Calvert Cliffs Nuclear Power Plant

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

CENG[SM]
a joint venture of
Constellation Energy · EDF

May 14, 2013

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant; Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Independent Spent Fuel Storage Installation; Docket No. 72-8
Annual Radiological Environmental Operating Report

REFERENCES: (a) Calvert Cliffs Nuclear Power Plant Technical Specification 5.6.2
(b) Calvert Cliffs Independent Spent Fuel Storage Installation Technical Specification 6.2

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

Should you have questions regarding this matter, please contact me at (410) 495-5219 or Mr. David Merryman at (410) 495-4913.

Very truly yours,

Douglas E. Lauver
Director-Licensing

DEL/PSF/bjd

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

cc: N. S. Morgan, NRC
W. M. Dean, NRC
Resident Inspector, NRC
S. Gray, DNR
R. Manley, MDE

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NRR
NMSS

ATTACHMENT (1)

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT

UNITS 1 AND 2

AND THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

Calvert Cliffs Nuclear Power Plant, LLC
May 14, 2013

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, 2012

A. M. Barnett
J. S. D'Souza
C. D. Merryman

CONSTELLATION ENERGY NUCLEAR GROUP, LLC

MAY 2013

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I. SUMMARY

During this operating period for Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 3375 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 652 radiochemical analyses were performed on 584 environmental samples and 534 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, 353 radiochemical analyses were performed on 293 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, 650 analyses were performed on 530 additional environmental samples, and 468 additional TLDs were analyzed for ambient radiation exposure rates.

And lastly, 200 radiochemical analyses were performed on 200 quality assurance samples and 126 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 3375 radiological analyses performed. Low levels of man-made fission products were also observed in 15 of these analyses. All of 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 3.10×10^{-2} mrem via liquid and gaseous pathways, which is about 0.041% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 "Environmental Radiation Protection Standards for Nuclear Power Operations" and 10CFR72.104, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste";

b. a maximum whole body dose of 9.17×10^{-4} mrem via liquid and gaseous pathways, which is about 0.004% of the acceptable limit of 25 mrem/yr as specified in both 40CFR190 and 10CFR72.104; and

c. a maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 9.51×10^{-4} mrem to the skin. This dose is about 0.004% of the allowable limit of 25 mrem/yr as specified in both 40CFR190 and 10CFR72.104.

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

II. CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

II.A. INTRODUCTION

Constellation Energy Nuclear Generation (CENG), previously known as Baltimore Gas and Electric Company (BGE), 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 NRC as required.

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

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

II.B. PROGRAM

II.B.1 Objectives

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

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

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

c. To monitor and evaluate ambient radiation levels, and

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

II.B.2 Sample Collection

The locations of the individual sampling stations are listed in Table A-1 and shown in Figures A-2 and A-3. All samples were collected by contractors to, or personnel of Constellation Energy according to CCNPP 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

The semiannual sample of shoreline sediment (sample code WB1) was not taken during the second half of 2012 as required by the ODCM (Ref. 6). No substitute sample was collected in lieu of the sample not taken from this location. This program exception has been entered into the site's Corrective Action Program to ensure it does not recur.

Three direct radiation dosimeters, one in the 3rd quarter and two in the 4th quarter, were found missing from ODCM (Ref. 6) sampling locations during this operating period. A direct radiation dosimeter was not taken from the Cove Point and Little Cove Point Roads sampling location (sample code DR17) in the 3rd quarter of this operating period, and direct radiation dosimeters were not taken in the 4th quarter of this operating period at Dirt Road off Mackall Road and Parran Road (sample code DR11) and Solomons Island (sample code DR22). 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.

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year were analyzed using Constellation Energy 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-110 observed in oysters from Camp Conoy (IA3) with annual effluent releases of Ag-110 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. Low level Cs-137 was observed in the oyster sample from Kenwood Beach (sample code IA6) during the third quarter. The Cs-137 observation was attributed to fallout from past atmospheric weapons testing. 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 first semiannual shoreline sediment sample obtained from this location was analyzed for gamma emitters. For more information regarding the second semiannual shoreline sediment sample, refer to II.B.4 Program Exception.

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

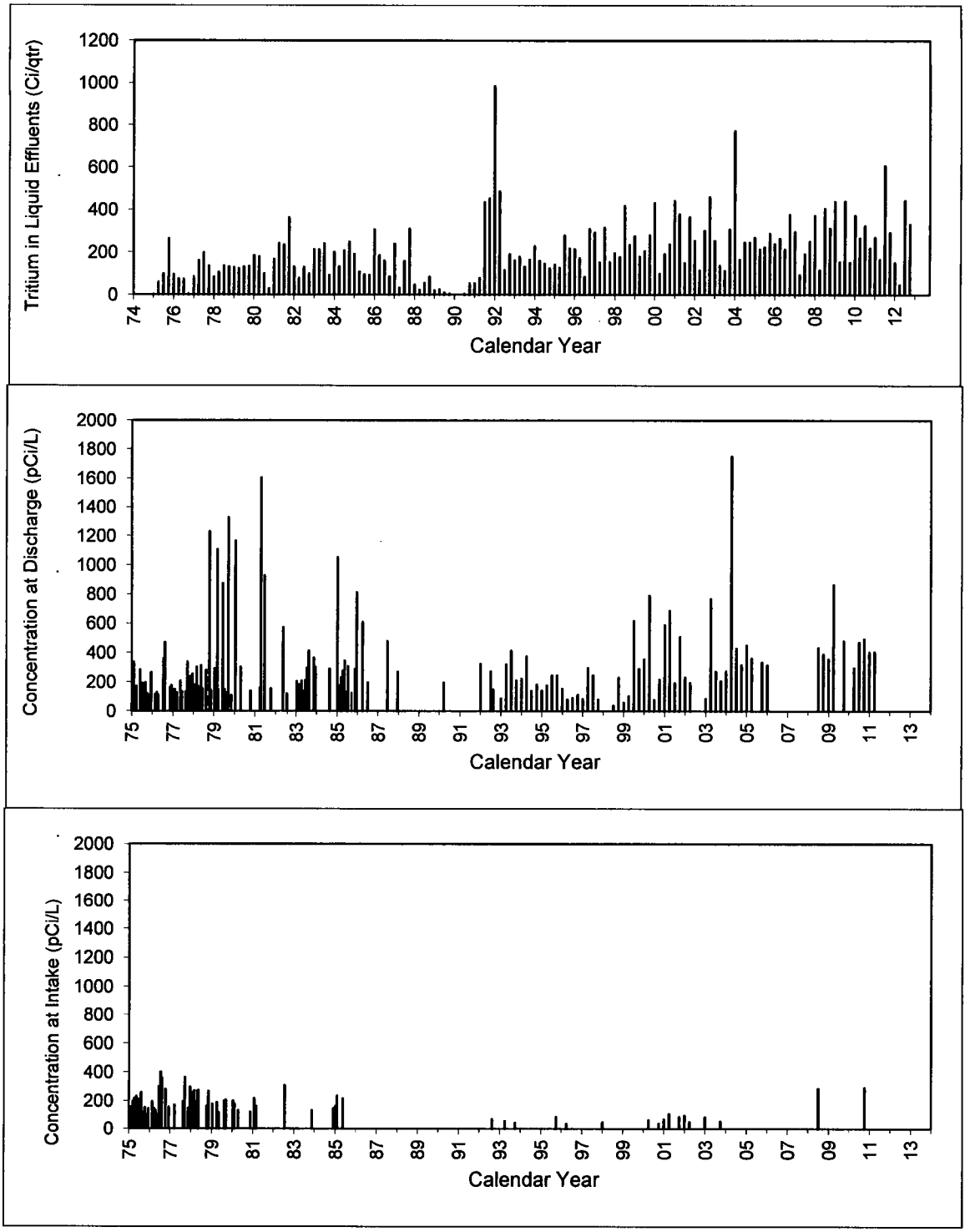
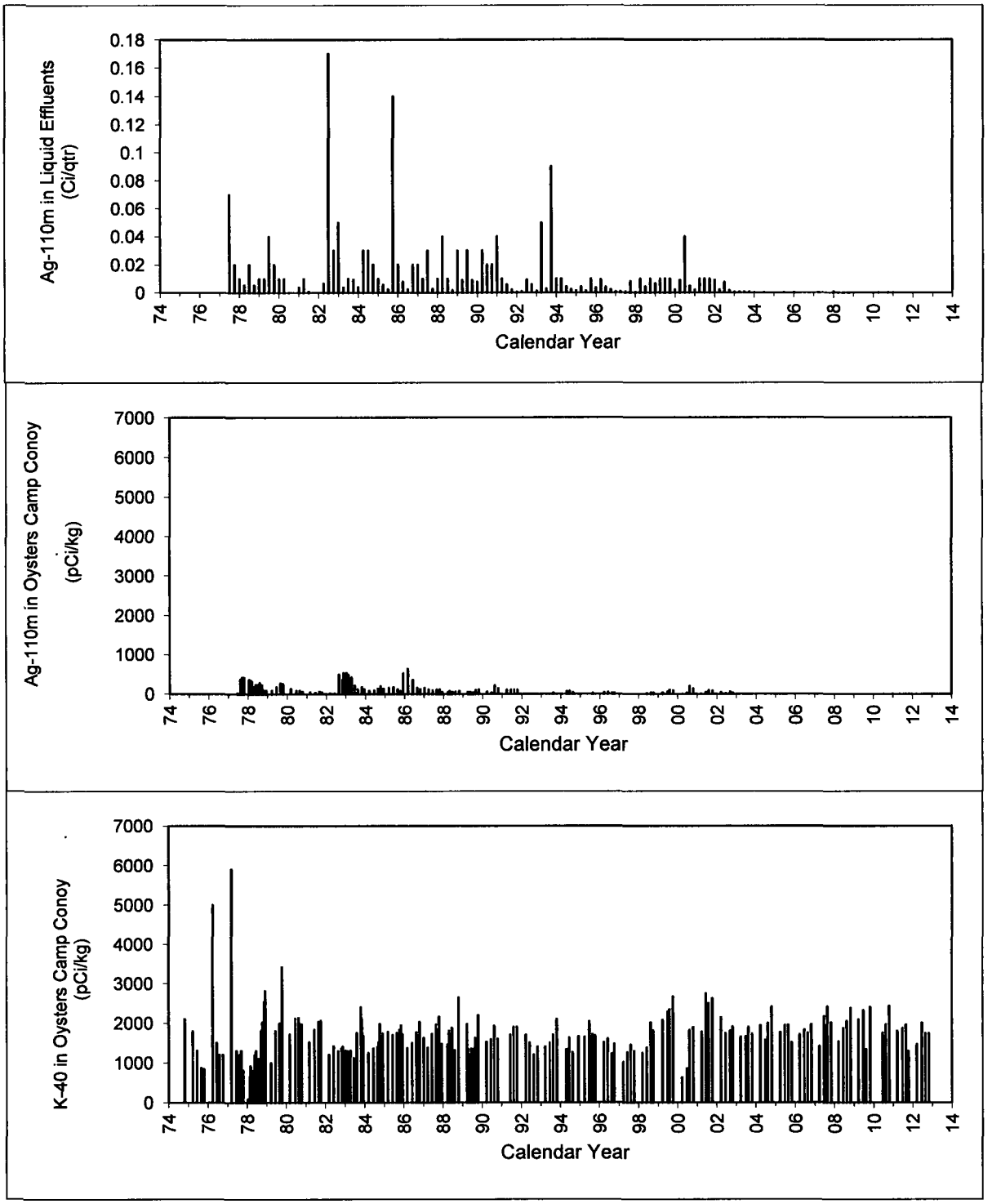


FIGURE 2
Silver-110m and Potassium-40 in Chesapeake Bay Oysters



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 at the 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 0.6×10^{-2} to 4.6×10^{-2} pCi/m^3 for the indicator locations and 0.7×10^{-2} to 5.1×10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 2.4×10^{-2} pCi/m^3 was A4, Route 765 at Lusby.

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

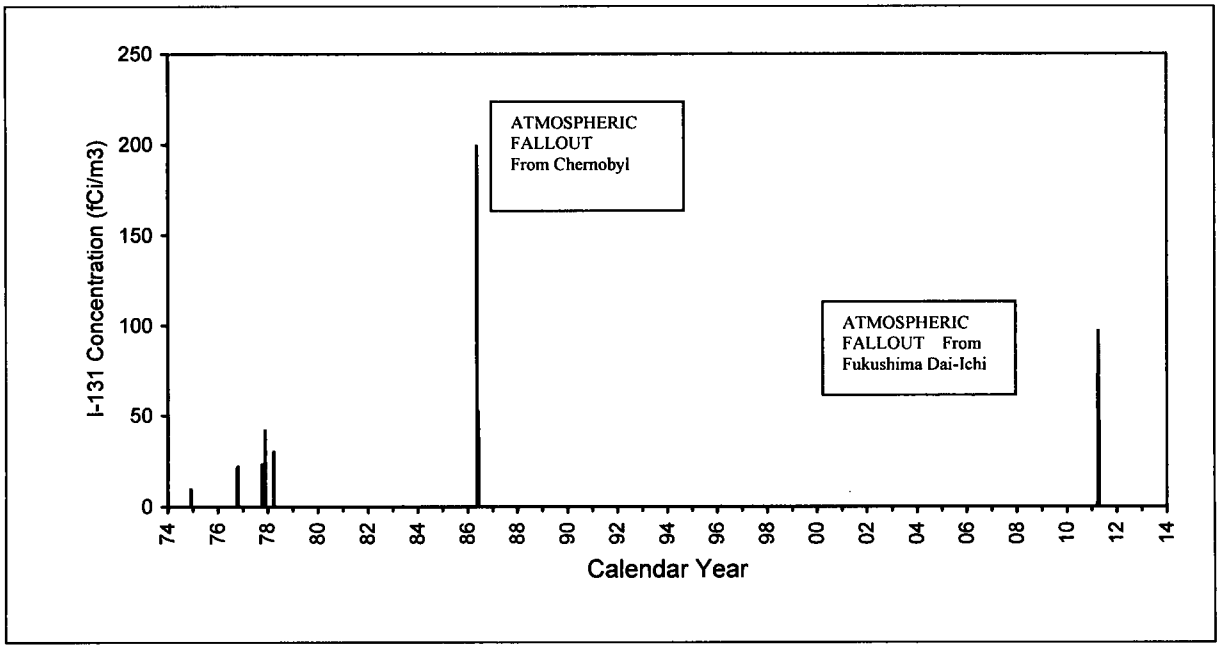
Weekly composited charcoal cartridges (for trapping radioiodine species) were collected from the five locations during the year. These samples were analyzed for radioiodine species.

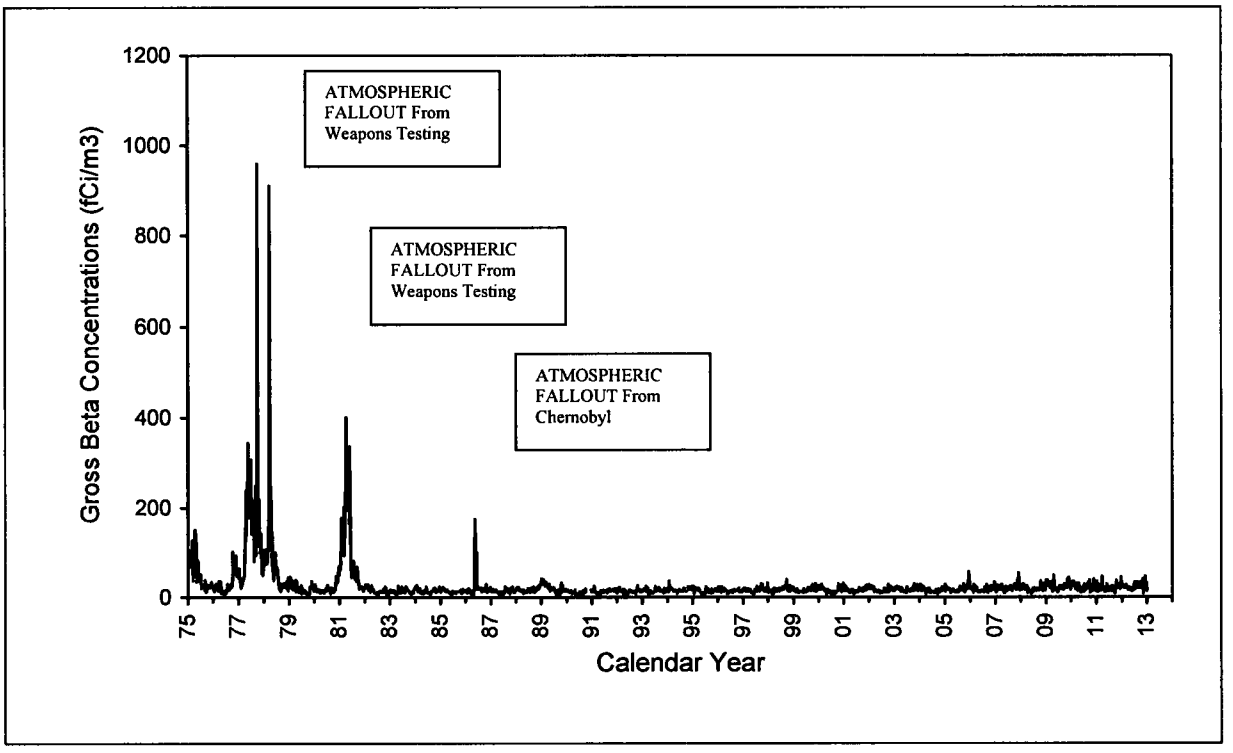
Weekly radioiodine analyses of charcoal cartridges collected from all five locations exhibited no detectable concentrations of I-131.

