Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

Constellation Energy Group

May 15, 2003

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
Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8
Radiological Environmental Monitoring Program Annual 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 Monitoring Report, dated April 2003.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

Mack Tonacci

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MET/CAN/bjd

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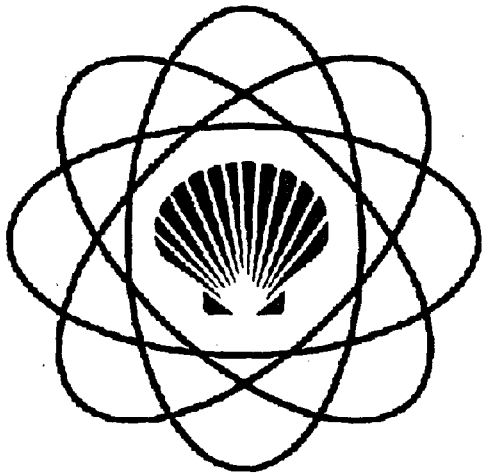
ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT



Calvert Cliffs Nuclear Power Plant Units 1 & 2
and the Independent Spent Fuel Storage Installation

January 1 - December 31, 2002

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT UNITS 1 AND 2 AND THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION

January 1 - December 31, 2002

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CONSTELLATION ENERGY GROUP
CONSTELLATION GENERATION GROUP, LLC

APRIL 2003

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I. SUMMARY

During the 2002 operating period for Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2, a total of 3343 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) and the Environmental and Independent Spent Fuel Storage Installation (ISFSI) Technical Specifications (Ref. 4, 54). 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 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 656 radiochemical analyses were performed on 588 environmental samples, and 552 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. 4).

For the ISFSI monitoring program, 358 radiochemical analyses were performed on 298 environmental samples, 51 of which were in common with the original REMP. In addition, 432 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. 54).

In addition, 594 analyses were performed on 546 additional environmental samples, and 480 additional TLDs were analyzed for ambient radiation exposure rates. Also, six pressurized ion chambers continuously monitored the environs around the plant for ambient radiation levels. As mentioned earlier, these additional analyses reflect a commitment to maintain historical continuity for samples and sampling pathways discontinued from the program when the Environmental Technical Specifications were changed in March 1985 and to satisfy monitoring commitments made to the surrounding community.

And lastly, 205 radiochemical analyses were performed on 189 quality assurance samples and 66 quality assurance TLDs were analyzed as part of an internal and external quality assurance program associated with Enrad Laboratories (Duke Power Company). 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 samples. 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 silver zeolite molecular sieve cartridges, respectively. The particulate filters were analyzed for beta activity and gamma emitting nuclides. The molecular sieve 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 3343 radiological analyses performed in the year 2002. Low levels of various man-made fission and activation products were also observed in 39 of these analyses. Thirty-one of these observations were attributed to fallout from past atmospheric weapons testing, while eight analyses yielded low level positive results for the presence of H-3 or Ag-110m, which were attributable to plant operation. 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 for 2002 indicate:

a. a maximum thyroid dose of 3.09×10^{-3} mR via liquid and gaseous pathways, which is less than 0.01% of the acceptable limit of 75 mR/yr as specified in 40 CFR Part 190;

b. a maximum whole body dose of 7.48×10^{-3} mR via liquid and gaseous pathways, which is less than 0.1% of the acceptable limit of 25 mR/yr as specified in 40 CFR Part 190;

c. a maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 1.74×10^{-1} mR to the GI-Tract. This dose is less than 1% of the allowable limit of 25 mR/yr as specified in 40 CFR Part 190.

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 during 2002.

II. CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

II.A. INTRODUCTION

Constellation Energy Group (CEG), 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, page 38.

Originally, the REMP was conducted under separate Environmental Technical Specifications (Ref. 1, 2). On July 29, 1977 the monitoring program began operation under a combined set of Technical Specifications (Ref. 3) for both units. The program has operated as such until March 1, 1985 when the Environmental Technical Specifications were revised to reflect a new generic format for radiological environmental monitoring adopted by the Nuclear Regulatory Commission (Ref. 4). Changes in the program (sample locations, sample types, and/or sampling frequencies) were implemented to conform to these revisions. In October 1996, the Nuclear Regulatory Commission approved the relocation of these Technical Specifications to the ODCM (Ref. 6) in accordance with Generic Letter 89-01 (Ref. 5).

Results of the monitoring program for the pre-operational and previous operational periods through December 31, 2001 have been reported in a series of documents (Ref. 16-53).

Results of the monitoring program for the current operational period of January 1, 2002 through December 31, 2002 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 of 2002 (Table 2), a compilation of the analytical data for 2002 (Appendix B), the results of the Analytics Intercomparison 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 in 2002 (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 during 2002.

II.B. PROGRAM

II.B.1 Objectives

The objectives of the REMP for the CCNPP are:

a. To verify that radioactivity and ambient radiation levels attributable to plant operation are within the limits specified in the ODCM (Ref. 6) and the Environmental Radiation Protection Standards as stated in 40 CFR Part 190,

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

c. To monitor and evaluate ambient radiation levels,

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 CEG according to CCNPP Procedures (Ref. 7).

II.B.3 Data Interpretation

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

II.B.4 Program Exceptions

There were no program exceptions during 2002.

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year were analyzed using Constellation Generation Group, LLC (CGG) 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). The samples were obtained from a composite sampling system operating at 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, showed the presence of tritium in the Discharge (Wa2) and the Intake (Wa1) samples in two of the four quarters. It is not unusual to observe concentrations of tritium occasionally in the Intake as a result of bay water recirculation. The detectable concentrations observed in the Discharge ranged from 87 ±36 to 195 ±39 pCi/L, and in the Intake ranged from 49 ±37 to 84 ±35 pCi/L which are similar to those ranges observed in previous years, (Ref. 22-53).

Figure 1 compares tritium observed in the plant discharge and intake with annual effluent releases in 2002 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

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

Gamma spectrometric analyses of the fish exhibited naturally occurring K-40, but no detectable concentrations of any plant-related radionuclides. Oyster samples exhibited naturally occurring K-40 and low levels of detectable concentrations of the plant-related radionuclide, Ag-110m, in samples obtained from Camp Conoy (Ia3). The concentration of naturally occurring K-40 ranged from 1741 to 2144 pCi/kg while the concentrations of Ag-110m, which are consistent with that expected due to liquid effluents from the plant in 2002, ranged from 19 ±7 to 55 ±8 pCi/kg.

II.C.1.c **Shoreline Sediment**

Semiannual shoreline sediment samples were taken from one location during the year. This location is Shoreline at Barge Road (sample code Wb1). The samples obtained from this location were analyzed for gamma emitters.

Gamma spectrometric analyses of these samples exhibited naturally occurring radionuclides, such as K-40, which ranged from 447 to 616 pCi/kg, but no detectable concentrations of any plant-related radionuclides.

Figure 1

Tritium in Plant Effluents and Chesapeake Bay Water

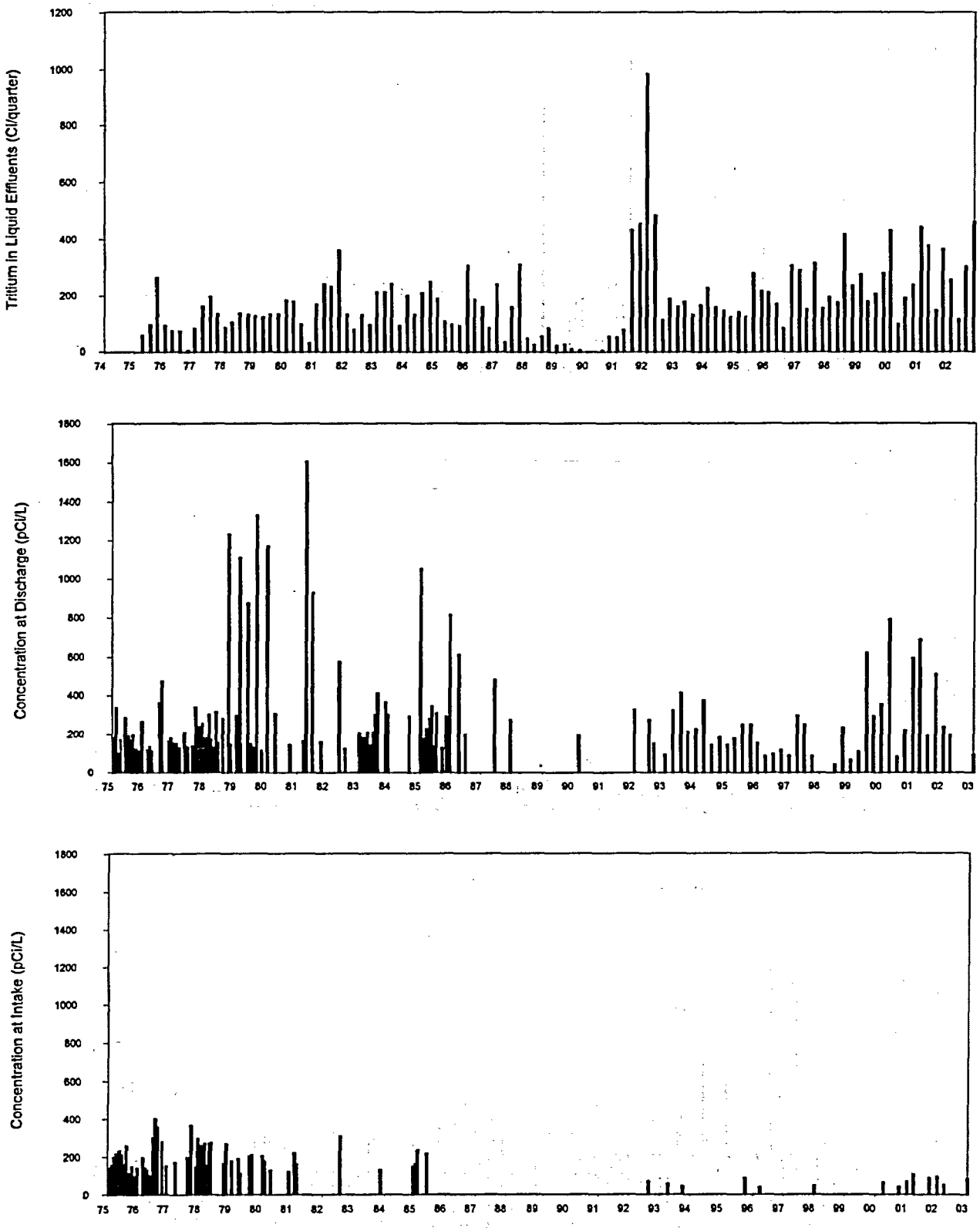
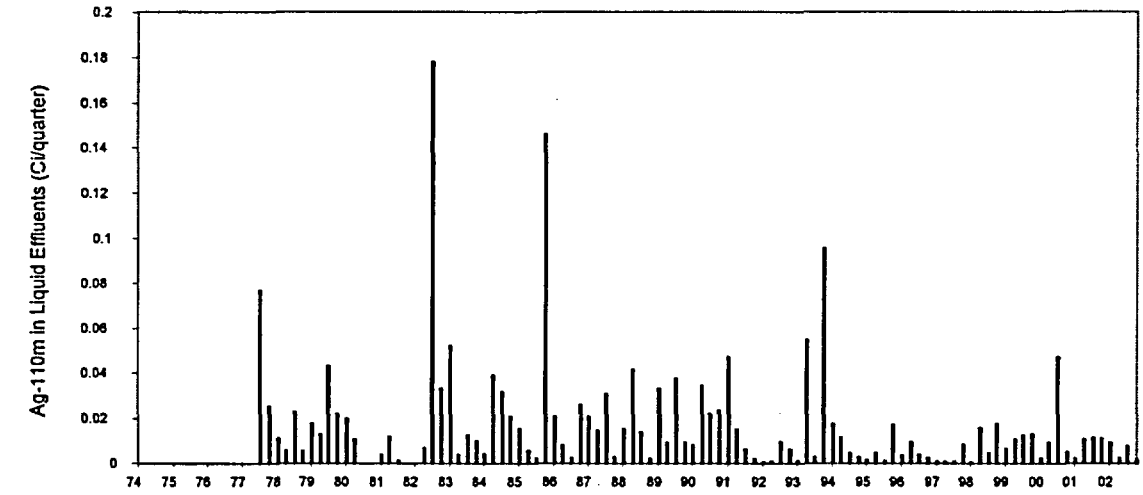
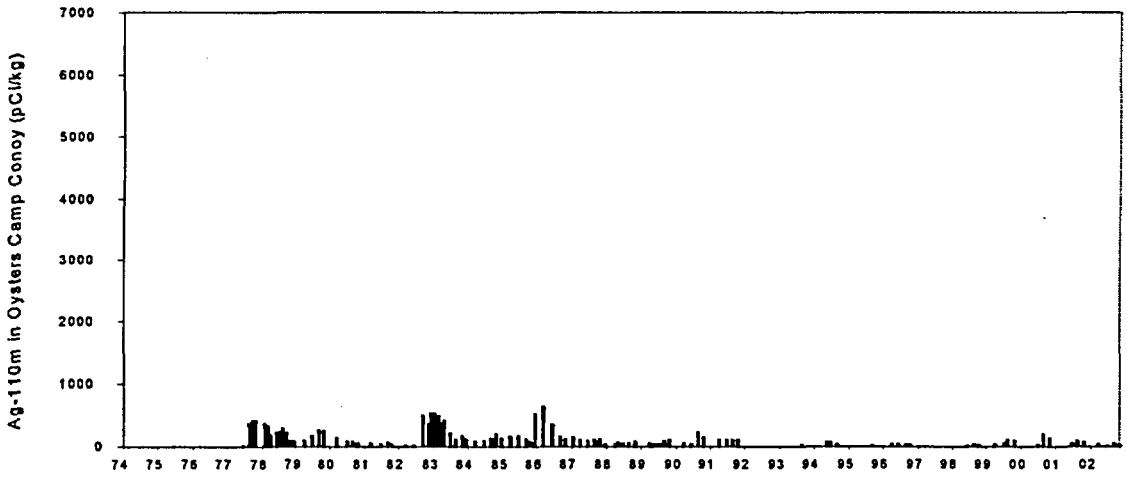
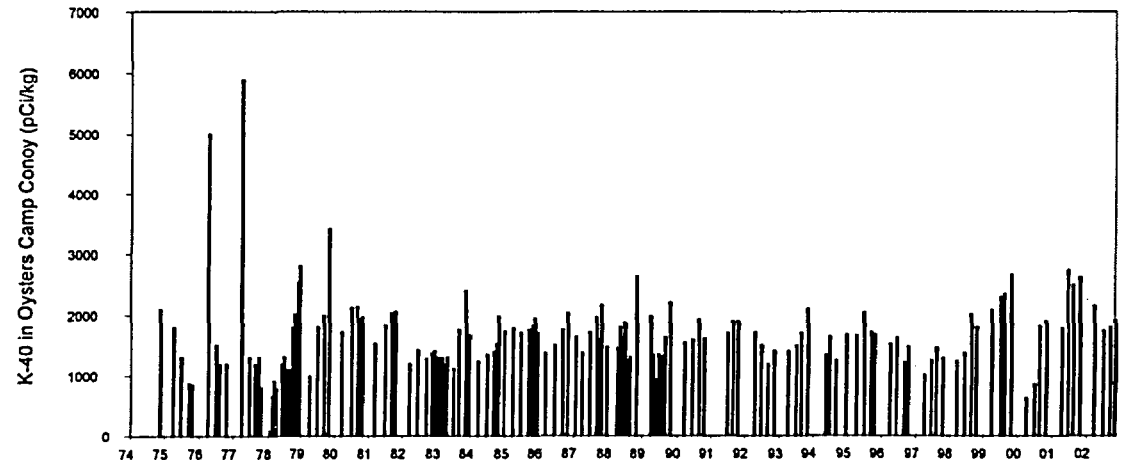


Figure 2

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 silver zeolite 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 (Ref. 16-53). The values ranged from 0.2 x 10^{-2} to 5.1 x 10^{-2} pCi/m^3 for the indicator locations and 0.9 x 10^{-2} to 2.8 x 10^{-2} pCi/m^3 at the control location. The location with the highest overall mean of 1.7x10^{-2} pCi/m^3 was A1, Entrance to Camp Conoy.

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 silver zeolite 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 silver zeolite cartridges collected from all five locations exhibited no detectable concentrations of I-131.

Figure 3 depicts the historical trends of radioiodine.

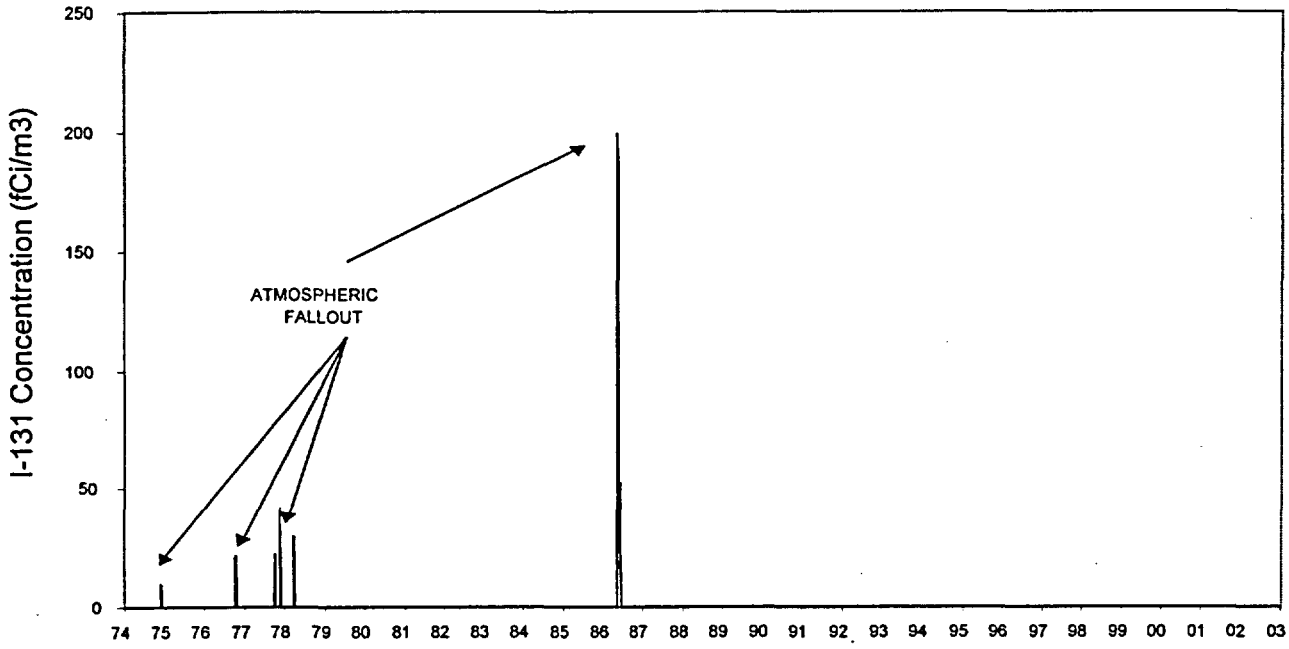
II.C.3 Terrestrial Environment

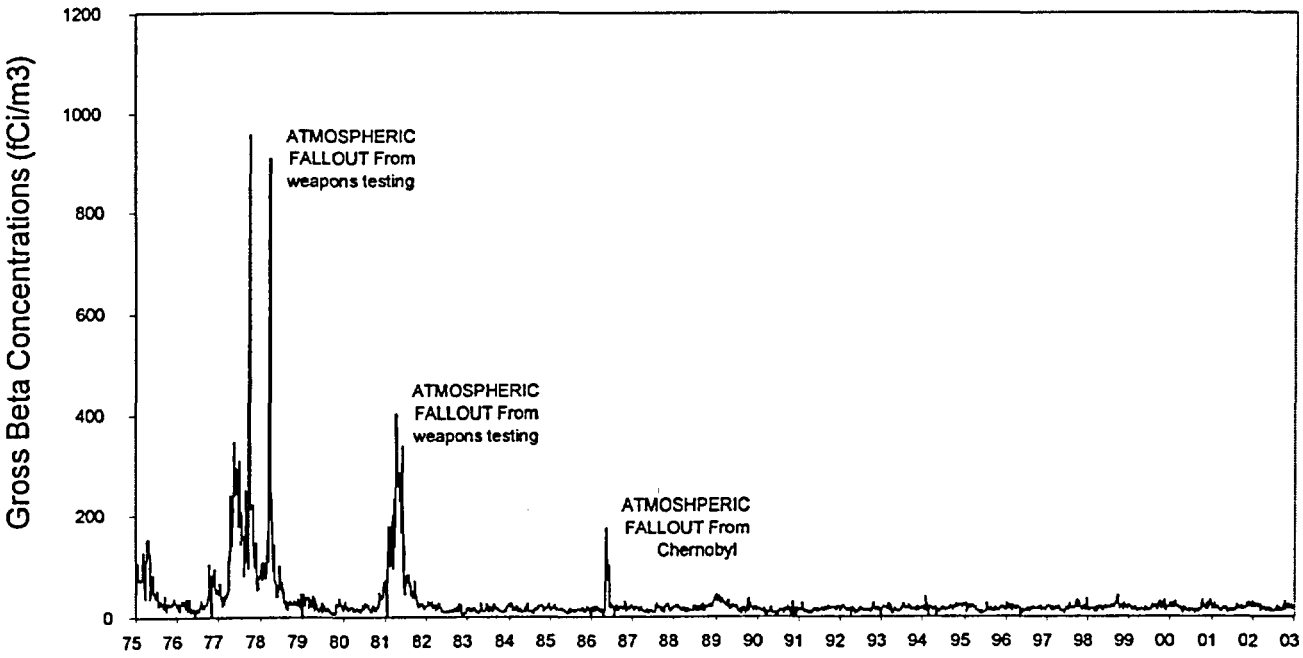
The terrestrial environment was monitored by analyzing samples of vegetation collected monthly, when available, from various sampling locations near the plant during the normal growing season.

