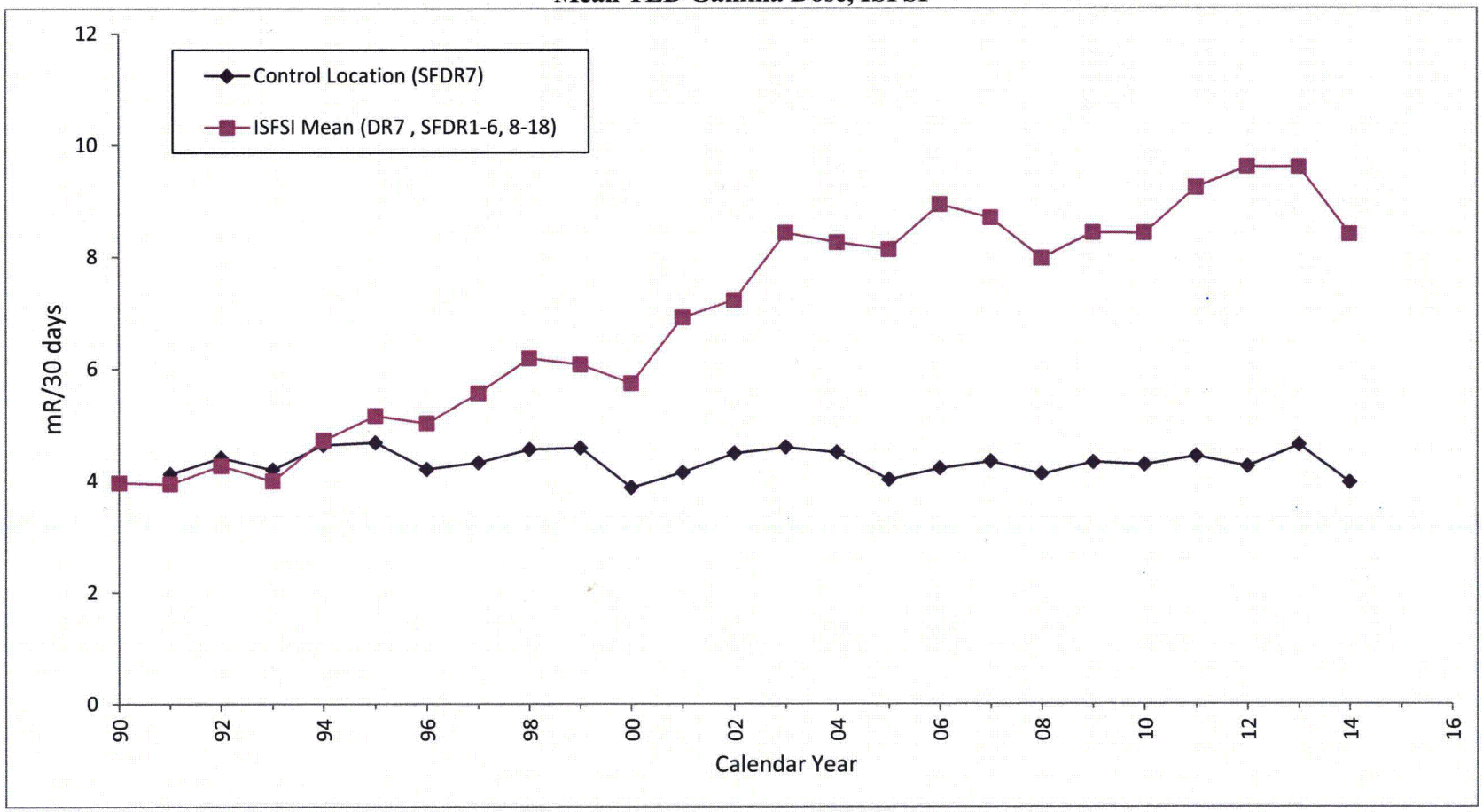


Table 3

Synopsis of 2014 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	MC	60
Direct Radiation						
Ambient Radiation	Q	20	480	TLD	Q	480
Terrestrial Environment						
Vegetation	Q	5	20	Gamma	Q	20
Soil	Q	5	20	Gamma	Q	20

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

Table 4

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

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (260)	0.5	2.0 (208/208) (1.2-3.9)	Visitors Center SFA2 0.7 km NNE	2.1 (52/52) (1.1-3.8)	2.1 (52/52) (1.1-3.8)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (480)	--	25.19 (456/456) (9.69-47.20)	WSW of ISFSI SFDR12 0.1 km WSW	42.84 (24/24) (39.83-47.20)	11.88 (24/24) (10.34-12.71)
Terrestrial Environment						
Vegetation (pCi/L)	Gamma (20) Cs-137	27	68 (1/16) --	On Site Before Entrance to Camp Conoy SFB5 0.7 km ESE	68 (1/4) --	-- --
Soil (pCi/kg)	Gamma (20) Cs-137	17	150 (4/16) (121-221)	Entrance to Camp Conoy SFS5 0.7 km ESE	150 (4/4) (121-221)	63 (2/4) (56-69)

[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) Offsite Dose Calculation Manual for the Calvert Cliffs Nuclear Power Plant.

(7) CP-234, Specification and Surveillance for the Radiological Environmental Monitoring Program.

(8) Exelon Industrial Services Quality Assurance Program Manual

(9) Constellation Energy, "Land Use Survey Around Calvert Cliffs Nuclear Power Plant, August 2014."

(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) CP-501, Liquid and Steam Sampling Techniques

(13) CNG-EV-1.01-1000, Radiological Environmental Monitoring Program (REMP).

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	Title	Page
A-1	Locations of Environmental Sampling Stations for the Calvert Cliffs Nuclear Power Plant	29
A-2	Locations of Environmental Sampling Stations for the Independent Spent Fuel Storage Installation at Calvert Cliffs	33

Figure	Title	Page
A-1	Map of Southern Maryland and Chesapeake Bay Showing Location of Calvert Cliffs Nuclear Power Plant	30
A-2	Calvert Cliffs Nuclear Power Plant Sampling Locations, 0-2 Miles	31
A-3	Calvert Cliffs Nuclear Power Plant Sampling Locations, 0-10 Miles	32
A-4	Independent Spent Fuel Storage Installation Sampling Locations	34
A-5	Enlarged Map of the Independent Spent Fuel Storage Installation Sampling Locations	35

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	0.4	S
A2	Camp Conoy Rd, at emergency siren	2.5	1.6	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	12.0	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	0.4	S
DR08	Camp Conoy Rd at Emergency Siren	2.5	1.6	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	4.0	S
DR17	Cove Point & Little Cove Point Rds	5.9	3.7	SSE
DR18	Cove Point	7.1	4.4	SE
DR19	Long Beach	4.4	2.7	NW
DR20	On site, near shore	0.4	0.2	NNW
DR21	Emergency Operations Facility (EOF)	19.3	12.0	WNW
DR22	Solomons Island	12.5	7.8	S
DR23	Taylors Island, Anderson's Property	12.6	7.8	ENE
IA1	Discharge Area	0.3	0.2	N
IA10	Hog Island	15.3	9.5	SSE
IA2	Discharge Vicinity	0.3	0.2	N
IA3	Camp Conoy	0.9	0.6	E
IA4	Patuxent River	0.0	0.0	Various
IA5	Patuxent river	0.0	0.0	Various
IA6	Kenwood Beach	10.7	6.7	NNW
IB1	Garden Off Bay Breeze Rd	2.6	1.6	SSE
IB2	Garden Off Bay Breeze Rd	2.6	1.6	SSE
IB3	Garden Off Bay Breeze Rd	2.6	1.6	SSE
IB4	On site, before entrance to Camp Conoy	0.7	0.4	S
IB5	On site, before entrance to Camp Conoy	0.7	0.4	S
IB6	On site, before entrance to Camp Conoy	0.7	0.4	S
IB7	Emergency offsite facility	19.3	12.0	WNW
IB8	Emergency offsite facility	19.3	12.0	WNW
IB9	Emergency offsite facility	19.3	12.0	WNW
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