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.

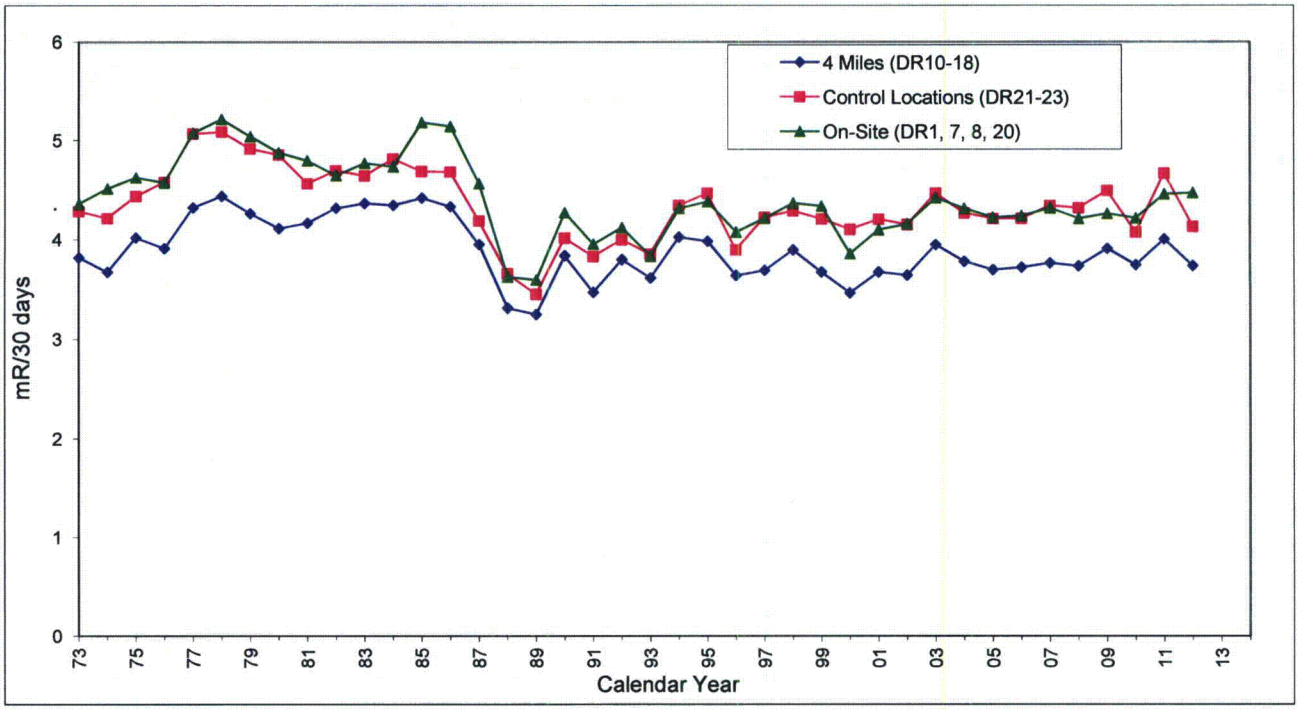
II.C.4 Direct Radiation

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 12.06 mR and ranged from 9.16 to 16.70 mR as reported in Table 2. The control locations showed a 90 day mean of 13.49 mR with ranges from 11.18 to 17.83 mR. The location with the highest overall mean of 16.13 was DR23, Taylors Island, which ranged from 14.08 to 17.83 mR. 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 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.

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 3.04×10^{-2} mrem to a child via the plume, ground, vegetable, and inhalation pathways at 1.8 km SW of the containments at Calvert Cliffs. This is about 0.04% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole body gamma dose of 2.96×10^{-4} mrem to a child at 1.8 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 40CFR190 and 10CFR72.104.

A maximum dose to any other organ, in this case the skin, of 9.32×10^{-4} mrem to a child at 1.8 km SW of the containments at Calvert Cliffs. This is about 0.004% of the acceptable dose limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

Liquid Pathways

A maximum thyroid dose of 5.95×10^{-4} mrem to an adult for all liquid pathways, which is about 0.0008 % of the acceptable dose limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole body dose of 6.21×10^{-4} mrem to an adult via all liquid pathways, which is about 0.002 % of the acceptable dose limit of 25 mrem/yr as stated in 40CFR190 and 10CFR72.104.

A maximum dose to any other organ, in this case GI Tract, of 6.81×10^{-4} mrem to an adult for all pathways, which is 0.003% of the acceptable dose limit of 25 mrem/yr specified in 40CFR190 and 10CFR72.104.

Gaseous and Liquid Pathways Combined

A maximum thyroid dose of 3.10×10^{-2} mrem via liquid and gaseous pathways, which is about 0.041% of the acceptable limit of 75 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum whole body dose of 9.17×10^{-4} mrem via liquid and gaseous pathways, which is about 0.004% of the acceptable limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

A maximum calculated dose to all other organs via liquid and gaseous pathways is equal to 9.51×10^{-4} mrem to the skin. This dose was about 0.004% of the allowable limit of 25 mrem/yr as specified in 40CFR190 and 10CFR72.104.

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

Therefore, it is concluded that the operation of Calvert Cliffs Units 1 and 2 produced radioactivity and ambient radiation levels significantly below the limits of the ODCM, 40CFR190, and 10CFR72.104. There was no significant buildup of plant-related radionuclides in the environment due to the operation of the CCNPP in 2012.

FIGURE 5

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

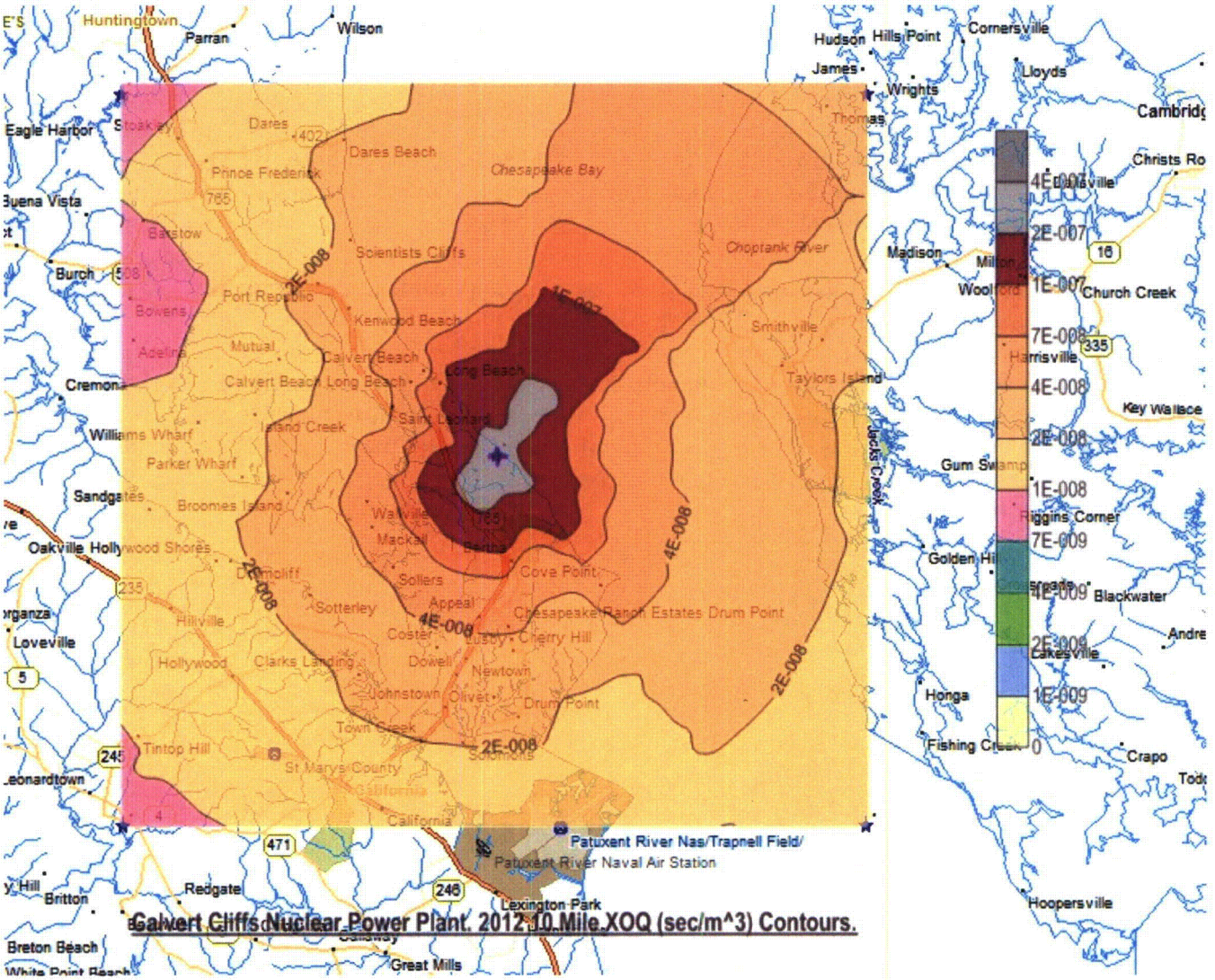


FIGURE 6

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

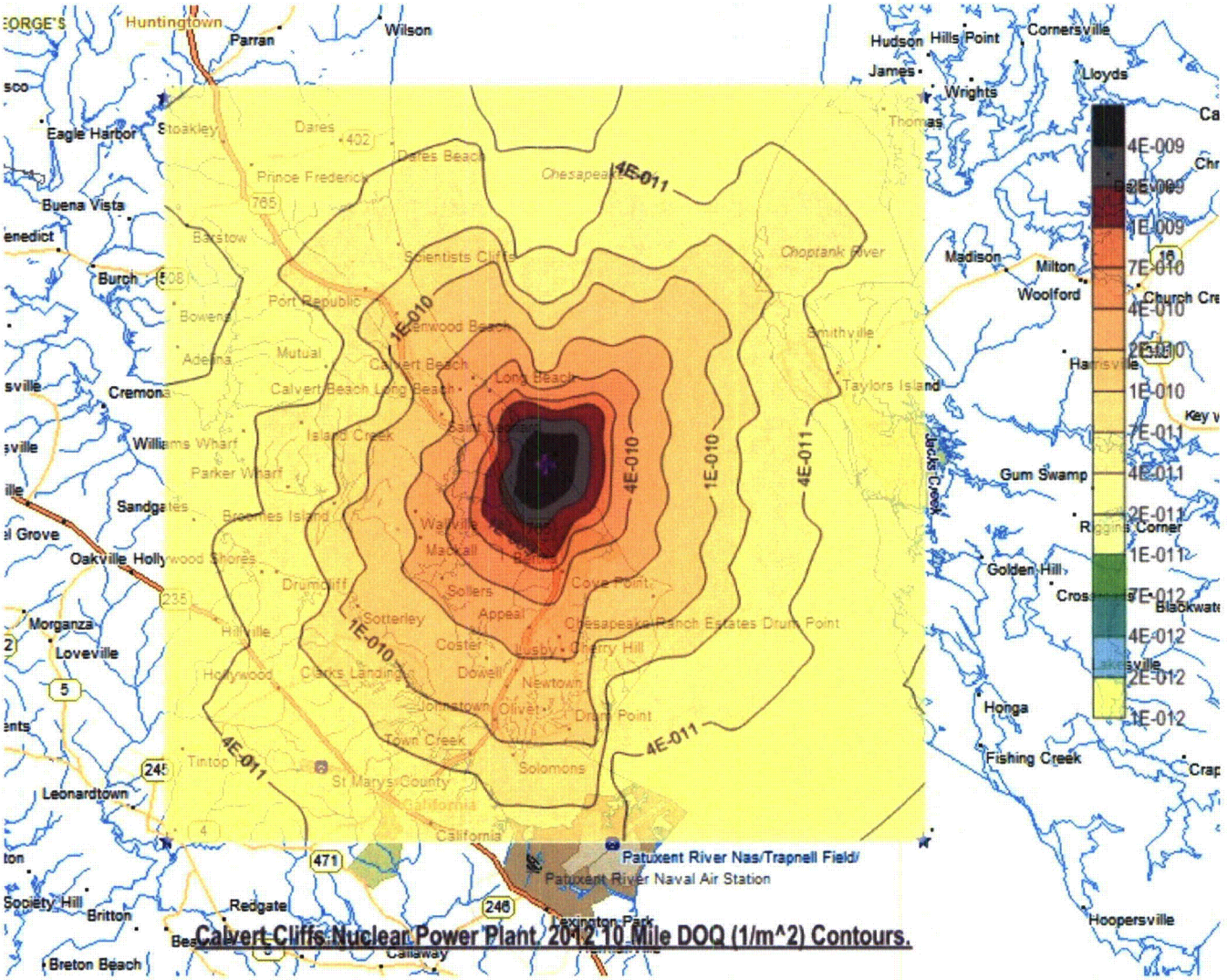


Table 1

Synopsis of 2012 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
				Tritium	Q	8
Fish[2]	A	4	4	Gamma	A	4
Oysters	Q	2	8	Gamma	Q	8
Shoreline Sediment	SA	1	1	Gamma	SA	1
Atmospheric Environment						
Air Iodine[3]	W	5	260	I-131	W	260
Air Particulates[4]	W	5	260	Gross Beta	W	260
				Gamma	MC	60
Direct Radiation						
Ambient Radiation	Q	23	534	TLD	Q	534
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 charcoal.
[4] Beta counting is performed after >72 hour decay. Gamma spectroscopy performed on monthly composites of weekly samples.
[5] Monthly during growing season when available

Table 2

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

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (260)	0.5	2.2 (208/208) (0.6-4.6)	Route 765 at Lusby A4 2.9 km SSW	2.4 (52/52) (0.7-4.6)	2.3 (52/52) (0.7-5.1)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (534)	--	12.06 (468/468) (9.16-16.70)	Taylors Island DR23 12.6 km ENE	16.13 (24/24) (14.08-17.83)	13.49 (66/66) (11.18-17.83)

[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, three 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 40CFRPart190 and 10CFR72.104,

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

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

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

III.B.2 Sample Collection

The locations of the individual sampling sites are listed in Table A-2 and shown in Figures A-4 and A-5. All samples were collected by contractors to, or personnel of, Constellation Energy personnel according to Constellation Energy Laboratory Procedures (Ref. 7, 8, 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 program exceptions during this operating period concerning the availability of air samples for concentrations of beta emitters in air particulates and concentrations of gamma emitters in air particulates analyses per the ODCM (Ref. 6). The concentrations of beta emitters in air particulates was not available from Meteorological Station (sample code SFA1) during the week beginning April 16 because of improper filter placement in capsule. This weekly sample from Meteorological Station (sample code SFA1) also was not available for the April composite sample for concentrations of gamma emitters in air particulates analysis. These program exceptions has been entered into the site's Corrective Action Program to ensure they do not recur.