Figure 3

Nuclear Fallout in the Calvert Cliffs Area

SURFACE AIR VAPORS, LUSBY, MD (A4)





II.C.3.a **Vegetation**

Nine 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.

Cesium-137 was detected at a concentration of 11±6 pCi/kg in a single broccoli sample from the EOF. This result is consistent with that found to be due to residual fallout in wind-borne soil dust from past atmospheric weapons testing (Ref. 22-53). No other detectable concentrations of plant-related radionuclides were found in any of these samples. All samples showed detectable amounts of naturally occurring K-40 in the ranges from 1424 to 3691 pCi/kg and naturally occurring Be-7 in the range of 52 to 322 pCi/kg.

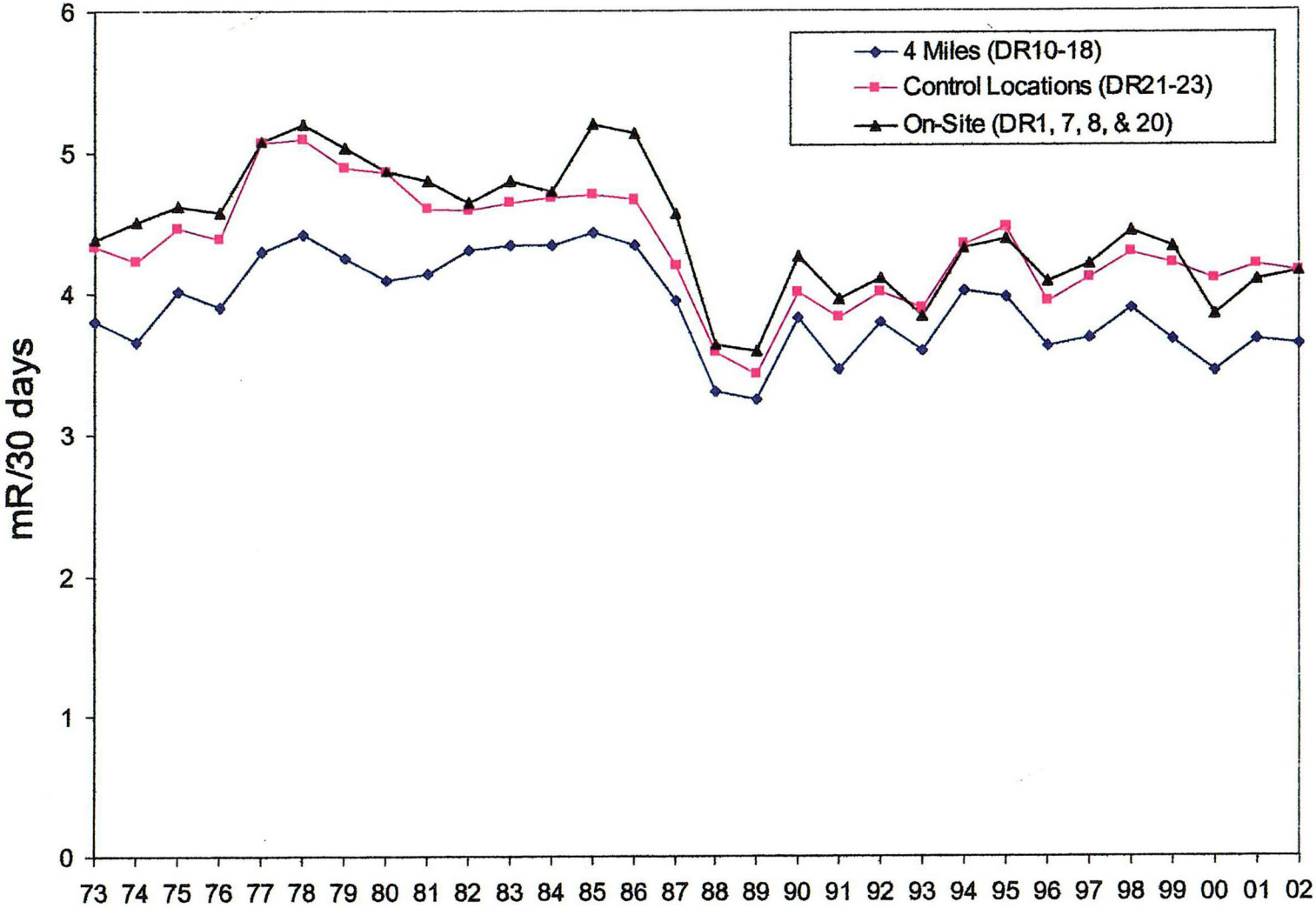
II.C.4 **Direct Radiation**

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, Carpenters Property (sample code DR23).

The mean 90 day ambient radiation measured at the indicator locations was 11.20 mR and ranged from 5.72 to 16.50 mR as reported in Table 2. The control locations showed a 90 day mean of 12.44 mR with ranges from 7.53 to 18.29 mR. The location with the highest overall mean of 15.43 was DR23, Taylors Island, Carpenters Property, which ranged from 11.72 to 18.29 mR. A comparison of the means and ranges of the current TLD data with those of both the historical data and the regional data (Ref. 22-53) shows no plant-related contribution to the measured direct radiation exposure for 2002. 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



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II.D. CONCLUSION

Low levels of various man-made fission by-products were observed in the environment surrounding the plant during 2002. Some of these observations were attributed to fallout from past atmospheric weapons testing. The others cited were related to the operation of the plant (e.g., tritium in quarterly composited bay water samples and Ag-110m in oysters).

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 during 2002.

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 1.19×10^{-3} mR to a child via the plume, ground, vegetable, meat, and inhalation pathways at 2.3 km SW of Calvert Cliffs. This is less than 0.01% of the acceptable limit of 75 mR/yr as specified in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

A maximum whole body gamma dose of 2.91×10^{-4} mR to a child at 2.1 km SE of Calvert Cliffs, which is about 0.001% of the acceptable dose limit of 25 mR/yr as specified in 40 CFR Part 190.

A maximum dose to any other organ, in this case the skin, of 9.40×10^{-4} mR to all age groups at 2.1 km SE of Calvert Cliffs. This is about 0.01% of the acceptable dose limit of 25 mR/yr as specified in 40 CFR Part 190.

Liquid Pathways

A maximum thyroid dose of 1.90×10^{-3} mR to a teenager for all liquid pathways, which is less than 0.01% of the acceptable dose limit of 75 mR/yr as specified in 40 CFR Part 190.

A maximum whole body dose of 7.19×10^{-3} mR to a child via all liquid pathways, which is about 0.03% of the acceptable dose limit of 25 mR/yr as stated in 40 CFR Part 190.

A maximum dose to any organ, in this case the GI-Tract, of 1.74×10^{-1} mR to an adult for all pathways, which is less than 1% of the acceptable dose limit of 25 mR/yr specified in 40 CFR Part 190.

Gaseous and Liquid Pathways Combined

A maximum thyroid dose of 3.09×10^{-3} mR via liquid and gaseous pathways, which is less than 0.01% of the acceptable limit of 75 mR/yr specified in 40 CFR Part 190.

A maximum whole body dose of 7.48×10^{-3} mR via liquid and gaseous pathways which is less than 0.1% of the acceptable limit of 25 mR/yr as specified in 40 CFR Part 190.

A maximum calculated dose to all other organs via liquid and gaseous pathways was equal to 1.74×10^{-1} mR to the GI-Tract. This dose is about 1% of the allowable limit of 25 mR/yr as specified in 40 CFR Part 190.

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

Therefore, it is concluded that the operation of Calvert Cliffs Units 1 & 2 produced radioactivity and ambient radiation levels significantly below the limits of the ODCM and 40 CFR Part 190, and there was no significant buildup of plant-related radionuclides in the environment due to the operation of the CCNPP.

FIGURE 5

Atmospheric Dispersion Around CCNPP 2002 Average Relative Air Concentrations

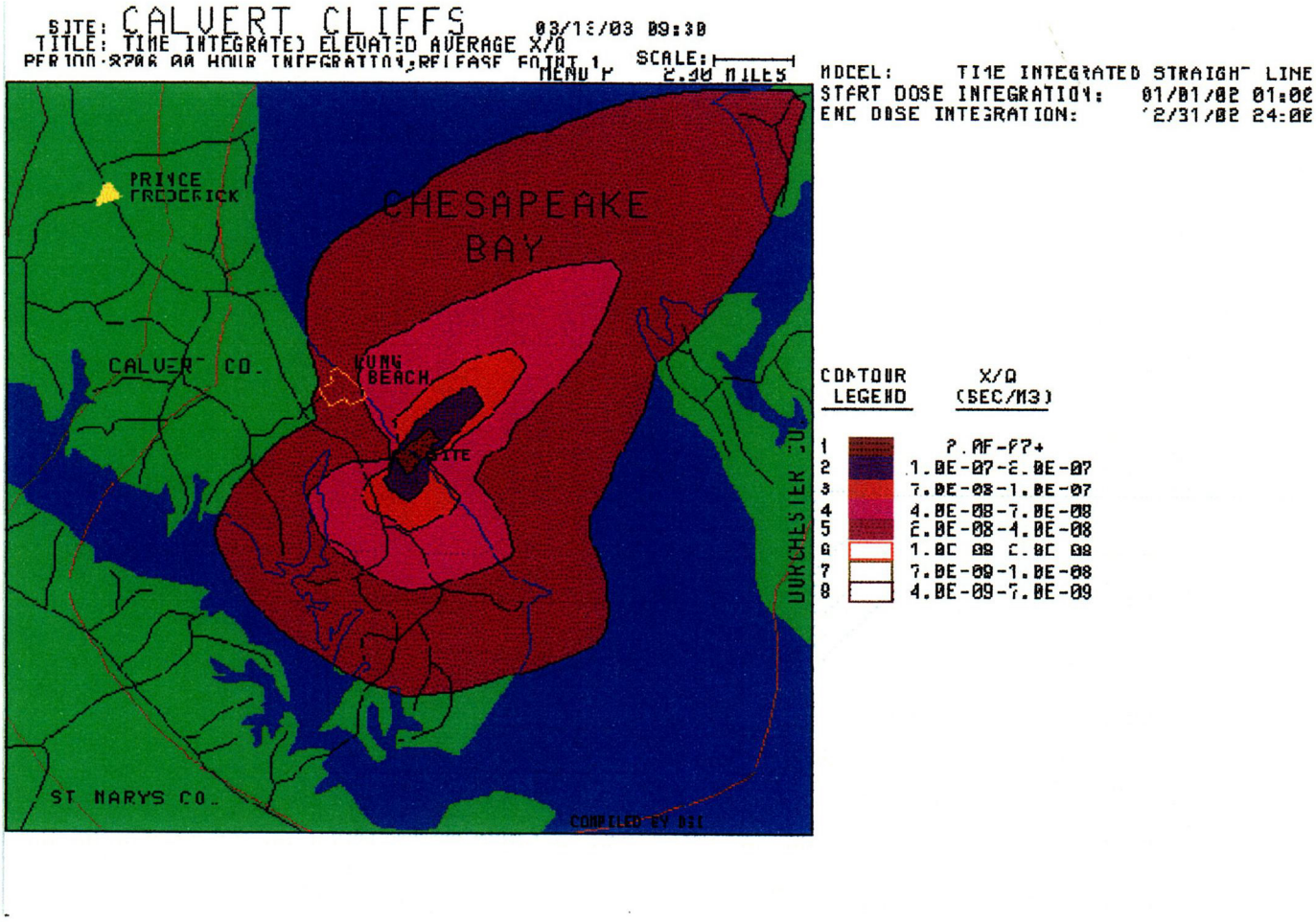

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FIGURE 6

Atmospheric Dispersion Around CCNPP 2002 Average Relative Ground Deposition

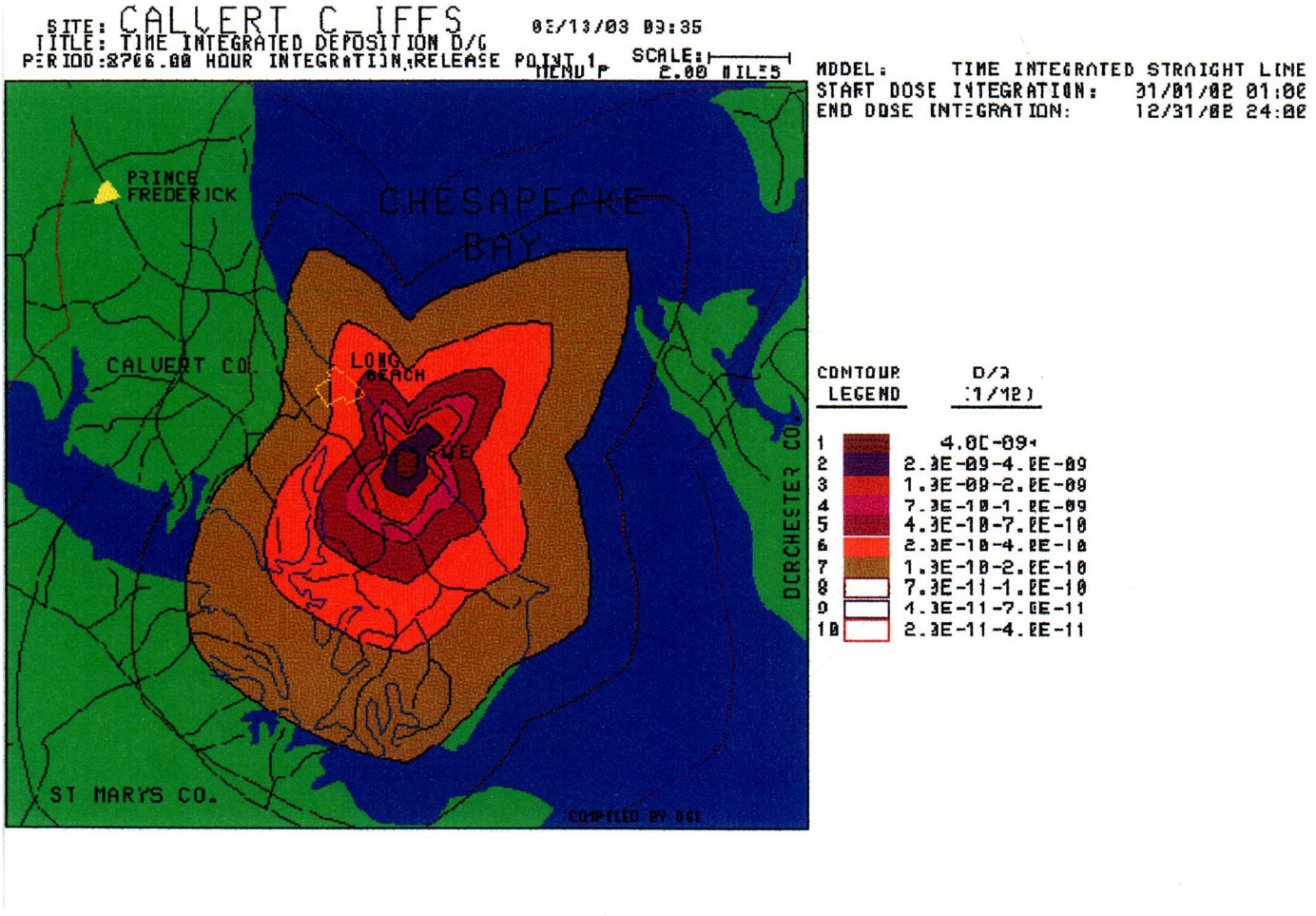

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Table 1
Synopsis of 2002 Calvert Cliffs Nuclear Power Plant Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Aquatic Environment						
Bay Water	MC	2	24	Gamma	M	24
				H-3	QC	8
Fish[2]	A	2	4	Gamma	A	4
Oysters	Q	2	8	Gamma	Q	8
Shoreline Sediment	SA	1	2	Gamma	SA	2
Atmospheric Environment						
Air Iodine[3]	W	5	258	I-131	W	258
Air Particulates[4]	W	5	256	Gross Beta	W	256
				Gamma	MC	60
Direct Radiation						
Ambient Radiation	Q	23	552	TLD	Q	552
Terrestrial Environment						
Vegetation[5]	M	3	36	Gamma	M	36

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

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[1]
Aquatic Environment						
Bay Water (pCi/L)	H-3 (8)	33	141 (2/4) (87-195)	Discharge Vicinity Wa2 0.3 km N	141 (2/4) (87-195)	67 (2/4) (49-84)
Oysters (pCi/kg)	Gamma (8) Ag110m	14	36 (4/4) (19-55)	Camp Conoy Ia3 0.9 km E	36 (4/4) (19-55)	<MDA
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (256)	0.5	1.6 (204/204) (0.2-5.1)	Entrance to Camp Conoy A1 0.7 km S	1.7 (51/52) (0.7-3.2)	1.6 (52/52) (0.9-2.8)
Terrestrial Environment						
Vegetation (pCi/kg)	Cs-137 (36)	27	<MDA(0/24) (<MDA)	Emergency Operations Facility Ib9 19.3 km WNW	11 (1/36) (<MDA-11)	11 (1/36) (<MDA-11)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (552)	-	11.20 (480/480) (5.72-16.50)	Taylors Island DR23 12.6 km ENE	15.43 (24/24) (11.72-18.29)	12.44 (72/72) (7.53-18.29)

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] From the centerpoint 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 ISFSI. The first dry fuel storage canister was loaded into the ISFSI in November of 1993, with more canisters being loaded in subsequent years. In the year 2002, four additional canisters of spent fuel were transferred to the ISFSI.