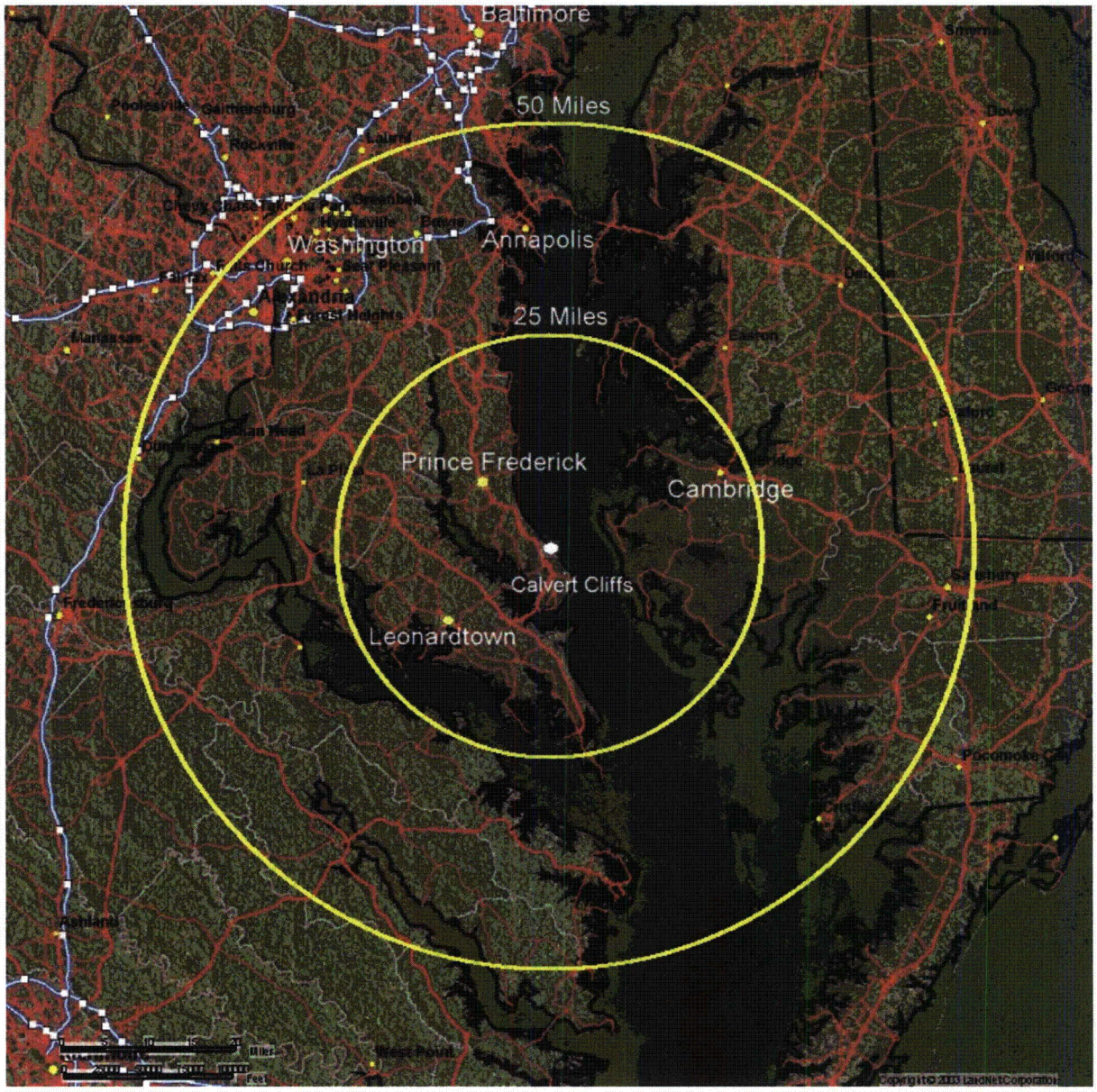


Figure A-2

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles

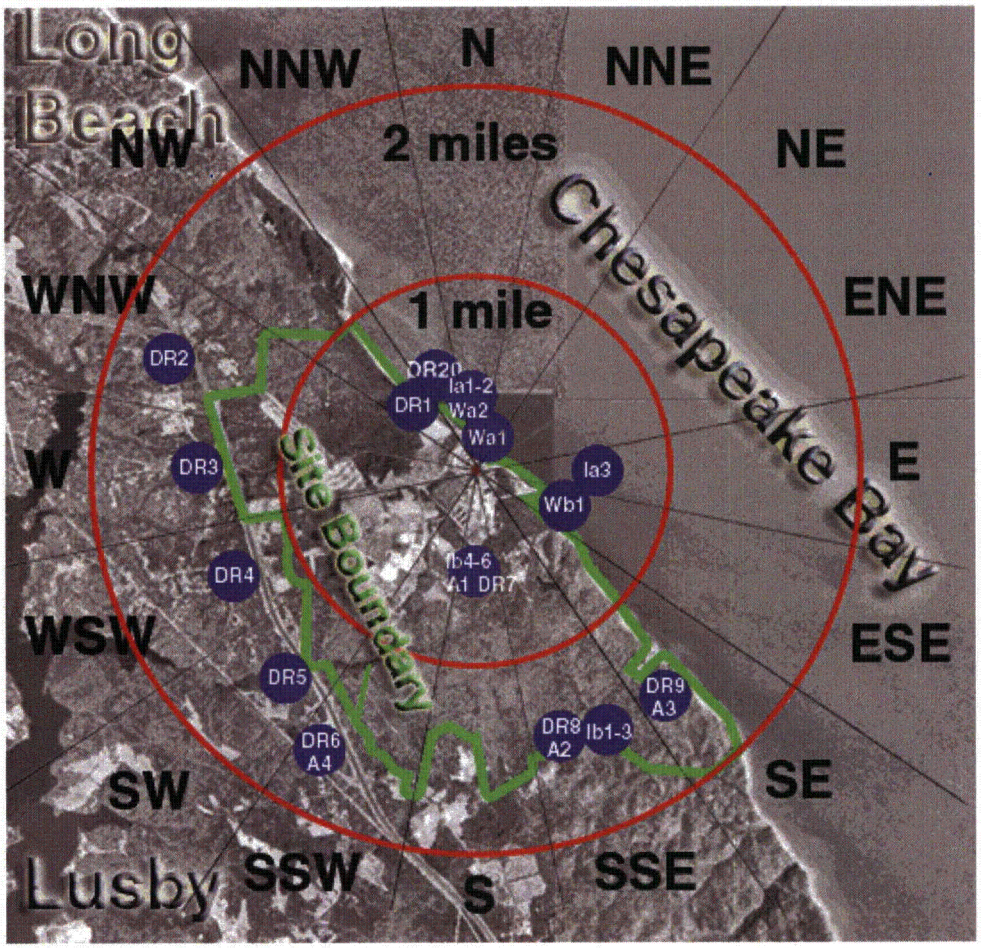


Figure A-3

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	0.7	S
SFA1	Meteorological Station	0.4	NW
SFA2	CCNPP Visitor's Center	0.7	NNE
SFA3	NNW of ISFSI	0.1	NNW
SFA4	SSE of ISFSF	0.1	SSE
	Direct Radiation		
DR07[2]	On Site Before Entrance to Camp Conoy	0.7	S
DR30	Meteorological Station	0.4	NW
SFDR01	SW of ISFSI	0.1	SW
SFDR02	NNW of ISFSI	0.1	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	0.7	NNE
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	SSW of ISFSI	0.1	SW
SFDR17	NNE of ISFSI	0.1	NNE
SFDR18	West of ISFSI	0.1	W
	Vegetation		
SFB1	ISFSI Vegetation Met Station	0.4	NW
SFB2	ISFSI Vegetation Visitors Center	0.7	NNE
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	0.7	ESE
	Soil		
SFS1	ISFSI Soil Meteorological Station	0.4	NW
SFS2	ISFSI Soil CCNPP Visitors Center	0.7	NNE
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	0.7	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

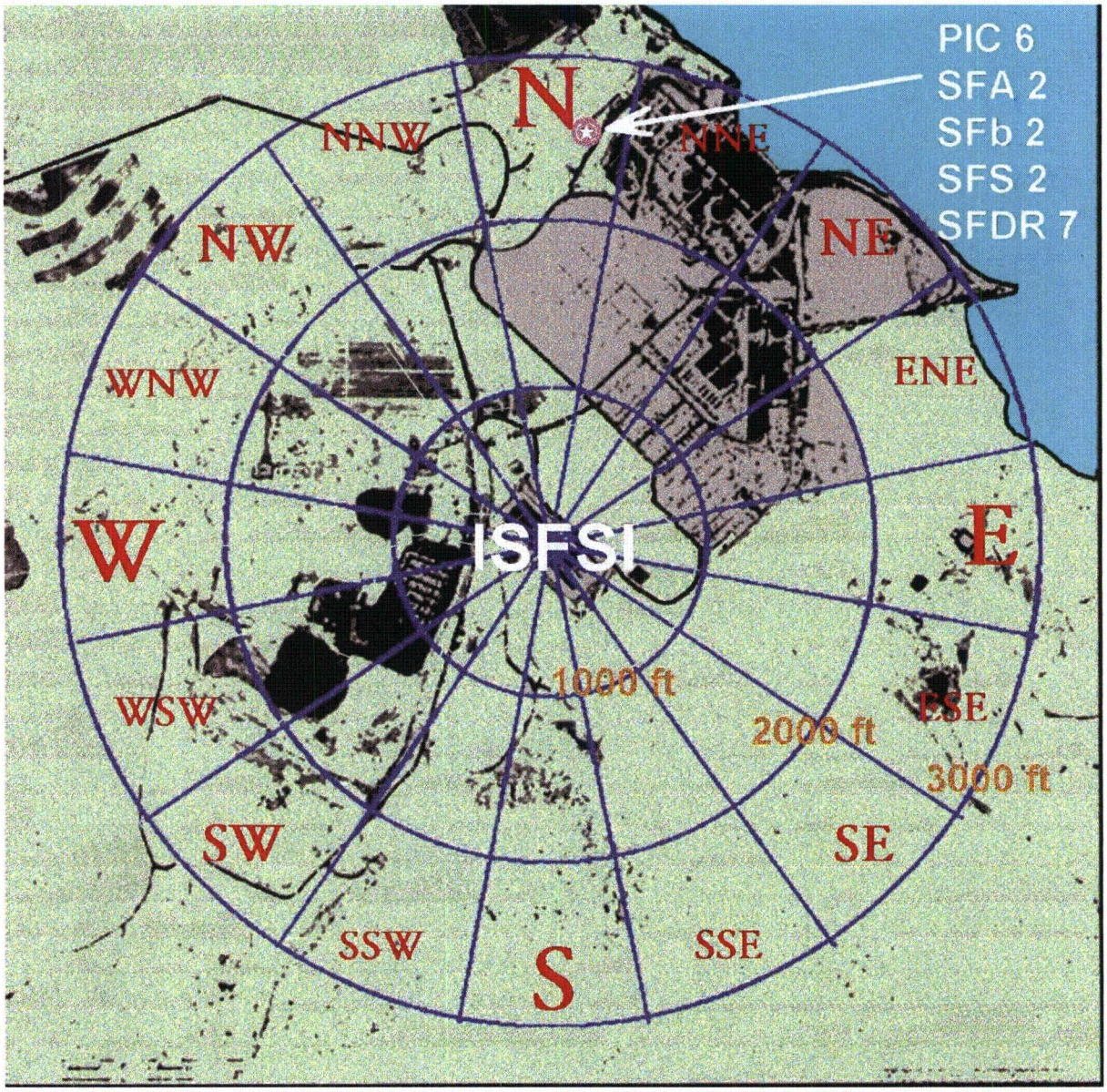
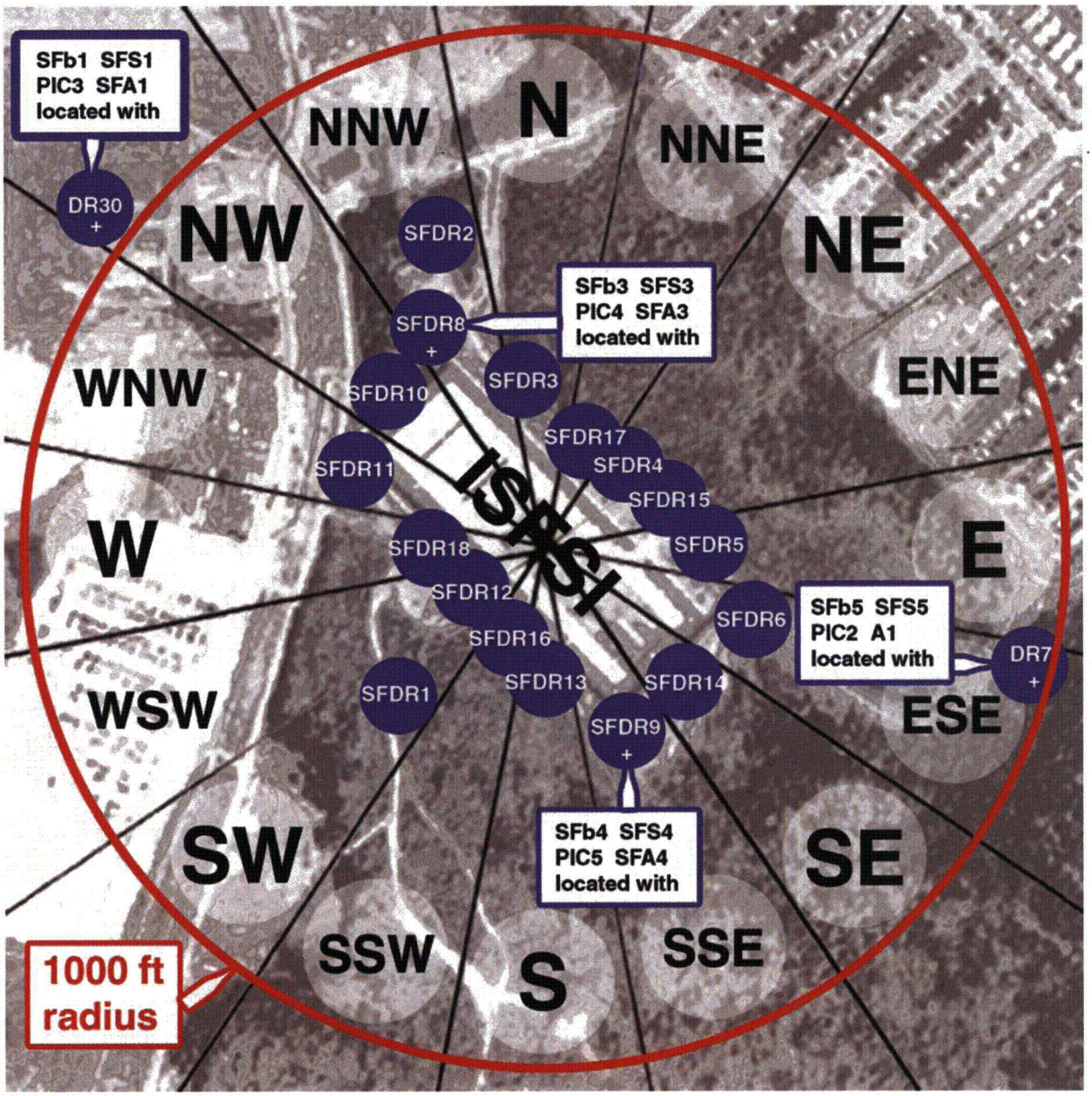


Figure A-5

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	Title	Page
B-1	Concentration of Tritium and Gamma Emitters in Bay Water	38
B-2	Concentration of Gamma Emitters in the Flesh of Edible Fish	39
B-3	Concentration of Gamma Emitters in Oyster Samples	40
B-4	Concentration of Gamma Emitters in Shoreline Sediment	41
B-5	Concentration of Iodine-131 in Filtered Air	42
B-6	Concentration of Beta Emitters in Air Particulates	44
B-7	Concentration of Gamma Emitters in Air Particulates	48
B-8a	Concentration of Gamma Emitters in Vegetation Samples	49
B-8b	Concentration of Gamma Emitters in Vegetation From Locations Around the ISFSI	50
B-9	Concentration of Gamma Emitters in Soil Samples From Locations Around the ISFSI	51
B-10	Typical MDA Ranges for Gamma Spectrometry	52
B-11	Typical LLDs for Gamma Spectrometry	53
B-12	Direct Radiation	54

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	2/3/2014	*	
	3/2/2014	*	
	3/31/2014	*	<307
	5/1/2014	*	
	5/30/2014	*	
	7/3/2014	*	<301
	8/1/2014	*	
	9/5/2014	*	
	10/3/2014	*	<152
	11/1/2014	*	
	12/3/2014	*	
	1/2/2015	*	<152
WA2			
Discharge Vicinity	2/3/2014	*	
	3/2/2014	*	
	3/31/2014	*	<307
	5/1/2014	*	
	5/30/2014	*	
	7/3/2014	*	<301
	8/1/2014	*	
	9/5/2014	*	
	10/3/2014	*	<152
	11/1/2014	*	
	12/3/2014	*	
	1/2/2015	*	<151