Air sampler power outages at CCNPP Visitor's Center (sample code SFA2) during the weeks beginning July 16, September 10 and September 17 resulted in the loss of air samples available for concentrations of beta emitters in air particulates analyses. An air sample from the week beginning July 16 was included in the July composite sample for concentrations of gamma emitters in air particulates analysis per the ODCM (Ref. 6), but the weeks beginning September 10 and September 17 were not included in the September composite sample for concentrations of gamma emitters in air particulates analysis. A sampler malfunction during the week beginning August 6 at CCNPP Visitor's Center (sample code SFA2) resulted in rejected data for concentrations of beta emitters in air particulates analysis, but this did not preclude the sample from inclusion in the August composite sample for concentrations of gamma emitters in air particulates analysis. These program exceptions have been entered into the site's Corrective Action Program to ensure they do not recur.

Air sampler power outages at SSE of ISFSI (sample code SFA4) during the weeks beginning July 23 and August 6 resulted in the loss of air samples available for weekly concentrations of beta emitters in air particulates analyses. The air sample from the week beginning August 6 at SSE of ISFSI (sample code SFA4) was available for the August composite sample for concentrations of gamma emitters in air particulates analysis, but the week beginning July 23 was not available for the July composite sample for concentrations of gamma emitters in air particulates analysis at the same location. These program exceptions have been entered into the site's Corrective Action Program to ensure they do not recur.

III.C. RESULTS AND DISCUSSIONS

All the environmental samples collected were analyzed using Constellation Energy 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 0.6×10^{-2} to 4.5×10^{-2} pCi/m^3 for the indicator locations and 0.6×10^{-2} to 4.2×10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 2.3×10^{-2} pCi/m^3 was SFA4, SSE of ISFSI.

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 83 ± 28 pCi/kg. While the presence of Cs-137 in this sample may be plant-related, this range is consistent with that found to be due to the residual fallout from past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40CFR190 and 10CFR72.104. These are comparable to those observed in previous annual reporting periods for the CCNPP REMP and in the earlier pre-operational data for the ISFSI. No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were 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 nine quarterly samples from both indicator and control locations. The Cs-137 concentrations ranged from 35 ± 27 to 324 ± 34 pCi/kg. While the presence of Cs-137 in these samples may be plant-related, this range is consistent with that found to be due to the residual fallout from past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40CFR190 and 10CFR72.104. These are comparable to those observed in previous annual reporting periods for the CCNPP REMP and in the earlier pre-operational data for the ISFSI. No detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40 were also detected in all these samples.

III.C.3 Direct Radiation

Direct radiation is measured by a network of TLDs surrounding the ISFSI. These TLDs are collected quarterly from nineteen locations surrounding the ISFSI, plus one control TLD location at the Visitor's Center (sample code SFDR7). The locations include On Site before the Entrance to Camp Conoy (sample code DR7, common to both the CCNPP Program and the ISFSI Program) and the Meteorological Station (sample code DR30, previously a location maintained for historical continuity.) The other sampling locations are: SW of ISFSI, (sample code SFDR1); 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 28.81 mR and ranged from 10.29 to 54.34 mR as reported in Table 4. The control location showed a 90 day

mean of 12.76 mR and ranged from 12.03 to 14.35 mR. The location with the highest overall mean of 51.70 mR with a range of 47.23 to 54.34 mR was SFDR18, West 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

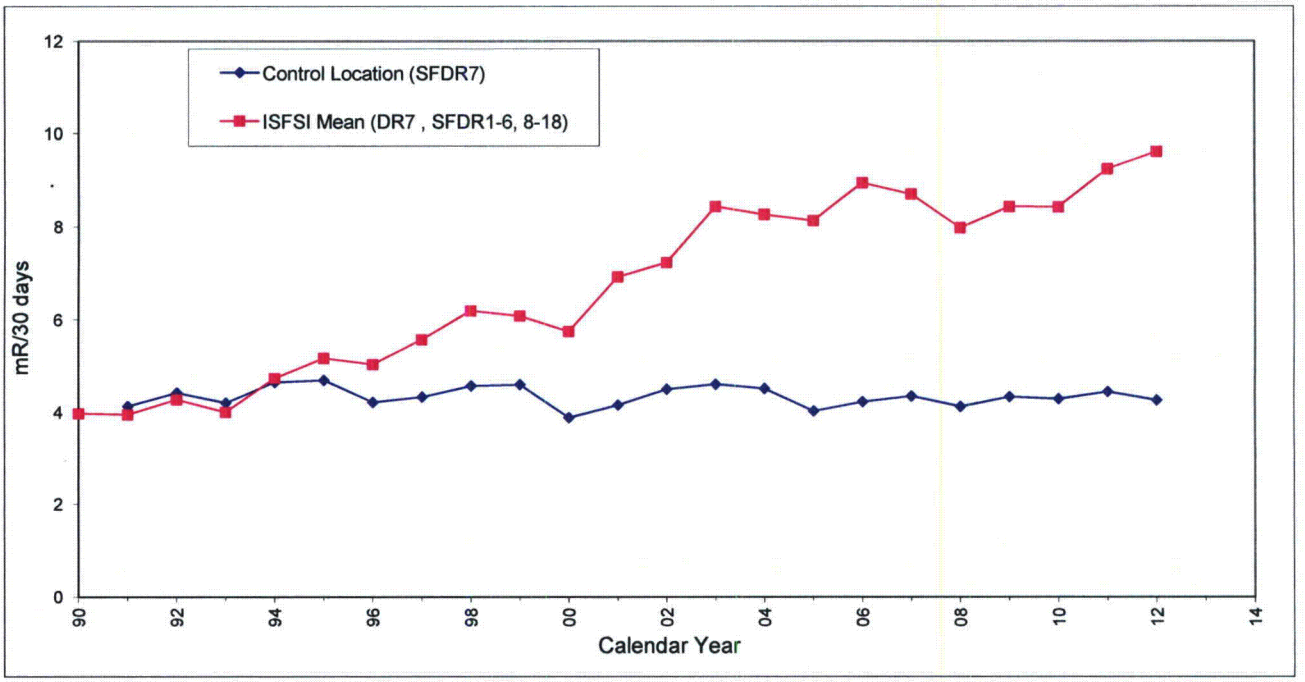


Table 3

**Synopsis of 2012 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	253	Gross Beta Gamma	W MC	253 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 (253)	0.5	2.3 (205/205) (0.6-4.5)	SSE of ISFSI SFA4 0.1 km SSE	2.3 (50/50) (0.7-4.5)	2.2 (48/48) (0.6-4.2)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (480)	--	28.81 (456/456) (10.29-54.34)	West of ISFSI SFDR18 0.1 km W	51.70 (24/24) (47.23-54.34)	12.76 (24/24) (12.03-14.35)
Terrestrial Environment						
Vegetation (pCi/kg)	Gamma (20) Cs-137	27	83 (1/16) --	On Site Before Entrance to Camp Conoy SFB5 0.7 km ESE	83 (1/4) --	-- --
Soil (pCi/kg)	Gamma (20) Cs-137	17	188 (6/16) (35-324)	Entrance to Camp Conoy SFS5 0.7 km ESE	255 (4/4) (203-324)	72 (3/4) (55-81)

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] From the central point of the ISFSI facility

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) Constellation Energy Laboratory Procedures Manual, General Services Department.

(9) Constellation Energy, "Land Use Survey Around Calvert Cliffs Nuclear Power Plant, August 2012."

(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 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

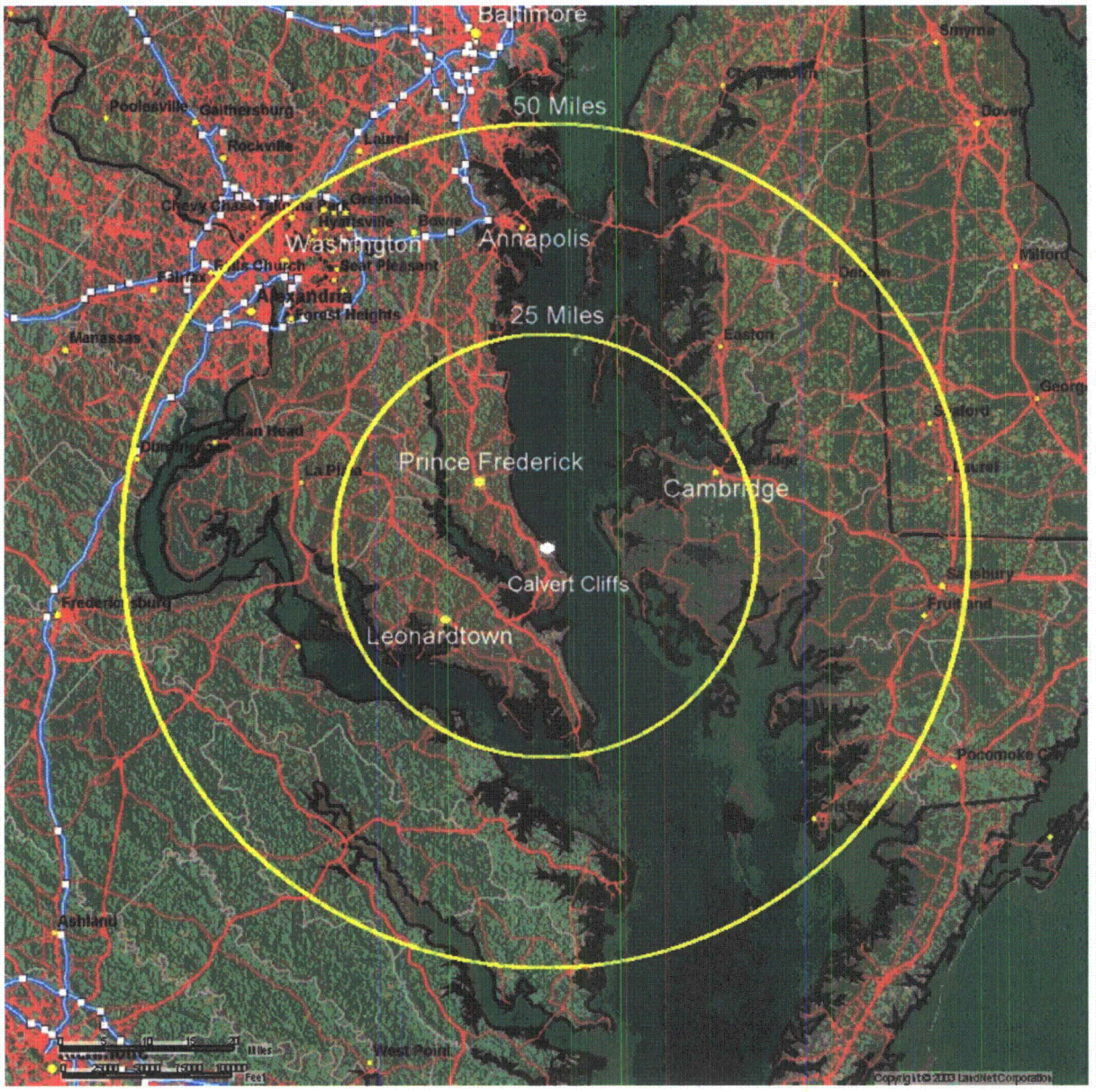


FIGURE A-2

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles

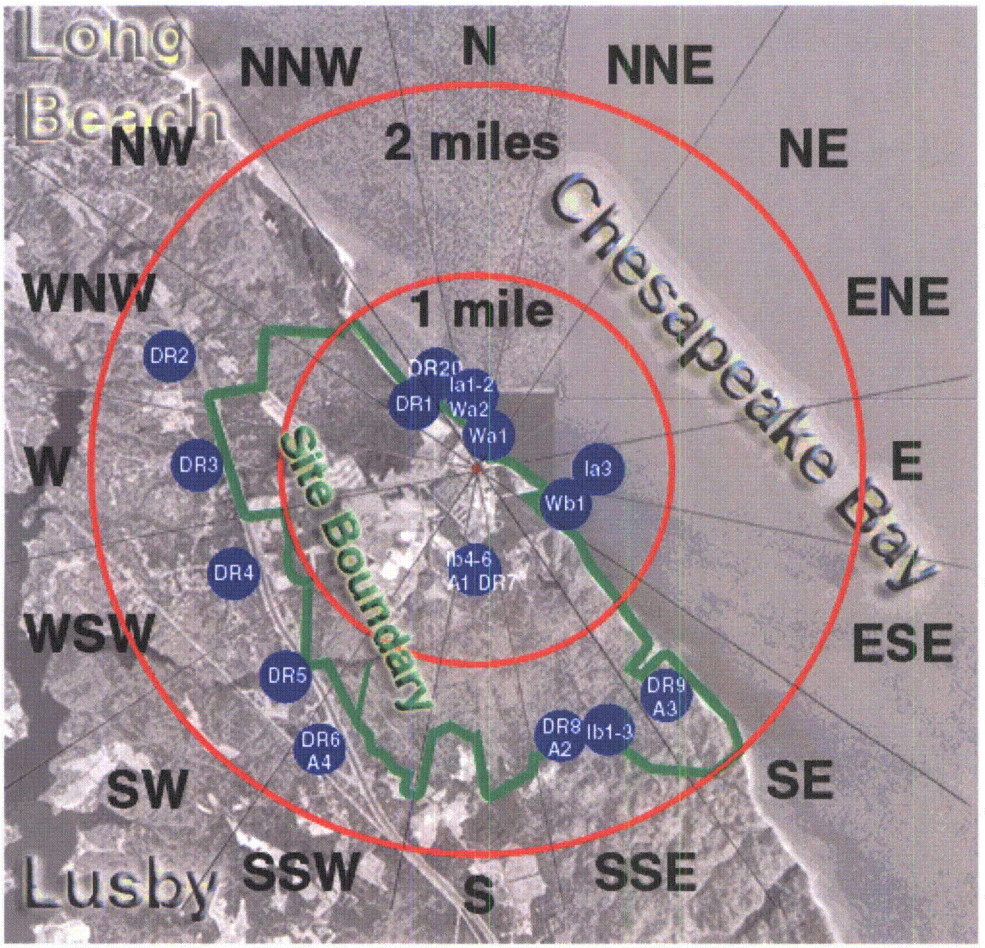


FIGURE A-3

Calvert Cliffs Nuclear Power Plant Sampling Locations
0-10 Miles

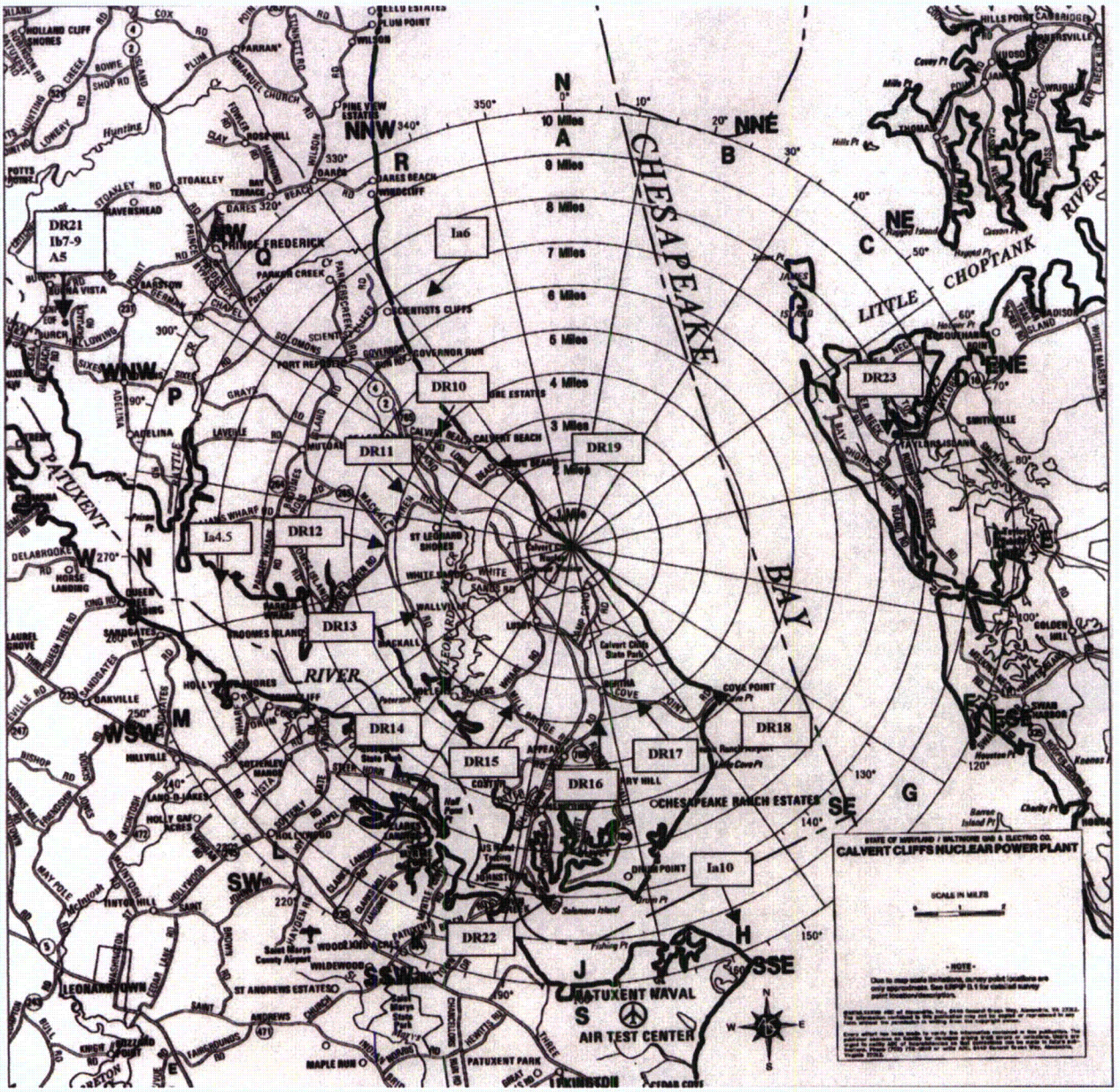


Table A-2

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 ISFSI	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 Visitor's 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 Visitor's 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