Results of the monitoring program for the ISFSI for the current period of January 1, 2002 through December 31, 2002 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 with the exception of the Pressurized Ion Chambers (PICs). PICs, because they duplicate direct surveillance by TLDs and because they experience problems with reliability, were excluded from the Technical Specification portion of the ISFSI monitoring program (Ref. 9). PIC results, however, are given in Table E-9 and will continue to be Non-ODCM surveillance to satisfy our commitment to the surrounding community.

The results for 2002 were compared with that generated during the previous ISFSI pre-operational periods (Ref. 10) and the current and previous CCNPP REMP periods (Ref. 22-53). These comparisons demonstrate the consistency of data throughout the CCNPP site, which are very close to the natural background levels for the region. More detailed discussions of these results are given in Section III. D.

Recently, all the historical sites associated with ISFSI that are depicted on the maps in Figures A-4 and A-5 were resurveyed using Global Positioning Systems and satellite imaging. As a result of this survey, the sector overlays depicted in previous representations of Figures A-4 and A-5 were found to be in error by about 15 degrees in the counter clockwise direction. This error was corrected based on this new survey and therefore some site sector designations were changed. These revisions are reflected in the current maps and table that appear in Figures A-4, A-5 and Table A-2.

III.B. PROGRAM

III.B.1 Objectives

The objectives of the REMP for the ISFSI are:

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

b. To verify that radioactivity and ambient radiation levels attributable to operation of the ISFSI are within the limits specified in the Environmental Radiation Protection Standards as stated in 40 CFR Part 190,

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,

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 CGG according to CGG Laboratory Procedures (Ref. 8).

III.B.3 Data Interpretation

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

III.B.4 Program Exceptions

There were no program exceptions during 2002

III.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year 2002 were analyzed using CGG's 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 (Ref. 22-53). These values ranged from 0.7×10^{-2} to 3.2×10^{-2} pCi/m^3 for the indicator locations and 1.0×10^{-2} to 4.3×10^{-2} pCi/m^3 for the control location. The location with the highest overall mean of 1.9×10^{-2} pCi/m^3 was SFA2, Visitor's Center.

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

III.C.2 **Terrestrial Environment**

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

III.C.2.a **Vegetation**

Vegetation samples were collected quarterly from five locations during the year. These locations are: Meteorological Station (sample code SFb1), CCNPP Visitor's Center (sample code SFb2), NNW of the ISFSI (sample code SFb3), SSE of the ISFSI (sample code SFb4), and On Site before the Entrance to Camp Conoy (sample code SFb5). These samples were analyzed for gamma emitters.

Cesium-137 was detected in three quarterly samples from both indicator and control locations. The Cs-137 concentration ranged from 16 ±6 to 24 ±8 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 in wind-borne soil dust from past atmospheric nuclear weapons testing (Ref. 22-53). No other detectable concentration of plant-related radionuclides were found in any of these

samples. Naturally occurring radionuclides such as K-40 which ranged from 306 to 7395 pCi/kg 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 thirteen quarterly samples from both indicator and control locations. The Cs-137 concentrations ranged from 49 ±25 to 866 ±71 pCi/kg. While the presence of Cs-137 in these samples may be plant-related, this range is consistent with that found to be due to the residual fallout from past atmospheric nuclear weapons testing. The activities of this radionuclide are well below the federal limits established in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" and are comparable to those observed in previous annual reporting periods for the CCNPP REMP (Ref. 22-53) and in the earlier pre-operational data for the ISFSI (Ref. 10). No other detectable concentrations of plant-related radionuclides were found in any of these samples. Naturally occurring radionuclides such as K-40, which ranged from 2031 to 8599 pCi/kg 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 seventeen 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); North 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); and SW of ISFSI, (sample code SFDR16). Sampling locations are shown on Figures A-4 and A-5.

The mean 90 day ambient radiation measured at the ISFSI indicator locations was 21.65 mR and ranged from 8.07 to 50.49 mR as reported in Table 4. The control location showed a 90 day mean of 13.45 mR and ranged from 12.09 to 14.93 mR. A comparison of the mean and ranges of the current TLD data with those of both the historical data and the regional data (22-53, 10) reveals only one set of elevated TLD readings. That location with the highest overall mean of 44.36 mR with a range of 35.34 to 50.49 mR was SFDR10, NW of ISFSI. These readings are consistent with those expected from the storage of spent fuel in the ISFSI (22-53, 10). 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 other plant-related radionuclide was observed in the environs of the ISFSI during 2002.

In general, the results in the following tables continue the historical trends previously observed at the official sites of the CCNPP REMP (Ref. 22-53).

FIGURE 7
Mean TLD Gamma Dose, ISFSI

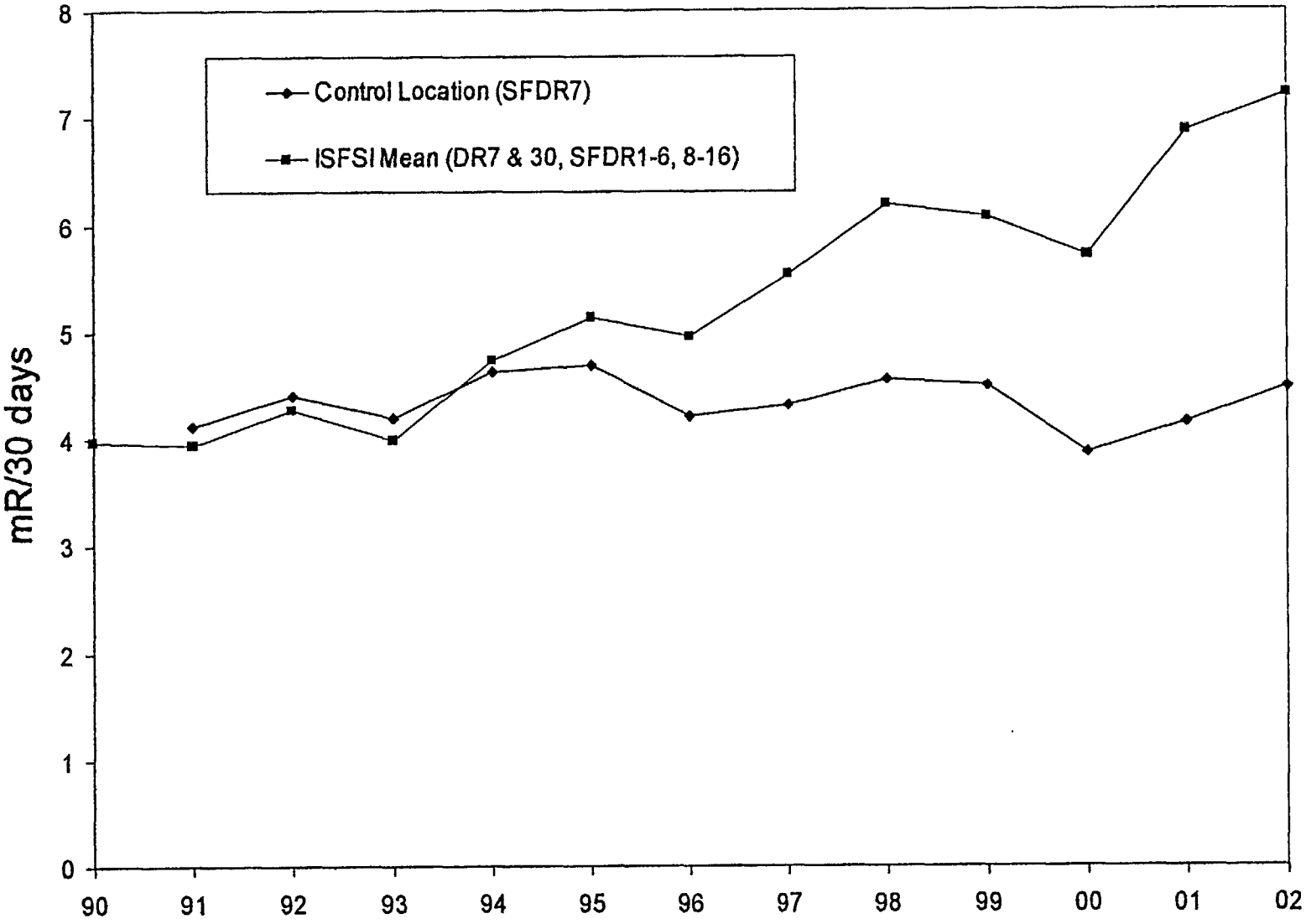

Table 3

Synopsis of 2002 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	258	Gross Beta	W	258
				Gamma	MC	60
Direct Radiation						
Ambient Radiation	Q	18	432	TLD	Q	432
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[1]
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (258)	0.5	1.7 (207/207) (0.7-3.2)	Visitors Center SFA2 0.7 km NNE	1.9 (51/52) (1.0-4.3)	1.9 (51/51) (1.0-4.3)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (432)	--	21.65 (408/408) (8.07-50.49)	NNW of ISFSI SFDR10 0.1 km NNW	44.36 (24/24) (35.34-50.49)	13.45 (24/24) (12.09-14.93)
Terrestrial Environment						
Vegetation (pCi/kg)	Gamma (20) Cs-137	27	21 (2/16) (18-24)	On Site before Entrance to Camp Conoy SFb5 0.7 km SE	21 (2/4) (18-24)	16 (1/4) --
Soil (pCi/kg)	Gamma (20) Cs-137	17	399 (9/16) (49-866)	NNW of ISFSI SFS3 0.1 km NNW	564 (4/4) (224-866)	144 (4/4) (108-232)

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

IV. REFERENCES

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APPENDIX A

Sample Locations for the REMP and the ISFSI

Appendix A contains information concerning the environmental samples which were collected during the period January 1, 2002 to December 31, 2002.

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 REMP 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.

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Sample Locations for the REMP and the ISFSI

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TABLE A-1
Locations of Environmental Sampling Stations
for the Calvert Cliffs Nuclear Power Plant

Station	Description	Distance[1]		Direction[1]
		(KM)	(Miles)	(Sector)
A1	On Site before Entrance to Camp Conoy	0.7	0.4	S
A2	Camp Conoy at Emergency Siren	2.5	1.6	SSE
A3	Bay Breeze Road	2.6	1.6	SE
A4	Route 765 Lusby	2.9	1.8	SSW
A5	Emergency Operations Facility (EOF)	19.3	12.0	WNW
DR1	On Site along Cliffs	0.6	0.4	NW
DR2	Route 765, Auto Dump	2.7	1.7	WNW
DR3	Route 765, Giovanni's Tavern (Knotty Pine)	2.3	1.4	W
DR4	Route 765, across from White Sands Drive	2.0	1.2	WSW
DR5	Route 765, John's Creek	2.4	1.5	SW
DR6	Route 765 Lusby	2.9	1.8	SSW
DR7[2]	On Site before Entrance to Camp Conoy	0.7	0.4	S
DR8	Camp Conoy at Emergency Siren	2.5	1.6	SSE
DR9	Bay Breeze Road	2.6	1.6	SE
DR10	Calvert Beach Rd. and Decatur Street	6.4	4.0	NW
DR11	Dirt road off Mackall & Parran Roads	6.6	4.1	WNW
DR12	Mackall and Bowen Roads	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 and Turner Roads	6.2	3.9	SSW
DR16	Across from Appeal School	6.5	4.0	S
DR17	Cove Point and Little Cove Point Roads	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, Carpenter's Property	12.6	7.8	ENE
Ia1,2	Discharge Area	0.3	0.2	N
Ia3	Camp Conoy	0.9	0.6	E
Ia4,5	Patuxent River	N/A	N/A	N/A
Ia6	Kenwood Beach	10.7	6.6	NNW
Ib1,2,3	Garden Off Bay Breeze Road	2.6	1.6	SSE
Ib4,5,6	On Site before Entrance to Camp Conoy	0.7	0.4	S
Ib7,8,9	Emergency Operations Facility (EOF)	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

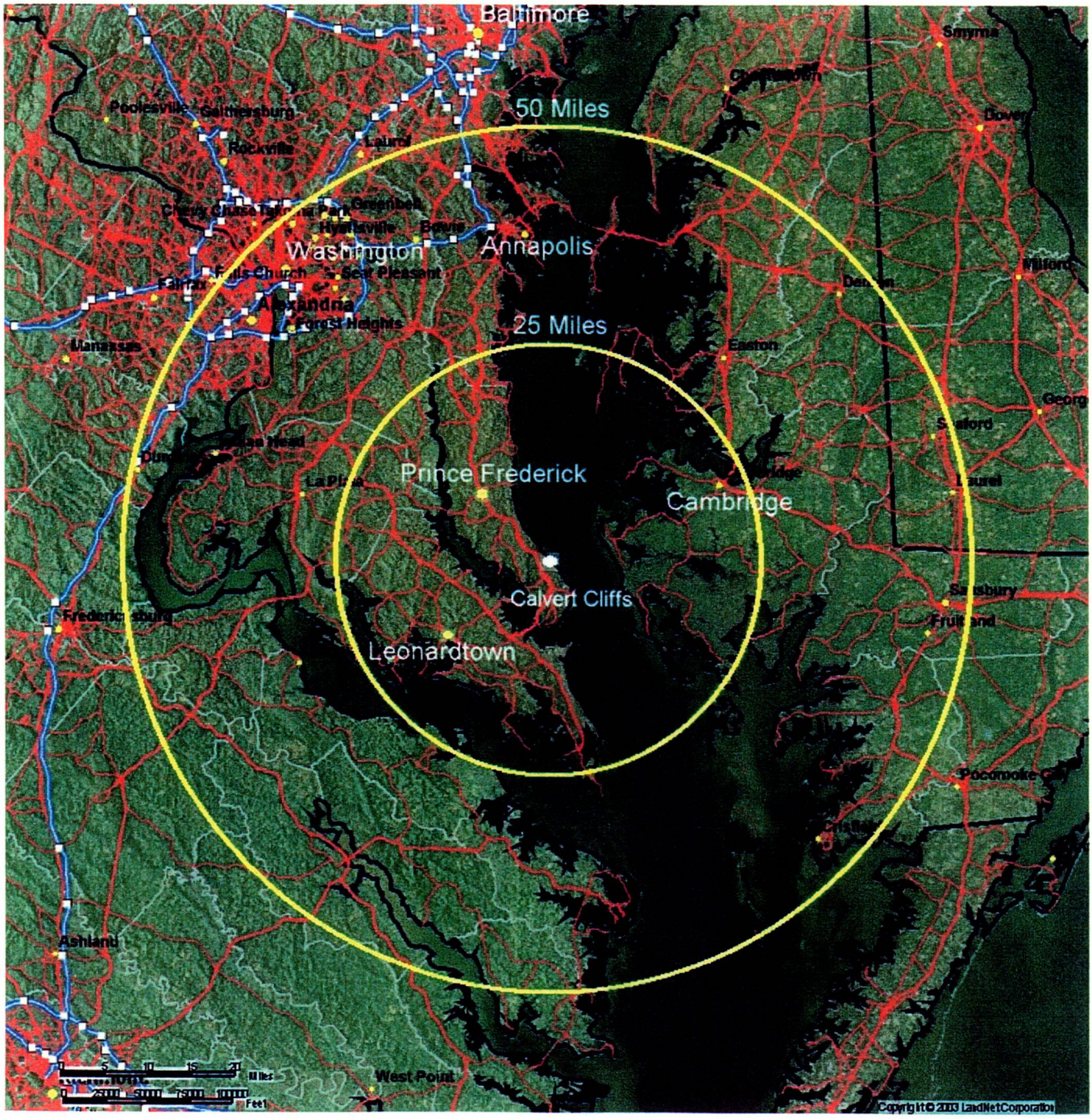

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FIGURE A-2
Calvert Cliffs Nuclear Power Plant Sampling Locations
0-2 Miles

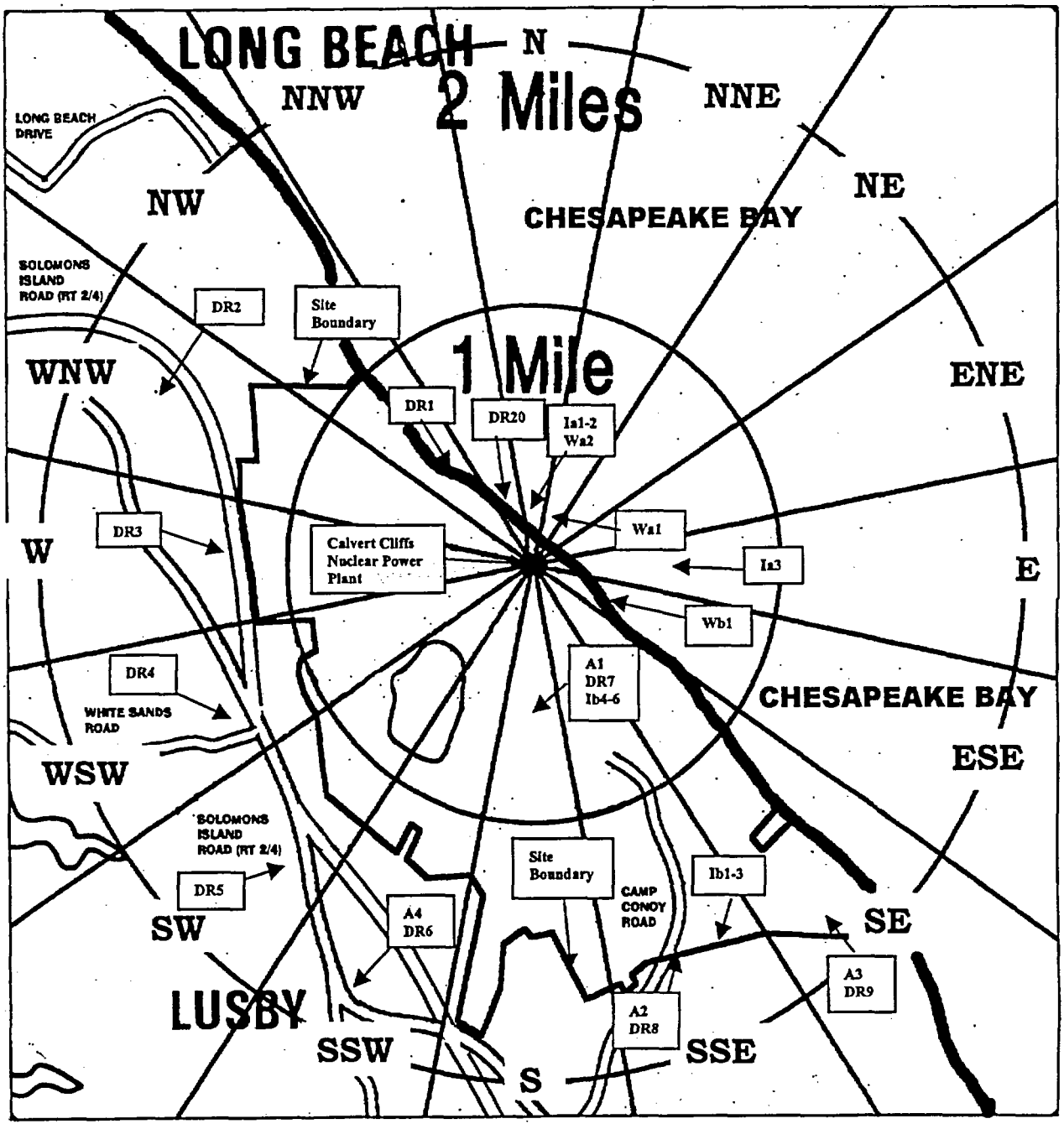

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FIGURE A-3
Calvert Cliffs Nuclear Power Plant Sampling Locations
0-10 Miles