[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) +/- 2σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
IA1 Discharge Area	8/18/2014	Perch	*
IA2 Discharge Area	8/18/2014	Striped bass	*
IA4[1] Patuxent River	8/18/2014	Perch	*
IA5[1] Patuxent River	9/4/2014	Striped bass	*

[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) +/- 2σ)

Sample Code	Sample Date	Gamma Emitters
IA3		
Camp Conoy	4/1/2014	*
	6/17/2014	*
	8/18/2014	*
	10/8/2014	*
IA6[1]		
Kenwood Beach	4/1/2014	*
	6/17/2014	*
	8/18/2014	*
	10/8/2014	*

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

Table B-4

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

Sample Code	Sample Date	Gamma Emitters
WB1		
Shoreline at Barge Rd.	4/2/2014	*
	9/30/2014	*

* 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
12/30/2013	1/6/2014	*	*	*	*	*
1/6/2014	1/13/2014	*	*	*	*	*
1/13/2014	1/20/2014	*	*	*	*	*
1/20/2014	1/27/2014	*	*	*	*	*
1/27/2014	2/3/2014	*	*	*	*	*
2/3/2014	2/10/2014	*	*	*	*	*
2/10/2014	2/17/2014	*	[2]	*	*	*
2/17/2014	2/24/2014	*	*	*	*	*
2/24/2014	3/3/2014	*	*	*	*	*
3/3/2014	3/10/2014	*	*	*	*	*
3/10/2014	3/17/2014	*	*	*	*	*
3/17/2014	3/24/2014	*	*	*	*	*
3/24/2014	3/31/2014	*	*	*	*	*
3/31/2014	4/7/2014	*	*	*	*	*
4/7/2014	4/14/2014	*	*	*	*	*
4/14/2014	4/21/2014	*	*	*	*	*
4/21/2014	4/28/2014	*	*	*	*	*
4/28/2014	5/5/2014	*	*	*	*	*
5/5/2014	5/12/2014	*	*	*	*	*
5/12/2014	5/19/2014	*	*	*	*	*
5/19/2014	5/26/2014	*	*	*	*	*
5/26/2014	6/2/2014	*	*	*	*	*
6/2/2014	6/9/2014	*	*	*	*	*
6/9/2014	6/16/2014	*	*	*	*	*
6/16/2014	6/23/2014	*	*	*	*	*
6/23/2014	6/30/2014	*	*	*	*	*
6/30/2014	7/7/2014	*	*	*	*	*
7/7/2014	7/14/2014	*	*	*	*	*
7/14/2014	7/21/2014	*	*	*	*	*
7/21/2014	7/28/2014	*	*	*	*	*
7/28/2014	8/4/2014	*	*	*	*	*
8/4/2014	8/11/2014	*	*	*	*	*
8/11/2014	8/18/2014	*	*	*	*	*
8/18/2014	8/25/2014	*	*	*	*	*
8/25/2014	9/1/2014	*	*	*	*	*

[1] Control Location
[2] Sampler malfunction/low flow
* 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
9/1/2014	9/8/2014	*	*	*	*	*
9/8/2014	9/15/2014	*	*	*	*	*
9/15/2014	9/22/2014	*	*	*	*	*
9/22/2014	9/29/2014	*	*	*	*	*
9/29/2014	10/6/2014	*	*	*	*	*
10/6/2014	10/13/2014	*	*	*	*	*
10/13/2014	10/20/2014	*	*	*	*	*
10/20/2014	10/27/2014	*	*	*	*	*
10/27/2014	11/3/2014	*	*	*	*	*
11/3/2014	11/10/2014	*	*	*	*	*
11/10/2014	11/17/2014	*	*	*	*	*
11/17/2014	11/24/2014	*	*	*	*	*
11/24/2014	12/1/2014	*	*	*	*	*
12/1/2014	12/8/2014	*	*	*	*	*
12/8/2014	12/15/2014	*	*	*	*	*
12/15/2014	12/22/2014	*	*	*	*	*
12/22/2014	12/29/2014	*	*	*	*	*

[1] Control Location
* 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
12/30/2013	1/6/2014	2.1 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1
1/6/2014	1/13/2014	2.8 +/- 0.2	2.7 +/- 0.2	2.8 +/- 0.2	2.8 +/- 0.2	3.0 +/- 0.2
1/13/2014	1/20/2014	2.2 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1	2.0 +/- 0.1	2.2 +/- 0.1
1/20/2014	1/27/2014	2.1 +/- 0.2	2.2 +/- 0.2	2.3 +/- 0.2	2.2 +/- 0.2	2.2 +/- 0.2
1/27/2014	2/3/2014	2.1 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	1.4 +/- 0.1	2.3 +/- 0.1
2/3/2014	2/10/2014	3.5 +/- 0.2	3.3 +/- 0.2	3.7 +/- 0.2	3.5 +/- 0.2	3.6 +/- 0.2
2/10/2014	2/17/2014	2.6 +/- 0.1	[2]	2.5 +/- 0.1	2.6 +/- 0.1	2.0 +/- 0.1
2/17/2014	2/24/2014	1.6 +/- 0.1	1.6 +/- 0.2	1.4 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1
2/24/2014	3/3/2014	3.1 +/- 0.2	3.1 +/- 0.1	3.1 +/- 0.1	3.2 +/- 0.1	3.2 +/- 0.2
3/3/2014	3/10/2014	2.1 +/- 0.2	2.2 +/- 0.2	2.1 +/- 0.2	2.2 +/- 0.2	2.3 +/- 0.2
3/10/2014	3/17/2014	1.8 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1
3/17/2014	3/24/2014	2.0 +/- 0.2	2.0 +/- 0.2	2.0 +/- 0.2	2.1 +/- 0.2	1.9 +/- 0.2
3/24/2014	3/31/2014	1.6 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1
3/31/2014	4/7/2014	1.7 +/- 0.2	1.7 +/- 0.2	1.8 +/- 0.2	1.8 +/- 0.2	1.7 +/- 0.2
4/7/2014	4/14/2014	1.9 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1
4/14/2014	4/21/2014	1.8 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1
4/21/2014	4/28/2014	1.8 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
4/28/2014	5/5/2014	1.3 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1
5/5/2014	5/12/2014	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
5/12/2014	5/19/2014	1.6 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	1.9 +/- 0.1
5/19/2014	5/26/2014	2.1 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1	2.2 +/- 0.1	2.0 +/- 0.1
5/26/2014	6/2/2014	1.4 +/- 0.1	1.6 +/- 0.1	1.4 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1
6/2/2014	6/9/2014	1.2 +/- 0.1	1.4 +/- 0.2	1.5 +/- 0.2	1.4 +/- 0.2	1.6 +/- 0.2
6/9/2014	6/16/2014	1.2 +/- 0.1	1.2 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1	1.2 +/- 0.1
6/16/2014	6/23/2014	2.4 +/- 0.1	2.5 +/- 0.1	2.5 +/- 0.1	2.6 +/- 0.1	2.5 +/- 0.1
6/23/2014	6/30/2014	1.5 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
6/30/2014	7/7/2014	2.1 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
7/7/2014	7/14/2014	2.1 +/- 0.1	2.2 +/- 0.2	2.1 +/- 0.1	2.4 +/- 0.2	2.0 +/- 0.1
7/14/2014	7/21/2014	1.6 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1
7/21/2014	7/28/2014	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
7/28/2014	8/4/2014	1.4 +/- 0.1	1.2 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.1
8/4/2014	8/11/2014	2.2 +/- 0.1	2.4 +/- 0.1	2.0 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1
8/11/2014	8/18/2014	2.0 +/- 0.2	2.1 +/- 0.2	2.1 +/- 0.2	2.0 +/- 0.2	2.2 +/- 0.2
8/18/2014	8/25/2014	1.6 +/- 0.1	1.8 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
8/25/2014	9/1/2014	1.9 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1

[1] Control Location
[2] Sampler malfunction/low flow

Table B-6

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

Start Date	Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
9/1/2014	9/8/2014	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1
9/8/2014	9/15/2014	1.2 +/- 0.1	1.3 +/- 0.1	1.3 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1
9/15/2014	9/22/2014	2.3 +/- 0.1	2.6 +/- 0.2	2.6 +/- 0.2	2.6 +/- 0.2	2.8 +/- 0.2
9/22/2014	9/29/2014	1.9 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1
9/29/2014	10/6/2014	1.9 +/- 0.2	2.0 +/- 0.2	1.8 +/- 0.2	1.9 +/- 0.2	1.8 +/- 0.2
10/6/2014	10/13/2014	2.6 +/- 0.2	2.3 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1	2.4 +/- 0.2
10/13/2014	10/20/2014	1.6 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1
10/20/2014	10/27/2014	1.7 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1
10/27/2014	11/3/2014	2.1 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.2 +/- 0.1
11/3/2014	11/10/2014	2.6 +/- 0.1	2.7 +/- 0.2	2.6 +/- 0.1	2.5 +/- 0.1	2.8 +/- 0.1
11/10/2014	11/17/2014	1.9 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1
11/17/2014	11/24/2014	2.4 +/- 0.1	2.5 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.6 +/- 0.1
11/24/2014	12/1/2014	2.2 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1
12/1/2014	12/8/2014	2.5 +/- 0.1	2.6 +/- 0.1	2.2 +/- 0.1	2.6 +/- 0.1	2.7 +/- 0.1
12/8/2014	12/15/2014	2.3 +/- 0.1	2.3 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1
12/15/2014	12/22/2014	2.5 +/- 0.1	2.6 +/- 0.1	2.5 +/- 0.1	2.5 +/- 0.1	2.5 +/- 0.1
12/22/2014	12/29/2014	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.1 +/- 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
12/30/2013	1/6/2014	2.1 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1
1/6/2014	1/13/2014	2.5 +/- 0.2	2.8 +/- 0.2	2.9 +/- 0.2	2.8 +/- 0.2
1/13/2014	1/20/2014	2.3 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
1/20/2014	1/27/2014	2.5 +/- 0.2	2.0 +/- 0.2	2.5 +/- 0.2	2.4 +/- 0.2
1/27/2014	2/3/2014	2.5 +/- 0.1	2.5 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1
2/3/2014	2/10/2014	3.7 +/- 0.2	3.8 +/- 0.2	3.9 +/- 0.2	3.6 +/- 0.2
2/10/2014	2/17/2014	2.8 +/- 0.1	2.7 +/- 0.1	2.9 +/- 0.1	2.5 +/- 0.1
2/17/2014	2/24/2014	1.6 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1
2/24/2014	3/3/2014	3.2 +/- 0.2	3.1 +/- 0.1	3.1 +/- 0.1	3.1 +/- 0.1
3/3/2014	3/10/2014	2.5 +/- 0.2	2.3 +/- 0.2	2.3 +/- 0.2	2.4 +/- 0.2
3/10/2014	3/17/2014	2.0 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1
3/17/2014	3/24/2014	2.2 +/- 0.2	1.9 +/- 0.2	2.1 +/- 0.2	2.1 +/- 0.2
3/24/2014	3/31/2014	1.7 +/- 0.1	1.8 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1
3/31/2014	4/7/2014	1.8 +/- 0.2	1.8 +/- 0.2	1.8 +/- 0.2	1.9 +/- 0.2
4/7/2014	4/14/2014	2.1 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1
4/14/2014	4/21/2014	1.8 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1
4/21/2014	4/28/2014	1.8 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	2.2 +/- 0.1
4/28/2014	5/5/2014	1.3 +/- 0.1	1.6 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1
5/5/2014	5/12/2014	2.1 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
5/12/2014	5/19/2014	1.6 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1
5/19/2014	5/26/2014	2.1 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
5/26/2014	6/2/2014	1.6 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1
6/2/2014	6/9/2014	1.3 +/- 0.2	1.5 +/- 0.2	1.4 +/- 0.2	1.5 +/- 0.2
6/9/2014	6/16/2014	1.4 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1	1.3 +/- 0.1
6/16/2014	6/23/2014	2.5 +/- 0.1	2.7 +/- 0.1	2.7 +/- 0.2	2.3 +/- 0.1
6/23/2014	6/30/2014	1.3 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
6/30/2014	7/7/2014	2.1 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
7/7/2014	7/14/2014	2.0 +/- 0.1	2.3 +/- 0.2	2.3 +/- 0.2	2.2 +/- 0.2
7/14/2014	7/21/2014	1.7 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1
7/21/2014	7/28/2014	1.7 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1
7/28/2014	8/4/2014	1.4 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.1	1.3 +/- 0.1
8/4/2014	8/11/2014	2.3 +/- 0.1	2.6 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1
8/11/2014	8/18/2014	1.9 +/- 0.1	2.2 +/- 0.2	2.4 +/- 0.2	2.0 +/- 0.2
8/18/2014	8/25/2014	1.5 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1
8/25/2014	9/1/2014	2.0 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	1.9 +/- 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
9/1/2014	9/8/2014	1.9 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1
9/8/2014	9/15/2014	1.2 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1	1.2 +/- 0.1
9/15/2014	9/22/2014	2.4 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1	2.5 +/- 0.1
9/22/2014	9/29/2014	2.0 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
9/29/2014	10/6/2014	1.5 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.2	1.8 +/- 0.2
10/6/2014	10/13/2014	2.5 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1
10/13/2014	10/20/2014	1.6 +/- 0.1	1.5 +/- 0.1	1.7 +/- 0.1	1.6 +/- 0.1
10/20/2014	10/27/2014	1.8 +/- 0.1	1.9 +/- 0.1	1.7 +/- 0.1	1.8 +/- 0.1
10/27/2014	11/3/2014	2.1 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
11/3/2014	11/10/2014	2.8 +/- 0.1	2.7 +/- 0.1	2.5 +/- 0.1	2.6 +/- 0.1
11/10/2014	11/17/2014	1.8 +/- 0.1	1.9 +/- 0.1	1.7 +/- 0.1	2.0 +/- 0.1
11/17/2014	11/24/2014	2.5 +/- 0.1	2.5 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1
11/24/2014	12/1/2014	2.4 +/- 0.1	2.4 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
12/1/2014	12/8/2014	2.4 +/- 0.1	2.4 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1
12/8/2014	12/15/2014	2.2 +/- 0.1	2.5 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
12/15/2014	12/22/2014	2.5 +/- 0.1	2.6 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.1
12/22/2014	12/29/2014	2.0 +/- 0.3	2.0 +/- 0.1	1.9 +/- 0.1	2.0 +/- 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
2/3/2014	*	*	*	*	*
3/3/2014	*	*	*	*	*
3/31/2014	*	*	*	*	*
4/28/2014	*	*	*	*	*
6/2/2014	*	*	*	*	*
6/30/2014	*	*	*	*	*
8/4/2014	*	*	*	*	*
9/1/2014	*	*	*	*	*
9/29/2014	*	*	*	*	*
11/3/2014	*	*	*	*	*
12/1/2014	*	*	*	*	*
12/29/2014	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
2/3/2014	*	*	*	*
3/3/2014	*	*	*	*
3/31/2014	*	*	*	*
4/28/2014	*	*	*	*
6/2/2014	*	*	*	*
6/30/2014	*	*	*	*
8/4/2014	*	*	*	*
9/1/2014	*	*	*	*
9/29/2014	*	*	*	*
11/3/2014	*	*	*	*
12/1/2014	*	*	*	*
12/29/2014	*	*	*	*