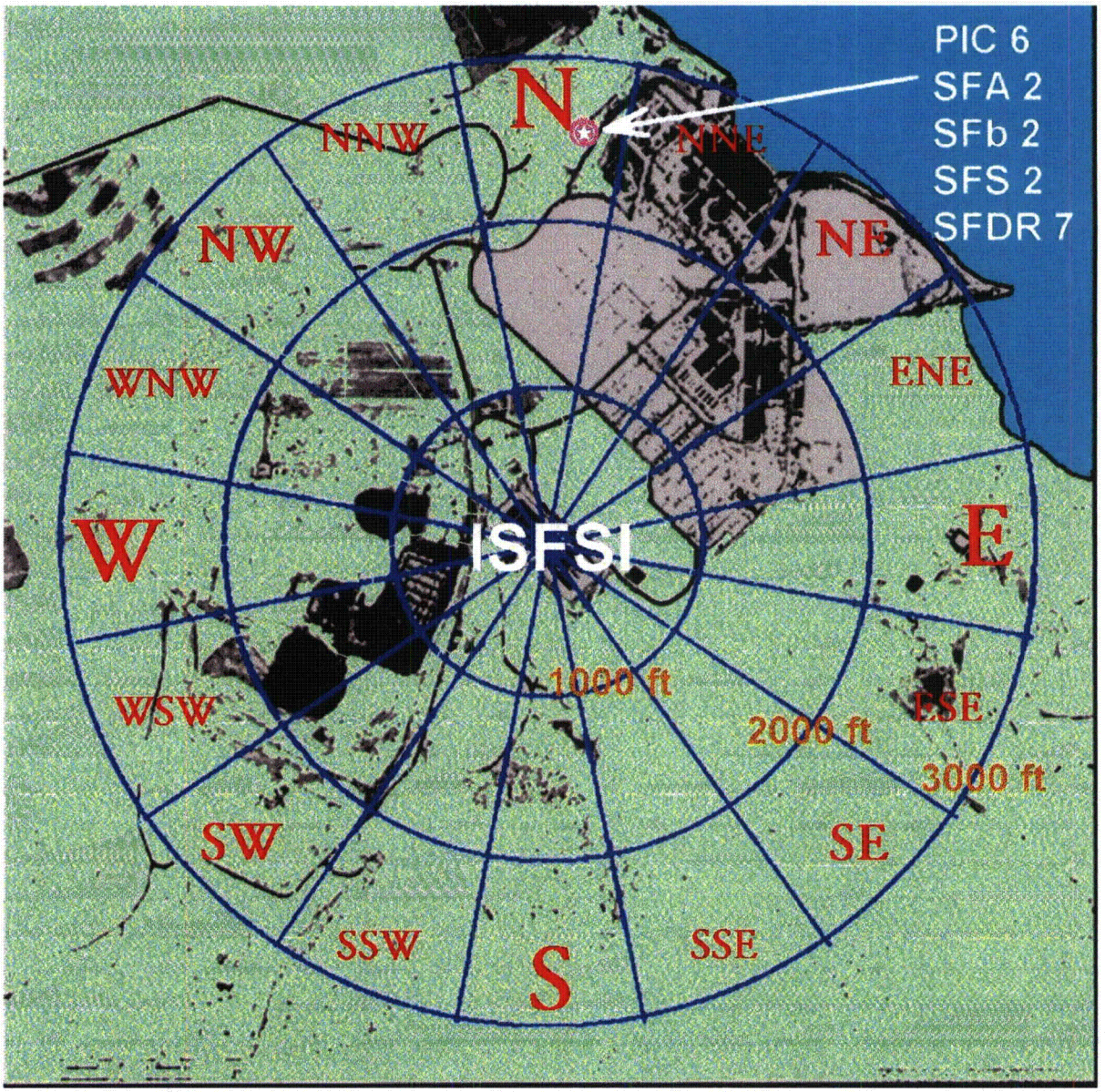
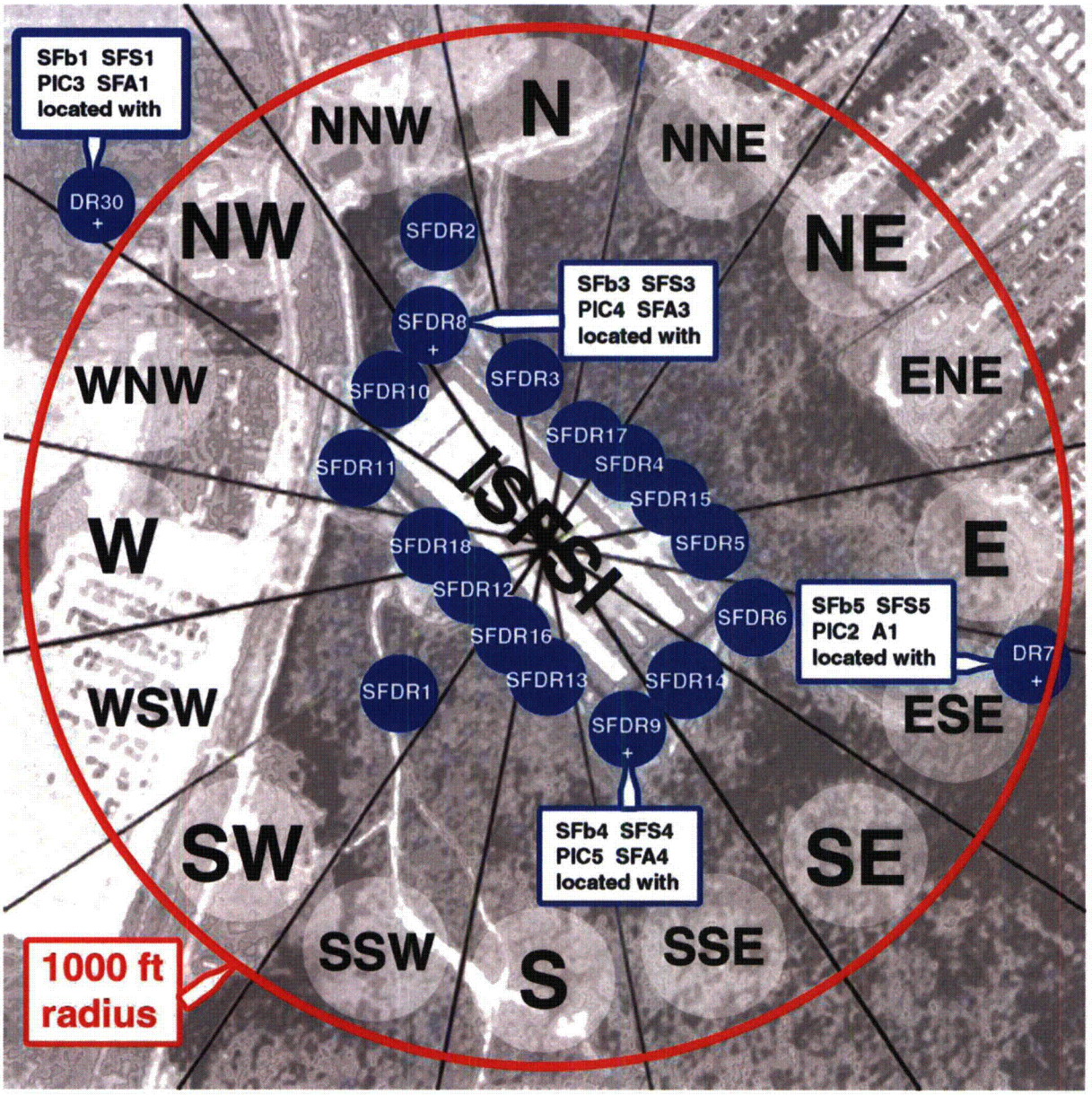


FIGURE A-5

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 B-1

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

Sample Code	Sample Date	Gamma Emitters	H-3[1]
WA1			
Intake Vicinity	1/31/2012	*	
	3/1/2012	*	
	4/2/2012	*	<276
	4/30/2012	*	
	5/31/2012	*	
	6/28/2012	*	<295
	8/2/2012	*	
	8/29/2012	*	
	9/29/2012	*	<325
	11/1/2012	*	
	11/30/2012	*	
	12/28/2012	*	<317
WA2			
Discharge Vicinity	1/31/2012	*	
	3/1/2012	*	
	4/2/2012	*	<285
	4/30/2012	*	
	5/31/2012	*	
	6/28/2012	*	<309
	8/2/2012	*	
	8/29/2012	*	
	9/29/2012	*	<325
	11/1/2012	*	
	11/30/2012	*	
	12/28/2012	*	<317

[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	8/23/2012	Spot	*
IA2 Discharge Area	8/23/2012	Striped bass	*
IA4[1] Patuxent River	8/23/2012	Spot	*
IA5[1] Patuxent River	8/23/2012	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	Cs-137	Gamma Emitters
IA3			
Camp Conoy	3/14/2012	#	*
	6/19/2012	#	*
	8/23/2012	#	*
	10/25/2012	#	*
IA6[1]			
Kenwood Beach	3/14/2012	#	*
	6/19/2012	#	*
	8/23/2012	15 +/- 6	*
	10/25/2012	#	*

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

Table B-4

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

Sample Code	Sample Date	Gamma Emitters
WB1 Shoreline at Barge Rd.	3/28/2012	*

* 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
1/2/2012	1/9/2012	*	*	*	*	*
1/9/2012	1/16/2012	*	*	*	*	*
1/16/2012	1/23/2012	*	*	*	*	*
1/23/2012	1/30/2012	*	*	*	*	*
1/30/2012	2/6/2012	*	*	*	*	*
2/6/2012	2/13/2012	*	*	*	*	*
2/13/2012	2/20/2012	*	*	*	*	*
2/20/2012	2/27/2012	*	*	*	*	*
2/27/2012	3/5/2012	*	*	*	*	*
3/5/2012	3/12/2012	*	*	*	*	*
3/12/2012	3/19/2012	*	*	*	*	*
3/19/2012	3/26/2012	*	*	*	*	*
3/26/2012	4/2/2012	*	*	*	*	*
4/2/2012	4/9/2012	*	*	*	*	*
4/9/2012	4/16/2012	*	*	*	*	*
4/16/2012	4/23/2012	*	*	*	*	*
4/23/2012	4/30/2012	*	*	*	*	*
4/30/2012	5/7/2012	*	*	*	*	*
5/7/2012	5/14/2012	*	*	*	*	*
5/14/2012	5/21/2012	*	*	*	*	*
5/21/2012	5/28/2012	*	*	*	*	*
5/28/2012	6/4/2012	*	*	*	*	*
6/4/2012	6/11/2012	*	*	*	*	*
6/11/2012	6/18/2012	*	*	*	*	*
6/18/2012	6/25/2012	*	*	*	*	*
6/25/2012	7/2/2012	*	*	*	*	*
7/2/2012	7/9/2012	*	*	*	*	*
7/9/2012	7/16/2012	*	*	*	*	*
7/16/2012	7/23/2012	*	*	*	*	*
7/23/2012	7/30/2012	*	*	*	*	*
7/30/2012	8/6/2012	*	*	*	*	*
8/6/2012	8/13/2012	*	*	*	*	*
8/13/2012	8/20/2012	*	*	*	*	*
8/20/2012	8/27/2012	*	*	*	*	*
8/27/2012	9/3/2012	*	*	*	*	*

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
9/3/2012	9/10/2012	*	*	*	*	*
9/10/2012	9/17/2012	*	*	*	*	*
9/17/2012	9/24/2012	*	*	*	*	*
9/24/2012	10/1/2012	*	*	*	*	*
10/1/2012	10/8/2012	*	*	*	*	*
10/8/2012	10/15/2012	*	*	*	*	*
10/15/2012	10/22/2012	*	*	*	*	*
10/22/2012	10/29/2012	*	*	*	*	*
10/29/2012	11/5/2012	*	*	*	*	*
11/5/2012	11/12/2012	*	*	*	*	*
11/12/2012	11/19/2012	*	*	*	*	*
11/19/2012	11/26/2012	*	*	*	*	*
11/26/2012	12/3/2012	*	*	*	*	*
12/3/2012	12/10/2012	*	*	*	*	*
12/10/2012	12/17/2012	*	*	*	*	*
12/17/2012	12/24/2012	*	*	*	*	*
12/24/2012	12/31/2012	*	*	*	*	*

[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
1/2/2012	1/9/2012	2.5 +/- 0.2	2.2 +/- 0.2	2.4 +/- 0.2	2.5 +/- 0.2	2.4 +/- 0.2
1/9/2012	1/16/2012	2.0 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.0 +/- 0.1
1/16/2012	1/23/2012	1.9 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	2.1 +/- 0.1	1.8 +/- 0.1
1/23/2012	1/30/2012	2.5 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.7 +/- 0.2	2.5 +/- 0.1
1/30/2012	2/6/2012	2.4 +/- 0.1	2.4 +/- 0.1	2.2 +/- 0.1	2.5 +/- 0.1	2.4 +/- 0.1
2/6/2012	2/13/2012	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.6 +/- 0.1
2/13/2012	2/20/2012	2.2 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
2/20/2012	2/27/2012	2.4 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1
2/27/2012	3/5/2012	2.3 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1	2.8 +/- 0.2	2.2 +/- 0.1
3/5/2012	3/12/2012	2.1 +/- 0.1	2.1 +/- 0.2	2.1 +/- 0.2	2.3 +/- 0.1	2.1 +/- 0.1
3/12/2012	3/19/2012	2.5 +/- 0.2	2.0 +/- 0.1	2.2 +/- 0.1	2.4 +/- 0.1	2.0 +/- 0.1
3/19/2012	3/26/2012	1.6 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1
3/26/2012	4/2/2012	1.1 +/- 0.1	1.2 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.2	1.3 +/- 0.1
4/2/2012	4/9/2012	2.0 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1	2.0 +/- 0.1	1.8 +/- 0.1
4/9/2012	4/16/2012	1.7 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1	2.0 +/- 0.1	1.8 +/- 0.1
4/16/2012	4/23/2012	1.5 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
4/23/2012	4/30/2012	2.2 +/- 0.2	2.0 +/- 0.1	2.0 +/- 0.1	2.2 +/- 0.2	2.2 +/- 0.2
4/30/2012	5/7/2012	1.5 +/- 0.1	1.3 +/- 0.1	1.4 +/- 0.1	1.6 +/- 0.1	1.4 +/- 0.1
5/7/2012	5/14/2012	1.9 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.1
5/14/2012	5/21/2012	1.4 +/- 0.1	1.4 +/- 0.1	1.2 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1
5/21/2012	5/28/2012	1.0 +/- 0.1	1.1 +/- 0.1	1.0 +/- 0.1	1.2 +/- 0.1	1.1 +/- 0.1
5/28/2012	6/4/2012	1.8 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
6/4/2012	6/11/2012	1.4 +/- 0.1	1.4 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.5 +/- 0.1
6/11/2012	6/18/2012	1.2 +/- 0.1	1.2 +/- 0.1	1.1 +/- 0.1	1.4 +/- 0.1	1.2 +/- 0.1
6/18/2012	6/25/2012	3.1 +/- 0.2	2.8 +/- 0.2	2.8 +/- 0.2	3.0 +/- 0.2	2.7 +/- 0.2
6/25/2012	7/2/2012	2.7 +/- 0.2	2.4 +/- 0.1	2.4 +/- 0.1	3.0 +/- 0.2	2.7 +/- 0.2