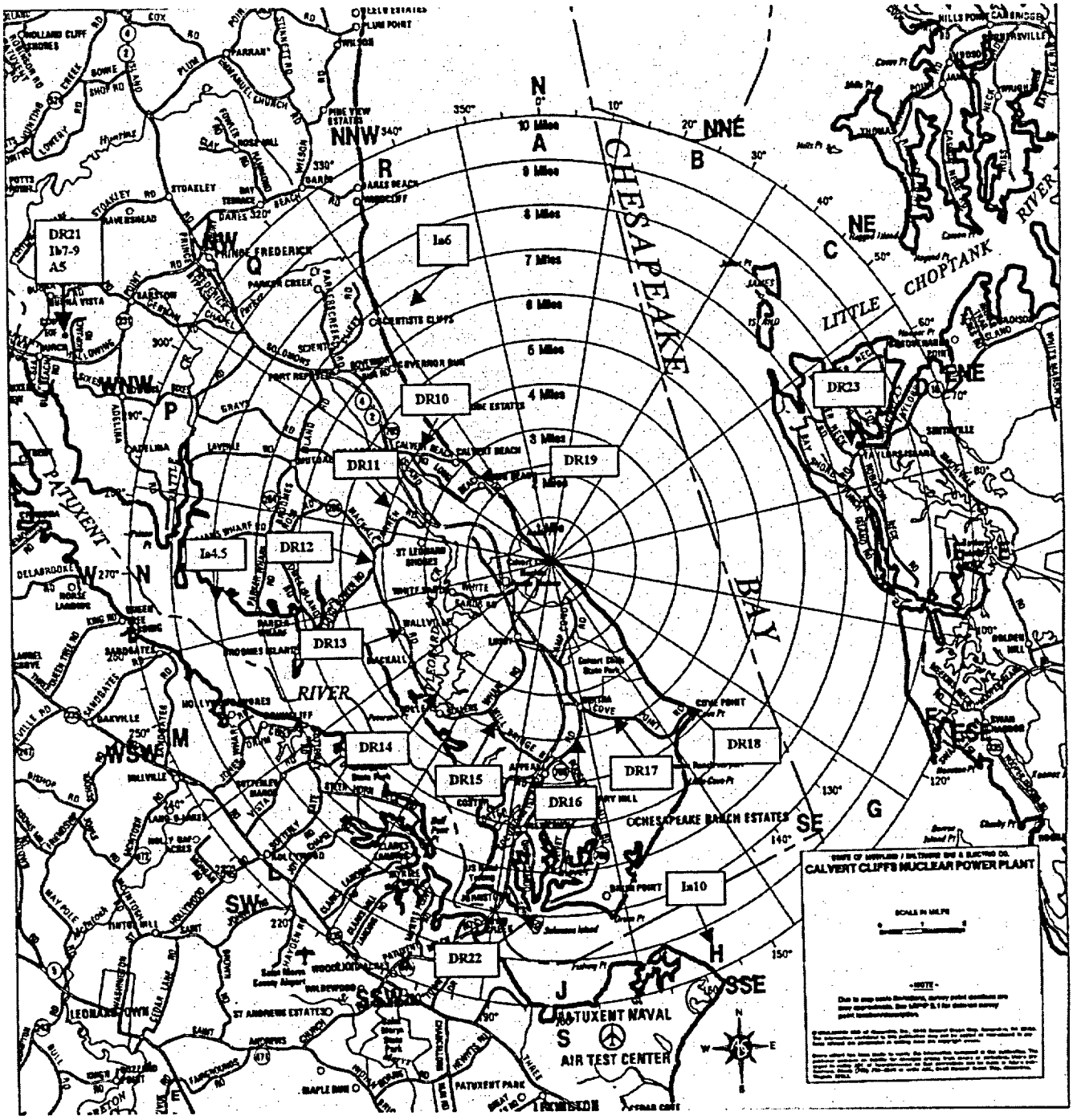

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TABLE A-2
Locations of Environmental Sampling Stations for the Independent Spent Fuel Storage Installation at Calvert Cliffs

Station	Description	Distance[1] (KM)	Direction[1] (Sector)
	Air Particulate		
A1[2]	On Site before Entrance to Camp Conoy	0.3	ESE
SFA1	Meteorological Station	0.3	NW
SFA2	CCNPP Visitor's Center	0.8	N
SFA3	NNW of ISFSI	0.1	NNW
SFA4	SSE of ISFSI	0.1	SSE
	Direct Radiation		
SFDR1	SW of ISFSI	0.2	SW
SFDR2	North of ISFSI	0.2	N
SFDR3	North of ISFSI	0.1	N
SFDR4	NE of ISFSI	0.1	NE
SFDR5	East of ISFSI	0.1	E
SFDR6	ESE of ISFSI	0.1	ESE
SFDR7	CCNPP Visitor's Center	0.8	N
SFDR8	NNW of ISFSI	0.1	NNW
SFDR9	SSE of ISFSI	0.1	SSE
SFDR10	NW of ISFSI	0.1	NW
SFDR11	WNW of ISFSI	0.1	WNW
SFDR12	WSW of ISFSI	0.04	WSW
SFDR13	South of ISFSI	0.1	S
SFDR14	SE of ISFSI	0.1	SE
SFDR15	ENE of ISFSI	0.1	ENE
SFDR16	SW of ISFSI	0.04	SW
DR7[2]	On Site before Entrance to Camp Conoy	0.3	ESE
DR30[3]	Meteorological Station	0.3	NW
	Vegetation		
SFb1	Meteorological Station	0.3	NW
SFb2	CCNPP Visitor's Center	0.8	N
SFb3	NNW of ISFSI	0.1	NNW
SFb4	SSE of ISFSI	0.1	SSE
SFb5	On Site before Entrance to Camp Conoy	0.3	ESE
	Soil		
SFS1	Meteorological Station	0.3	NW
SFS2	CCNPP Visitor's Center	0.8	N
SFS3	NNW of ISFSI	0.1	NNW
SFS4	SSE of ISFSI	0.1	SSE
SFS5	On Site before Entrance to Camp Conoy	0.3	ESE

[1] Distance and direction from the central point of the ISFSI
[2] Common to both REMP and ISFSI monitoring program
[3] Formerly, part of the historical non-ODCM monitoring program. DR30 became a Tech Spec location when it was designated part of the ISFSI program

FIGURE A-4
Independent Spent Fuel Storage Installation Sampling Locations

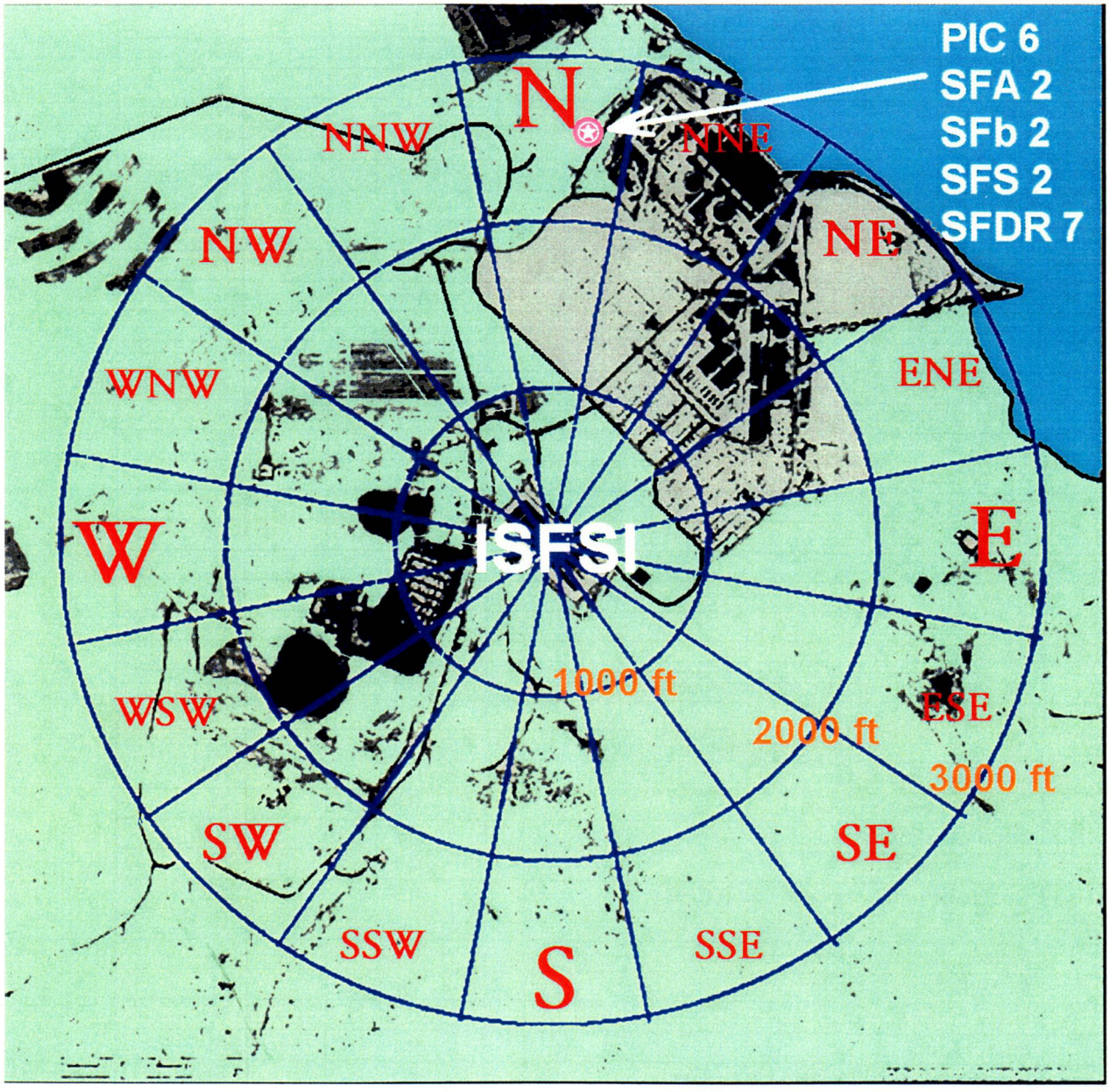

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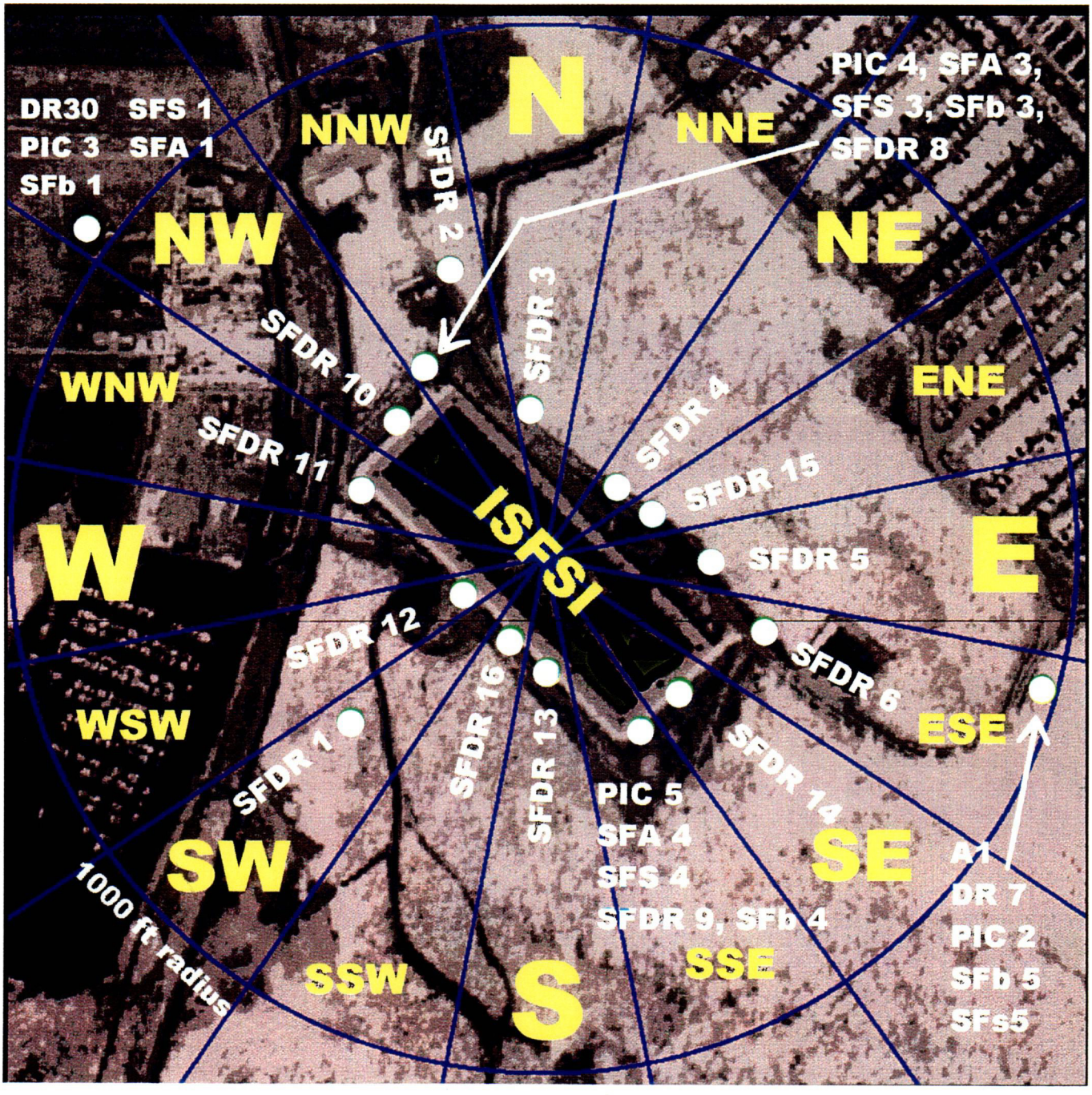
FIGURE A-5
Enlarged Map of the Independent Spent Fuel Storage Installation
Sampling Locations



C06

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APPENDIX B

Analysis Results for the REMP and the ISFSI

Appendix B is a presentation of the analytical results of the 2002 CCNPP and the ISFSI radiological environmental monitoring programs.

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TABLE OF CONTENTS

Analysis Results for the REMP and the ISFSI

Table B-1

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

Sample Code	Sample Date	H-3[1]	Gamma Emitters
Wa1	02/01/2002		*
Intake Vicinity	02/28/2002		*
	03/29/2002		*
	03/30/2002	49 ± 37	
	04/30/2002		*
	05/29/2002		*
	06/28/2002		*
	06/30/2002	<38	
	07/31/2002		*
	08/30/2002		*
	09/30/2002	<37	*
	11/01/2002		*
	12/02/2002		*
	12/31/2002	84 ± 35	*
Wa2	02/01/2002		*
Discharge Vicinity	02/28/2002		*
	03/29/2002		*
	03/30/2002	195 ± 39	
	04/30/2002		*
	05/29/2002		*
	06/28/2002		*
	06/30/2002	<38	
	07/31/2002		*
	08/30/2002		*
	09/30/2002	<37	*
	11/01/2002		*
	12/02/2002		*
	12/31/2002	87 ± 36	*

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

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	08/22/2002	Croaker	*
Ia2 Discharge Area	09/02/2002	Spot	*
Ia4[1] Patuxent River	08/04/2002	Croaker	*
Ia5[1] Patuxent River	08/04/2002	Spot	*

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

Table B-3

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

Sample Code	Sample Date	Ag-110m	Gamma Emitters
Ia3	03/19/2002	42 ± 8	*
Camp Conoy	06/14/2002	19 ± 7	*
	09/04/2002	55 ± 8	*
	10/22/2002	27 ± 7	*
Ia6[1]	03/19/2002	[2]	*
Kenwood	06/14/2002	[2]	*
Beach	09/04/2002	[2]	*
	10/22/2002	[2]	*

* All Other Non-Natural Gamma Emitters < MDA
[1] Control Location
[2] This Isotope < 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	02/25/2002	[1]
Shoreline at Barge Rd.	12/16/2002	[1]

[1] Non-Natural Gamma Emitters <MDA

Table B-5

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

Start Date	Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
12/31/2001	01/07/2002	*	*	*	*	*
01/07/2002	01/14/2002	*	*	*	*	*
01/14/2002	01/21/2002	*	*	[2]	*	*
01/21/2002	01/28/2002	*	*	*	*	*
01/28/2002	02/04/2002	*	*	*	*	*
02/04/2002	02/11/2002	*	*	*	*	*
02/11/2002	02/19/2002	*	*	*	*	*
02/19/2002	02/25/2002	*	*	*	*	*
02/25/2002	03/04/2002	*	*	*	*	*
03/04/2002	03/11/2002	*	*	*	*	*
03/11/2002	03/18/2002	*	*	*	*	*
03/18/2002	03/25/2002	*	*	*	*	*
03/25/2002	04/01/2002	*	*	*	*	*
04/01/2002	04/08/2002	*	*	*	*	*
04/08/2002	04/15/2002	*	*	*	*	*
04/15/2002	04/22/2002	*	*	*	*	*
04/22/2002	04/29/2002	*	*	*	*	*
04/29/2002	05/06/2002	*	*	*	*	*
05/06/2002	05/13/2002	*	*	*	*	*
05/13/2002	05/20/2002	*	*	*	*	*
05/20/2002	05/28/2002	*	*	*	*	*
05/28/2002	06/03/2002	*	*	*	*	*
06/03/2002	06/10/2002	*	*	*	*	*
06/10/2002	06/17/2002	*	*	*	*	*
06/17/2002	06/24/2002	*	*	*	*	*
06/24/2002	07/01/2002	*	*	*	*	*
07/01/2002	07/08/2002	*	*	*	*	*
07/08/2002	07/15/2002	*	*	*	*	*
07/15/2002	07/22/2002	*	*	*	*	*
07/22/2002	07/29/2002	*	*	*	*	*