[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
IB1			
Bay Breeze Rd	6/9/2014	Cabbage	*
	7/21/2014	Cabbage	*
	8/18/2014	Cabbage	*
IB2			
Bay Breeze Rd	6/9/2014	Brussels sprouts	*
	7/21/2014	Brussels sprouts	*
	8/18/2014	Brussels sprouts	*
IB3			
Bay Breeze Rd	6/9/2014	Broccoli	*
	7/21/2014	Tree Leaves	*
	8/18/2014	Tree Leaves	*
IB4			
Camp Conoy Entrance	6/9/2014	Tree Leaves	*
	7/21/2014	Cabbage	*
	8/18/2014	Tree Leaves	*
IB5			
Camp Conoy Entrance	6/9/2014	Tree Leaves	*
	7/21/2014	Tree Leaves	*
	8/18/2014	Tree Leaves	*
IB6			
Camp Conoy Entrance	6/9/2014	Tree Leaves	*
	7/21/2014	Tree Leaves	*
	8/18/2014	Tree Leaves	*
IB7[1]			
EOF	6/9/2014	Cabbage	*
	7/21/2014	Cabbage	*
	8/18/2014	Mint	*
IB8[1]			
EOF	6/9/2014	Brussels sprouts	*
	7/21/2014	Tree Leaves	*
	8/18/2014	Cabbage	*
IB9[1]			
EOF	6/9/2014	Broccoli	*
	7/21/2014	Tree Leaves	*
	8/18/2014	Tree Leaves	*

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

Table B-8b

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

Sample Code	Sample Date	Cs-137	Gamma Emitters
SFB1			
MET Station	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFB2[2]			
Visitor's Center	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFB3			
NNW of ISFSI	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFB4			
SSE of ISFSI	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFB5			
On Site Before Entrance to Camp Conoy	3/24/2014	68 +/- 24	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*

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

Table B-9

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

Sample Code	Sample Date	Cs-137	Gamma Emitters
SFS1			
MET station	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFS2[2]			
Visitors Center	3/24/2014	69 +/- 33	*
	5/27/2014	56 +/- 21	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFS3			
NNW of ISFSI	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFS4			
SSE of ISFSI	3/24/2014	[1]	*
	5/27/2014	[1]	*
	9/15/2014	[1]	*
	10/13/2014	[1]	*
SFS5			
Entrance to Camp Conoy	3/24/2014	221 +/- 32	*
	5/27/2014	127 +/- 24	*
	9/15/2014	132 +/- 28	*
	10/13/2014	121 +/- 31	*

[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^{-2} pCi/m^3)	Bay Water, Surface Water, Drinking Water (pCi/L)	Fish (pCi/kg) wet	Groundwater (pCi/L)	Milk (pCi/L)	Oysters (pCi/kg) Wet	Shoreline Sediment (pCi/kg) Dry	Soil (pCi/kg) Dry	Vegetation (pCi/L) Wet
Na-22	0 - 0	1.7 - 4	1 - 54.5	2.2 - 4.2	3.9 - 5.3	4.4 - 21.1	34.5 - 59.5	22.4 - 86	11.2 - 34.1
K-40	0 - 0	18.6 - 44.1	0 - 421	22.4 - 47.8	30.7 - 43.5	37.2 - 152	316.3 - 441	163 - 734	77.6 - 287
Cr-51	0 - 0	13 - 34.8	0 - 533	20.1 - 33.2	20.7 - 31.2	24.5 - 112	253 - 378	126 - 706	57.6 - 206
Mn-54	0 - 0	1.7 - 3.6	0 - 51.4	2.1 - 3.7	2.9 - 3.9	4.4 - 36.3	30.5 - 44.8	21.3 - 78.2	8.5 - 29.7
Co-58	0 - 0	1.8 - 3.6	0 - 57.1	2.1 - 3.9	2.9 - 4	0.5 - 44.8	29.9 - 46.7	21.6 - 72.2	8.4 - 28.6
Fe-59	0 - 0	3.7 - 8.2	0 - 147	4.7 - 8.2	6.9 - 9.9	6.2 - 91.7	71.1 - 108	46.1 - 173	19.7 - 62.3
Co-60	0 - 0	1.8 - 3.7	0 - 57.9	2.1 - 4	3.5 - 4.8	7.2 - 37.3	34.7 - 49.7	20.3 - 79.8	10.3 - 32.4
Zn-65	0 - 0	3.6 - 7.5	0 - 132	4.2 - 10.6	7.4 - 9.6	13.2 - 82.2	83.2 - 128	56.2 - 202	21.3 - 69.5
Nb-95	0 - 0	1.9 - 4.2	0 - 80.2	2.4 - 4.3	2.9 - 4	3.6 - 16.5	38.1 - 53.6	22.8 - 100	8.9 - 29.5
Zr-95	0 - 0	3.1 - 6.3	0 - 87.9	3.8 - 6.7	5 - 6.7	5.9 - 26.4	53.2 - 81	38.2 - 136	15 - 49
Ru-106	0 - 0	13.9 - 31.1	0 - 359	17.8 - 32.9	24.7 - 31.2	29 - 134	263 - 368	187 - 586	73.2 - 252
Ag-110m	0 - 0	1.5 - 3.4	0 - 46.7	1.9 - 3.5	2.7 - 3.4	3.3 - 15	28.2 - 41.9	25.1 - 75.1	7.4 - 28.1
I-131*	0 - .4	0 - 63.2	0 - 1329	3.6 - 9	0.4 - 0.6	4 - 18.6	49.5 - 106	0 - 4808	10.4 - 32.6
Cs-134	0 - 0	1.6 - 3.4	0 - 66.2	1.9 - 3.8	2.6 - 3.3	4.5 - 33.3	30.1 - 45.9	37 - 74.5	9.3 - 27.6
Cs-137	0 - 0	1.6 - 3.6	0 - 54.9	1.8 - 3.9	2.9 - 3.8	5.4 - 34.8	30.6 - 47.6	30.5 - 79.6	10.6 - 29.3
Ba-140	0 - .1	0 - 16.6	0 - 355	4.2 - 8.2	3 - 6.6	4.8 - 22.8	52.2 - 102	0 - 703	11 - 41.4
La-140	0 - .1	0 - 16.6	0 - 355	4.2 - 8.2	3 - 6.6	4.8 - 22.8	52.2 - 102	0 - 703	11 - 41.4
Ce-144	0 - 0	8.9 - 17.9	0 - 174	10.9 - 21.7	15.5 - 18.8	14 - 62.5	124 - 180	93.2 - 310	29.8 - 117

* This MDA range for I-131 on a charcoal cartridge is typical 4.16 x 10^{-3} to 3.40 x 10^{-2} pCi/m^3

Table B-11

Typical LLDs 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	Oysters pCi/kg (wet)	Precipitation pCi/L	Soil pCi/kg (dry)	Vegetation pCi/kg (wet)
Na-22	2.9	2.9	22	2.9	22	2.9	24	35
Cr-51	12	17	88	17	88	17	110	162
Mn-54	2.1	2.4	17	2.4	17	2.4	18	27
Co-58	2	2.4	16	2.4	16	2.4	17	25
Fe-59	4.6	5.2	37	5.2	37	5.2	38	60
Co-60	2.7	2.8	22	2.8	22	2.8	21	33
Zn-65	2.8	5.6	23	5.6	23	5.6	54	66
Nb-95	1.9	2.2	15	2.2	15	2.2	18	25
Zr-95	3.3	3.8	27	3.8	27	3.8	29	44
Ru-106	17	20	135	20	135	20	146	223
Ag-110m	1.8	2.1	14	2.1	14	2.1	16	25
Te-129m	20	26	149	26	149	26	180	265
I-131*	1.5	2	11	2	11	2	14	20
Cs-134	1.9	2.2	15	2.2	15	2.2	20	24
Cs-137	1.8	2.3	15	2.3	15	2.3	17	27
Ba-140	6.1	7.3	48	7.3	48	7.3	54	80
La-140	3.4	4.1	26	4.1	26	4.1	25	41
Ce-144	5.5	12	43	12	43	12	75	101

* The LLD for I-131 measured on a charcoal cartridge is 2.0 x10^{-3} pCi/m^3

Table B-12

Direct Radiation
(Results in Units of mR/90 days +/- 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR01	On Site, along Cliffs	12.96 +/- 0.69	12.98 +/- 0.62	13.52 +/- 1.61	13.79 +/- 1.05
DR02	Route 765, Auto Dump	11.05 +/- 0.87	11.16 +/- 0.60	10.68 +/- 1.93	11.36 +/- 1.03
DR03	Route 765, Giovanni's Tavern	10.90 +/- 1.23	10.70 +/- 1.07	9.66 +/- 2.49	11.20 +/- 1.41
DR04	Route 765, across from Vera's Beach Club	12.57 +/- 1.55	12.68 +/- 0.70	11.65 +/- 2.44	12.87 +/- 1.51
DR05	Route 765, John's Creek	12.76 +/- 0.41	11.79 +/- 1.18	11.30 +/- 1.05	12.40 +/- 1.01
DR06	Route 765 at Lusby	10.65 +/- 0.97	10.77 +/- 1.37	10.22 +/- 2.80	11.10 +/- 0.82
DR07	Entrance to Camp Conoy	10.57 +/- 0.49	10.27 +/- 0.82	9.69 +/- 1.28	11.06 +/- 1.40
DR08	Camp Conoy Rd at Emergency Siren	15.15 +/- 0.94	15.06 +/- 1.56	13.75 +/- 2.58	15.98 +/- 1.71
DR09	Bay Breeze Rd	10.64 +/- 1.38	10.84 +/- 0.61	11.15 +/- 1.34	11.23 +/- 0.76
DR10	Calvert Beach Rd and Decatur Street	10.86 +/- 1.15	10.80 +/- 0.81	10.91 +/- 0.64	11.39 +/- 1.11
DR11	Dirt road off Mackall & Parren Rd	10.95 +/- 1.06	10.59 +/- 0.92	10.59 +/- 1.60	11.73 +/- 0.51
DR12	Mackall & Bowen Rds	11.33 +/- 0.65	10.73 +/- 0.75	10.42 +/- 0.81	11.55 +/- 1.15
DR13	Mackall Rd, near Wallville	12.01 +/- 0.64	12.12 +/- 0.83	13.03 +/- 0.54	*