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
7/2/2012	7/9/2012	3.2 +/- 0.2	3.0 +/- 0.2	2.8 +/- 0.2	3.5 +/- 0.2	3.0 +/- 0.2
7/9/2012	7/16/2012	1.5 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1
7/16/2012	7/23/2012	2.3 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.1	2.3 +/- 0.1
7/23/2012	7/30/2012	2.3 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1	2.5 +/- 0.1	2.3 +/- 0.1
7/30/2012	8/6/2012	2.3 +/- 0.1	2.3 +/- 0.1	2.1 +/- 0.1	2.6 +/- 0.1	2.5 +/- 0.1
8/6/2012	8/13/2012	1.7 +/- 0.1	1.7 +/- 0.1	1.7 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1
8/13/2012	8/20/2012	3.2 +/- 0.2	3.0 +/- 0.2	3.0 +/- 0.2	3.5 +/- 0.2	3.0 +/- 0.2
8/20/2012	8/27/2012	2.4 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1	2.6 +/- 0.1	2.9 +/- 0.2
8/27/2012	9/3/2012	2.4 +/- 0.1	2.3 +/- 0.1	2.5 +/- 0.1	2.6 +/- 0.1	2.5 +/- 0.1
9/3/2012	9/10/2012	2.2 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1	2.3 +/- 0.1	2.1 +/- 0.1
9/10/2012	9/17/2012	1.9 +/- 0.1	1.8 +/- 0.1	1.7 +/- 0.1	2.0 +/- 0.2	1.9 +/- 0.1
9/17/2012	9/24/2012	2.0 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1
9/24/2012	10/1/2012	3.3 +/- 0.1	3.1 +/- 0.1	3.0 +/- 0.1	3.5 +/- 0.2	3.0 +/- 0.1
10/1/2012	10/8/2012	2.8 +/- 0.2	2.8 +/- 0.2	2.7 +/- 0.2	3.0 +/- 0.2	3.1 +/- 0.2
10/8/2012	10/15/2012	2.2 +/- 0.2	2.1 +/- 0.2	2.5 +/- 0.2	2.5 +/- 0.2	2.8 +/- 0.2
10/15/2012	10/22/2012	2.1 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1
10/22/2012	10/29/2012	3.6 +/- 0.2	3.6 +/- 0.2	3.8 +/- 0.2	4.1 +/- 0.2	4.4 +/- 0.2
10/29/2012	11/5/2012	0.6 +/- 0.1	0.6 +/- 0.1	0.7 +/- 0.1	0.7 +/- 0.1	0.7 +/- 0.1
11/5/2012	11/12/2012	2.6 +/- 0.1	2.6 +/- 0.1	2.8 +/- 0.2	3.0 +/- 0.2	3.2 +/- 0.2
11/12/2012	11/19/2012	2.9 +/- 0.2	2.9 +/- 0.2	3.0 +/- 0.2	3.3 +/- 0.2	3.7 +/- 0.2
11/19/2012	11/26/2012	3.2 +/- 0.2	3.1 +/- 0.2	3.1 +/- 0.2	3.4 +/- 0.2	3.4 +/- 0.2
11/26/2012	12/3/2012	4.1 +/- 0.2	3.8 +/- 0.2	4.1 +/- 0.2	4.6 +/- 0.2	5.1 +/- 0.2
12/3/2012	12/10/2012	2.2 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1
12/10/2012	12/17/2012	3.0 +/- 0.2	2.7 +/- 0.2	2.9 +/- 0.2	3.1 +/- 0.2	3.4 +/- 0.2
12/17/2012	12/24/2012	3.4 +/- 0.1	2.9 +/- 0.1	3.0 +/- 0.1	3.3 +/- 0.1	3.2 +/- 0.1
12/24/2012	12/31/2012	1.3 +/- 0.2	1.2 +/- 0.2	1.2 +/- 0.2	1.3 +/- 0.2	1.4 +/- 0.2

[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
1/2/2012	1/9/2012	2.7 +/- 0.2	2.7 +/- 0.2	2.8 +/- 0.2	2.6 +/- 0.2
1/9/2012	1/16/2012	2.1 +/- 0.1	2.1 +/- 0.1	2.2 +/- 0.1	2.0 +/- 0.1
1/16/2012	1/23/2012	1.9 +/- 0.1	1.8 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.1
1/23/2012	1/30/2012	2.5 +/- 0.1	2.4 +/- 0.1	2.5 +/- 0.1	2.4 +/- 0.1
1/30/2012	2/6/2012	2.3 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1
2/6/2012	2/13/2012	1.7 +/- 0.1	1.8 +/- 0.1	1.9 +/- 0.1	1.9 +/- 0.1
2/13/2012	2/20/2012	2.1 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.1	2.1 +/- 0.1
2/20/2012	2/27/2012	2.4 +/- 0.1	2.4 +/- 0.1	2.6 +/- 0.1	2.4 +/- 0.1
2/27/2012	3/5/2012	2.3 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1	2.3 +/- 0.1
3/5/2012	3/12/2012	2.0 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
3/12/2012	3/19/2012	2.2 +/- 0.1	2.1 +/- 0.1	2.3 +/- 0.1	2.2 +/- 0.1
3/19/2012	3/26/2012	1.5 +/- 0.1	1.5 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1
3/26/2012	4/2/2012	1.3 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1	1.1 +/- 0.1
4/2/2012	4/9/2012	2.0 +/- 0.1	1.9 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1
4/9/2012	4/16/2012	1.9 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
4/16/2012	4/23/2012	[2]	1.4 +/- 0.1	1.5 +/- 0.1	1.4 +/- 0.1
4/23/2012	4/30/2012	2.2 +/- 0.2	2.0 +/- 0.1	2.3 +/- 0.2	2.1 +/- 0.1
4/30/2012	5/7/2012	1.4 +/- 0.1	1.4 +/- 0.1	1.6 +/- 0.1	1.5 +/- 0.1
5/7/2012	5/14/2012	1.8 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1	2.1 +/- 0.1
5/14/2012	5/21/2012	1.3 +/- 0.1	1.4 +/- 0.1	1.5 +/- 0.1	1.3 +/- 0.1
5/21/2012	5/28/2012	1.1 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1	1.0 +/- 0.1
5/28/2012	6/4/2012	1.9 +/- 0.1	1.8 +/- 0.1	2.0 +/- 0.1	1.8 +/- 0.1
6/4/2012	6/11/2012	1.5 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1
6/11/2012	6/18/2012	1.1 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1	1.2 +/- 0.1
6/18/2012	6/25/2012	2.9 +/- 0.2	2.9 +/- 0.2	2.9 +/- 0.2	3.0 +/- 0.2
6/25/2012	7/2/2012	2.8 +/- 0.2	2.5 +/- 0.1	2.6 +/- 0.1	2.7 +/- 0.2
7/2/2012	7/9/2012	3.2 +/- 0.2	3.0 +/- 0.2	3.2 +/- 0.2	3.2 +/- 0.2
7/9/2012	7/16/2012	1.6 +/- 0.1	1.5 +/- 0.1	1.7 +/- 0.1	1.5 +/- 0.1
7/16/2012	7/23/2012	2.4 +/- 0.1	[3]	2.6 +/- 0.1	4.2 +/- 0.3
7/23/2012	7/30/2012	2.2 +/- 0.1	2.1 +/- 0.1	2.1 +/- 0.1	[3]
7/30/2012	8/6/2012	2.1 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.2	2.1 +/- 0.1
8/6/2012	8/13/2012	1.8 +/- 0.1	[4]	1.7 +/- 0.1	[3]
8/13/2012	8/20/2012	3.1 +/- 0.2	3.0 +/- 0.2	3.0 +/- 0.2	3.1 +/- 0.2
8/20/2012	8/27/2012	2.4 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1	2.4 +/- 0.1
8/27/2012	9/3/2012	2.6 +/- 0.1	2.3 +/- 0.1	2.4 +/- 0.1	2.3 +/- 0.1
9/3/2012	9/10/2012	2.0 +/- 0.1	2.1 +/- 0.2	2.0 +/- 0.1	2.0 +/- 0.1
9/10/2012	9/17/2012	2.0 +/- 0.2	[3]	1.8 +/- 0.1	1.8 +/- 0.1
9/17/2012	9/24/2012	1.7 +/- 0.1	[3]	2.0 +/- 0.1	2.0 +/- 0.1
9/24/2012	10/1/2012	3.1 +/- 0.1	3.0 +/- 0.2	3.1 +/- 0.1	3.0 +/- 0.1

Table B-6 - Continued

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

Start Date	Stop Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
10/1/2012	10/8/2012	2.8 +/- 0.2	2.7 +/- 0.2	2.8 +/- 0.2	2.7 +/- 0.2
10/8/2012	10/15/2012	2.3 +/- 0.2	2.2 +/- 0.2	2.1 +/- 0.2	2.6 +/- 0.2
10/15/2012	10/22/2012	2.4 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.1
10/22/2012	10/29/2012	4.4 +/- 0.2	3.6 +/- 0.2	3.8 +/- 0.2	3.8 +/- 0.2
10/29/2012	11/5/2012	0.7 +/- 0.1	0.6 +/- 0.1	0.7 +/- 0.1	0.7 +/- 0.1
11/5/2012	11/12/2012	3.0 +/- 0.2	2.7 +/- 0.2	2.7 +/- 0.2	2.9 +/- 0.2
11/12/2012	11/19/2012	3.2 +/- 0.2	2.9 +/- 0.2	2.7 +/- 0.2	3.2 +/- 0.2
11/19/2012	11/26/2012	3.6 +/- 0.2	3.4 +/- 0.2	3.4 +/- 0.2	3.6 +/- 0.2
11/26/2012	12/3/2012	4.4 +/- 0.2	4.2 +/- 0.2	4.1 +/- 0.2	4.5 +/- 0.2
12/3/2012	12/10/2012	2.1 +/- 0.1	2.2 +/- 0.1	2.1 +/- 0.1	2.4 +/- 0.1
12/10/2012	12/17/2012	3.1 +/- 0.2	2.0 +/- 0.3	3.1 +/- 0.2	3.3 +/- 0.2
12/17/2012	12/24/2012	3.0 +/- 0.1	2.8 +/- 0.1	2.9 +/- 0.1	2.8 +/- 0.1
12/24/2012	12/31/2012	1.3 +/- 0.2	1.4 +/- 0.2	1.2 +/- 0.2	1.3 +/- 0.2

[1] Control Location
[2] NCR, Lost Sample
[3] NCR, Power outage
[4] NCR, Reject data

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
1/30/2012	*	*	*	*	*
2/27/2012	*	*	*	*	*
4/2/2012	*	*	*	*	*
4/30/2012	*	*	*	*	*
5/28/2012	*	*	*	*	*
7/2/2012	*	*	*	*	*
7/30/2012	*	*	*	*	*
9/3/2012	*	*	*	*	*
10/1/2012	*	*	*	*	*
10/29/2012	*	*	*	*	*
12/3/2012	*	*	*	*	*
12/31/2012	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
1/30/2012	*	*	*	*
2/27/2012	*	*	*	*
4/2/2012	*	*	*	*
4/30/2012	*	*	*	*
5/28/2012	*	*	*	*
7/2/2012	*	*	*	*
7/30/2012	*	*	*	*
9/3/2012	*	*	*	*
10/1/2012	*	*	*	*
10/29/2012	*	*	*	*
12/3/2012	*	*	*	*
12/31/2012	*	*	*	*

[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	6/4/2012	Cabbage	*
	7/16/2012	Cabbage	*
	8/20/2012	Leafy portion of Green Peppers	*
IB2			
Bay Breeze Rd	6/4/2012	Collards	*
	7/16/2012	Collards	*
	8/20/2012	Tree Leaves	*
IB3			
Bay Breeze Rd	6/4/2012	Brussels sprouts	*
	7/16/2012	Brussels sprouts	*
	8/20/2012	Tree Leaves	*
IB4			
Camp Conoy Entrance	6/4/2012	Cabbage	*
	7/16/2012	Cabbage	*
	8/20/2012	Leafy portion of Green Peppers	*
IB5			
Camp Conoy Entrance	6/4/2012	Collards	*
	7/16/2012	Collards	*
	8/20/2012	Eggplant Leaves	*
IB6			
Camp Conoy Entrance	6/4/2012	Brussels sprouts	*
	7/16/2012	Brussels sprouts	*
	8/20/2012	Tree Leaves	*
IB7[1]			
EOF	6/4/2012	Cabbage	*
	7/16/2012	Cabbage	*
	8/20/2012	Leafy portion of Green Peppers	*
IB8[1]			
EOF	6/4/2012	Collards	*
	7/16/2012	Collards	*
	8/20/2012	Eggplant Leaves	*
IB9[1]			
EOF	6/4/2012	Brussels sprouts	*
	7/16/2012	Brussels sprouts	*
	8/20/2012	Collards	*

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

Table B-8b

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

Sample Code	Sample Date	Cs-137	Gamma Emitters
SFB1			
MET Station	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFB2[1]			
Visitor's Center	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFB3			
NNW of ISFSI	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFB4			
SSE of ISFSI	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFB5			
On Site Before Entrance to Camp			
Conoy	3/12/2012	83 +/- 28	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*

[1] Control Location
This isotope <MDA
* 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	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFS2[1]			
Visitors Center	3/12/2012	81 +/- 30	*
	6/11/2012	#	*
	9/24/2012	55 +/- 25	*
	11/26/2012	81 +/- 29	*
SFS3			
NNW of ISFSI	3/12/2012	73 +/- 24	*
	6/11/2012	35 +/- 27	*
	9/24/2012	#	*
	11/26/2012	#	*
SFS4			
SSE of ISFSI	3/12/2012	#	*
	6/11/2012	#	*
	9/24/2012	#	*
	11/26/2012	#	*
SFS5			
Entrance to Camp			
Conoy	3/12/2012	207 +/- 39	*
	6/11/2012	324 +/- 34	*
	9/24/2012	203 +/- 43	*
	11/26/2012	286 +/- 36	*

[1] Control Location
This isotope <MDA
* 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	Ground water (pCi/L)	Milk (pCi/L)	Oysters (pCi/kg)wet	Shoreline Sediment (pCi/kg)Dry	Soil (pCi/kg)Dry	Vegetation (pCi/kg)wet
Na-22	0 - 0	2.7 – 7.0	13.6 - 34.4	3.3 - 7.2	5.2 - 10.2	5.8 - 22.2	21.2 – 74.0	25.1 - 82.5	12.5 - 50.4
K-40	0 - 0	27 - 75.8	94.3 - 284	35.7 – 84.0	44.4 - 85.1	71.4 - 188	218 - 519	230 - 697	84.0 - 445
Cr-51	0 - 0.1	22.1 - 48.6	80.1 - 416	24.1 - 49.2	29.9 - 55.2	41.8 - 164	205 - 520	111 - 670	65.0 - 294
Mn-54	0 - 0	2.4 - 6.2	14.3 - 27.2	2.9 - 6.5	3.9 - 7.8	4.6 - 17.4	18.9 – 55.0	22.3 - 70.3	10.0 - 39.6
Co-58	0 - 0	2.5 - 6.2	13.3 - 31.9	3.1 - 6.5	3.9 - 7.8	5.0 - 18.4	22.1 - 59.3	20.7 - 70.9	9.8 - 40.6
Fe-59	0 - 0	5.5 - 12.9	39.1 - 118	5.9 - 12.5	9.2 - 18.3	13.3 - 48.5	53.1 - 144	45.1 - 172	23.6 - 93.1
Co-60	0 - 0	2.6 - 6.8	11.9 – 31.0	3.2 - 6.9	4.7 - 9.3	5.4 - 20.4	17.4 - 64.6	23.2 - 72.2	11.3 – 47.0
Zn-65	0 - 0	5.2 - 13.4	37.4 - 68.4	8.1 - 17.5	9.6 - 19.6	11.3 - 41.6	52.5 - 153	53.9 - 189	24.5 – 98.0
Nb-95	0 - 0	2.6 - 6.4	12 - 51.7	2.8 - 6.8	3.7 - 7.9	5.8 - 23	29.8 - 78.1	21.2 - 97.1	9.7 - 42.7
Zr-95	0 - 0	4.1 - 10.6	22.8 - 54.6	4.5 - 11.1	6.3 - 13.3	8.5 - 31.7	39.1 - 101	38.3 - 132	15.0 - 70.3
Ru-106	0 - 0	20.3 - 54.4	84.4 - 209	23.1 - 56.7	32.1 - 65.6	37.7 - 137	144 - 416	179.6 - 572	74.8 - 344
Ag-110m	0 - 0	2.2 - 5.8	9.8 - 25.3	2.5 - 5.9	3.5 - 7.1	4.2 - 15.3	15.9 - 49.9	23.4 - 70.3	8.3 - 37.5
I-131*	0 - 42.1	0 - 6.5	0 - 233	2.2 - 10.2	0.5 - 0.8	0 - 126	20.2 - 516	0 - 249	13.2 - 59.5
Cs-134	0.0 – 0.0	2.3 – 6.0	9.9 - 22.4	2.7 – 7.0	3.3 - 7.3	6.6 - 24.1	14.6 - 55.6	33.9 - 73.5	9.1 - 37.7
Cs-137	0.0 – 8.0	2.4 - 6.3	8.8 - 25.3	3.0 - 6.8	3.6 - 7.9	7.3 - 23.3	15.8 - 54.3	32.7 - 69.3	9.7 - 40.5
Ba-140	0.0 - 0.9	4.5 - 13.9	0 - 676	4.6 - 10.9	5.3 - 11.2	4.7 - 77.2	57.4 - 274	0 - 555	15.9 - 66.2
La-140	0.0 - 0.9	4.8 - 12.1	0 - 676	4.6 - 10.9	5.3 - 11.2	4.7 - 77.2	57.4 - 274	0 - 555	15.9 - 66.2
Ce-144	0 - 0	12.6 - 32.5	39.2 - 96.5	14.9 - 38.1	19.4 - 38.3	19.7 - 70.8	73.2 - 195.8	84.5 - 273	33.6 - 165

* This MDA range for I-131 on a charcoal cartridge is typically 4.16×10^{-3} to 3.40×10^{-2}.