* < MDA
[1] Control Location
[2] Sampler malfunction/low flow

Table B-5 - Continued

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
07/29/2002	08/05/2002	*	*	*	*	*
08/05/2002	08/12/2002	*	*	*	*	*
08/12/2002	08/19/2002	*	*	*	*	*
08/19/2002	08/26/2002	*	*	*	*	*
08/26/2002	09/03/2002	*	*	*	*	*
09/03/2002	09/09/2002	[1]	*	*	*	*
09/09/2002	09/16/2002	*	*	*	*	*
09/16/2002	09/23/2002	*	*	*	*	*
09/23/2002	09/30/2002	*	*	*	*	*
09/30/2002	10/07/2002	*	*	*	*	*
10/07/2002	10/14/2002	*	*	*	*	*
10/14/2002	10/21/2002	*	*	*	*	*
10/21/2002	10/28/2002	*	*	*	*	*
10/28/2002	11/04/2002	*	*	*	*	*
11/04/2002	11/11/2002	*	*	*	*	*
11/11/2002	11/18/2002	*	*	*	*	*
11/18/2002	11/25/2002	*	*	*	*	*
11/25/2002	12/02/2002	*	*	*	*	*
12/02/2002	12/09/2002	*	*	*	*	*
12/09/2002	12/16/2002	*	*	*	*	*
12/16/2002	12/23/2002	*	*	*	*	*
12/23/2002	12/30/2002	*	*	*	*	*

* < MDA
[1] Sampler malfunction/low flow

Table B-6

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

Start Date	Stop Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
12/31/2001	01/07/2002	1.5 ± 0.2	2.5 ± 0.3	1.5 ± 0.2	1.7 ± 0.2	2.1 ± 0.2
01/07/2002	01/14/2002	2.2 ± 0.2	2.5 ± 0.3	1.9 ± 0.2	2.5 ± 0.3	2.3 ± 0.2
01/14/2002	01/21/2002	2.1 ± 0.2	2.3 ± 0.3	[2]	1.8 ± 0.2	1.8 ± 0.2
01/21/2002	01/28/2002	1.9 ± 0.2	2.0 ± 0.2	1.7 ± 0.2	1.8 ± 0.2	1.8 ± 0.2
01/28/2002	02/04/2002	1.7 ± 0.2	1.9 ± 0.3	1.6 ± 0.2	1.7 ± 0.2	1.7 ± 0.2
02/04/2002	02/11/2002	2.3 ± 0.2	1.7 ± 0.3	2.4 ± 0.2	2.6 ± 0.2	2.5 ± 0.3
02/11/2002	02/19/2002	1.8 ± 0.2	2.5 ± 0.3	1.9 ± 0.2	1.8 ± 0.2	1.7 ± 0.2
02/19/2002	02/25/2002	2.0 ± 0.2	3.0 ± 0.4	1.8 ± 0.2	1.8 ± 0.2	1.9 ± 0.2
02/25/2002	03/04/2002	1.7 ± 0.2	3.1 ± 0.4	1.8 ± 0.2	1.8 ± 0.2	1.8 ± 0.2
03/04/2002	03/11/2002	2.8 ± 0.3	5.1 ± 0.5	2.6 ± 0.3	2.2 ± 0.2	2.6 ± 0.3
03/11/2002	03/18/2002	1.5 ± 0.2	1.6 ± 0.2	1.5 ± 0.2	1.0 ± 0.2	1.3 ± 0.2
03/18/2002	03/25/2002	2.0 ± 0.2	2.0 ± 0.2	[2]	1.7 ± 0.2	1.9 ± 0.2
03/25/2002	04/01/2002	1.8 ± 0.2	1.6 ± 0.2	3.0 ± 0.3	1.3 ± 0.2	1.3 ± 0.2
04/01/2002	04/08/2002	2.0 ± 0.2	1.7 ± 0.2	1.6 ± 0.2	1.7 ± 0.2	1.7 ± 0.2
04/08/2002	04/15/2002	1.6 ± 0.2	1.5 ± 0.2	1.3 ± 0.2	1.5 ± 0.2	1.5 ± 0.2
04/15/2002	04/22/2002	1.4 ± 0.2	1.2 ± 0.2	1.1 ± 0.2	1.0 ± 0.2	1.1 ± 0.2
04/22/2002	04/29/2002	1.1 ± 0.2	0.9 ± 0.2	0.9 ± 0.2	1.0 ± 0.2	0.9 ± 0.2
04/29/2002	05/06/2002	1.2 ± 0.2	1.0 ± 0.2	1.0 ± 0.2	1.1 ± 0.2	1.0 ± 0.2
05/06/2002	05/13/2002	1.6 ± 0.2	1.2 ± 0.2	1.2 ± 0.2	1.5 ± 0.2	1.6 ± 0.2
05/13/2002	05/20/2002	1.0 ± 0.2	0.8 ± 0.2	0.9 ± 0.2	1.3 ± 0.2	1.4 ± 0.2
05/20/2002	05/28/2002	1.1 ± 0.1	1.2 ± 0.2	1.0 ± 0.2	1.2 ± 0.1	1.3 ± 0.2
05/28/2002	06/03/2002	1.7 ± 0.2	1.2 ± 0.2	2.1 ± 0.3	1.5 ± 0.2	1.8 ± 0.2
06/03/2002	06/10/2002	0.9 ± 0.1	0.6 ± 0.2	1.3 ± 0.3	0.7 ± 0.1	1.4 ± 0.2
06/10/2002	06/17/2002	0.7 ± 0.1	0.7 ± 0.3	1.2 ± 0.2	1.3 ± 0.2	1.2 ± 0.2
06/17/2002	06/24/2002	0.9 ± 0.1	0.2 ± 0.0	0.8 ± 0.2	0.9 ± 0.1	1.0 ± 0.2
06/24/2002	07/01/2002	1.4 ± 0.2	[2]	0.9 ± 0.2	0.9 ± 0.1	0.9 ± 0.2
07/01/2002	07/08/2002	1.9 ± 0.2	1.1 ± 0.3	1.2 ± 0.2	1.2 ± 0.2	1.4 ± 0.2
07/08/2002	07/15/2002	1.2 ± 0.2	0.4 ± 0.2	0.9 ± 0.2	0.9 ± 0.2	1.2 ± 0.2
07/15/2002	07/22/2002	2.1 ± 0.2	1.3 ± 0.2	2.0 ± 0.2	1.0 ± 0.2	1.4 ± 0.2
07/22/2002	07/29/2002	1.1 ± 0.1	0.7 ± 0.2	1.3 ± 0.2	1.1 ± 0.2	1.3 ± 0.2

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

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	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
07/29/2002	08/05/2002	1.8 ± 0.2	1.1 ± 0.2	2.4 ± 0.3	2.0 ± 0.2	2.1 ± 0.2
08/05/2002	08/12/2002	0.8 ± 0.2	0.6 ± 0.3	1.1 ± 0.2	1.0 ± 0.1	1.0 ± 0.2
08/12/2002	08/19/2002	1.6 ± 0.2	1.0 ± 0.2	1.8 ± 0.2	1.4 ± 0.1	1.0 ± 0.2
08/19/2002	08/26/2002	1.7 ± 0.2	2.1 ± 0.2	2.0 ± 0.3	1.9 ± 0.2	2.8 ± 0.3
08/26/2002	09/03/2002	1.0 ± 0.1	1.1 ± 0.1	1.0 ± 0.2	0.9 ± 0.1	1.1 ± 0.2
09/03/2002	09/09/2002	[2]	1.3 ± 0.2	1.7 ± 0.3	1.3 ± 0.2	1.7 ± 0.2
09/09/2002	09/16/2002	1.0 ± 0.2	0.9 ± 0.2	1.6 ± 0.3	1.0 ± 0.2	1.4 ± 0.2
09/16/2002	09/23/2002	2.2 ± 0.2	1.8 ± 0.2	2.2 ± 0.3	1.9 ± 0.2	1.9 ± 0.3
09/23/2002	09/30/2002	1.7 ± 0.2	1.4 ± 0.2	2.0 ± 0.2	1.5 ± 0.2	1.4 ± 0.2
09/30/2002	10/07/2002	2.4 ± 0.2	2.1 ± 0.2	2.4 ± 0.3	2.9 ± 0.3	1.6 ± 0.2
10/07/2002	10/14/2002	1.2 ± 0.2	1.2 ± 0.2	1.1 ± 0.2	1.1 ± 0.1	1.3 ± 0.2
10/14/2002	10/21/2002	2.3 ± 0.2	1.8 ± 0.3	1.6 ± 0.2	1.6 ± 0.2	1.5 ± 0.2
10/21/2002	10/28/2002	1.7 ± 0.2	1.6 ± 0.2	1.4 ± 0.2	1.5 ± 0.2	1.4 ± 0.2
10/28/2002	11/04/2002	2.1 ± 0.2	1.7 ± 0.2	2.1 ± 0.2	1.9 ± 0.2	2.3 ± 0.2
11/04/2002	11/11/2002	2.2 ± 0.2	2.1 ± 0.3	1.7 ± 0.2	2.4 ± 0.2	1.9 ± 0.2
11/11/2002	11/18/2002	1.5 ± 0.3	1.1 ± 0.3	1.0 ± 0.2	1.4 ± 0.2	1.7 ± 0.2
11/18/2002	11/25/2002	2.1 ± 0.2	1.5 ± 0.3	1.3 ± 0.2	1.9 ± 0.2	1.9 ± 0.2
11/25/2002	12/02/2002	2.0 ± 0.2	1.4 ± 0.2	1.2 ± 0.2	1.7 ± 0.2	1.8 ± 0.2
12/02/2002	12/09/2002	3.2 ± 0.3	1.9 ± 0.3	1.8 ± 0.2	2.1 ± 0.2	1.7 ± 0.2
12/09/2002	12/16/2002	1.5 ± 0.2	1.1 ± 0.3	1.6 ± 0.2	1.2 ± 0.2	1.1 ± 0.2
12/16/2002	12/23/2002	1.7 ± 0.2	1.2 ± 0.2	1.2 ± 0.2	1.6 ± 0.2	1.5 ± 0.2
12/23/2002	12/30/2002	2.1 ± 0.2	1.4 ± 0.2	1.4 ± 0.2	2.0 ± 0.2	1.4 ± 0.2

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

Table B-6 - Continued

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

Start Date	Stop Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
12/31/2001	01/07/2002	1.5 ± 0.2	1.3 ± 0.2	2.1 ± 0.2	1.7 ± 0.2
01/07/2002	01/14/2002	2.0 ± 0.2	2.3 ± 0.2	2.3 ± 0.2	2.0 ± 0.2
01/14/2002	01/21/2002	1.5 ± 0.2	1.4 ± 0.2	1.8 ± 0.2	2.0 ± 0.2
01/21/2002	01/28/2002	1.8 ± 0.2	1.8 ± 0.2	1.9 ± 0.2	2.0 ± 0.2
01/28/2002	02/04/2002	1.6 ± 0.2	1.7 ± 0.2	1.6 ± 0.2	1.8 ± 0.2
02/04/2002	02/11/2002	2.3 ± 0.2	2.2 ± 0.2	2.5 ± 0.2	2.6 ± 0.3
02/11/2002	02/19/2002	1.8 ± 0.2	1.8 ± 0.2	1.9 ± 0.2	2.0 ± 0.2
02/19/2002	02/25/2002	1.8 ± 0.2	1.9 ± 0.2	1.8 ± 0.2	2.2 ± 0.3
02/25/2002	03/04/2002	1.6 ± 0.2	2.0 ± 0.2	2.0 ± 0.2	1.9 ± 0.2
03/04/2002	03/11/2002	2.4 ± 0.2	2.5 ± 0.2	2.5 ± 0.3	2.7 ± 0.3
03/11/2002	03/18/2002	1.1 ± 0.2	1.2 ± 0.2	1.3 ± 0.2	1.2 ± 0.2
03/18/2002	03/25/2002	1.8 ± 0.2	[2]	1.9 ± 0.2	2.0 ± 0.2
03/25/2002	04/01/2002	1.3 ± 0.2	2.7 ± 0.2	1.7 ± 0.2	2.0 ± 0.3
04/01/2002	04/08/2002	1.6 ± 0.2	1.7 ± 0.2	1.6 ± 0.2	2.0 ± 0.2
04/08/2002	04/15/2002	1.2 ± 0.2	1.5 ± 0.2	1.5 ± 0.2	1.7 ± 0.2
04/15/2002	04/22/2002	1.5 ± 0.2	1.3 ± 0.2	1.5 ± 0.2	1.9 ± 0.2
04/22/2002	04/29/2002	1.2 ± 0.2	1.0 ± 0.2	1.3 ± 0.2	1.5 ± 0.2
04/29/2002	05/06/2002	1.1 ± 0.2	1.0 ± 0.2	1.5 ± 0.2	1.0 ± 0.2
05/06/2002	05/13/2002	1.7 ± 0.2	1.6 ± 0.2	1.9 ± 0.2	1.9 ± 0.2
05/13/2002	05/20/2002	1.0 ± 0.2	1.4 ± 0.2	1.6 ± 0.2	1.1 ± 0.2
05/20/2002	05/28/2002	1.3 ± 0.2	1.4 ± 0.2	1.4 ± 0.2	1.4 ± 0.2
05/28/2002	06/03/2002	2.0 ± 0.2	1.9 ± 0.2	1.9 ± 0.2	1.6 ± 0.2
06/03/2002	06/10/2002	1.3 ± 0.2	1.2 ± 0.2	1.3 ± 0.2	1.3 ± 0.2
06/10/2002	06/17/2002	1.3 ± 0.2	1.0 ± 0.1	1.3 ± 0.2	1.2 ± 0.2
06/17/2002	06/24/2002	1.1 ± 0.2	1.2 ± 0.2	1.4 ± 0.2	1.8 ± 0.3
06/24/2002	07/01/2002	1.3 ± 0.2	1.2 ± 0.2	1.0 ± 0.2	0.9 ± 0.2
07/01/2002	07/08/2002	1.9 ± 0.2	2.8 ± 0.3	1.7 ± 0.2	1.4 ± 0.2
07/08/2002	07/15/2002	1.6 ± 0.2	2.3 ± 0.3	1.1 ± 0.2	0.8 ± 0.2
07/15/2002	07/22/2002	2.4 ± 0.2	3.2 ± 0.3	2.7 ± 0.2	2.3 ± 0.2
07/22/2002	07/29/2002	1.3 ± 0.2	1.2 ± 0.2	1.4 ± 0.2	1.3 ± 0.2
07/29/2002	08/05/2002	2.4 ± 0.2	4.3 ± 0.4	2.4 ± 0.2	2.2 ± 0.2
08/05/2002	08/12/2002	1.4 ± 0.2	1.5 ± 0.2	1.3 ± 0.2	1.0 ± 0.1
08/12/2002	08/19/2002	1.9 ± 0.2	2.2 ± 0.2	1.9 ± 0.2	1.5 ± 0.2
08/19/2002	08/26/2002	1.9 ± 0.2	2.6 ± 0.3	1.4 ± 0.2	2.0 ± 0.2
08/26/2002	09/03/2002	1.1 ± 0.2	1.1 ± 0.2	0.7 ± 0.1	1.4 ± 0.1

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

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
09/03/2002	09/09/2002	1.4 ± 0.2	1.9 ± 0.2	1.4 ± 0.2	1.4 ± 0.2
09/09/2002	09/16/2002	1.1 ± 0.2	2.1 ± 0.3	1.3 ± 0.2	1.3 ± 0.2
09/16/2002	09/23/2002	2.6 ± 0.2	3.1 ± 0.3	2.3 ± 0.2	1.9 ± 0.2
09/23/2002	09/30/2002	2.0 ± 0.2	2.2 ± 0.2	1.5 ± 0.2	1.3 ± 0.2
09/30/2002	10/07/2002	3.0 ± 0.3	3.3 ± 0.3	2.6 ± 0.2	2.1 ± 0.2
10/07/2002	10/14/2002	1.2 ± 0.2	1.5 ± 0.2	1.3 ± 0.2	1.1 ± 0.1
10/14/2002	10/21/2002	2.3 ± 0.2	2.5 ± 0.2	1.7 ± 0.2	1.8 ± 0.2
10/21/2002	10/28/2002	1.6 ± 0.2	1.7 ± 0.2	1.7 ± 0.2	1.3 ± 0.2
10/28/2002	11/04/2002	2.6 ± 0.3	2.1 ± 0.2	2.2 ± 0.2	1.8 ± 0.2
11/04/2002	11/11/2002	1.8 ± 0.2	2.2 ± 0.2	1.9 ± 0.2	1.3 ± 0.2
11/11/2002	11/18/2002	1.3 ± 0.2	1.4 ± 0.2	0.9 ± 0.2	1.3 ± 0.2
11/18/2002	11/25/2002	2.3 ± 0.3	2.0 ± 0.2	2.0 ± 0.2	1.7 ± 0.2
11/25/2002	12/02/2002	2.1 ± 0.2	1.7 ± 0.2	1.8 ± 0.2	1.5 ± 0.2
12/02/2002	12/09/2002	2.4 ± 0.2	1.9 ± 0.2	2.1 ± 0.2	2.0 ± 0.2
12/09/2002	12/16/2002	1.5 ± 0.2	1.3 ± 0.2	1.1 ± 0.2	1.4 ± 0.2
12/16/2002	12/23/2002	2.1 ± 0.2	1.4 ± 0.2	1.5 ± 0.2	1.4 ± 0.2
12/23/2002	12/30/2002	2.3 ± 0.2	2.1 ± 0.2	1.7 ± 0.2	1.7 ± 0.2

[1] Control Location

Table B-7

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

Sample Date	A1 Entrance to Camp Conoy	A2 Camp Conoy Siren	A3 Bay Breeze Rd	A4 Route 765 at Lusby	A5[1] EOF
01/15/2002	*	*	*	*	*
02/15/2002	*	*	*	*	*
03/15/2002	*	*	*	*	*
04/15/2002	*	*	*	*	*
05/15/2002	*	*	*	*	*
06/15/2002	*	*	*	*	*
07/15/2002	*	*	*	*	*
08/15/2002	*	*	*	*	*
09/15/2002	*	*	*	*	*
10/15/2002	*	*	*	*	*
11/15/2002	*	*	*	*	*
12/15/2002	*	*	*	*	*

Sample Date	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
01/15/2002	*	*	*	*
02/15/2002	*	*	*	*
03/15/2002	*	*	*	*
04/15/2002	*	*	*	*
05/15/2002	*	*	*	*
06/15/2002	*	*	*	*
07/15/2002	*	*	*	*
08/15/2002	*	*	*	*
09/15/2002	*	*	*	*
10/15/2002	*	*	*	*
11/15/2002	*	*	*	*
12/15/2002	*	*	*	*

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

Table B-8a

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

Sample Code	Sample Date	Sample Type	Cs-137	Gamma Emitters
Ib1	07/29/2002	Cabbage	[1]	*
Bay Breeze Rd	08/26/2002	Cabbage	[1]	*
	10/07/2002	Collards	[1]	*
	10/28/2002	Collards	[1]	*
Ib2	07/29/2002	Brussels sprouts	[1]	*
Bay Breeze Rd	08/26/2002	Broccoli	[1]	*
	10/07/2002	Cabbage	[1]	*
	10/28/2002	Cabbage	[1]	*
Ib3	07/29/2002	Broccoli	[1]	*
Bay Breeze Rd	08/26/2002	Brussels sprouts	[1]	*
	10/07/2002	Broccoli	[1]	*
	10/28/2002	Broccoli	[1]	*
Ib4	07/29/2002	Cabbage	[1]	*
Camp Conoy	08/26/2002	Cabbage	[1]	*
Entrance	10/07/2002	Collards	[1]	*
	10/28/2002	Collards	[1]	*
Ib5	07/29/2002	Brussels sprouts	[1]	*
Camp Conoy	08/26/2002	Broccoli	[1]	*
Entrance	10/07/2002	Cabbage	[1]	*
	10/28/2002	Cabbage	[1]	*
Ib6	07/29/2002	Broccoli	[1]	*
Camp Conoy	08/26/2002	Brussels sprouts	[1]	*
Entrance	10/07/2002	Broccoli	[1]	*
	10/28/2002	Broccoli	[1]	*
Ib7[2]	07/29/2002	Cabbage	[1]	*
EOF	08/26/2002	Cabbage	[1]	*
	10/07/2002	Collards	[1]	*
	10/28/2002	Collards	[1]	*
Ib8[2]	07/29/2002	Brussels sprouts	[1]	*
EOF	08/26/2002	Broccoli	[1]	*
	10/07/2002	Cabbage	[1]	*
	10/28/2002	Cabbage	[1]	*