* Missing TLD

Table B-12

Direct Radiation
(Results in Units of mR/90 days +/- 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR14	Rodney Point	13.65 +/- 0.77	13.14 +/- 1.45	13.01 +/- 1.26	13.85 +/- 0.90
DR15	Mill Bridge & Turner Rds	11.96 +/- 1.11	11.64 +/- 0.29	9.64 +/- 1.05	12.24 +/- 0.65
DR16	Across from Appeal School	10.83 +/- 0.85	10.57 +/- 0.53	10.54 +/- 3.20	11.13 +/- 0.63
DR17	Cove Point & Little Cove Point Rds	12.20 +/- 1.68	11.88 +/- 0.66	12.23 +/- 1.87	*
DR18	Cove Point	9.95 +/- 0.44	9.57 +/- 0.84	9.61 +/- 1.31	9.96 +/- 0.92
DR19	Long Beach	11.19 +/- 1.41	11.30 +/- 0.42	11.99 +/- 1.47	11.22 +/- 0.57
DR20	On site, near shore	13.43 +/- 0.88	13.35 +/- 0.33	12.55 +/- 3.25	14.14 +/- 0.60
DR21[1]	EOF	12.91 +/- 0.95	12.26 +/- 0.44	12.61 +/- 2.20	12.84 +/- 1.44
DR22[1]	Solomons Island	11.81 +/- 0.80	11.05 +/- 0.59	10.90 +/- 1.97	11.52 +/- 0.28
DR23[1]	Taylors Island	16.21 +/- 1.93	15.59 +/- 1.22	16.46 +/- 3.87	16.15 +/- 1.44
DR30	MET Station	12.92 +/- 1.18	11.47 +/- 0.40	12.04 +/- 3.35	12.33 +/- 0.99
SFDR01	SW of ISFSI	18.55 +/- 1.59	16.79 +/- 2.08	14.98 +/- 2.82	17.21 +/- 0.81
SFDR02	NNW of ISFSI	18.34 +/- 2.27	17.62 +/- 2.10	16.61 +/- 4.55	19.06 +/- 2.33
SFDR03	North of ISFSI	37.28 +/- 7.19	37.35 +/- 7.54	32.82 +/- 6.58	39.21 +/- 5.28
SFDR04	NE of ISFSI	31.12 +/- 4.76	30.42 +/- 5.07	29.47 +/- 7.83	34.24 +/- 4.60

*Missing TLD
[1]Control Location

Table B-12

Direct Radiation
(Results in Units of mR/90 days +/- 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
SFDR05	East of ISFSI	19.18 +/- 2.82	18.84 +/- 4.09	16.68 +/- 1.88	21.53 +/- 2.83
SFDR06	ESE of ISFSI	16.35 +/- 2.23	15.86 +/- 1.72	14.71 +/- 3.80	19.38 +/- 2.62
SFDR07[1]	Visitor's Center	12.36 +/- 1.28	12.13 +/- 1.02	10.34 +/- 0.98	12.71 +/- 0.52
SFDR08	NNW of ISFSI	27.25 +/- 3.56	26.12 +/- 3.21	25.91 +/- 3.01	27.17 +/- 3.77
SFDR09	SSE of ISFSI	14.63 +/- 1.66	12.82 +/- 0.58	12.77 +/- 3.17	21.15 +/- 1.12
SFDR10	NW of ISFSI	31.31 +/- 8.09	24.69 +/- 5.95	25.98 +/- 8.99	31.75 +/- 0.75
SFDR11	WNW ISFSI	25.55 +/- 2.69	23.73 +/- 2.06	24.88 +/- 6.06	23.53 +/- 1.92
SFDR12	WSW of ISFSI	43.64 +/- 6.11	40.70 +/- 7.21	39.83 +/- 11.12	47.20 +/- 11.94
SFDR13	South of ISFSI	19.82 +/- 4.04	21.01 +/- 3.64	21.87 +/- 4.62	28.17 +/- 3.53
SFDR14	SE of ISFSI	15.70 +/- 1.85	13.91 +/- 1.85	14.37 +/- 1.12	35.09 +/- 4.32
SFDR15	ENE of ISFSI	19.83 +/- 2.65	19.08 +/- 4.21	19.23 +/- 6.12	22.09 +/- 4.47
SFDR16	SSW of ISFSI	35.22 +/- 4.28	34.08 +/- 2.62	32.83 +/- 6.98	38.24 +/- 4.95
SFDR17	NNE of ISFSI	42.47 +/- 5.37	37.85 +/- 2.52	40.55 +/- 9.08	42.95 +/- 7.43
SFDR18	West of ISFSI	45.54 +/- 9.87	39.46 +/- 2.48	40.27 +/- 8.14	40.67 +/- 7.18

[1] Control Location

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 Analytics, Inc. 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, and Table C-3, which is a list of typical MDAs achieved by Teledyne Brown for Gamma Spectroscopy.

All the EIS laboratory's results contained in Table C-1 generally agree with the interlaboratory's comparison results within the range of $\pm 2\sigma$ of each other. In addition, all the sets of intercomparison results in the table are in full agreement when they were further evaluated using the NRC Resolution Test Criteria[1]. The uncertainties for the EIS laboratory's results and Analytics' results are $\pm 2\sigma$ while the ERA laboratory's uncertainty is based on USEPA guidelines[2].

All the results contained in Table C-2 agree within the range of $\pm 2\sigma$ of each other with their respective EIS laboratory original, replicate and/or Teledyne Brown Engineering's split laboratory samples, except for the comparisons of three samples involving Cs-137 results: a miscellaneous ground cover sample at SFB5 collected on 3/24/14, bottom sediment sample at WBS4 collected on 6/17/14, and soil at SFS2 collected on 9/15/14. The original and replicate analysis of the ground cover sample from SFB5 collected on 3/24/14 agree within $\pm 2\ \sigma$ of each other and was not detected in the split lab results. Low level Cs-137 was observed in the split lab results of the comparison set for SFS2 collected on 9/15/14 and observed below MDA in the original and duplicate. In the bottom sediment sample, WBS4 collected on 6/17/14, the original and replicate analysis do agree within $\pm 2\ \sigma$ of each other and one result does not agree within $\pm 2\ \sigma$ of the split lab results. These minor discrepancies, which have been observed in previous reporting periods, are most probably due to counting statistics and/or the non-homogeneous nature of this type of sample. Other samples whose nature generally preclude sample splitting are marked "**" in the Split Analysis column.

[1] NRC Inspection Manual, Inspection Procedure 84750, March 15, 1994
[2] National Standards for Water Proficiency Testing Studies Criteria Document, December 1998

TABLE OF CONTENTS - ANALYTICAL RESULTS

Table	Title	Page
C-1	Results of Participation in Cross Check Programs	59
C-2	Results of Quality Assurance Program	62
C-3	Teledyne Brown Engineering's Typical MDAs for Gamma Spectrometry	70

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
03/20/14	Air Iodine– pCi	I-131	67.0 +/- 5.0	75.1 +/- 1.3
03/20/14	Milk – pCi/L	Co-58	240 +/- 16	268 +/- 4.5
		Co-60	310 +/- 12	337 +/- 5.7
		Zn-65	306 +/- 26	323 +/- 5.4
		I-131	86.0 +/- 18	98.5 +/- 1.7
		Cs-134	166 +/- 8.0	210 +/- 3.5
		Cs-137	234 +/- 15	253 +/- 4.2
		Ce-141	113 +/- 14	119 +/- 2.0
		Cr-51	408 +/- 69	491 +/- 8.2
		Mn-54	285 +/- 16	297 +/- 5.0
		Fe-59	214 +/- 18	219 +/- 3.7
		I-131	29.0 +/- 5.0	25.7 +/- 1.6
04/07/14	Water – pCi/L	Co-60	62.3 +/- 4.7	64.2
		Zn-65	25.6 +/- 18	23.5
		Cs-134	40.2 +/- 3.6	44.3
		Cs-137	87.4 +/- 6.8	89.1
		Ba-133	86.8 +/- 5.5	87.9
05/09/14	Water- pCi/L	H-3	2.77×10^4	2.47×10^4
06/12/14	Air Filter– pCi	Fe-59	88.0 +/- 9.0	76.4 +/- 1.3
		Cr-51	194 +/- 33	189 +/- 3.2
		Ce-141	101 +/- 7.0	92.2 +/- 1.5
		Cs-137	96.0 +/- 6.0	89.4 +/- 1.5
		Cs-134	99.0 +/- 4.0	121 +/- 2.0
		Zn-65	211 +/- 16	188 +/- 3.1
		Co-60	172 +/- 7.0	167 +/- 2.8
		Co-58	83.0 +/- 7.0	83.7 +/- 1.4
		Mn-54	126 +/- 8.0	116 +/- 1.9
06/12/14	Water - pCi/L	Gross Beta	253 +/- 3.4	253 +/- 3.0

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
07/07/14	Water	Cs-134	68.0 +/- 6.0	72.3
		I-131	21.0 +/- 7.0	26.1
		Ba-133	66.0 +/- 7.0	68.7
		Cs-137	174 +/- 13.0	163
		Co-60	78.0 +/- 8.0	75.5
		Zn-65	94.0 +/- 18.0	82.0
07/07/14	Water - pCi/L	Gross Beta	28.3 +/- 1	33.5
08/15/14	Water- pCi/L	H-3	1.50×10^6	9.76×10^5
09/11/14	Air Filter	Gross Beta	93.2 +/- 2.0	89.8 +/- 1.5
09/22/14	Air Filter– pCi	Am-241	34.0 +/- 15	38.6
		Co-60	553 +/- 10	523
		Cs-134	631 +/- 11	765
		Cs-137	714 +/- 16	647
		Zn-65	665 +/- 23	547
10/06/14	Water – pCi/L	Co-60	96.0 +/- 4.0	92.1
		Zn-65	340 +/- 16	310
		Cs-134	78.0 +/- 4.0	89.8
		Cs-137	97.0 +/- 5.0	98.8
		Ba-133	43.0 +/- 3.0	49.1
12/04/14	Air Filter– pCi	Mn-54	148 +/- 10	135 +/- 2.3
		Fe-59	127 +/- 11	105 +/- 1.8
		Co-58	80.0 +/- 8.0	78.0 +/- 1.3
		Co-60	151 +/- 7.0	141 +/- 2.4
		Cr-51	279 +/- 35	243 +/- 4.1
		Cs-134	88.0 +/- 6.0	98.7 +/- 1.7
		Cs-137	128 +/- 9.0	119 +/- 2.0
		Ce-141	144 +/- 7.0	131 +/- 2.2
		Zn-65	207 +/- 18	178 +/- 3.0

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
12/04/14	Air Iodine	I-131	93.0 +/- 4.0	97.3 +/- 1.6
12/04/14	Milk – pCi/L	Mn-54	253 +/- 21	225 +/- 3.8
		Fe-59	203 +/- 23	175 +/- 2.9
		Co-58	141 +/- 18	130 +/- 2.2
		Co-60	258 +/- 16	235 +/- 3.9
		Cr-51	428 +/- 93	406 +/- 6.8
		I-131	114 +/- 18	95.1 +/- 1.6
		Cs-134	159 +/- 11	164 +/- 2.8
		Cs-137	218 +/- 20	198 +/- 3.3
		Ce-141	248 +/- 22	219 +/- 3.7
		Zn-65	357 +/- 42	297 +/- 5.0

[1] See discussion at the beginning of the Appendix

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
Air Iodine - A3	01/20/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	01/20/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	01/20/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Filter - A1	01/27/14	Gross Beta	pCi/m^3	2.1 +/- 0.2	2.1 +/- 0.2	**
Air Filter - A2	01/27/14	Gross Beta	pCi/m^3	2.2 +/- 0.2	2.1 +/- 0.2	**
Air Filter - A3	01/27/14	Gross Beta	pCi/m^3	2.3 +/- 0.2	2.1 +/- 0.2	**
Air Filter - A4	01/27/14	Gross Beta	pCi/m^3	2.2 +/- 0.2	2.4 +/- 0.2	**
Air Filter - A5	01/27/14	Gross Beta	pCi/m^3	2.2 +/- 0.2	2.4 +/- 0.2	**
Air Filter - SFA1	01/27/14	Gross Beta	pCi/m^3	2.5 +/- 0.2	2.3 +/- 0.2	**
Air Filter - SFA2	01/27/14	Gross Beta	pCi/m^3	2.0 +/- 0.2	2.3 +/- 0.2	**
Air Filter - SFA3	01/27/14	Gross Beta	pCi/m^3	2.5 +/- 0.2	2.3 +/- 0.2	**
Air Filter - SFA4	01/27/14	Gross Beta	pCi/m^3	2.4 +/- 0.2	2.2 +/- 0.2	**
Air Filter - A1	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A2	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A3	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A4	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A5	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA1	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA2	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA3	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA4	02/03/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA