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	12.63 +/- 0.50	13.53 +/- 1.85	12.77 +/- 1.25	16.65 +/- 2.62
DR02	Route 765, Auto Dump	10.95 +/- 1.42	10.65 +/- 1.20	10.79 +/- 1.07	12.62 +/- 1.18
DR03	Route 765, Giovanni's Tavern	10.77 +/- 1.07	10.79 +/- 0.83	9.95 +/- 0.80	12.16 +/- 0.49
DR04	Route 765, across from Vera's Beach Club	12.60 +/- 1.18	12.27 +/- 1.33	12.00 +/- 0.86	13.96 +/- 1.64
DR05	Route 765, John's Creek	12.44 +/- 1.21	12.57 +/- 0.87	12.08 +/- 0.59	13.57 +/- 0.79
DR06	Route 765 at Lusby	10.50 +/- 1.29	10.70 +/- 1.13	10.16 +/- 0.67	11.59 +/- 1.26
DR07	Entrance to Camp Conoy	10.53 +/- 0.81	10.50 +/- 0.94	10.29 +/- 1.36	11.56 +/- 0.65
DR08	Camp Conoy Rd at Emergency Siren	14.69 +/- 2.24	14.68 +/- 1.16	15.04 +/- 0.80	16.70 +/- 1.38
DR09	Bay Breeze Rd	10.74 +/- 0.83	11.13 +/- 1.42	10.72 +/- 0.98	12.58 +/- 1.03
DR10	Calvert Beach Rd and Decatur Street	10.98 +/- 0.74	10.63 +/- 0.93	10.90 +/- 1.03	12.08 +/- 0.96
DR11	Dirt road off Mackall & Parren Rd	10.98 +/- 1.17	11.20 +/- 1.27	10.83 +/- 0.73	[1]
DR12	Mackall & Bowen Rds	10.68 +/- 0.58	10.67 +/- 1.07	10.61 +/- 0.44	12.39 +/- 0.84
DR13	Mackall Rd, near Wallville	11.93 +/- 0.70	12.10 +/- 0.88	11.93 +/- 1.06	14.10 +/- 0.76

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	13.54 +/- 1.48	13.26 +/- 1.14	13.38 +/- 0.57	16.20 +/- 0.98
DR15	Mill Bridge & Turner Rds	12.19 +/- 1.37	11.85 +/- 1.39	11.75 +/- 2.09	13.63 +/- 0.97
DR16	Across from Appeal School	10.31 +/- 1.40	11.21 +/- 0.92	10.80 +/- 0.80	12.53 +/- 2.24
DR17	Cove Point & Little Cove Point Rds	12.46 +/- 0.89	12.92 +/- 1.06	[1]	14.37 +/- 0.64
DR18	Cove Point	9.88 +/- 0.57	9.98 +/- 0.64	9.16 +/- 0.36	11.47 +/- 1.06
DR19	Long Beach	10.67 +/- 1.29	10.68 +/- 1.11	10.45 +/- 1.28	12.87 +/- 1.13
DR20	On site, near shore	12.95 +/- 0.61	13.65 +/- 1.52	12.87 +/- 1.37	15.45 +/- 1.00
DR21[2]	EOF	11.89 +/- 1.60	12.58 +/- 0.67	11.78 +/- 0.82	13.66 +/- 0.75
DR22[2]	Solomons Island	11.18 +/- 1.35	11.57 +/- 1.42	11.23 +/- 0.56	[1]
DR23[2]	Taylors Island	14.08 +/- 0.80	15.77 +/- 1.01	16.85 +/- 1.01	17.83 +/- 1.31
DR30	MET Station	15.44 +/- 1.22	18.91 +/- 1.79	15.88 +/- 1.93	14.88 +/- 1.06
SFDR01	SW of ISFSI	20.22 +/- 2.37	21.92 +/- 4.64	18.63 +/- 0.47	20.67 +/- 1.98
SFDR02	NNW of ISFSI	21.50 +/- 1.90	20.45 +/- 3.49	19.39 +/- 2.00	21.53 +/- 2.38
SFDR03	North of ISFSI	39.36 +/- 4.35	39.95 +/- 6.99	31.97 +/- 4.31	46.59 +/- 8.49
SFDR04	NE of ISFSI	34.48 +/- 2.71	30.89 +/- 4.36	36.27 +/- 4.44	41.66 +/- 6.78

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	20.92 +/- 2.44	19.78 +/- 1.84	18.44 +/- 2.68	22.89 +/- 4.31
SFDR06	ESE of ISFSI	17.18 +/- 1.13	16.88 +/- 1.45	16.83 +/- 2.05	19.38 +/- 1.91
SFDR07[2]	Visitor's Center	12.03 +/- 0.33	12.04 +/- 0.73	12.61 +/- 1.03	14.35 +/- 1.09
SFDR08	NNW of ISFSI	33.67 +/- 4.87	35.35 +/- 3.69	29.22 +/- 4.43	31.34 +/- 4.93
SFDR09	SSE of ISFSI	17.28 +/- 1.15	14.12 +/- 1.47	14.10 +/- 1.13	16.43 +/- 1.33
SFDR10	NW of ISFSI	34.13 +/- 5.70	38.60 +/- 6.79	30.60 +/- 7.39	40.58 +/- 6.95
SFDR11	WNW ISFSI	36.24 +/- 2.87	38.51 +/- 6.24	33.93 +/- 6.30	35.22 +/- 5.04
SFDR12	WSW of ISFSI	48.82 +/- 15.74	49.32 +/- 12.26	49.10 +/- 10.84	50.05 +/- 9.37
SFDR13	South of ISFSI	23.16 +/- 6.14	23.16 +/- 6.01	20.40 +/- 4.15	27.97 +/- 1.74
SFDR14	SE of ISFSI	19.50 +/- 3.38	17.76 +/- 3.63	13.67 +/- 1.36	17.08 +/- 2.27
SFDR15	ENE of ISFSI	23.71 +/- 4.83	21.98 +/- 6.04	21.82 +/- 3.45	23.77 +/- 2.70
SFDR16	SSW of ISFSI	37.94 +/- 7.20	37.99 +/- 4.61	37.82 +/- 4.83	40.96 +/- 4.96
SFDR17	NNE of ISFSI	40.62 +/- 6.52	39.86 +/- 7.19	42.30 +/- 7.32	49.20 +/- 8.85
SFDR18	West of ISFSI	53.28 +/- 9.22	51.95 +/- 10.14	47.23 +/- 8.86	54.34 +/- 9.14

[1] TLD missing
[2] Control Location

APPENDIX C

Quality Assurance Program

Appendix C is a summary of Constellation Energy laboratory's quality assurance program. It consists of Table C-1 which is a compilation of the results of the Constellation Energy 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 Constellation Energy 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 Constellation Energy 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 Constellation Energy laboratory's results and Analytics' results are $\pm 2\sigma$ while the ERA laboratory's uncertainty is based on USEPA guidelines[2].

All the Constellation Energy laboratory's results contained in Table C-1 generally agree with the intercomparison results within the range of $\pm 2\sigma$ of each other with the exception of a beta result for the water sample type on 6/14/12 from Analytics. In 2011 the June water study had a similar performance issue and the initial investigation into the matter yielded no apparent cause for this discrepancy. A sample preparation error was thought to be the most probable explanation. Further investigation into the 2012 and 2011 samples revealed that they contained a similarly high level of Americium 241 as compared to Cesium 137. It was determined that the lab's result was high due to the interference of alpha from the Americium. The laboratory does not encounter alpha emitters in the Constellation Energy Nuclear Generation Fleet and so does not have an alpha correction in its Beta result calculations. All other intercomparisons for beta filters and water samples analyzed on the instrument, prior to and after this sample, were in full agreement.

With this one exception, all other sets of intercomparison results listed in the table are in full agreement when they were further evaluated using the NRC Resolution Test Criteria[1]. The uncertainties for the Constellation Energy 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 Constellation Energy laboratory original, replicate and/or Teledyne Brown Engineering's split laboratory samples, except for the comparisons of two soil samples and an oyster sample involving Cs-137 results. The original and replicate analysis of the soil sample from SFS3 collected on 6/11/2012 do agree within $\pm 2\sigma$ of each other and do not agree within $\pm 2\sigma$ of the split lab results. The original analysis of the soil sample from SFS5 collected on 6/11/2012, and the original analysis of the oyster sample collected on 8/23/2012 do not agree within the range of $\pm 2\sigma$ of their respective QC comparison samples analyzed. These minor

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

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.

TABLE OF CONTENTS – ANALYTICAL RESULTS

Table C-1

Results of Participation in Cross Check Programs

Sample Date	Sample Type and Units	Isotope Observed	Reported Laboratory's Results	Cross Check Lab Results
03/15/12	Air Iodine - pCi	I-131	84.0 +/- 5.0	93.2 +/- 1.6
03/15/12	Milk – pCi/L	Co-58	116 +/- 14	132 +/- 2.2
		Co-60	269 +/- 14	279 +/- 4.7
		Zn-65	302 +/- 31	333 +/- 5.6
		I-131	91 +/- 22	92.5 +/- 1.5
		Cs-134	118 +/- 9.0	149 +/- 2.5
		Cs-137	144 +/- 14	159 +/- 2.7
		Ce-141	238 +/- 17	260 +/- 4.3
		Cr-51	443 +/- 86	436 +/- 7.3
		Mn-54	188 +/- 16	195 +/- 3.3
		Fe-59	158 +/- 19	168 +/- 2.8
03/15/12	Water – pCi/L	Gross Beta	336 +/- 4.0	297 +/- 4.96
06/14/12	Air Filter - pCi	Ce-141	50.0 +/- 4.0	46.5 +/- 0.8
		Cs-137	127.0 +/- 8.0	120.0 +/- 2.0
		Mn-54	78.0 +/- 7.0	74.9 +/- 1.3
		Zn-65	128.0 +/- 16.0	113.0 +/- 1.9
		Co-60	207.0 +/- 9.0	201.0 +/- 3.4
		Co-58	51.0 +/- 7.0	52.3 +/- 0.9
		Fe-59	84.0 +/- 10.0	72.3 +/- 1.2
		Cr-51	244.0 +/- 4.0	22.7 +/- 3.8
		Cs-134	85.0 +/- 5.0	98.8 +/- 1.7
06/14/12	Water– pCi/L	H-3	26.3E+4	25.0E+4
06/14/12	Water – pCi/L	Cr-51	595.0 +/- 110.0	548.0 +/- 9.1
		Cs-137	285.0 +/- 18.0	289.0 +/- 4.8
		Cs-134	213.0 +/- 10.0	238.0 +/- 4.0
		I-131	106.0 +/- 22.0	99.4 +/- 1.7
		Ce-141	123.0 +/- 18.0	112.0 +/- 1.9
		Co-60	504.0 +/- 18.0	484.0 +/- 8.1
		Co-58	114.0 +/- 14.0	126.0 +/- 2.1
		Fe-59	191.0 +/- 21.0	174.0 +/- 2.9
		Mn-54	179.0 +/- 16.0	180.0 +/- 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
		Zn-65	275.0 +/- 30.0	272.0 +/- 4.5
06/14/12	Water – pCi/L [1]	Gross Beta	211.0 +/- 3.0	148.0 +/- 2.47
07/09/12	Water – pCi/L	Co-60	46.0 +/- 2.0	51.3
		Zn-65	101.0 +/- 7.0	98.9
		Cs-134	75.2 +/- 2.0	92.5
		Cs-137	196.0 +/- 6.0	216.0
		Ba-133	54.1 +/- 3.0	65.0
		I-131	24.7 +/- 4.0	26.5
07/09/12	Water – pCi/L	Gross Beta	24.88	36.8
09/13/12	Air Filter – pCi	Gross Beta	97.2 +/- 2.0	94.9 +/- 1.58
09/13/12	Water – pCi/L	H-3	9.23E+05	1.00E+06
10/05/12	Water – pCi/L	Co-60	78.0 +/- 4.0	78.3
		Zn-65	212.0 +/- 14.0	204.0
		Cs-134	70.0 +/- 3.0	76.6
		Cs-137	185.0 +/- 8.0	183.0
		Ba-133	82.0 +/- 4.0	84.8
		I-131	23.0 +/- 4.0	24.8
12/06/12	Air Filter – pCi	Mn-54	101.0 +/- 7.0	104.0 +/- 1.7
		Fe-59	109.0 +/- 8.0	104.0 +/- 1.7
		Co-58	82.0 +/- 7.0	88.8 +/- 1.5
		Co-60	154.0 +/- 6.0	153.0 +/- 2.6
		Cr-51	281.0 +/- 29.0	313.0 +/- 5.2
		Cs-134	118.0 +/- 5.0	149.0 +/- 2.5
		Cs-137	102.0 +/- 6.0	105.0 +/- 1.8
		Ce-141	43.0 +/- 4.0	46.0 +/- 0.8
		Zn-65	178.0 +/- 15.0	167.0 +/- 2.8
12/06/12	Air Iodine – pCi	I-131	66.0 +/- 4.0	72.8 +/- 1.2
12/06/12	Water – pCi/L	H-3	9.30E+02	2.50E+02

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
12/06/12	Milk – pCi/L			
		Fe-59	149.0 +/- 19.0	116.0 +/- 1.9
		Co-58	113.0 +/- 14.0	98.5 +/- 1.7
		Co-60	203.0 +/- 13.0	170.0 +/- 2.8
		Mn-54	119.0 +/- 13.0	116.0 +/- 1.9
		Zn-65	220.0 +/- 31.0	186.0 +/- 3.1
		I-131	106.0 +/- 15.0	90.0 +/- 1.5
		Cs-134	184.0 +/- 10.0	165.0 +/- 2.8
		Cs-137	129.0 +/- 13.0	117.0 +/- 2.0
		Ce-141	63.0 +/- 13.1	51.0 +/- 0.9
		Cr-51	427.0 +/- 69.0	348.0 +/- 5.8
12/06/12	Water - pCi/L	Gross Beta	219.0 +/- 3.0	274.0 +/- 4.57