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

Table B-8a - Continued

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

Sample Code	Sample Date	Sample Type	Cs-137	Gamma Emitters
Ib9[2]	07/29/2002	Broccoli	11 ± 6	*
EOF	08/26/2002	Brussels sprouts	[1]	*
	10/07/2002	Broccoli	[1]	*
	10/28/2002	Broccoli	[1]	*

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

Table B-8b

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

Sample Code	Sample Date	Cs-137	Gamma Emitters
SFb1	02/04/2002	[1]	*
MET Station	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFb2[2]	02/04/2002	16 ± 6	*
Visitor's Center	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFb3	02/04/2002	[1]	*
NNW of ISFSI	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFb4	02/04/2002	[1]	*
SSE of ISFSI	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFb5	02/04/2002	24 ± 8	*
On Site before	06/17/2002	[1]	*
Entrance to Camp	09/16/2002	[1]	*
Conoy	12/02/2002	18 ± 10	*

[1] This Isotope < MDA
[2] Control Location
* All Other 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	02/04/2002	[1]	*
MET station	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFS2[2]	02/04/2002	120 ± 26	*
Visitors Center	06/17/2002	117 ± 39	*
	09/16/2002	232 ± 48	*
	12/02/2002	108 ± 33	*
SFS3	02/04/2002	866 ± 71	*
NNW of ISFSI	06/17/2002	544 ± 55	*
	09/16/2002	224 ± 52	*
	12/02/2002	622 ± 70	*
SFS4	02/04/2002	49 ± 25	*
SSE of ISFSI	06/17/2002	[1]	*
	09/16/2002	[1]	*
	12/02/2002	[1]	*
SFS5	02/04/2002	317 ± 38	*
Entrance to Camp	06/17/2002	429 ± 51	*
Conoy	09/16/2002	144 ± 33	*
	12/02/2002	396 ± 48	*

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

TABLE B-10

Typical MDA Ranges for Gamma Spectrometry

Selected Nuclides	Bay Water pCi/l	Fish pCi/kg	Shellfish pCi/kg	Shoreline pCi/kg	Vegetation pCi/kg	Soil pCi/kg	Particulates 10^{-3}pCi/m^3
Na-22	1.6 – 3.8	21 – 29	18 – 30	28 – 29	16 – 37	33 – 95	1.3 – 3.4
Cr-51	12 – 40	160 - 166	118 - 176	208 - 213	14 - 164	203 - 486	13 – 39
Mn-54	1.4 - 3.2	16 – 20	15 – 22	26 – 30	13 – 28	32 – 81	1.2 – 6.2
Co-58	1.5 - 4.0	20 – 23	16 - 26	28 – 32	13 – 26	28 – 79	1.4 – 3.4
Fe-59	3.5 – 11	53 – 74	36 – 65	60 – 77	28 – 69	65 - 174	3.7 – 8.2
Co-60	1.5 - 3.7	18 – 25	18 – 26	27 – 39	15 – 35	23 - 97	1.3 - 3.3
Zn-65	3.3 – 7.9	46 – 62	36 – 57	69 – 97	32 – 73	67 - 238	3.0 – 6.9
Nb-95	1.7 – 5.8	25 – 31	20 – 35	34 – 40	13 – 27	34 – 93	2.1 – 5.0
Zr-95	2.8 - 6.9	35 – 44	29 – 43	45 – 62	21 – 48	53 - 141	2.1 – 6.4
Ru-106	12 – 26	131-149	124 - 185	224 - 287	108 - 239	264 - 643	10 - 25
Ag-110m	1.2 – 2.9	15 – 18	15 – 18	21 – 31	11 – 25	29 – 88	0.1 - 2.6
Te-129m	18 – 60	247 - 280	192 - 284	321 - 367	135 - 281	346 - 855	19 – 55
I-131	2.4 - 49	99 - 121	30 – 89	50 – 52	11 – 37	32.7 – 179	[1]
Cs-134	1.2 - 2.6	14 – 17	13 – 19	24 – 34.5	11 – 24	27 – 94	1.0 – 2.4
Cs-137	1.2 – 3.0	15 - 18	15 – 34	25 – 30	1.5 – 26	27 - 72	1.0 – 2.8
Ba-140	7.3 – 66	174 - 208	75 - 184	138 - 150	41 - 109	112 - 430	12 – 84
La-140	3.2 – 29	-	49 – 74	75 – 75	17 – 51	60 – 138	8.7 – 19
Ce-144	7.1 – 12	45 – 49	42 – 49	101 - 111	49 – 86	110 - 245	2.8 – 8.2

[1] The MDA range for I-131 on a silver zeolite cartridge is typically 4.16×10^{-3} to 3.40×10^{-2}

TABLE B-11
Typical LLDs for Gamma Spectrometry

Selected Nuclides	Bay Water pCi/l	Fish pCi/kg	Shellfish pCi/kg	Sediment pCi/kg	Particulate 10^{-3}pCi/m^3	Precipitation pCi/l	Vegetation pCi/Kg	Soil pCi/Kg	Well Water pCi/l
Na-22	2.9	22	22	24	2.9	2.9	35	24	2.9
Cr-51	17	88	88	110	12	17	162	110	17
Mn-54	2.4	17	17	18	2.1	2.4	27	18	2.4
Co-58	2.4	16	16	17	2.0	2.4	25	17	2.4
Fe-59	5.2	37	37	38	4.6	5.2	60	38	5.2
Co-60	2.8	22	22	21	2.7	2.8	33	21	2.8
Zn-65	5.6	23	23	54	2.8	5.6	66	54	5.6
Nb-95	2.2	15	15	18	1.9	2.2	25	18	2.2
Zr-95	3.8	27	27	29	3.3	3.8	44	29	3.8
Ru-106	20	135	135	146	17	20	223	146	20
Ag-110m	2.1	14	14	16	1.8	2.1	25	16	2.1
Te-129m	26	149	149	180	20	26	265	180	26
I-131	2.0	11	11	14	1.5*	2.0	20	14	2.0
Cs-134	2.2	15	15	20	1.9	2.2	24	20	2.2
Cs-137	2.3	15	15	17	1.8	2.3	27	17	2.3
Ba-140	7.3	48	48	54	6.1	7.3	80	54	7.3
La-140	4.1	26	26	25	3.4	4.1	41	25	4.1
Ce-144	12	43	43	75	5.5	12	101	75	12

*The LLD for I-131 measured on a silver zeolite cartridge is 2.0×10^{-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	11.97 ± 1.37	11.24 ± 0.58	14.96 ± 1.71	13.95 ± 1.34
DR02	Route 765, Auto Dump	9.57 ± 1.08	8.53 ± 0.28	10.79 ± 1.11	11.29 ± 1.27
DR03	Route 765, Giovanni's Tavern	10.07 ± 0.83	9.32 ± 1.17	11.49 ± 1.54	11.93 ± 1.03
DR04	Route 765, across from White Sands Drive.	12.06 ± 0.92	11.01 ± 0.51	13.58 ± 0.82	13.63 ± 0.56
DR05	Route 765, St. John's Creek	11.71 ± 0.61	10.51 ± 2.28	13.18 ± 1.25	12.76 ± 1.18
DR06	Route 765 at Lusby	5.72 ± 2.56	8.85 ± 1.48	10.96 ± 0.85	11.41 ± 1.28
DR07	Entrance to Camp Conoy	8.07 ± 0.92	8.51 ± 1.44	10.68 ± 0.80	11.70 ± 1.14
DR08	Camp Conoy Rd at Emergency Siren	11.54 ± 0.79	13.39 ± 0.20	16.50 ± 1.34	16.01 ± 1.63
DR09	Bay Breeze Rd	9.02 ± 0.72	9.79 ± 1.00	11.78 ± 0.84	12.39 ± 1.65
DR10	Decatur St. and Calvert Beach Rd.	8.59 ± 1.01	9.12 ± 1.32	11.10 ± 1.01	12.45 ± 0.42
DR11	Dirt road off Mackall & Parran Rd	8.59 ± 0.76	9.85 ± 0.38	11.80 ± 1.45	12.39 ± 1.10
DR12	Mackall & Bowen Rds	8.12 ± 0.30	9.71 ± 1.37	10.92 ± 0.39	12.11 ± 1.46
DR13	Mackall Rd, near Wallville	8.96 ± 0.57	10.82 ± 0.96	12.48 ± 1.33	13.03 ± 1.55
DR14	Rodney Point	9.73 ± 0.47	12.59 ± 1.22	14.50 ± 0.64	14.76 ± 2.23
DR15	Mill Bridge & Turner Rds	9.03 ± 0.27	10.69 ± 0.19	13.13 ± 1.75	13.34 ± 0.73
DR16	Across from Appeal School	7.93 ± 0.75	10.00 ± 1.18	11.57 ± 1.22	11.69 ± 0.77

Table B-12 - Continued

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

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
DR17	Cove Point & Little Cove Point Rds	9.07 ± 0.72	11.99 ± 1.49	13.10 ± 1.87	13.48 ± 0.94
DR18	Cove Point	6.91 ± 0.36	8.91 ± 0.98	9.79 ± 0.77	10.62 ± 1.08
DR19	Long Beach	7.96 ± 0.65	10.21 ± 0.17	12.06 ± 0.31	12.20 ± 0.82
DR20	On site, near Shore	9.75 ± 1.49	12.20 ± 1.41	14.15 ± 0.64	14.68 ± 1.39
DR21[1]	EOF	8.91 ± 1.04	11.58 ± 0.45	12.70 ± 1.37	13.53 ± 1.52
DR22[1]	Solomons Island	7.53 ± 0.49	9.95 ± 0.79	11.11 ± 0.59	12.23 ± 1.17
DR23[1]	Taylors Island	11.72 ± 1.11	14.63 ± 1.51	18.29 ± 1.07	17.06 ± 1.43
DR30	MET Station	12.16 ± 0.51	11.00 ± 0.79	13.13 ± 1.14	14.25 ± 1.57
SFDR01	SW of ISFSI	15.84 ± 1.86	15.23 ± 1.10	17.06 ± 1.40	18.31 ± 1.45
SFDR02	North of ISFSI	24.16 ± 1.72	38.00 ± 5.27	20.34 ± 0.69	21.09 ± 2.38
SFDR03	North of ISFSI	29.66 ± 2.12	29.35 ± 4.41	32.97 ± 1.88	36.88 ± 5.81
SFDR04	NE of ISFSI	19.79 ± 2.65	17.83 ± 2.46	20.32 ± 2.83	23.05 ± 2.85
SFDR05	East of ISFSI	14.17 ± 1.01	13.61 ± 1.21	15.55 ± 2.37	18.30 ± 2.41
SFDR06	ESE of ISFSI	14.58 ± 1.23	13.75 ± 1.63	15.34 ± 1.59	17.50 ± 1.31
SFDR07[1]	Visitor's Center	12.88 ± 0.87	12.09 ± 0.85	13.89 ± 1.12	14.93 ± 0.57

[1] Control Location

Table B-12 - Continued

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

Site Code	Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
SFDR08	NNW of ISFSI	28.30 ± 3.85	29.84 ± 2.03	33.27 ± 3.86	34.91 ± 3.80
SFDR09	SSE of ISFSI	12.66 ± 0.68	10.82 ± 0.78	12.20 ± 1.66	15.65 ± 0.97
SFDR10	NW of ISFSI	49.52 ± 7.20	35.34 ± 4.78	42.10 ± 8.81	50.49 ± 1.19
SFDR11	WNW ISFSI	30.42 ± 3.18	27.28 ± 6.77	34.50 ± 3.64	35.32 ± 8.45
SFDR12	WSW of ISFSI	28.48 ± 7.35	23.56 ± 3.76	27.58 ± 5.90	39.38 ± 2.42
SFDR13	South of ISFSI	14.36 ± 1.41	12.26 ± 1.57	15.99 ± 2.03	20.12 ± 2.85
SFDR14	SE of ISFSI	12.29 ± 0.73	10.72 ± 0.62	12.85 ± 0.99	14.92 ± 1.06
SFDR15	ENE of ISFSI	16.15 ± 1.38	13.59 ± 1.69	19.19 ± 3.11	19.90 ± 2.28
SFDR16	SW of ISFSI	21.07 ± 3.61	19.42 ± 2.29	22.96 ± 1.66	32.93 ± 2.64

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APPENDIX C

Quality Assurance Program

Appendix C is a summary of CGG Laboratory's Quality Assurance Program. It consists of Table C-1 which is a compilation of the results of the CGG Laboratory's participation in an intercomparison program in 2002 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 CGG Laboratory's participation in a split sample program with Enrad Laboratories (Duke Power) located in Huntersville, North Carolina and Table C-3 which is a list of typical MDAs achieved by Enrad Laboratories for Gamma Spectroscopy.

All the CGG Laboratory's results contained in Table C-1 agree with the intercomparison laboratory results with the exception of a Cs-134 result for the filter sample type on 6/13/02 from Analytics and four out of five isotopes for a water sample type from ERA on 8/21/02. The Cs-134 result was reevaluated using the NRC Resolution Test Criteria[1] and found to be in agreement. The water sample on 8/21/02 was reanalyzed and the remaining four isotopes were found to be in agreement with the exception of Zn-65 which was found to be in agreement using the NRC Resolution Test Criteria[1]. The corrected results are included in the table. The uncertainties reported for the filter sample types for both laboratories are expressed as ±3 . The uncertainties for the CGG Laboratory's other sample types are ±1 and the cross check laboratory's uncertainty is based on USEPA guidelines[2]. The results in this table are used as a check of instrumentation function and not meant to be used for reporting purposes of actual activity present in samples.

All the results contained in Table C-2 generally agree with their respective CGG Laboratory replicates and split laboratory samples, except for the Ag-110m result for an oyster sample collected 9/4/02. This disagreement is due to the poor condition of the sample when it arrived at the split laboratory. When the originally prepared sample was sent to the laboratory the Ag-110m result was determined to be 52 ±4 pCi/kg which is in agreement with the original result. As indicated in Table C-2 there were some instances where activity was observed in split samples, but not observed in the original sample. This is due to the lower MDA achieved by the split laboratory using very long count times. Other samples whose nature generally precludes sample splitting are marked "**" in the Split Analysis column.

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

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Quality Assurance Program

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TABLE C-1

Results of Participation in Cross Check Programs for 2002

Sample Date	Sample Type and Units	Isotope Observed	CGG Laboratory's Results[1]	Cross Check Lab Results[1]
3/10/02	Water-pCi/L	Ba-133	26±3	29±5
		Co-60	74±2	76±5
		Cs-134	38±2	42±5
		Cs-137	85±2	91±5
		Zn-65	370±18	359±36
5/22/02	Water-pCi/L	H-3	16400±67	17400±1740
		I-131	19±6	15±2
6/13/02	Filter-pCi/filter	Beta	27±1	27±1
6/13/02	Filter-pCi/filter	Ce-141	88±6	81±4
		Cr-51	215±42	210±11
		Cs-134	92±4[1]	108±5
		Cs-137	82±8	82±4
		Mn-54	91±8	85±4
		Fe-59	80±11	72±4
		Zn-65	183±18	161±8
		Co-58	90±9	89±4
		Co-60	116±6	111±6

[1] See discussion at the beginning of this appendix

TABLE C-1 - Continued

Results of Participation in Cross Check Programs for 2002

Sample Date	Sample Type and Units	Isotope Observed	CGG Laboratory's Results[1]	Cross Check Lab Results[1]	Corrected CGG Lab Results[1]
8/21/02	Water-pCi/L	Ba-133	91±4	80±8	84±4
		Cs-134	90±2[1]	72±5	68±2
		Cs-137	279±7[1]	214±11	221±7
		Zn-65	138±8[1]	96±10	71±8
		Co-60	36±2[1]	23±5	23±2
11/20/02	Water-pCi/L	H-3	9460±47	10200±1020	-
	Water-pCi/L	I-131	9± 3	7± 2	-

[1] See discussion at the beginning of this appendix.