** The nature of these samples precluded splitting them with an independent laboratory.

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
Air Iodine - A1	02/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A2	02/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A3	02/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	02/10/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	02/10/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A1	03/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A2	03/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A3	03/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	03/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	03/03/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Filter - A1	03/10/14	Gross Beta	pCi/m^3	2.1 +/- 0.2	2.3 +/- 0.2	**
Air Filter - A2	03/10/14	Gross Beta	pCi/m^3	2.2 +/- 0.2	2.2 +/- 0.2	**
Air Filter - A3	03/10/14	Gross Beta	pCi/m^3	2.1 +/- 0.2	2.1 +/- 0.2	**
Air Filter - A4	03/10/14	Gross Beta	pCi/m^3	2.2 +/- 0.2	2.1 +/- 0.2	**
Air Filter - A5	03/10/14	Gross Beta	pCi/m^3	2.3 +/- 0.2	2.4 +/- 0.2	**
Air Filter - SFA1	03/10/14	Gross Beta	pCi/m^3	2.5 +/- 0.2	2.5 +/- 0.2	**
Air Filter - SFA2	03/10/14	Gross Beta	pCi/m^3	2.3 +/- 0.2	2.4 +/- 0.2	**
Air Filter - SFA3	03/10/14	Gross Beta	pCi/m^3	2.3 +/- 0.2	2.3 +/- 0.2	**
Air Filter - SFA4	03/10/14	Gross Beta	pCi/m^3	2.4 +/- 0.2	2.4 +/- 0.2	**

** The nature of these samples precluded splitting them with an independent laboratory.

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
Air Filter - A1	03/17/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.9 +/- 0.1	**
Air Filter - A2	03/17/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**
Air Filter - A3	03/17/14	Gross Beta	pCi/m^3	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - A4	03/17/14	Gross Beta	pCi/m^3	2.1 +/- 0.1	1.9 +/- 0.1	**
Air Filter - A5	03/17/14	Gross Beta	pCi/m^3	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - SFA1	03/17/14	Gross Beta	pCi/m^3	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - SFA2	03/17/14	Gross Beta	pCi/m^3	1.9 +/- 0.1	1.9 +/- 0.1	**
Air Filter - SFA3	03/17/14	Gross Beta	pCi/m^3	2.1 +/- 0.1	1.9 +/- 0.1	**
Air Filter - SFA4	03/17/14	Gross Beta	pCi/m^3	2.0 +/- 0.1	1.8 +/- 0.1	**
Misc ground coverage - SFB5 [1]	03/24/14	Cs-137	pCi/kg	68.4 +/- 23.9	52.1 +/- 21.2	<MDA
Soil - SFS5	03/24/14	Cs-137	pCi/kg	221 +/- 31.6	218 +/- 31.0	194 +/- 60.8
Bay Water - WA1	03/31/14	Gamma	pCi/L	<MDA	<MDA	<MDA
Bay Water - WA2	03/31/14	Gamma	pCi/L	<MDA	<MDA	<MDA
Oysters - IA3	04/01/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Shoreline sediment - WB1	04/02/14	Gamma	pCi/kg	<MDA	<MDA	<MDA

[1] See discussion at the beginning of the Appendix

** The nature of these samples precluded splitting them with an independent laboratory.

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
Air Iodine - A1	04/07/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A2	04/07/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A3	04/07/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	04/07/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	04/07/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Filter - A1	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.6 +/- 0.1	**
Air Filter - A2	04/21/14	Gross Beta	pCi/m^3	1.7 +/- 0.1	1.7 +/- 0.1	**
Air Filter - A3	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.7 +/- 0.1	**
Air Filter - A4	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**
Air Filter - A5	04/21/14	Gross Beta	pCi/m^3	1.9 +/- 0.1	1.9 +/- 0.1	**
Air Filter - SFA1	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**
Air Filter - SFA2	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.9 +/- 0.1	**
Air Filter - SFA3	04/21/14	Gross Beta	pCi/m^3	1.9 +/- 0.1	1.8 +/- 0.1	**
Air Filter - SFA4	04/21/14	Gross Beta	pCi/m^3	1.8 +/- 0.1	1.8 +/- 0.1	**
Air Filter - A1	05/05/14	Gross Beta	pCi/m^3	1.3 +/- 0.1	1.2 +/- 0.1	**
Air Filter - A2	05/05/14	Gross Beta	pCi/m^3	1.3 +/- 0.1	1.5 +/- 0.1	**
Air Filter - A3	05/05/14	Gross Beta	pCi/m^3	1.4 +/- 0.1	1.2 +/- 0.1	**
Air Filter - A4	05/05/14	Gross Beta	pCi/m^3	1.3 +/- 0.1	1.4 +/- 0.1	**
Air Filter - A5	05/05/14	Gross Beta	pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**

** The nature of these samples precluded splitting them with an independent laboratory.

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
Air Filter - SFA1	05/05/14	Gross Beta	pCi/m^3	1.3 +/- 0.1	1.3 +/- 0.1	**
Air Filter - SFA2	05/05/14	Gross Beta	pCi/m^3	1.6 +/- 0.1	1.5 +/- 0.1	**
Air Filter - SFA3	05/05/14	Gross Beta	pCi/m^3	1.4 +/- 0.1	1.4 +/- 0.1	**
Air Filter - SFA4	05/05/14	Gross Beta	pCi/m^3	1.5 +/- 0.1	1.4 +/- 0.1	**
Air Iodine - A1	05/05/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A2	05/05/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A3	05/05/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	05/05/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	05/05/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A1	06/09/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A2	06/09/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A4	06/09/14	I-131	pCi/m^3	<MDA	<MDA	**
Air Iodine - A5	06/09/14	I-131	pCi/m^3	<MDA	<MDA	**
Cabbage - IB1	06/09/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Cabbage - IB7	06/09/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Tree Leaves - IB4	06/09/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Bottom sediment - WBS2	06/17/14	Cs-137	pCi/kg	128 +/- 40.4	119 +/- 46.6	263 +/- 131
Bottom sediment - WBS4[1]	06/17/14	Cs-137	pCi/kg	117 +/- 55.5	83.6 +/- 37.8	215 +/- 87.0

[1] See discussion at the beginning of the Appendix

** The nature of these samples precluded splitting them with an independent laboratory.

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
Oysters - IA3	06/17/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Oysters - IA6	06/17/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Gamma field - DR05	07/01/14	TLD	mR/90 days	12.0 +/- 1.1	11.6 +/- 1.7	**
Gamma field - DR06	07/01/14	TLD	mR/90 days	11.0 +/- 1.4	10.2 +/- 0.5	**
Gamma field - DR07	07/01/14	TLD	mR/90 days	10.5 +/- 0.8	10.1 +/- 0.7	**
Gamma field - DR08	07/01/14	TLD	mR/90 days	15.3 +/- 1.5	14.6 +/- 1.1	**
Gamma field - DR09	07/01/14	TLD	mR/90 days	10.8 +/- 1.2	10.4 +/- 0.9	**
Gamma field - DR10	07/01/14	TLD	mR/90 days	11.0 +/- 0.8	10.3 +/- 1.0	**
Gamma field - DR11	07/01/14	TLD	mR/90 days	11.4 +/- 1.0	10.6 +/- 0.9	**
Gamma field - DR29	07/01/14	TLD	mR/90 days	14.4 +/- 1.2	14.2 +/- 0.6	**
Gamma field - DR31	07/01/14	TLD	mR/90 days	14.6 +/- 0.6	14.8 +/- 1.1	**
Gamma field - SFDR14	07/01/14	TLD	mR/90 days	14.2 +/- 1.9	13.2 +/- 1.2	**
Gamma field - SFDR15	07/01/14	TLD	mR/90 days	19.4 +/- 4.3	19.8 +/- 2.7	**
Air Filter - A1	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A2	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A3	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A4	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - A5	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA1	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA2	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA3	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA
Air Filter - SFA4	08/17/14	Gamma	pCi/m^3	<MDA	<MDA	<MDA

** The nature of these samples precluded splitting them with an independent laboratory.

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
Oysters - IA3	08/18/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Oysters - IA6	08/18/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Perch - IA1	08/18/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Perch - IA4	08/18/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Bay Water - WA1	09/05/14	Gamma	pCi/L	<MDA	<MDA	<MDA
Bay Water - WA2	09/05/14	Gamma	pCi/L	<MDA	<MDA	<MDA
Misc ground coverage - SFB2	09/15/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Misc ground coverage - SFB4	09/15/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Misc ground coverage - SFB5	09/15/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Soil - SFS2[1]	09/15/14	Gamma	pCi/kg	<MDA	<MDA	100+/- 45
Soil - SFS4	09/15/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Soil - SFS5	09/15/14	Cs-137	pCi/kg	132 +/- 27.7	133 +/- 31.0	130 +/- 53.0
Oysters - IA3	10/08/14	Gamma	pCi/kg	<MDA	<MDA	<MDA
Oysters - IA6	10/08/14	Gamma	pCi/kg	<MDA	<MDA	<MDA

[1] See discussion at the beginning of the Appendix

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
Gamma field - DR05	01/08/15	TLD	mR/90 days	14.4 +/- 1.6	13.9 +/- 2.7	**
Gamma field - DR06	01/08/15	TLD	mR/90 days	12.3 +/- 1.3	11.7 +/- 3.0	**
Gamma field - DR07	01/08/15	TLD	mR/90 days	12.4 +/- 1.8	11.9 +/- 1.4	**
Gamma field - DR08	01/08/15	TLD	mR/90 days	18.3 +/- 2.4	17.3 +/- 2.9	**
Gamma field - DR09	01/08/15	TLD	mR/90 days	12.8 +/- 1.1	13.2 +/- 1.8	**
Gamma field - DR10	01/08/15	TLD	mR/90 days	12.3 +/- 1.0	12.8 +/- 1.1	**
Gamma field - DR11	01/08/15	TLD	mR/90 days	13.1 +/- 1.2	12.0 +/- 1.7	**
Gamma field - DR29	01/08/15	TLD	mR/90 days	17.9 +/- 2.0	17.4 +/- 2.5	**
Gamma field - DR31	01/08/15	TLD	mR/90 days	18.0 +/- 1.6	17.0 +/- 1.9	**
Gamma field - SFDR14	01/08/15	TLD	mR/90 days	41.4 +/- 3.7	40.4 +/- 3.3	**
Gamma field - SFDR15	01/08/15	TLD	mR/90 days	26.1 +/- 6.4	24.6 +/- 4.7	**

** The nature of these samples precluded splitting them with an independent laboratory.

TABLE C-3

Teledyne Brown Engineering's Typical MDAs for Gamma Spectrometry

Selected Nuclides	Bay Water pCi/l	Fish pCi/kg	Shellfish pCi/kg	Sediment pCi/kg	Vegetation pCi/kg	Particulates 10^{-3}pCi/m^3
H-3	175	--	--	--	--	--
Na-22	1	8	3	12	6	5
Cr-51	12	105	4	104	50	63
Mn-54	1	9	3	12	5	4
Co-58	1	9	4	9	4	5
Fe-59	3	28	9	24	10	12
Co-60	1	9	4	12	5	6
Zn-65	2	20	8	25	10	9
Nb-95	1	12	7	14	6	9
Zr-95	2	18	8	20	9	9
Ru-106	9	75	30	90	41	40
Ag-110m	1	10	10	10	5	4
Te-129m	16	131	60	162	79	95
I-131	4	65	30	35	22	74
Cs-134	1	8	4	10	5	4
Cs-137	1	9	4	10	5	4
BaLa-140	3	32	15	25	14	36
Ce-144	7	40	16	54	26	18

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. There are no animals producing milk for human consumption within the 5 mile radius. The nearest garden location has changed in the NW, W, S and SSE sectors since 2013 and are still located within the 5-mile radius.