[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	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
Air Filter - A1	01/09/12	Gross Beta	2.5 +/- 0.2	2.7 +/- 0.2	**
Air Filter - A2	01/09/12	Gross Beta	2.2 +/- 0.1	2.3 +/- 0.2	**
Air Filter - A3	01/09/12	Gross Beta	2.4 +/- 0.2	2.3 +/- 0.2	**
Air Filter - A4	01/09/12	Gross Beta	2.5 +/- 0.2	2.7 +/- 0.2	**
Air Filter - A5	01/09/12	Gross Beta	2.4 +/- 0.2	2.4 +/- 0.2	**
Air Filter - SFA1	01/09/12	Gross Beta	2.7 +/- 0.2	2.6 +/- 0.2	**
Air Filter - SFA2	01/09/12	Gross Beta	2.7 +/- 0.2	2.5 +/- 0.2	**
Air Filter - SFA3	01/09/12	Gross Beta	2.8 +/- 0.2	2.8 +/- 0.2	**
Air Filter - SFA4	01/09/12	Gross Beta	2.6 +/- 0.2	2.5 +/- 0.2	**
Air Iodine - A2	01/16/12	I-131	#	#	**
Air Iodine - A4	01/16/12	I-131	#	#	**
Air Iodine - A5	01/16/12	I-131	#	#	**
Air Filter - A1	02/06/12	Gross Beta	2.4 +/- 0.1	2.2 +/- 0.1	**
Air Filter - A3	02/06/12	Gross Beta	2.2 +/- 0.1	2.1 +/- 0.1	**
Air Filter - A4	02/06/12	Gross Beta	2.5 +/- 0.1	2.4 +/- 0.1	**
Air Filter - A5	02/06/12	Gross Beta	2.4 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA1	02/06/12	Gross Beta	2.3 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA2	02/06/12	Gross Beta	2.3 +/- 0.1	2.4 +/- 0.1	**
Air Filter - SFA3	02/06/12	Gross Beta	2.4 +/- 0.1	2.4 +/- 0.1	**
Air Filter - SFA4	02/06/12	Gross Beta	2.3 +/- 0.1	2.2 +/- 0.1	**
Air Iodine - A2	02/06/12	I-131	#	#	**
Air Iodine - A3	02/06/12	I-131	#	#	**
Air Filter - A1	02/14/12	Gamma	#	#	#
Air Filter - A2	02/14/12	Gamma	#	#	#
Air Filter - A3	02/14/12	Gamma	#	#	#
Air Filter - A4	02/14/12	Gamma	#	#	#
Air Filter - A5	02/14/12	Gamma	#	#	#
Air Filter - SFA1	02/14/12	Gamma	#	#	#
Air Filter - SFA2	02/14/12	Gamma	#	#	#
Air Filter - SFA3	02/14/12	Gamma	#	#	#
Air Filter - SFA4	02/14/12	Gamma	#	#	#

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
Air Filter - A1	03/05/12	Gross Beta	2.2 +/- 0.1	2.2 +/- 0.1	**
Air Filter - A2	03/05/12	Gross Beta	2.2 +/- 0.1	2.2 +/- 0.1	**
Air Filter - A3	03/05/12	Gross Beta	2.2 +/- 0.1	2.1 +/- 0.1	**
Air Filter - A4	03/05/12	Gross Beta	2.7 +/- 0.2	3.1 +/- 0.2	**
Air Filter - A5	03/05/12	Gross Beta	2.2 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA1	03/05/12	Gross Beta	2.3 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA2	03/05/12	Gross Beta	2.2 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA3	03/05/12	Gross Beta	2.3 +/- 0.1	2.4 +/- 0.1	**
Air Filter - SFA4	03/05/12	Gross Beta	2.3 +/- 0.1	2.3 +/- 0.1	**
Soil - SFS1	03/12/12	Gamma	#	#	#
Soil - SFS4	03/12/12	Gamma	#	#	#
Oysters - IA3	03/14/12	Gamma	#	#	**
Air Iodine - A1	03/28/12	I-131	#	#	**
Air Iodine - A2	03/28/12	I-131	#	#	**
Shoreline Sediment - WB1	03/28/12	Gamma	#	#	**
Air Filter - A1	04/09/12	Gross Beta	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - A2	04/09/12	Gross Beta	1.6 +/- 0.1	1.6 +/- 0.1	**
Air Filter - A3	04/09/12	Gross Beta	1.5 +/- 0.1	1.6 +/- 0.1	**
Air Filter - A4	04/09/12	Gross Beta	2.0 +/- 0.1	2.1 +/- 0.1	**
Air Filter - A5	04/09/12	Gross Beta	1.8 +/- 0.1	1.8 +/- 0.1	**
Air Filter - SFA1	04/09/12	Gross Beta	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - SFA2	04/09/12	Gross Beta	1.9 +/- 0.1	2.0 +/- 0.1	**
Air Filter - SFA3	04/09/12	Gross Beta	1.8 +/- 0.1	1.9 +/- 0.1	**
Air Filter - SFA4	04/09/12	Gross Beta	2.0 +/- 0.1	1.9 +/- 0.1	**
Air Iodine - A3	04/09/12	I-131	#	#	**
Air Iodine - A4	04/09/12	I-131	#	#	**

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
Air Filter - A1	05/07/12	Gross Beta	1.5 +/- 0.1	1.4 +/- 0.1	**
Air Filter - A2	05/07/12	Gross Beta	1.2 +/- 0.1	1.3 +/- 0.1	**
Air Filter - A3	05/07/12	Gross Beta	1.4 +/- 0.1	1.3 +/- 0.1	**
Air Filter - A4	05/07/12	Gross Beta	1.6 +/- 0.1	1.6 +/- 0.1	**
Air Filter - A5	05/07/12	Gross Beta	1.4 +/- 0.1	1.4 +/- 0.1	**
Air Filter - SFA1	05/07/12	Gross Beta	1.4 +/- 0.1	1.4 +/- 0.1	**
Air Filter - SFA2	05/07/12	Gross Beta	1.4 +/- 0.1	1.5 +/- 0.1	**
Air Filter - SFA4	05/07/12	Gross Beta	1.5 +/- 0.1	1.4 +/- 0.1	**
Air Iodine - A1	05/28/12	I-131	#	#	**
Air Iodine - A2	05/28/12	I-131	#	#	**
Misc ground coverage - SFB2	06/11/12	Gamma	#	#	#
Misc ground coverage - SFB3	06/11/12	Gamma	#	#	#
Misc ground coverage - SFB5	06/11/12	Gamma	#	#	#
Soil - SFS2	06/11/12	Gamma	#	#	#
Soil - SFS3	06/11/12(1)	Cs-137	34.7 +/- 27.0	56.5 +/- 24.8	120.0 +/- 40.1
Soil - SFS5	06/11/12(1)	Cs-137	324.2 +/- 33.9	260.0 +/- 31.7	663.0 +/- 49.3
Bottom sediment - WBS2	06/19/12	Cs-137	128.9 +/- 39.2	92.4 +/- 43.0	196.0 +/- 46.8
Bottom sediment - WBS4	06/19/12	Cs-137	128.6 +/- 35.3	85.4 +/- 37.7	163.0 +/- 46.8
Oysters - IA3	06/19/12	Gamma	#	#	#
Oysters - IA6	06/19/12	Gamma	#	#	#
DR05	06/20/12	TLD	12.0 +/- 0.8	13.0 +/- 0.5	**
DR06	06/20/12	TLD	10.2 +/- 1.1	11.5 +/- 1.4	**
DR07	06/20/12	TLD	10.0 +/- 0.9	12.0 +/- 1.1	**
DR08	06/20/12	TLD	14.0 +/- 1.1	15.9 +/- 2.0	**
DR09	06/20/12	TLD	10.6 +/- 1.3	11.9 +/- 0.9	**

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
DR10	06/20/12	TLD	10.1 +/- 0.9	11.7 +/- 1.1	**
DR11	06/20/12	TLD	10.7 +/- 1.2	12.2 +/- 1.2	**
DR29	06/20/12	TLD	13.3 +/- 2.8	15.5 +/- 1.2	**
DR31	06/20/12	TLD	13.6 +/- 2.1	17.0 +/- 2.7	**
SFDR14	06/20/12	TLD	16.5 +/- 4.3	19.4 +/- 4.3	**
SFDR15	06/20/12	TLD	21.0 +/- 5.7	24.8 +/- 3.8	**
Air Iodine - A1	06/25/12	I-131	#	#	**
Air Iodine - A3	06/25/12	I-131	#	#	**
Air Iodine - A4	06/25/12	I-131	#	#	**
Bay Water - WA1	06/28/12	Gamma	#	**	#
Bay Water - WA2	06/28/12	Gamma	#	**	#
Air Iodine - A1	07/09/12	I-131	#	#	**
Air Iodine - A2	07/09/12	I-131	#	#	**
Air Iodine - A5	07/09/12	I-131	#	#	**
Brussels sprouts - IB3	07/16/12	Gamma	#	#	**
Brussels sprouts - IB9	07/16/12	Gamma	#	#	#
Cabbage - IB1	07/16/12	Gamma	#	#	**
Cabbage - IB4	07/16/12	Gamma	#	#	**
Cabbage - IB7	07/16/12	Gamma	#	#	#
Collards - IB2	07/16/12	Gamma	#	#	#
Collards - IB5	07/16/12	Gamma	#	#	**
Collards - IB8	07/16/12	Gamma	#	#	#
Air Filter - A1	08/06/12	Gross Beta	2.3 +/- 0.1	2.3 +/- 0.1	**
Air Filter - A2	08/06/12	Gross Beta	2.2 +/- 0.1	2.3 +/- 0.1	**
Air Filter - A3	08/06/12	Gross Beta	2.1 +/- 0.1	2.2 +/- 0.1	**
Air Filter - A4	08/06/12	Gross Beta	2.6 +/- 0.1	2.5 +/- 0.1	**

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
Air Filter - A5	08/06/12	Gross Beta	2.5 +/- 0.1	2.3 +/- 0.1	**
Air Filter - SFA1	08/06/12	Gross Beta	2.1 +/- 0.1	2.4 +/- 0.1	**
Air Filter - SFA2	08/06/12	Gross Beta	2.1 +/- 0.1	2.1 +/- 0.1	**
Air Filter - SFA3	08/06/12	Gross Beta	2.3 +/- 0.2	2.3 +/- 0.1	**
Air Filter - SFA4	08/06/12	Gross Beta	2.1 +/- 0.1	2.3 +/- 0.1	**
Air Iodine - A4	08/13/12	I-131	#	#	**
Air Iodine - A5	08/13/12	I-131	#	#	**
Lake Trout - NORTH	08/23/12	Gamma	#	#	#
Oysters - IA3	08/23/12	Gamma	#	**	#
Oysters - IA6	08/23/12	Cs-137	15.3 +/- 6.5	**	**
Oysters - IA6	08/23/12	Gamma	#	**	#
Striped bass - IA5	08/23/12	Gamma	#	#	**
Air Filter - A1	09/10/12	Gross Beta	2.2 +/- 0.1	2.1 +/- 0.1	**
Air Filter - A2	09/10/12	Gross Beta	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - A3	09/10/12	Gross Beta	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Filter - A4	09/10/12	Gross Beta	2.3 +/- 0.1	2.4 +/- 0.1	**
Air Filter - A5	09/10/12	Gross Beta	2.1 +/- 0.1	2.1 +/- 0.1	**
Air Filter - SFA1	09/10/12	Gross Beta	2.0 +/- 0.1	2.2 +/- 0.1	**
Air Filter - SFA2	09/10/12	Gross Beta	2.1 +/- 0.2	2.1 +/- 0.2	**
Air Filter - SFA3	09/10/12	Gross Beta	2.0 +/- 0.1	2.1 +/- 0.1	**
Air Filter - SFA4	09/10/12	Gross Beta	2.0 +/- 0.1	2.0 +/- 0.1	**
Air Iodine - A1	09/17/12	I-131	#	#	**
Air Iodine - A2	09/17/12	I-131	#	#	**
Air Filter - A1	10/15/12	Gross Beta	2.2 +/- 0.2	2.3 +/- 0.2	**
Air Filter - A2	10/15/12	Gross Beta	2.1 +/- 0.2	2.2 +/- 0.2	**
Air Filter - A3	10/15/12	Gross Beta	2.5 +/- 0.2	2.3 +/- 0.2	**

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis (2)	Replicate Analysis (2)	Split Analysis (2)
Air Filter - A4	10/15/12	Gross Beta	2.5 +/- 0.2	2.7 +/- 0.2	**
Air Filter - A5	10/15/12	Gross Beta	2.8 +/- 0.2	2.6 +/- 0.2	**
Air Filter - SFA1	10/15/12	Gross Beta	2.3 +/- 0.2	2.3 +/- 0.2	**
Air Filter - SFA2	10/15/12	Gross Beta	2.2 +/- 0.2	2.2 +/- 0.2	**
Air Filter - SFA3	10/15/12	Gross Beta	2.1 +/- 0.2	2.2 +/- 0.2	**
Air Filter - SFA4	10/15/12	Gross Beta	2.6 +/- 0.2	2.4 +/- 0.2	**
Oysters - IA3	10/25/12	Gamma	#	#	#
Oysters - IA6	10/25/12	Gamma	#	#	#
Rainbow Trout - NORTH	11/16/12	Gamma	#	#	#
Air Filter - A1	11/19/12	Gross Beta	2.9 +/- 0.2	2.8 +/- 0.2	**
Air Filter - A2	11/19/12	Gross Beta	2.9 +/- 0.2	2.8 +/- 0.2	**
Air Filter - A3	11/19/12	Gross Beta	3.0 +/- 0.2	3.1 +/- 0.2	**
Air Filter - A4	11/19/12	Gross Beta	3.3 +/- 0.2	3.3 +/- 0.2	**
Air Filter - A5	11/19/12	Gross Beta	3.7 +/- 0.2	3.5 +/- 0.2	**
Air Filter - SFA1	11/19/12	Gross Beta	3.2 +/- 0.2	3.2 +/- 0.2	**
Air Filter - SFA2	11/19/12	Gross Beta	2.9 +/- 0.2	2.6 +/- 0.2	**
Air Filter - SFA3	11/19/12	Gross Beta	2.7 +/- 0.2	2.7 +/- 0.2	**
Air Filter - SFA4	11/19/12	Gross Beta	3.2 +/- 0.2	3.2 +/- 0.2	**
Air Iodine - A1	12/10/12	I-131	#	#	**
Air Iodine - A2	12/10/12	I-131	#	#	**
Air Iodine - A3	12/10/12	I-131	#	#	**
Bay Water - WA1	12/28/12	Gamma	#	#	#
Bay Water - WA2	12/28/12	Gamma	#	#	#
Air Iodine - A1	12/31/12	I-131	#	#	**
Air Iodine - A5	12/31/12	I-131	#	#	**

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Original Analysis [2]	Replicate Analysis [2]	Split Analysis [2]
DR05	01/03/13	TLD	13.6 +/- 0.8	13.5 +/- 1.0	**
DR06	01/03/13	TLD	11.6 +/- 1.3	11.4 +/- 1.1	**
DR07	01/03/13	TLD	11.6 +/- 0.6	11.4 +/- 0.7	**
DR08	01/03/13	TLD	16.7 +/- 1.4	16.1 +/- 1.4	**
DR09	01/03/13	TLD	12.6 +/- 1.0	11.9 +/- 1.4	**
DR10	01/03/13	TLD	12.1 +/- 1.0	12.1 +/- 2.6	**
DR29	01/03/13	TLD	16.5 +/- 2.1	17.4 +/- 1.8	**
DR31	01/03/13	TLD	17.4 +/- 2.1	17.4 +/- 2.1	**
SFDR14	01/03/13	TLD	17.1 +/- 2.3	18.0 +/- 1.4	**
SFDR15	01/03/13	TLD	23.8 +/- 2.7	25.3 +/- 1.9	**

[1] See discussion at the beginning of the Appendix.
[2] Results reported for Air samples I-131 and Beta are in 10^{-2} pCi/m^3. All Vegetation and Soil, Oysters and Fish are in pCi/kg. All water and milk are in pCi/L. TLD are in mR/90 Day.
All Non-Natural Gamma Emitters are <MDA
** 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/resident has changed since 2011 and is still located within the 5-mile radius in the SW sector.