TABLE C-2

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-2} pCi/m^3	
Air Iodine-A1	1/07/02	I-131	<1.7	<1.6	**
Air Iodine-A2	1/07/02	I-131	<1.6	<1.4	**
Air Filter -A1	1/07/02	Beta	1.4±0.2	1.5±0.2	**
Air Filter -A2	1/07/02	Beta	2.5±0.2	2.6±0.2	**
Air Filter -A3	1/07/02	Beta	1.5±0.2	1.8±0.2	**
Air Filter -A4	1/07/02	Beta	1.7±0.2	1.8±0.2	**
Air Filter -A5	1/07/02	Beta	2.1±0.2	2.3±0.2	**
Air Filter -SFA1	1/07/02	Beta	1.5±0.2	1.6±0.2	**
Air Filter -SFA2	1/07/02	Beta	1.3±0.2	1.5±0.2	**
Air Filter -SFA3	1/07/02	Beta	2.1±0.2	2.2±0.2	**
Air Filter -SFA4	1/07/02	Beta	1.7±0.2	1.6±0.2	**
				pCi /kg	
Soil-SFS4	2/04/02	Cs-137	49±25	39±27	20±7
Soil-SFS5	2/04/02	Cs-137	316±38	258±31	305±13
Vegetation-SFb4	2/04/02	Cs-137	<MDA	<MDA	16±2 (1)
Vegetation-SFb5	2/04/02	Cs-137	24±8	<MDA	26±2
				10^{-2} pCi/m^3	
Air Filter-A1	2/11/02	Beta	2.3±0.2	2.4±0.2	**
Air Filter-A2	2/11/02	Beta	1.7±0.2	3.1±0.2	**
Air Filter-A3	2/11/02	Beta	2.4±0.2	2.5±0.2	**
Air Filter-A4	2/11/02	Beta	2.6±0.2	2.7±0.2	**
Air Filter-A5	2/11/02	Beta	2.5±0.2	2.7±0.2	**
Air Filter-SFA1	2/11/02	Beta	2.3±0.2	2.2±0.2	**
Air Filter-SFA2	2/11/02	Beta	2.2±0.2	2.2±0.2	**
Air Filter-SFA3	2/11/02	Beta	2.5±0.2	2.6±0.2	**
Air Filter-SFA4	2/11/02	Beta	2.6±0.2	2.6±0.2	**
Air Iodine-A3	2/11/02	I-131	<2.4	<2.4	**
Air Iodine-A4	2/11/02	I-131	<1.3	<1.5	**

**The nature of these samples precluded splitting them with an independent laboratory.
(1) Result is below the CGG Laboratory's LLD for this isotope

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				pCi/L	
Bay Water-Wa2	2/15/02	Tritium	195±39	136±38	<153
Bay Water-Wa2	2/28/02	Gamma	<MDA	<MDA	<MDA
				pCi/Kg	
Shoreline-Wb1	2/25/02	Gamma	<MDA	<MDA	<MDA
				10^{-2} pCi/m^3	
Air Filter-A1	3/11/02	Beta	2.8±0.3	2.8±0.3	**
Air Filter-A2	3/11/02	Beta	5.1±0.5	4.9±0.5	**
Air Filter-A3	3/11/02	Beta	2.6±0.3	2.8±0.3	**
Air Filter-A4	3/11/02	Beta	2.2±0.2	2.5±0.2	**
Air Filter-A5	3/11/02	Beta	2.6±0.3	2.7±0.3	**
Air Filter-SFA1	3/11/02	Beta	2.4±0.2	2.5±0.2	**
Air Filter-SFA2	3/11/02	Beta	2.5±0.2	2.6±0.2	**
Air Filter-SFA3	3/11/02	Beta	2.5±0.2	2.5±0.2	**
Air Filter-SFA4	3/11/02	Beta	2.7±0.3	2.8±0.3	**
Air Iodine-A3	3/11/02	I-131	<1.8	<1.8	**
Air Iodine-A4	3/11/02	I-131	<1.4	<1.5	**
				pCi/Kg	
Oysters-Ia3	3/19/02	Ag-110m	42 ± 8	48 ± 8	35 ± 6
				10^{-2} pCi/m^3	
Air Iodine-A1	4/08/02	I-131	<1.2	<1.4	**
Air Iodine-A2	4/08/02	I-131	<1.4	<1.1	**

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

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-2} pCi/m^3	
Air Filter-A1	4/08/02	Beta	1.9±0.2	2.0±0.2	**
Air Filter-A2	4/08/02	Beta	1.7±0.2	1.8±0.2	**
Air Filter-A3	4/08/02	Beta	1.6±0.2	1.6±0.2	**
Air Filter-A4	4/08/02	Beta	1.6±0.2	1.8±0.2	**
Air Filter-A5	4/08/02	Beta	1.7±0.2	1.7±0.2	**
Air Filter-SFA1	4/08/02	Beta	1.6±0.2	1.6±0.2	**
Air Filter-SFA2	4/08/02	Beta	1.7±0.2	1.7±0.2	**
Air Filter-SFA3	4/08/02	Beta	1.6±0.2	1.8±0.2	**
Air Filter-SFA4	4/08/02	Beta	2.0±0.2	2.1±0.2	**
				pCi /L	
Bay Water-Wa2	4/30/02	Gamma	<MDA	<MDA	<MDA
				10^{-2} pCi/m^3	
Air Iodine-A1	5/13/02	I-131	<1.1	<1.1	**
Air Iodine-A2	5/13/02	I-131	<1.3	<1.2	**
Air Filter-A1	5/13/02	Beta	1.6±0.2	1.4±0.2	**
Air Filter-A2	5/13/02	Beta	1.2±0.2	1.2±0.2	**
Air Filter-A3	5/13/02	Beta	1.2±0.2	1.2±0.2	**
Air Filter-A4	5/13/02	Beta	1.5±0.2	1.6±0.2	**
Air Filter-A5	5/13/02	Beta	1.6±0.2	1.6±0.2	**
Air Filter-SFA1	5/13/02	Beta	1.7±0.2	1.6±0.2	**
Air Filter-SFA2	5/13/02	Beta	1.6±0.2	1.7±0.2	**
Air Filter-SFA3	5/13/02	Beta	1.9±0.2	1.9±0.2	**
Air Filter-SFA4	5/13/02	Beta	1.9±0.2	1.9±0.2	**

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

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-2} pCi/m^3	
Air Filter-A1	6/10/02	Beta	0.9±0.2	0.9±0.2	**
Air Filter-A2	6/10/02	Beta	0.6±0.2	0.6±0.2	**
Air Filter-A3	6/10/02	Beta	1.3±0.2	1.3±0.3	**
Air Filter-A4	6/10/02	Beta	0.7±0.2	0.7±0.2	**
Air Filter-A5	6/10/02	Beta	1.4±0.2	1.2±0.2	**
Air Filter-SFA1	6/10/02	Beta	1.3±0.2	1.2±0.2	**
Air Filter-SFA2	6/10/02	Beta	1.2±0.2	1.2±0.2	**
Air Filter-SFA3	6/10/02	Beta	1.2±0.2	1.3±0.2	**
Air Filter-SFA4	6/10/02	Beta	1.3±0.2	1.1±0.2	**
Air Iodine-A3	6/10/02	I-131	<2.1	<2.4	**
Air Iodine-A4	6/10/02	I-131	<1.1	<1.0	**
				pCi/kg	
Oysters-Ia3	6/14/02	Ag-110m	19±6	17±6	(2)
				10^{-3} pCi/m^3	
Air Filters-A1	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A2	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A3	6/15/02	Gamma	<MDA	<MDA	Cs-137 1± 0.4(1)
Air Filters-A4	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A5	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA1	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA2	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA3	6/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA4	6/15/02	Gamma	<MDA	<MDA	<MDA

**The nature of these samples precluded splitting them with an independent laboratory.
(1) Result is below the CGG Laboratory's LLD for this isotope
(2) This sample was not split.

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				pCi/kg	
Soil-SFS1	6/17/02	Gamma	<MDA	<MDA	Cs-137 14±1(1) Mn-54 6±1 (1)
Soil-SFS5	6/17/02	Cs-137	429±51	445±47	Cs-137 445 ±3 Mn-54 4±1 (1)
Vegetation-SFb1	6/17/02	Gamma	<MDA	<MDA	Cs-137 5±2 (1)
Vegetation-SFb5	6/17/02	Gamma	<MDA	<MDA	<MDA
				mR/90 Days	
DR05	6/30/02	TLD	10.51±2.28	10.25±0.80	**
DR06	6/30/02	TLD	8.85±1.48	9.30±0.93	**
DR07	6/30/02	TLD	8.51±1.44	9.27±0.97	**
DR08	6/30/02	TLD	13.39±0.20	13.66±1.27	**
DR09	6/30/02	TLD	9.79±1.00	10.65±0.55	**
DR10	6/30/02	TLD	9.12±1.32	10.03±0.44	**
DR29	6/30/02	TLD	11.88±1.06	13.21±1.42	**
DR31	6/30/02	TLD	13.37±1.16	15.10±1.37	**
SFDR14	6/30/02	TLD	10.72±0.62	10.99±1.39	**
SFDR15	6/30/02	TLD	13.59±1.69	15.43±2.85	**
RPDR07	6/30/02	TLD	15.78±1.86	17.01±0.99	**
				10^{-2} pCi/m^3	
Air Filter-A1	7/08/02	Beta	1.9±0.2	2.0±0.2	**
Air Filter-A2	7/08/02	Beta	1.1±0.3	0.8±0.3	**
Air Filter-A3	7/08/02	Beta	1.2±0.2	1.1±0.2	**
Air Filter-A4	7/08/02	Beta	1.2±0.2	1.2±0.2	**
Air Filter-A5	7/08/02	Beta	1.4±0.2	1.3±0.2	**
Air Filter-SFA1	7/08/02	Beta	1.9±0.1	1.8±0.1	**
Air Filter-SFA2	7/08/02	Beta	2.8±0.3	2.9±0.3	**
Air Filter-SFA3	7/08/02	Beta	1.7±0.2	1.7±0.2	**
Air Filter-SFA4	7/08/02	Beta	1.4±0.2	1.5±0.2	**
Air Iodine-A3	7/08/02	I-131	<2.1	<2.2	**
Air Iodine-A4	7/08/02	I-131	<1.1	<1.1	**

**The nature of these samples precluded splitting them with an independent laboratory.
(1) Result is below the CGG Laboratory's LLD for this isotope

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				pCi/L	
Bay Water-Wa2	7/30/02	Gamma	<MDA	<MDA	<MDA
				10^{-2} pCi/m^3	
Air Filter-A1	8/5/02	Beta	1.8±0.2	1.9±0.2	**
Air Filter-A2	8/5/02	Beta	1.1±0.2	1.1±0.2	**
Air Filter-A3	8/5/02	Beta	2.4±0.3	2.2±0.3	**
Air Filter-A4	8/5/02	Beta	2.0±0.2	1.9±0.2	**
Air Filter-A5	8/5/02	Beta	2.1±0.3	2.0±0.3	**
Air Filter-SFA1	8/5/02	Beta	2.3±0.2	2.2±0.2	**
Air Filter-SFA2	8/5/02	Beta	4.3±0.4	4.3±0.4	**
Air Filter-SFA3	8/5/02	Beta	2.4±0.2	2.3±0.2	**
Air Filter-SFA4	8/5/02	Beta	2.2±0.2	2.3±0.2	**
Air Iodine-A1	8/5/02	I-131	<1.3	<1.2	**
Air Iodine-A2	8/5/02	I-131	<1.7	<1.8	**
				pCi/L	
Bay Water-Wa2	8/15/02	Tritium	<37	<38	<150
				pCi /kg	
Vegetation-Ib4	8/26/02	Gamma	<MDA	<MDA	Cs-137 3±2 (1)
Vegetation-Ib5	8/26/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib6	8/26/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib7	8/26/02	Gamma	<MDA	<MDA	Cs-137 3 ±2(1)
Vegetation-Ib8	8/26/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib9	8/26/02	Gamma	<MDA	<MDA	<MDA
				pCi/kg	
Fish-Ia2	9/2/02	Gamma	<MDA	<MDA	<MDA
Oysters-Ia3	9/4/02	Ag-110m	55 ±8	76 ±9	<11

**The nature of these samples precluded splitting them with an independent laboratory.
(1) Result is below the CGG Laboratory's LLD for this isotope

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-2} pCi/m^3	
Air Iodine-A3	9/3/02	I-131	<1.5	<1.6	**
Air Iodine-A4	9/3/02	I-131	<1.4	<1.0	**
Air Filter-A1	9/3/02	Beta	1.0±0.1	1.0±0.1	**
Air Filter-A2	9/3/02	Beta	1.1±0.1	1.0±0.1	**
Air Filter-A3	9/3/02	Beta	1.0±0.2	0.9±0.2	**
Air Filter-A4	9/3/02	Beta	0.9±0.1	0.8±0.1	**
Air Filter-A5	9/3/02	Beta	1.1±0.2	1.0±0.2	**
Air Filter-SFA1	9/3/02	Beta	1.1±0.2	1.1±0.2	**
Air Filter-SFA2	9/3/02	Beta	1.1±0.2	1.2±0.2	**
Air Filter-SFA3	9/3/02	Beta	0.7±0.1	0.6±0.1	**
Air Filter-SFA4	9/3/02	Beta	1.3±0.1	1.4±0.2	**
				10^{-2} pCi/m^3	
Air Filter-A1	10/07/02	Beta	2.4±0.2	2.6±0.2	**
Air Filter-A2	10/07/02	Beta	2.1±0.2	2.1±0.2	**
Air Filter-A3	10/07/02	Beta	2.4±0.3	2.5±0.3	**
Air Filter-A4	10/07/02	Beta	2.9±0.2	2.6±0.2	**
Air Filter-A5	10/07/02	Beta	1.6±0.2	1.7±0.2	**
Air Filter-SFA1	10/07/02	Beta	3.0±0.3	3.2±0.3	**
Air Filter-SFA2	10/07/02	Beta	3.3±0.3	3.4±0.3	**
Air Filter-SFA3	10/07/02	Beta	2.6±0.2	2.7±0.2	**
Air Filter-SFA4	10/07/02	Beta	2.1±0.2	2.3±0.2	**
Air Iodine-A1	10/07/02	I-131	<1.5	<2.0	**
Air Iodine-A2	10/07/02	I-131	<1.5	<1.8	**
				pCi /kg	
Vegetation-Ib4	10/28/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib5	10/28/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib6	10/28/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib7	10/28/02	Gamma	<MDA	<MDA	<MDA
Vegetation-Ib8	10/28/02	Gamma	<MDA	<MDA	Cs-137 1 ±0.5(1)
Vegetation-Ib9	10/28/02	Gamma	<MDA	<MDA	<MDA

**The nature of these samples precluded splitting them with an independent laboratory.
(1) Result is below the CGG Laboratory's LLD for this isotope

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-2} pCi/m^3	
Air Filter-A1	11/04/02	Beta	2.1±0.2	2.3±0.2	**
Air Filter-A2	11/04/02	Beta	1.7±0.2	1.8±0.2	**
Air Filter-A3	11/04/02	Beta	2.1±0.2	2.2±0.2	**
Air Filter-A4	11/04/02	Beta	1.9±0.2	2.1±0.2	**
Air Filter-A5	11/04/02	Beta	2.3±0.2	2.4±0.2	**
Air Filter-SFA1	11/04/02	Beta	2.6±0.2	2.5±0.2	**
Air Filter-SFA2	11/04/02	Beta	2.1±0.2	2.4±0.2	**
Air Filter-SFA3	11/04/02	Beta	2.2±0.2	2.5±0.2	**
Air Filter-SFA4	11/04/02	Beta	1.8±0.2	2.0±0.2	**
Air Iodine-A3	11/04/02	I-131	<1.5	<1.6	**
Air Iodine-A4	11/04/02	I-131	<1.6	<1.5	**
				pCi/L	
Bay Water-Wa2	12/02/02	Gamma	<MDA	<MDA	<MDA
				10^{-2} pCi/m^3	
Air Filter-A1	12/09/02	Beta	3.2±0.2	3.4±0.2	**
Air Filter-A2	12/09/02	Beta	1.9±0.3	1.6±0.3	**
Air Filter-A3	12/09/02	Beta	1.8±0.2	2.0±0.2	**
Air Filter-A4	12/09/02	Beta	2.1±0.2	2.2±0.2	**
Air Filter-A5	12/09/02	Beta	1.7±0.2	1.9±0.3	**
Air Filter-SFA1	12/09/02	Beta	2.4±0.2	2.4±0.2	**
Air Filter-SFA2	12/09/02	Beta	2.1±0.2	1.9±0.2	**
Air Filter-SFA3	12/09/02	Beta	2.0±0.2	2.2±0.2	**
Air Filter-SFA4	12/09/02	Beta	2.0±0.2	2.2±0.2	**
Air Iodine-A1	12/09/02	I-131	<1.5	<1.4	**
Air Iodine-A2	12/09/02	I-131	<2.1	<2.1	**

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

TABLE C-2 - Continued

Results of Quality Assurance Program for 2002

Sample Type And Location	Sample Date	Type of Analysis	Original Analysis	Replicate Analysis	Split Analysis
				10^{-3} pCi/m^3	
Air Filters-A1	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A2	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A3	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A4	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-A5	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA1	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA2	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA3	12/15/02	Gamma	<MDA	<MDA	<MDA
Air Filters-SFA4	12/15/02	Gamma	<MDA	<MDA	<MDA
				mR/90 Days	
DR05	12/31/02	TLD	12.76 ±1.18	12.95 ± 0.84	**
DR06	12/31/02	TLD	11.41 ±1.28	11.17 ± 0.55	**
DR07	12/31/02	TLD	11.70 ±1.14	11.37 ± 0.90	**
DR08	12/31/02	TLD	16.01 ±1.63	16.68 ± 0.80	**
DR09	12/31/02	TLD	12.39 ±1.65	12.38 ± 0.72	**
DR10	12/31/02	TLD	12.45 ±0.42	11.95 ±1.10	**
DR11	12/31/02	TLD	12.39 ±1.10	12.52 ± 0.52	**
DR29	12/31/02	TLD	16.14 ±1.52	16.06 ± 1.40	**
DR31	12/31/02	TLD	16.96 ± 0.99	16.91 ±1.75	**
SFDR14	12/31/02	TLD	14.92 ±1.06	14.73 ±1.30	**
SFDR15	12/31/02	TLD	19.90 ± 2.28	19.65 ±1.78	**

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

TABLE C-3

EnRad Laboratories 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	5	9	4	4	1
Cr-51	26	51	127	109	58	21
Mn-54	1	5	8	4	3	1
Co-58	2	5	10	5	4	2
Fe-59	4	12	24	16	11	4
Co-60	1	5	9	4	4	1
Zn-65	3	10	19	8	8	2
Nb-95	3	7	16	11	7	3
Zr-95	3	9	19	11	7	3
Ru-106	11	36	69	28	24	7
Ag-110m	-	-	23	-	-	-
Te-129m	32	69	158	122	70	25
I-131	80	-	-	-	-	22
Cs-134	1	4	7	3	3	1
Cs-137	1	4	8	3	5	1
BaLa-140	16	15	51	130	43	28
Ce-144	8	23	42	21	15	4

APPENDIX D

Land Use Survey

Appendix D contains the results of a Land Use Survey (Ref. 12) conducted around CCNPP during August 2002. A table listing the raw data of this survey and a discussion of the results are included in this appendix.

Table D-1
Land Use Survey

	Distance From Plant (km)	
Sector	Residence	Garden
SE	2.7	2.7
SSE	2.9	2.9
S	3.1	7.2
SSW	2.6	2.7
SW	2.1	2.4
WSW	1.9	1.9
W	2.1	2.4
WNW	2.6	2.6
NW	2.9	2.9

Discussion

A Land Use Survey was conducted during August 2002 to identify, within a distance of 8 km, 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. 12). The position of the nearest residence and garden in each sector out to 8 km are given in the adjacent table. No dairy animal was found within 8 km in any direction. There has not been any significant change in the use of local lands in the last few years.

The closest residence and nearest garden is situated in the WSW 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 0.7 km, and another is situated near the site boundary in the SSE sector at a distance of 2.6 km from the plant. These two sampling sites are considered good indicator locations for radioactive depositions around the plant.

The dose assessment using 2002 meteorological data was performed, and no significant impact from the plant was found.

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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 during the year 2002. 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. Additionally, they include the PICs added for the ISFSI.

Table E-9 shows the average monthly direct radiation as measured by the pressurized ion chamber at five locations. The dose rates at the south end of the Old Steam Generator Storage Facility (OSGSF) took a slight step increase when the old steam generators were placed into the building in 2002. On April 2 and April 3, PIC4 (NNW of ISFSI) showed a step increase in dose rate as a result of the transfer of 11 Steam Generator and 12 Steam Generator into the storage facility. The slight increase in dose rate was localized at SFDR02 and TLDs located in the immediate vicinity of the building showed no appreciable increase for the calendar quarter.

Sampling around the OSGSF was also increased with the addition of TLDs around the building. Table E-10 lists those results for 2002.

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 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.