Table D-1
Land Use Survey

	Distance From Plant (miles)	
Sector	Residence	Garden
SE	1.5	1.5
SSE	1.6	1.6
S	1.6	1.8
SSW	1.5	1.6
SW	1.1	1.1
WSW	1.3	1.4
W	1.3	1.6
WNW	2.7	2.7
NW	2.0	2.0

The closest residence is situated in the SW sector and the nearest garden is also in the SW sector, which is one of the least prevalent wind directions. In the S, SSE, and SE sectors, there is the highest probability of wind blowing from the direction of the plant. The two gardens used for vegetable samples by the REMP have been placed in the sectors with the highest X/Q. One sampling garden is located in the S sector at a distance of 0.4 miles, and another is situated near the site boundary in the SSE sector at a distance of 1.6 miles from the plant. These two sampling sites are considered good indicator locations for radioactive depositions around the plant.

The dose assessment using this operating period meteorological data was performed, and no significant impact from the plant was found.

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 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-10 contain analytical results for samples taken from the various radiological pathways (i.e., aquatic, atmospheric, terrestrial, and direct radiation) surrounding the plant. In general, these results continue the historical trends previously observed in the official sites of the CCNPP REMP and ISFSI.

Table E-10 shows the direct radiation readings from TLDs placed at the perimeter of the Resin Storage Area which is a temporary waste resin storage and cask transfer area located to the west of the ISFSI facility. The TLD values are somewhat higher than those in the REMP program due to their proximity to this source of the radiation. However, when the direct radiation readings for the Resin Storage Area are compared with those from the ISFSI and Site Boundary TLDs, it is apparent that temporary storage of spent resin and cask transfers are having no significant, measurable effect on the environs surrounding CCNPP.

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 and analysis for gamma and tritium.

Groundwater samples were collected from 17 on-site piezometer tubes in 2014. These were identified as Piezometers 11 – 30 on Figure E-1, Site Map Groundwater Monitoring Wells. 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 showed any plant-related activity. 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. The 2014 analysis results for tritium are shown in Table E-11, and analysis results for gamma emitting radionuclides are shown in Table E-12.

TABLE OF CONTENTS - ANALYTICAL RESULTS

Table	Title	Page
E-1	Locations of Non-Tech Spec Environmental Sampling Stations for Calvert Cliffs Nuclear Power Plant	74
E-2	Synopsis of 2014 Calvert Cliffs Nuclear Power Plant Non-Tech Spec Radiological Environmental Monitoring Program	75
E-3	Annual Summary for Calvert Cliffs Nuclear Power Plant Units 1 & 2 Non-Tech Spec Radiological Environmental Monitoring Program	76
E-4	Concentration of Gamma Emitters in Bottom Sediment	77
E-5	Concentration of Iodine-131 in Filtered Air	78
E-6	Concentration of Beta Emitters in Air Particulates	80
E-7	Concentration of Gamma Emitters in Air Particulates	82
E-8	Concentration of Tritium and Gamma Emitters in TaylorsIsland Well Water	83
E-9	Direct Radiation	84
E-10	Direct Radiation from Resin Storage Area	85
E-11	Concentration of Tritium in Groundwater	86
E-12	Gross Concentration of Gamma Emitters in Groundwater	87

Figure	Title	Page
E-1	Site Map Groundwater Monitoring Wells	88

TABLE E-1

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

Station	Description	Distance[1]		Direction[1]
		(KM)	(Miles	(Sector)
A6	Long Beach	4.4	2.7	NW
A7	Taylors Island Anderson's Property	12.6	7.8	ENE
A8	Cambridge, U of MD Estuarine Center	32.0	19.9	NE
DR24	Route 4 and Parran Road	3.0	1.9	SW
DR25	Camp Conoy Guard House	1.0	0.6	S
DR26	Route 235 & Clarks Landing Rd.	20.5	12.7	SW
DR27	Route 231 & Route 4	23.0	14.3	NW
DR28	Taylors Island Emergency Siren #35	12.3	7.6	ENE
DR29	Taylors Island Emergency Siren #38	12.5	7.8	E
DR31	Cambridge, U of MD Estuarine Center	32.0	19.9	NE
DR32	Twining Property, Taylors Island	12.3	7.6	NE
DR33	P.A. Ransome Property, Taylors Island	14.8	9.2	ESE
DR34	Shoreline at Barge Road	0.2	0.1	NE
OSGDR1	North of Old Steam Generator Storage Facility	0.3	0.2	SW
OSGDR2	West of Old Steam Generator Storage Facility	0.3	0.2	SW
PIC1	Taylors Island, Anderson's Property	12.6	7.8	ENE
PIC2	On Site before Entrance to Camp Conoy	0.7	0.4	S
PIC3	Meteorological Station	0.8	0.5	WSW
PIC4	NNW of ISFSI	0.6	0.4	SW
PIC5	SSE of ISFSI	0.6	0.4	SSW
PIC8	CCNPP Visitor's Center	0.3	0.2	NW
RPDR5	Resin Storage Area – North Fence Lower	0.7	0.4	SW
RPDR6	Resin Storage Area – North Fence Upper	0.7	0.4	SW
RPDR7	Resin Storage Area – West Fence Right	0.7	0.4	SW
RPDR8	Resin Storage Area – West Fence Left	0.7	0.4	SW
RPDR9	Resin Storage Area – South Fence Upper	0.7	0.4	SW
RPDR10	Resin Storage Area – South Fence Lower	0.7	0.4	SW
RPDR11	Resin Storage Area – East Fence Left	0.7	0.4	SW
RPDR12	Resin Storage Area – East Fence Right	0.7	0.4	SW
WBS2	Discharge Area	0.3	0.2	N
WBS4	Camp Conoy/Rocky Point	3.0	1.9	SE
WW1	Taylors Island, Anderson's Property	12.6	7.8	ENE

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

Table E-2

Synopsis of 2014 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	7	364	I-131	W	364
Air Particulates[3]	W	3	156	Gross Beta	W	156
				Gamma	MC	36
Direct Radiation						
Ambient Radiation	Q	20	480	TLD	Q	480
Terrestrial Environment						
Ground water	M	1	12	Gamma	M	12
				H-3	M	12

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

Table E-3

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

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Aquatic Environment						
Bottom Sediment (pCi/kg)	Gamma (4) Cs-137	17	131 (2/2) (128-133)	Discharge Area WBS2 0.3 km N	131 (2/2) (128-133)	121 (2/2) (117-126)
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (156)	0.5	2.0 (104/104) (1.1-3.8)	TAYLOR'S ISLAND TI 12.6 km ENE	2.6 (52/52) (1.2-8.5)	2.6 (52/52) (1.2-8.5)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (480)	--	20.67 (480/480) (7.87-73.04)	East Fence Left RPDR11 0.7 km SW	55.67 (24/24) (39.76-73.04)	-- --

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

Table E-4

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

Sample Code	Sample Date	Cs-137	Gamma Emitters
WBS2			
Discharge Area	6/17/2014	128 +/- 40	*
	10/8/2014	133 +/- 69	*
WBS4[1]			
Camp Conoy/ Rocky Point	6/17/2014	117 +/- 55	*
	10/8/2014	126 +/- 58	*

[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	CA Cambridge	LB LONG BEACH	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI	TI[1] TAYLOR'S ISLAND
12/30/2013	1/6/2014	*	*	*	*	*	*	*
1/6/2014	1/13/2014	*	*	*	*	*	*	*
1/13/2014	1/20/2014	*	*	*	*	*	*	*
1/20/2014	1/27/2014	*	*	*	*	*	*	*
1/27/2014	2/3/2014	*	*	*	*	*	*	*
2/3/2014	2/10/2014	*	*	*	*	*	*	*
2/10/2014	2/17/2014	*	*	*	*	*	*	*
2/17/2014	2/24/2014	*	*	*	*	*	*	*
2/24/2014	3/3/2014	*	*	*	*	*	*	*
3/3/2014	3/10/2014	*	*	*	*	*	*	*
3/10/2014	3/17/2014	*	*	*	*	*	*	*
3/17/2014	3/24/2014	*	*	*	*	*	*	*
3/24/2014	3/31/2014	*	*	*	*	*	*	*
3/31/2014	4/7/2014	*	*	*	*	*	*	*
4/7/2014	4/14/2014	*	*	*	*	*	*	*
4/14/2014	4/21/2014	*	*	*	*	*	*	*
4/21/2014	4/28/2014	*	*	*	*	*	*	*
4/28/2014	5/5/2014	*	*	*	*	*	*	*
5/5/2014	5/12/2014	*	*	*	*	*	*	*
5/12/2014	5/19/2014	*	*	*	*	*	*	*
5/19/2014	5/26/2014	*	*	*	*	*	*	*
5/26/2014	6/2/2014	*	*	*	*	*	*	*
6/2/2014	6/9/2014	*	*	*	*	*	*	*
6/9/2014	6/16/2014	*	*	*	*	*	*	*
6/16/2014	6/23/2014	*	*	*	*	*	*	*
6/23/2014	6/30/2014	*	*	*	*	*	*	*

[1] Control Location
* <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	CA Cambridge	LB LONG BEACH	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI	TI[1] TAYLOR'S ISLAND
6/30/2014	7/7/2014	*	*	*	*	*	*	*
7/7/2014	7/14/2014	*	*	*	*	*	*	*
7/14/2014	7/21/2014	*	*	*	*	*	*	*
7/21/2014	7/28/2014	*	*	*	*	*	*	*
7/28/2014	8/4/2014	*	*	*	*	*	*	*
8/4/2014	8/11/2014	*	*	*	*	*	*	*
8/11/2014	8/18/2014	*	*	*	*	*	*	*
8/18/2014	8/25/2014	*	*	*	*	*	*	*
8/25/2014	9/1/2014	*	*	*	*	*	*	*
9/1/2014	9/8/2014	*	*	*	*	*	*	*
9/8/2014	9/15/2014	*	*	*	*	*	*	*
9/15/2014	9/22/2014	*	*	*	*	*	*	*
9/22/2014	9/29/2014	*	*	*	*	*	*	*
9/29/2014	10/6/2014	*	*	*	*	*	*	*
10/6/2014	10/13/2014	*	*	*	*	*	*	*
10/13/2014	10/20/2014	*	*	*	*	*	*	*
10/20/2014	10/27/2014	*	*	*	*	*	*	*
10/27/2014	11/3/2014	*	*	*	*	*	*	*
11/3/2014	11/10/2014	*	*	*	*	*	*	*
11/10/2014	11/17/2014	*	*	*	*	*	*	*
11/17/2014	11/24/2014	*	*	*	*	*	*	*
11/24/2014	12/1/2014	*	*	*	*	*	*	*
12/1/2014	12/8/2014	*	*	*	*	*	*	*
12/8/2014	12/15/2014	*	*	*	*	*	*	*
12/15/2014	12/22/2014	*	*	*	*	*	*	*
12/22/2014	12/29/2014	*	*	*	*	*	*	*

[1] Control Location
* <MDA

Table E-6

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

Start Date	Stop Date	CA Cambridge	LB LONG BEACH	TI[1] TAYLOR'S ISLAND
12/30/2013	1/6/2014	1.8 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1
1/6/2014	1/13/2014	2.7 +/- 0.1	2.8 +/- 0.2	2.5 +/- 0.1
1/13/2014	1/20/2014	2.5 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1
1/20/2014	1/27/2014	2.4 +/- 0.2	2.3 +/- 0.2	2.7 +/- 0.2
1/27/2014	2/3/2014	2.6 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
2/3/2014	2/10/2014	3.6 +/- 0.2	3.8 +/- 0.2	3.6 +/- 0.2
2/10/2014	2/17/2014	2.8 +/- 0.1	2.5 +/- 0.1	2.8 +/- 0.1
2/17/2014	2/24/2014	1.7 +/- 0.1	1.6 +/- 0.1	1.7 +/- 0.1
2/24/2014	3/3/2014	3.3 +/- 0.1	3.2 +/- 0.1	3.3 +/- 0.1
3/3/2014	3/10/2014	2.3 +/- 0.2	2.3 +/- 0.2	2.4 +/- 0.2
3/10/2014	3/17/2014	2.1 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1
3/17/2014	3/24/2014	2.0 +/- 0.2	2.0 +/- 0.2	2.1 +/- 0.2
3/24/2014	3/31/2014	1.8 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1
3/31/2014	4/7/2014	1.6 +/- 0.2	1.8 +/- 0.2	2.0 +/- 0.2
4/7/2014	4/14/2014	2.1 +/- 0.1	2.1 +/- 0.1	3.6 +/- 0.2
4/14/2014	4/21/2014	1.6 +/- 0.1	1.8 +/- 0.1	2.2 +/- 0.2
4/21/2014	4/28/2014	2.0 +/- 0.1	1.9 +/- 0.1	2.3 +/- 0.2
4/28/2014	5/5/2014	1.1 +/- 0.3	1.5 +/- 0.1	1.8 +/- 0.2
5/5/2014	5/12/2014	1.7 +/- 0.1	2.0 +/- 0.1	2.8 +/- 0.2
5/12/2014	5/19/2014	2.1 +/- 0.2	1.8 +/- 0.1	4.0 +/- 0.3
5/19/2014	5/26/2014	2.2 +/- 0.1	2.1 +/- 0.1	3.7 +/- 0.2
5/26/2014	6/2/2014	1.3 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1
6/2/2014	6/9/2014	1.4 +/- 0.1	1.4 +/- 0.2	1.8 +/- 0.2
6/9/2014	6/16/2014	1.1 +/- 0.1	1.3 +/- 0.1	2.0 +/- 0.2
6/16/2014	6/23/2014	2.2 +/- 0.1	2.5 +/- 0.1	8.5 +/- 0.5
6/23/2014	6/30/2014	1.4 +/- 0.1	1.4 +/- 0.1	2.7 +/- 0.2
6/30/2014	7/7/2014	2.4 +/- 0.3	1.9 +/- 0.1	2.8 +/- 0.2
7/7/2014	7/14/2014	2.0 +/- 0.2	2.2 +/- 0.1	7.0 +/- 0.5
7/14/2014	7/21/2014	1.5 +/- 0.1	1.4 +/- 0.1	3.6 +/- 0.3
7/21/2014	7/28/2014	1.8 +/- 0.1	1.8 +/- 0.1	3.1 +/- 0.2
7/28/2014	8/4/2014	1.6 +/- 0.1	1.3 +/- 0.1	1.7 +/- 0.2
8/4/2014	8/11/2014	2.4 +/- 0.1	2.4 +/- 0.1	3.2 +/- 0.2
8/11/2014	8/18/2014	2.1 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1
8/18/2014	8/25/2014	1.4 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1
8/25/2014	9/1/2014	2.0 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1