Table D-1
Land Use Survey

	Distance From Plant (miles)	
Sector	Residence	Garden
SE	1.5	1.5
SSE	1.6	2.4*
S	1.6	1.6*
SSW	1.5	1.6
SW	1.1	1.1
WSW	1.3	1.4
W	1.3	1.3*
WNW	2.7	2.7
NW	2.0	2.1*

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.

* GPS was used to determine distance from the central point between the two containment buildings.

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-11 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 nine on-site piezometer tubes in 2012. 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 tube 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 2012 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 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
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 2012 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	358	I-131	W	358
Air Particulates[3]	W	3	156	Gross Beta Gamma	W MC	156 36
Direct Radiation						
Ambient Radiation	Q	20	468	TLD	Q	468
Terrestrial Environment						
Ground water	M	1	12	Gamma H-3	M M	12 12

[1] W=weekly, M=monthly, Q=quarterly, SA=semiannual, A=annual, C=composite
[2] The collection device contains charcoal.
[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	--	133 (2/2) (129-137)	Discharge Area WBS2 0.3 km N	133 (2/2) (129-137)	115 (2/2) (102-129)
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (156)	0.5	2.1 (104/104) (0.7-4.4)	TAYLOR'S ISLAND TI 12.6 km ENE	2.2 (52/52) (0.8-4.1)	2.2 (52/52) (0.8-4.1)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (468)	--	55.85 (468/468) (9.36-296.86)	South Fence Upper RPDR09 0.7 km SW	211.61 (24/24) (129.34-296.86)	-- --

[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	6/19/2012	129 +/- 39	*
	10/25/2012	137 +/- 43	*
WBS4[1]			
Camp Conoy/ Rocky Point	6/19/2012	129 +/- 35	*
	10/25/2012	102 +/- 34	*

[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
1/2/2012	1/9/2012	*	*	*	*	*	*	*
1/9/2012	1/16/2012	*	*	*	*	*	*	*
1/16/2012	1/23/2012	*	*	*	*	*	*	*
1/23/2012	1/30/2012	*	*	*	*	*	*	*
1/30/2012	2/6/2012	*	*	*	*	*	*	*
2/6/2012	2/13/2012	*	*	*	*	*	*	*
2/13/2012	2/20/2012	*	*	*	*	*	*	*
2/20/2012	2/27/2012	*	*	*	*	*	*	*
2/27/2012	3/5/2012	*	*	*	*	*	*	*
3/5/2012	3/12/2012	*	*	*	*	*	*	*
3/12/2012	3/19/2012	*	*	*	*	*	*	*
3/19/2012	3/26/2012	*	*	*	*	*	*	*
3/26/2012	4/2/2012	*	*	*	*	*	*	*
4/2/2012	4/9/2012	*	*	*	*	*	*	*
4/9/2012	4/16/2012	*	*	*	*	*	*	*
4/16/2012	4/23/2012	*	*	*	*	*	*	*
4/23/2012	4/30/2012	*	*	*	*	*	*	*
4/30/2012	5/7/2012	*	*	*	*	*	*	*
5/7/2012	5/14/2012	*	*	*	*	*	*	*
5/14/2012	5/21/2012	*	*	*	*	*	*	*
5/21/2012	5/28/2012	*	*	*	*	*	*	*
5/28/2012	6/4/2012	*	*	*	*	*	*	*
6/4/2012	6/11/2012	*	*	*	*	*	*	*
6/11/2012	6/18/2012	*	*	*	*	*	*	*
6/18/2012	6/25/2012	*	*	*	*	*	*	*
6/25/2012	7/2/2012	*	*	*	*	*	*	*
7/2/2012	7/9/2012	*	*	*	*	*	*	*
7/9/2012	7/16/2012	*	*	*	*	*	*	*
7/16/2012	7/23/2012	*	*	*	[2]	*	*	*

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
7/23/2012	7/30/2012	*	*	*	*	*	2	*
7/30/2012	8/6/2012	*	*	*	*	*	*	*
8/6/2012	8/13/2012	*	*	*	3	*	2	*
8/13/2012	8/20/2012	*	*	*	*	*	*	*
8/20/2012	8/27/2012	*	*	*	*	*	*	*
8/27/2012	9/3/2012	*	*	*	*	*	*	*
9/3/2012	9/10/2012	*	*	*	*	*	*	*
9/10/2012	9/17/2012	*	*	*	2	*	*	*
9/17/2012	9/24/2012	*	*	*	2	*	*	*
9/24/2012	10/1/2012	*	*	*	*	*	*	*
10/1/2012	10/8/2012	*	*	*	*	*	*	*
10/8/2012	10/15/2012	*	*	*	*	*	*	*
10/15/2012	10/22/2012	*	*	*	*	*	*	*
10/22/2012	10/29/2012	*	*	*	*	*	*	*
10/29/2012	11/5/2012	*	*	*	*	*	*	*
11/5/2012	11/12/2012	*	*	*	*	*	*	*
11/12/2012	11/19/2012	*	*	*	*	*	*	*
11/19/2012	11/26/2012	*	*	*	*	*	*	*
11/26/2012	12/3/2012	*	*	*	*	*	*	*
12/3/2012	12/10/2012	*	*	*	*	*	*	*
12/10/2012	12/17/2012	*	*	*	*	*	*	*
12/17/2012	12/24/2012	*	*	*	*	*	*	*
12/24/2012	12/31/2012	*	*	*	*	*	*	*

[1] Control Location
[2] Power outage
[3] Sampler malfunction/low flow
* <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
1/2/2012	1/9/2012	2.7 +/- 0.2	2.4 +/- 0.2	2.5 +/- 0.2
1/9/2012	1/16/2012	2.1 +/- 0.2	2.1 +/- 0.1	2.1 +/- 0.2
1/16/2012	1/23/2012	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
1/23/2012	1/30/2012	2.4 +/- 0.2	2.3 +/- 0.1	2.6 +/- 0.2
1/30/2012	2/6/2012	2.4 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
2/6/2012	2/13/2012	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
2/13/2012	2/20/2012	2.2 +/- 0.1	2.2 +/- 0.1	2.2 +/- 0.1
2/20/2012	2/27/2012	2.4 +/- 0.1	2.5 +/- 0.1	2.3 +/- 0.1
2/27/2012	3/5/2012	2.3 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
3/5/2012	3/12/2012	2.1 +/- 0.1	1.9 +/- 0.1	2.0 +/- 0.1
3/12/2012	3/19/2012	2.0 +/- 0.1	2.1 +/- 0.1	2.0 +/- 0.1
3/19/2012	3/26/2012	1.6 +/- 0.1	1.3 +/- 0.1	1.7 +/- 0.1
3/26/2012	4/2/2012	1.4 +/- 0.1	1.2 +/- 0.1	1.2 +/- 0.1
4/2/2012	4/9/2012	2.0 +/- 0.1	2.0 +/- 0.1	1.9 +/- 0.1
4/9/2012	4/16/2012	1.9 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
4/16/2012	4/23/2012	1.6 +/- 0.1	1.4 +/- 0.1	1.6 +/- 0.1
4/23/2012	4/30/2012	2.2 +/- 0.1	2.1 +/- 0.1	1.9 +/- 0.1
4/30/2012	5/7/2012	1.4 +/- 0.1	1.3 +/- 0.1	1.5 +/- 0.1
5/7/2012	5/14/2012	1.9 +/- 0.1	2.0 +/- 0.1	2.0 +/- 0.1
5/14/2012	5/21/2012	1.1 +/- 0.1	1.5 +/- 0.1	1.1 +/- 0.1
5/21/2012	5/28/2012	1.0 +/- 0.1	1.1 +/- 0.1	1.2 +/- 0.1
5/28/2012	6/4/2012	2.1 +/- 0.3	1.8 +/- 0.1	1.7 +/- 0.1
6/4/2012	6/11/2012	1.5 +/- 0.1	1.5 +/- 0.1	1.6 +/- 0.1
6/11/2012	6/18/2012	0.8 +/- 0.1	1.1 +/- 0.1	1.0 +/- 0.1
6/18/2012	6/25/2012	2.4 +/- 0.1	2.9 +/- 0.2	2.8 +/- 0.1
6/25/2012	7/2/2012	2.7 +/- 0.1	2.5 +/- 0.1	2.7 +/- 0.2
7/2/2012	7/9/2012	3.0 +/- 0.2	3.2 +/- 0.2	3.2 +/- 0.2
7/9/2012	7/16/2012	1.5 +/- 0.1	1.6 +/- 0.1	1.6 +/- 0.1
7/16/2012	7/23/2012	2.3 +/- 0.1	2.2 +/- 0.1	2.3 +/- 0.1
7/23/2012	7/30/2012	2.5 +/- 0.1	1.4 +/- 0.1	2.3 +/- 0.1

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
7/30/2012	8/6/2012	2.1 +/- 0.1	2.0 +/- 0.1	2.3 +/- 0.1
8/6/2012	8/13/2012	1.8 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
8/13/2012	8/20/2012	2.7 +/- 0.1	2.9 +/- 0.2	2.8 +/- 0.1
8/20/2012	8/27/2012	1.6 +/- 0.1	1.6 +/- 0.1	2.3 +/- 0.1
8/27/2012	9/3/2012	2.9 +/- 0.2	2.5 +/- 0.1	2.9 +/- 0.2
9/3/2012	9/10/2012	2.2 +/- 0.2	2.2 +/- 0.1	2.1 +/- 0.1
9/10/2012	9/17/2012	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
9/17/2012	9/24/2012	1.7 +/- 0.1	1.8 +/- 0.1	1.8 +/- 0.1
9/24/2012	10/1/2012	3.0 +/- 0.2	3.1 +/- 0.1	3.2 +/- 0.2
10/1/2012	10/8/2012	2.5 +/- 0.2	2.3 +/- 0.1	2.5 +/- 0.2
10/8/2012	10/15/2012	1.8 +/- 0.1	2.2 +/- 0.2	2.1 +/- 0.1
10/15/2012	10/22/2012	2.6 +/- 0.2	2.1 +/- 0.1	2.6 +/- 0.2
10/22/2012	10/29/2012	2.8 +/- 0.2	3.6 +/- 0.2	3.9 +/- 0.2
10/29/2012	11/5/2012	0.8 +/- 0.1	0.7 +/- 0.1	0.8 +/- 0.1
11/5/2012	11/12/2012	3.7 +/- 0.2	2.5 +/- 0.1	3.2 +/- 0.2
11/12/2012	11/19/2012	3.4 +/- 0.2	2.1 +/- 0.1	3.2 +/- 0.2
11/19/2012	11/26/2012	4.1 +/- 0.2	3.2 +/- 0.2	3.6 +/- 0.2
11/26/2012	12/3/2012	4.4 +/- 0.2	3.8 +/- 0.2	4.1 +/- 0.2
12/3/2012	12/10/2012	2.2 +/- 0.2	2.2 +/- 0.1	2.0 +/- 0.1
12/10/2012	12/17/2012	2.9 +/- 0.2	2.7 +/- 0.2	2.9 +/- 0.2
12/17/2012	12/24/2012	3.3 +/- 0.1	2.6 +/- 0.1	3.1 +/- 0.1
12/24/2012	12/31/2012	1.4 +/- 0.2	1.3 +/- 0.2	1.4 +/- 0.2

[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
1/30/2012	*	*	*
2/27/2012	*	*	*
4/2/2012	*	*	*
4/30/2012	*	*	*
5/28/2012	*	*	*
7/2/2012	*	*	*
7/30/2012	*	*	*
9/3/2012	*	*	*
10/1/2012	*	*	*
10/29/2012	*	*	*
12/3/2012	*	*	*
12/31/2012	*	*	*

[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 10^{-3} pCi/L +/- 2σ)

Sample Date	Gamma Emitters	H-3
1/16/2012	*	<281
2/20/2012	*	<281
3/20/2012	*	<276
4/16/2012	*	<292
5/22/2012	*	<292
6/18/2012	*	<295
7/30/2012	*	<310
8/21/2012	*	<315
9/25/2012	*	<315
10/23/2012	*	<310
11/20/2012	*	<317
12/30/2012	*	<317

* 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.	11.28 +/- 1.35	11.60 +/- 0.61	11.01 +/- 0.92	13.75 +/- 1.15
DR25	Camp Conoy Guard House	12.84 +/- 1.38	12.93 +/- 1.66	12.47 +/- 0.63	14.83 +/- 1.10
DR26	Rt. 235 and Clark's Landing Road	10.92 +/- 1.45	10.81 +/- 1.84	10.51 +/- 0.28	12.81 +/- 1.43
DR27	Rt. 231 and Rt. 4	10.95 +/- 0.87	11.23 +/- 1.14	[1]	13.29 +/- 1.37
DR28	Taylors Is. Siren #35	12.38 +/- 1.07	14.49 +/- 2.15	14.56 +/- 0.99	15.12 +/- 0.82
DR29	Taylors Is. Siren #38	13.64 +/- 0.41	14.02 +/- 1.37	14.45 +/- 1.46	16.54 +/- 2.05
DR31	Cambridge	14.39 +/- 1.02	14.36 +/- 0.66	14.35 +/- 0.55	16.86 +/- 0.94
DR32	Twining Property, Taylors Island	13.30 +/- 0.93	14.30 +/- 1.95	15.22 +/- 1.37	[1]
DR33	P. A. Ransome Property	14.72 +/- 1.43	15.28 +/- 1.22	15.48 +/- 1.20	16.91 +/- 1.86
DR34	Shoreline at Barge Rd.	9.67 +/- 1.16	9.61 +/- 1.27	9.36 +/- 0.26	11.00 +/- 1.63
OSG1	North of Old Steam Generator Storage Facility	20.12 +/- 2.31	23.27 +/- 3.61	21.64 +/- 1.23	22.55 +/- 2.10
OSG2	West of Old Steam Generator Storage Facility	19.98 +/- 2.74	24.46 +/- 2.92	20.96 +/- 4.19	20.73 +/- 4.26

[1] TLD Missing

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	31.26 +/- 8.58	97.84 +/- 10.72	153.51 +/- 12.19	44.05 +/- 4.12
RPDR06	North Fence Upper	84.74 +/- 6.25	146.20 +/- 14.62	98.98 +/- 11.56	48.72 +/- 5.28
RPDR07	West Fence Right	63.06 +/- 11.76	116.39 +/- 11.73	91.88 +/- 10.58	51.48 +/- 5.64
RPDR08	West Fence Left	63.54 +/- 11.24	152.42 +/- 23.71	208.81 +/- 23.92	96.02 +/- 14.15
RPDR09	South Fence Upper	237.46 +/- 25.24	296.86 +/- 21.21	129.34 +/- 18.82	182.76 +/- 11.78
RPDR10	South Fence Lower	155.79 +/- 11.83	201.28 +/- 24.45	129.99 +/- 10.32	140.85 +/- 10.87
RPDR11	East Fence Left	114.56 +/- 12.26	124.03 +/- 18.41	86.93 +/- 11.76	103.61 +/- 12.78
RPDR12	East Fence Right	92.88 +/- 8.95	128.21 +/- 12.45	61.73 +/- 4.88	53.22 +/- 2.78

Table E-11

Concentration of Tritium in Groundwater
(Results in units of pCi/L +/- 2σ)

Sample Date	Piezometer Tube #s								
	11	12	13	15	18	19	20	21	22
01/20/2012	#	#	#	#	#	#	#	#	#
06/19/2012	#	#	#	#	#	#	#	#	#
09/11/2012	ND	ND	ND	ND	ND	ND	#	#	#
09/24/2012	388 +/- 185	#	ND[1]	#	#	#	ND	ND	ND
10/1/2012	ND	ND	#	ND	ND	ND	ND	ND	ND
12/2/2012	#	#	#	#	ND	ND	#	#	#
12/5/2012	ND	ND	ND	ND	#	#	ND	ND	ND

# Tritium Less than Minimum Detectable Activity (<MDA)
ND = No Data – Quarterly sample obtained as required.
[1] Third quarter sample was re-prepared and rerun on 10/1/2012.

Table E-12

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

Sample Date	Piezometer Tube #s								
	11	12	13	15	18	19	20	21	22
01/20/2012	*	*	*	*	*	*	*	*	*
06/19/2012	*	*	*	*	*	*	*	*	*
09/11/2012	ND	ND	ND	ND	ND	ND	*	*	*
09/24/2012	*	*	*	*	*	*	ND	ND	ND
12/2/2012	*	*	*	*	ND	*	*	*	*
12/5/2012	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