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Additional Samples and Analysis Results

TABLE E-1

Locations of Non-ODCM 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, Carpenter'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
PIC1	Taylors Island, Carpenter's Property	12.6	7.8	ENE
PIC2	On Site before Entrance to Camp Conoy	0.7	0.4	S
PIC3	Meteorological Station	0.8	0.5	WSW
PIC4	NNW of ISFSI	0.6	0.4	SW
PIC5	SSE of ISFSI	0.6	0.4	SSW
PIC8	CCNPP Visitor's Center	0.3	0.2	NW
Wbs2	Intake Area	0.2	0.1	NE
Wbs2	Discharge Area	0.3	0.2	N
Wbs3	Long Beach	4.4	2.7	NW
Wbs4	Camp Conoy/Rocky Point	3.0	1.9	SE
Ww1	Taylors Island, Carpenter'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 2002 Calvert Cliffs Nuclear Power Plant
Non-ODCM Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Aquatic Environment						
Bottom Sediment	Q	4	16	Gamma	Q	16
Atmospheric Environment						
Air Iodine[2]	W	7	363	I-131	W	363
Air Particulates[3]	W	3	155	Gross Beta	W	155
				Gamma	MC	36
Direct Radiation						
Pressurized Ion Chamber	M	6	72	Gamma	M	72
Ambient Radiation	Q	20	480	TLD	Q	480
Terrestrial Environment						
Ground water	M	1	12	Gamma	M	12
				H-3	M	12

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

Table E-3

Annual Summary for Calvert Cliffs Nuclear Power Plant Units 1 & 2
Non-ODCM 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[1]
Aquatic Environment						
Bottom Sediment (pCi/kg)	Gamma (16) Cs-137	17	162 (10/12) (24-256)	Discharge Area Wbs2 0.3 km N	207 (4/4) (178-256)	154 (4/4) (121-174)
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (155)	0.5	1.7 (103/103) (0.7-3.8)	Cambridge CAM 32. km NE	1.7 (51/52) (0.8-2.8)	1.6 (52/52) (0.8-3.5)
Direct Radiation						
Ambient Radiation (mR/90 days)	TLD (480)	-	16.71 (480/480) (8.50-38.04)	East Fence Right RPDR12 0.8 km	25.92 (24/24) (21.78-29.63)	12.44(72/72) (7.53-18.29)
Pressurized Ion Chamber (mR/30 days)	Ionization Chamber (72)	-	6.13 (60/60) (3.71-14.09)	NNW of ISFSI PIC4 0.6 km SW	11.69 (12/12) (10.25-14.09)	6.22 (12/12) (5.55-6.64)

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses.
[2] From the centerpoint 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
Wbs1	03/19/2002	24 ± 20	*
Intake Area	06/14/2002	[1]	*
	08/01/2002	39 ± 23	*
	10/22/2002	[1]	*
Wbs2	03/19/2002	256 ± 45	*
Discharge Area	06/14/2002	178 ± 40	*
	08/01/2002	212 ± 44	*
	10/22/2002	181 ± 48	*
Wbs3	03/19/2002	164 ± 47	*
Long Beach	06/14/2002	147 ± 49	*
	08/01/2002	198 ± 51	*
	10/22/2002	219 ± 56	*
Wbs4[2]	03/19/2002	121 ± 37	*
Camp Conoy/ Rocky Point	06/14/2002	174 ± 39	*
	08/01/2002	153 ± 45	*
	10/22/2002	169 ± 37	*

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

Table E-5

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

Start Date	Stop Date	A6 Long Beach	A7[1] Taylors Island	CAM Cambridge	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
12/31/2001	01/07/2002	*	*	*	*	*	*	*
01/07/2002	01/14/2002	*	*	*	*	*	*	*
01/14/2002	01/21/2002	*	*	*	*	*	*	*
01/21/2002	01/28/2002	*	*	*	*	*	*	*
01/28/2002	02/04/2002	*	*	[2]	*	*	*	*
02/04/2002	02/11/2002	*	*	*	*	*	*	*
02/11/2002	02/19/2002	*	*	*	*	*	*	*
02/19/2002	02/25/2002	*	*	*	*	*	*	*
02/25/2002	03/04/2002	*	*	*	*	*	*	*
03/04/2002	03/11/2002	*	*	*	*	*	*	*
03/11/2002	03/18/2002	*	*	*	*	*	*	*
03/18/2002	03/25/2002	*	*	*	*	*	*	*
03/25/2002	04/01/2002	*	*	*	*	*	*	*
04/01/2002	04/08/2002	*	*	*	*	*	*	*
04/08/2002	04/15/2002	*	*	*	*	*	*	*
04/15/2002	04/22/2002	*	*	*	*	*	*	*
04/22/2002	04/29/2002	*	*	*	*	*	*	*
04/29/2002	05/06/2002	*	*	*	*	*	*	*
05/06/2002	05/13/2002	*	*	*	*	*	*	*
05/13/2002	05/20/2002	*	*	*	*	*	*	*
05/20/2002	05/28/2002	*	*	*	*	*	*	*
05/28/2002	06/03/2002	*	*	*	*	*	*	*
06/03/2002	06/10/2002	*	*	*	*	*	*	*
06/10/2002	06/17/2002	*	*	*	*	*	*	*
06/17/2002	06/24/2002	*	*	*	*	*	*	*
06/24/2002	07/01/2002	*	*	*	*	*	*	*
07/01/2002	07/08/2002	*	*	*	*	*	*	*
07/08/2002	07/15/2002	*	*	*	*	*	*	*
07/15/2002	07/22/2002	*	*	*	*	*	*	*
07/22/2002	07/29/2002	*	*	*	*	*	*	*

* < MDA
[1] Control Location
[2] Sampler malfunction/low flow

Table E-5 - Continued

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

Start Date	Stop Date	A6 Long Beach	A7[1] Taylors Island	CAM Cambridge	SFA1 MET Station	SFA2[1] Visitors Center	SFA3 NNW of ISFSI	SFA4 SSE of ISFSI
07/29/2002	08/05/2002	*	*	*	*	*	*	*
08/05/2002	08/12/2002	*	*	*	*	*	*	*
08/12/2002	08/19/2002	*	*	*	*	*	*	*
08/19/2002	08/26/2002	*	*	*	*	*	*	*
08/26/2002	09/03/2002	*	*	*	*	*	*	*
09/03/2002	09/09/2002	*	*	*	*	*	*	*
09/09/2002	09/16/2002	*	*	*	*	*	*	*
09/16/2002	09/23/2002	*	*	*	*	*	*	*
09/23/2002	09/30/2002	*	*	*	*	*	*	*
09/30/2002	10/07/2002	*	*	*	*	*	*	*
10/07/2002	10/14/2002	*	*	*	*	*	*	*
10/14/2002	10/21/2002	*	*	*	*	*	*	*
10/21/2002	10/28/2002	*	*	*	*	*	*	*
10/28/2002	11/04/2002	*	*	*	*	*	*	*
11/04/2002	11/11/2002	*	*	*	*	*	*	*
11/11/2002	11/18/2002	*	*	*	*	*	*	*
11/18/2002	11/25/2002	*	*	*	*	*	*	*
11/25/2002	12/02/2002	*	*	*	*	*	*	*
12/02/2002	12/09/2002	*	*	*	*	*	*	*
12/09/2002	12/16/2002	*	*	*	*	*	*	*
12/16/2002	12/23/2002	*	*	*	*	*	*	*
12/23/2002	12/30/2002	*	*	*	*	*	*	*

*<MDA
[1]Control Location

Table E-6

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

Start Date	Stop Date	A6 Long Beach	A7[1] Taylors Island	CAM Cambridge
12/31/2001	01/07/2002	2.6 ± 0.3	1.6 ± 0.2	2.1 ± 0.3
01/07/2002	01/14/2002	3.8 ± 0.4	1.9 ± 0.2	2.8 ± 0.3
01/14/2002	01/21/2002	2.6 ± 0.3	1.5 ± 0.2	2.8 ± 0.3
01/21/2002	01/28/2002	1.5 ± 0.2	1.7 ± 0.2	2.3 ± 0.3
01/28/2002	02/04/2002	1.5 ± 0.2	1.3 ± 0.2	[2]
02/04/2002	02/11/2002	2.2 ± 0.2	2.0 ± 0.2	2.8 ± 0.4
02/11/2002	02/19/2002	1.6 ± 0.2	1.5 ± 0.2	1.9 ± 0.2
02/19/2002	02/25/2002	1.7 ± 0.2	1.7 ± 0.2	2.1 ± 0.2
02/25/2002	03/04/2002	1.8 ± 0.2	1.3 ± 0.2	1.9 ± 0.3
03/04/2002	03/11/2002	2.5 ± 0.2	2.2 ± 0.2	2.7 ± 0.2
03/11/2002	03/18/2002	1.2 ± 0.2	1.0 ± 0.2	1.1 ± 0.2
03/18/2002	03/25/2002	1.8 ± 0.2	2.2 ± 0.2	2.2 ± 0.3
03/25/2002	04/01/2002	1.3 ± 0.2	1.3 ± 0.2	1.8 ± 0.2
04/01/2002	04/08/2002	1.6 ± 0.2	1.7 ± 0.2	2.0 ± 0.2
04/08/2002	04/15/2002	1.4 ± 0.2	1.1 ± 0.2	1.5 ± 0.2
04/15/2002	04/22/2002	1.2 ± 0.2	1.1 ± 0.1	1.9 ± 0.2
04/22/2002	04/29/2002	1.0 ± 0.2	1.0 ± 0.2	1.8 ± 0.2
04/29/2002	05/06/2002	1.1 ± 0.2	1.2 ± 0.1	1.4 ± 0.2
05/06/2002	05/13/2002	1.5 ± 0.2	1.1 ± 0.1	1.8 ± 0.2
05/13/2002	05/20/2002	1.1 ± 0.2	1.3 ± 0.2	1.4 ± 0.2
05/20/2002	05/28/2002	1.1 ± 0.1	1.3 ± 0.2	1.5 ± 0.2
05/28/2002	06/03/2002	2.1 ± 0.2	1.6 ± 0.2	1.6 ± 0.3
06/03/2002	06/10/2002	1.1 ± 0.1	1.3 ± 0.2	1.4 ± 0.2
06/10/2002	06/17/2002	1.6 ± 0.2	1.2 ± 0.2	1.0 ± 0.2
06/17/2002	06/24/2002	1.7 ± 0.2	1.2 ± 0.2	1.2 ± 0.2
06/24/2002	07/01/2002	1.5 ± 0.2	0.8 ± 0.1	0.8 ± 0.1
07/01/2002	07/08/2002	2.0 ± 0.3	1.5 ± 0.2	1.6 ± 0.2
07/08/2002	07/15/2002	2.1 ± 0.4	1.3 ± 0.2	1.4 ± 0.2
07/15/2002	07/22/2002	1.6 ± 0.2	2.6 ± 0.3	1.9 ± 0.2
07/22/2002	07/29/2002	1.5 ± 0.2	1.1 ± 0.2	1.3 ± 0.2
07/29/2002	08/05/2002	2.0 ± 0.2	2.4 ± 0.2	2.0 ± 0.2
08/05/2002	08/12/2002	1.1 ± 0.2	1.3 ± 0.2	1.1 ± 0.1
08/12/2002	08/19/2002	1.7 ± 0.2	1.6 ± 0.2	2.1 ± 0.2
08/19/2002	08/26/2002	1.7 ± 0.2	2.1 ± 0.2	1.7 ± 0.2
08/26/2002	09/03/2002	1.2 ± 0.2	3.5 ± 0.2	0.8 ± 0.1

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

Table E-6 - Continued

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

Start Date	Stop Date	A6 Long Beach	A7[1] Taylors Island	CAM Cambridge
09/03/2002	09/09/2002	1.4 ± 0.2	1.6 ± 0.2	1.4 ± 0.2
09/09/2002	09/16/2002	1.7 ± 0.2	1.1 ± 0.2	1.4 ± 0.2
09/16/2002	09/23/2002	2.5 ± 0.3	2.2 ± 0.2	2.0 ± 0.2
09/23/2002	09/30/2002	1.8 ± 0.2	1.6 ± 0.2	1.5 ± 0.2
09/30/2002	10/07/2002	2.3 ± 0.3	2.4 ± 0.2	2.2 ± 0.2
10/07/2002	10/14/2002	1.2 ± 0.2	1.2 ± 0.2	1.2 ± 0.2
10/14/2002	10/21/2002	1.9 ± 0.2	1.6 ± 0.2	1.5 ± 0.2
10/21/2002	10/28/2002	1.7 ± 0.2	1.7 ± 0.2	1.4 ± 0.2
10/28/2002	11/04/2002	2.0 ± 0.2	2.1 ± 0.2	2.0 ± 0.2
11/04/2002	11/11/2002	1.8 ± 0.2	1.4 ± 0.2	1.6 ± 0.2
11/11/2002	11/18/2002	1.0 ± 0.2	1.7 ± 0.2	1.6 ± 0.2
11/18/2002	11/25/2002	1.5 ± 0.2	1.6 ± 0.2	1.8 ± 0.2
11/25/2002	12/02/2002	1.2 ± 0.2	1.6 ± 0.2	1.6 ± 0.2
12/02/2002	12/09/2002	1.2 ± 0.2	1.6 ± 0.2	1.7 ± 0.2
12/09/2002	12/16/2002	0.7 ± 0.2	1.4 ± 0.2	1.4 ± 0.2
12/16/2002	12/23/2002	1.0 ± 0.2	1.9 ± 0.2	1.6 ± 0.2
12/23/2002	12/30/2002	1.2 ± 0.2	1.7 ± 0.2	1.7 ± 0.3

[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	A6 Long Beach	A7[1] Taylors Island	CAM Cambridge
01/15/2002	*	*	*
02/15/2002	*	*	*
03/15/2002	*	*	*
04/15/2002	*	*	*
05/15/2002	*	*	*
06/15/2002	*	*	*
07/15/2002	*	*	*
08/15/2002	*	*	*
09/15/2002	*	*	*
10/15/2002	*	*	*
11/15/2002	*	*	*
12/15/2002	*	*	*

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

Table E-8

Concentration of Tritium and Gamma Emitters in Taylors Island Well Water (Results in units of 10^{-3} pCi/m^3 ± 2σ)

Sample Date	H-3	Gamma Emitters
01/29/2002	<39	*
03/12/2002	<38	*
04/03/2002	<39	*
04/30/2002	<38	*
05/29/2002	<38	*
06/25/2002	<38	*
07/30/2002	<37	*
08/27/2002	<37	*
09/30/2002	<37	*
10/29/2002	<36	*
12/10/2002	<36	*
12/31/2002	<36	*

*Non-Natural Gamma Emitters <MDA

Table E-9

Direct Radiation as Measured in Pressurized Ion Chamber
(Results in units of mR/30 days ± 10%)

Sample Code	Month		Month	
PIC1[1]	JAN	6.21 ± 0.62	FEB	6.22 ± 0.62
Taylor's Island	MAR	6.11 ± 0.61	APR	6.03 ± 0.60
	MAY	6.23 ± 0.62	JUN	6.48 ± 0.65
	JUL	6.64 ± 0.66	AUG	6.57 ± 0.66
	SEP	6.38 ± 0.64	OCT	6.36 ± 0.64
	NOV	5.90 ± 0.59	DEC	5.55 ± 0.56
PIC2	JAN	4.17 ± 0.41	FEB	4.12 ± 0.41
Entrance to	MAR	4.05 ± 0.40	APR	4.13 ± 0.41
Camp Conoy	MAY	4.00 ± 0.40	JUN	3.81 ± 0.38
	JUL	3.81 ± 0.38	AUG	3.74 ± 0.37
	SEP	3.71 ± 0.37	OCT	4.12 ± 0.41
	NOV	3.98 ± 0.40	DEC	3.96 ± 0.40
PIC3	JAN	4.84 ± 0.48	FEB	5.11 ± 0.51
MET Station	MAR	5.43 ± 0.54	APR	5.14 ± 0.51
	MAY	5.04 ± 0.50	JUN	5.21 ± 0.52
	JUL	4.89 ± 0.49	AUG	4.90 ± 0.49
	SEP	4.70 ± 0.47	OCT	4.82 ± 0.48
	NOV	4.94 ± 0.49	DEC	4.94 ± 0.49
PIC4	JAN	10.28 ± 1.03	FEB	10.25 ± 1.02
NNW of ISFSI	MAR	10.38 ± 1.04	APR	14.09 ± 1.41
	MAY	12.22 ± 1.22	JUN	11.89 ± 1.19
	JUL	11.81 ± 1.18	AUG	11.82 ± 1.18
	SEP	11.76 ± 1.18	OCT	11.85 ± 1.18
	NOV	11.94 ± 1.19	DEC	12.00 ± 1.20
PIC5	JAN	5.10 ± 0.51	FEB	5.03 ± 0.50
SSE of ISFSI	MAR	5.00 ± 0.50	APR	4.84 ± 0.48
	MAY	4.82 ± 0.48	JUN	4.93 ± 0.49
	JUL	5.06 ± 0.51	AUG	5.01 ± 0.50
	SEP	4.96 ± 0.50	OCT	5.24 ± 0.52
	NOV	5.45 ± 0.54	DEC	5.72 ± 0.57
PIC8	JAN	4.76 ± 0.48	FEB	4.97 ± 0.50
Visitor's Center	MAR	5.02 ± 0.50	APR	4.92 ± 0.49
	MAY	4.85 ± 0.48	JUN	4.96 ± 0.50
	JUL	5.08 ± 0.51	AUG	4.86 ± 0.49
	SEP	4.65 ± 0.46	OCT	4.66 ± 0.47
	NOV	4.90 ± 0.49	DEC	4.91 ± 0.49

[1] Control Location

Table E-10

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.	8.62 ± 1.15	10.75 ± 0.96	12.28 ± 0.76	13.10 ± 0.98
DR25	Camp Conoy Guard House	9.50 ± 0.90	11.98 ± 1.14	13.74 ± 1.54	13.77 ± 1.18
DR26	Rt. 234 and Clark's Landing Road	10.12 ± 0.95	9.34 ± 0.46	11.55 ± 0.75	12.24 ± 0.20
DR27	Rt. 231 and Rt. 4	11.30 ± 0.77	10.39 ± 0.41	12.09 ± 0.70	13.13 ± 0.97
DR28	Taylors Is. Siren #35	14.05 ± 1.29	13.56 ± 0.46	16.63 ± 1.84	15.68 ± 1.00
DR29	Taylors Is. Siren #38	14.02 ± 0.89	11.88 ± 1.06	15.28 ± 2.01	16.14 ± 1.52
DR31	Cambridge	14.60 ± 0.83	13.37 ± 1.16	16.60 ± 1.72	16.96 ± 0.99
DR32	Twining Property, Taylors Island	10.14 ± 0.20	8.77 ± 1.09	16.49 ± 1.49	15.90 ± 1.14
DR33	P. A. Ransome Property	14.89 ± 1.03	13.56 ± 1.62	16.99 ± 1.42	17.18 ± 0.61
DR34	Shoreline at Barge Rd.	9.23 ± 0.57	8.50 ± 0.86	10.23 ± 1.04	11.18 ± 1.30
OSGDR1	North of OSGSF	17.88 ±1.69	17.70 ±1.83	18.38 ±2.57	20.44 ±1.28
OSGDR2	West of OSGSF	15.94 ±1.97	14.09 ±1.61	16.10 ±1.66	17.00 ±1.84

Table E-11

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
RPDR5	North Fence Lower	20.91 ± 2.90	19.07 ± 2.82	15.83 ± 1.45	16.87 ± 2.38
RPDR6	North Fence Upper	23.04 ± 5.17	18.71 ± 2.28	16.20 ± 1.50	17.04 ± 0.66
RPDR7	West Fence Right	38.04 ± 2.18	15.78 ± 1.86	19.20 ± 1.55	23.38 ± 2.38
RPDR8	West Fence Left	37.08 ± 6.37	17.54 ± 1.63	18.68 ± 1.23	18.94 ± 1.85
RPDR9	South Fence Upper	28.29 ± 2.75	19.28 ± 0.71	21.08 ± 2.14	18.91 ± 2.29
RPDR10	South Fence Lower	28.45 ± 2.88	20.96 ± 1.68	23.75 ± 1.57	21.48 ± 2.43
RPDR11	East Fence Left	13.96 ± 1.34	13.43 ± 0.41	16.27 ± 2.01	17.89 ± 1.10
RPDR12	East Fence Right	24.30 ± 2.74	21.78 ± 1.67	27.98 ± 2.62	29.63 ± 0.77