[1] Control Location

Table E-6

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

Start Date	Stop Date	CA Cambridge	LB LONG BEACH	TI[1] TAYLOR'S ISLAND
9/1/2014	9/8/2014	1.9 +/- 0.1	1.7 +/- 0.1	2.0 +/- 0.1
9/8/2014	9/15/2014	1.3 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1
9/15/2014	9/22/2014	1.5 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.2
9/22/2014	9/29/2014	1.8 +/- 0.1	1.6 +/- 0.1	2.2 +/- 0.1
9/29/2014	10/6/2014	1.9 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.2
10/6/2014	10/13/2014	2.3 +/- 0.1	2.5 +/- 0.1	2.6 +/- 0.2
10/13/2014	10/20/2014	1.7 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1
10/20/2014	10/27/2014	1.8 +/- 0.1	1.7 +/- 0.1	2.8 +/- 0.2
10/27/2014	11/3/2014	2.2 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1
11/3/2014	11/10/2014	2.3 +/- 0.1	2.7 +/- 0.1	2.5 +/- 0.1
11/10/2014	11/17/2014	1.7 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1
11/17/2014	11/24/2014	2.4 +/- 0.1	2.6 +/- 0.1	2.4 +/- 0.1
11/24/2014	12/1/2014	2.1 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.1
12/1/2014	12/8/2014	2.2 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1
12/8/2014	12/15/2014	2.2 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
12/15/2014	12/22/2014	2.1 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1
12/22/2014	12/29/2014	2.0 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1

[1] Control Location

Table E-7

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

Sample Date	CA Cambridge	LB LONG BEACH	TI[1] TAYLOR'S ISLAND
2/3/2014	*	*	*
3/3/2014	*	*	*
3/31/2014	*	*	*
4/28/2014	*	*	*
6/2/2014	*	*	*
6/30/2014	*	*	*
8/4/2014	*	*	*
9/1/2014	*	*	*
9/29/2014	*	*	*
11/3/2014	*	*	*
12/1/2014	*	*	*
12/29/2014	*	*	*

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

Table E-8

Concentration of Tritium and Gamma Emitters in Taylors Island Well Water (Results in units of pCi/L +/- 2σ)

Sample Date	Gamma Emitters	H-3
1/23/2014	*	<303
2/19/2014	*	<303
3/19/2014	*	<301
4/21/2014	*	<304
5/28/2014	*	<304
6/16/2014	*	<306
7/21/2014	*	<150
8/18/2014	*	<152
9/15/2014	*	<150
10/20/2014	*	<155
11/10/2014	*	<154
12/15/2014	*	<145

* Non-Natural Gamma Emitters <MDA

Table E-9

Direct Radiation
(Results in units of mR/90 days +/- 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR24	Rt. 4 and Parran Rd.	11.74 +/- 0.48	11.90 +/- 1.48	11.65 +/- 2.93	12.86 +/- 1.38
DR25	Camp Conoy Guard House	13.22 +/- 1.35	12.79 +/- 0.28	9.93 +/- 1.73	13.71 +/- 1.30
DR26	Rt. 235 and Clark's Landing Road	10.99 +/- 0.83	10.86 +/- 0.31	9.81 +/- 1.20	11.64 +/- 1.17
DR27	Rt. 231 and Rt. 4	12.42 +/- 1.58	11.44 +/- 0.83	10.58 +/- 1.80	11.88 +/- 0.73
DR28	Taylors Is. Siren #35	13.71 +/- 0.92	13.31 +/- 0.81	13.39 +/- 2.11	15.34 +/- 1.03
DR29	Taylors Is. Siren #38	15.09 +/- 1.27	14.18 +/- 1.16	14.26 +/- 0.94	15.01 +/- 0.98
DR31	Cambridge	14.55 +/- 1.23	14.33 +/- 0.68	13.73 +/- 0.87	15.69 +/- 0.46
DR32	Twining Property, Taylors Island	14.26 +/- 1.28	14.29 +/- 1.07	14.81 +/- 2.51	15.57 +/- 1.34
DR33	P. A. Ransome Property	15.20 +/- 0.96	14.91 +/- 1.10	14.88 +/- 1.95	16.05 +/- 1.35
DR34	Shoreline at Barge Rd.	10.27 +/- 1.13	9.44 +/- 0.52	7.87 +/- 1.80	10.10 +/- 1.08
OSG1	North of Old Steam Generator Storage Facility	19.43 +/- 1.96	17.64 +/- 0.79	16.80 +/- 2.54	18.45 +/- 0.53
OSG2	West of Old Steam Generator Storage Facility	15.43 +/- 2.73	15.78 +/- 1.50	16.97 +/- 2.70	15.98 +/- 2.47

Table E-10

Direct Radiation from Resin Storage Area
(Results in units of mR/90 days +/- 2σ)

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
RPDR05	North Fence Lower	41.41 +/- 2.77	32.49 +/- 2.74	34.03 +/- 11.05	30.01 +/- 0.73
RPDR06	North Fence Upper	23.33 +/- 2.81	16.30 +/- 1.31	17.22 +/- 3.53	16.29 +/- 0.68
RPDR07	West Fence Right	30.56 +/- 2.21	28.37 +/- 1.36	22.08 +/- 3.51	24.50 +/- 2.02
RPDR08	West Fence Left	25.14 +/- 1.75	20.51 +/- 2.10	17.81 +/- 1.90	19.75 +/- 1.84
RPDR09	South Fence Upper	35.11 +/- 1.91	28.27 +/- 3.35	23.04 +/- 1.55	27.11 +/- 3.26
RPDR10	South Fence Lower	51.86 +/- 3.49	38.63 +/- 4.52	27.97 +/- 2.94	42.47 +/- 2.31
RPDR11	East Fence Left	61.21 +/- 6.08	48.69 +/- 3.03	39.76 +/- 4.77	73.04 +/- 9.75
RPDR12	East Fence Right	30.63 +/- 2.98	26.13 +/- 2.19	23.76 +/- 2.30	22.14 +/- 1.05

Table E-11

Concentration of Tritium in Groundwater
(Results in units of pCi/L)

By Piezometer Tube Locations

Sample Date	11	12	13	15	18	19	20	21	22	23	24	25	26	27	28	29	30
3/02/2014	478	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
5/19/2014	#	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
6/24/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	#	#	#	#	#	#
7/18/2014	825	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
8/16/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	ND	#	#	ND	ND	ND
8/29/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	ND	ND	#	#	#
11/22/2014	1570	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
12/13/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	#	#	#	#	#	#

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

Table E-12

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

By Piezometer Tube Locations

Sample Date	11	12	13	15	18	19	20	21	22	23	24	25	26	27	28	29	30
3/02/2014	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5/19/2014	*	*	*	*	*	*	*	*	*	ND	ND	ND	ND	ND	ND	ND	ND
6/24/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	*	*	*	*	*	*
7/18/2014	*	*	*	*	*	*	*	*	*								
8/16/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	ND	*	*	ND	ND	ND
8/29/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	ND	ND	*	*	*
11/22/2014	*	*	*	*	*	*	*	*	*	ND	ND	ND	ND	ND	ND	ND	ND
12/13/2014	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	*	*	*	*	*	*

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

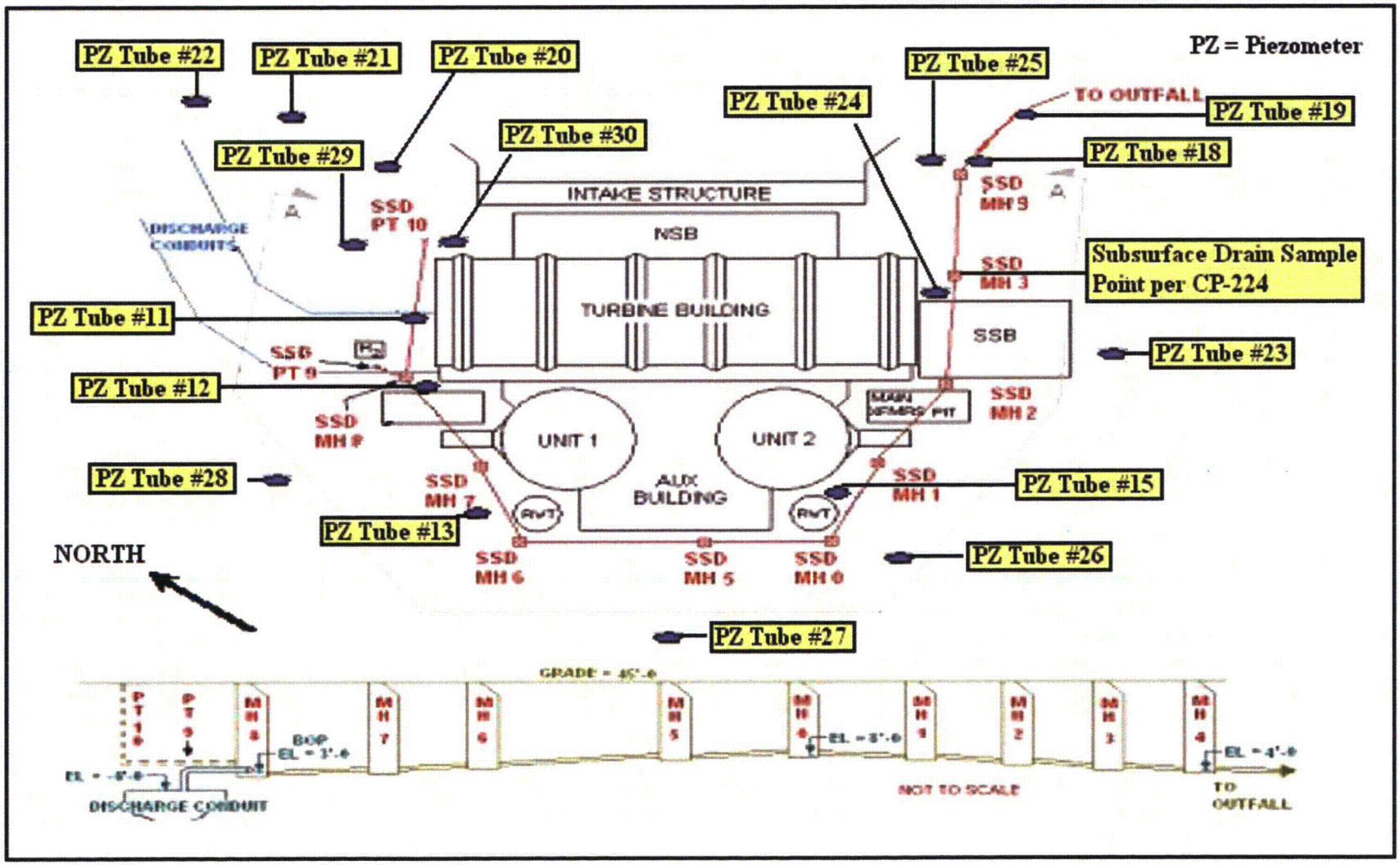



Figure E-1
Site Map Groundwater Monitoring Wells