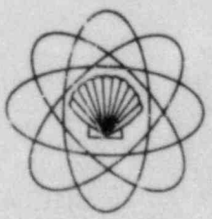
# *RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

# *ANNUAL REPORT*

*For The*

## *CALVERT CLIFFS NUCLEAR POWER PLANT*
## *UNITS 1 AND 2*

*January 1, — December 31, 1982*



*Prepared by*

## *BALTIMORE GAS & ELECTRIC COMPANY*

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# RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT CALVERT CLIFFS NUCLEAR PLANT UNITS 1 AND 2 JANUARY 1 - DECEMBER 31, 1982

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## A. SUMMARY

During this operating period for Calvert Cliffs Unit 1 and Unit 2, Radiation Management Corporation (RMC) and Baltimore Gas and Electric Company (BG&E) analyzed samples from the aquatic, atmospheric, and terrestrial environments. A total of 1,046 analyses were performed on 738 environmental samples during this period. In addition, BG&E personnel analyzed 612 thermoluminescent dosimeters (TLD's) for ambient radiation dose rates.

Samples from the aquatic environment included bay water, fish, shellfish (oysters, crabs), and sediment. Bay water was analyzed for tritium, Sr-89, Sr-90, and gamma emitting nuclides. Fish, shellfish, and sediment were analyzed for gamma emitting nuclides. Fish bones and sediment were also analyzed for Sr-89 and Sr-90.

Monitoring of the atmospheric environment included sampling air and precipitation. Air particulates and gaseous iodine were collected on glass fiber filters and silver zeolite molecular sieve cartridges, respectively. The particulate filters were analyzed for gross beta activity and for gamma emitting nuclides while the molecular sieve cartridges were analyzed for I-131. Analyses were made for Sr-89 and Sr-90 on quarterly composited air particulate filters. Precipitation was analyzed for gross beta, H-3, Sr-89, Sr-90 and gamma emitting nuclides.

Samples from the terrestrial environment included vegetation, soil, and ground water samples. The vegetation and soil samples were analyzed for gamma emitters, Sr-89, and Sr-90. The ground water samples were analyzed for H-3 and gamma emitting nuclides.

Measurements of external radiation were performed by analyzing TLD's from 13 locations surrounding the plant.

Low levels of various radionuclides were observed in the environment surrounding the plant during 1982. Some of these observations may be attributed to the fallout from recent and past atmospheric nuclear testing, and some may be directly related to the operation of the plant. With reference to the later observations: H-3, Co-58, and Sr-89 were observed in a few bay water samples taken from locations 7 and 8; Ag-110m was observed in both oyster and crab samples from all locations and Co-58 and Zn-65 were observed in some oyster samples from location 5; Mn-54, Co-60, and Sr-89 appeared in sediment samples in a pattern similar to that observed in the past; and Sr-89 was sporadically observed in a few air particulate filter, vegetation, and soil samples taken from locations nearby the plant. In all of these cases the activities are low and, consequently, would have very little radiological impact on the surrounding environment.

In order 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, and appropriate

pathways. The results of these dose calculations indicate:

a. a maximum thyroid dose (via inhalation and garden vegetable pathways) of 0.22 mrem at location 14, which is less than 0.3% of the acceptable limit of 75 mrem/year as specified in 40 CFR 190 Environmental Radiation Protection Standards for Nuclear Power Operations;

b. a maximum whole body gamma dose of 0.034 mrem at location 18, which is less than 0.2% of the acceptable dose of 25 mrem/year (40 CFR 190);

c. a maximum whole body dose (via all liquid pathways) of 0.08 mrem, which is less than 0.5% of the acceptable limit of 25 mrem/year (40 CFR 190).

Thus it is concluded, based upon the levels of radioactivity observed and the various dose calculations performed, that the operation of Calvert Cliffs Nuclear Power Plant Units 1 and 2 during 1982 did not cause any significant changes in radionuclide inventory of the surrounding environment or in the ambient radiation levels of critical pathways.

## B. INTRODUCTION

Baltimore Gas and Electric Company (BG&E) has been conducting a radiological environmental monitoring program in the environs of the Calvert Cliffs Nuclear Power Plant since the summer of 197C. Results of the analyses of environmental samples for the preoperational and operational periods through December 31, 1981, have been reported in a series of documents (1-18).

This report presents the type and number of samples analyzed, the analyses performed (see Table 1 for a summary of the surveillance program) and the data generated during 1982. Interpretation of the data and conclusions are presented.

Appendix A summarizes the sample media and relative sampling locations with respect to the Calvert Cliffs Nuclear Power Plant (Table A-1 and Figure A-1). Figure A-2 shows the location of the Calvert Cliffs Nuclear Site in relation to the Chesapeake Bay and Southern Maryland. The Calvert Cliffs site is an operating nuclear generating station consisting of two PWR Units. 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. Since July 29, 1977, we have been operating under combined Environmental Technical Specifications for Units 1 and 2 (19). Prior to this date, separate Environmental Technical Specifications (20, 21) were in effect for each unit.

## C. PROGRAM

The environmental surveillance data collected during this reporting period were compared with that generated in previous periods in evaluating the environmental radiological impact of the operation of Calvert Cliffs Nuclear Power Plant Units 1 and 2.

### C.1 Objectives

The objectives of the operational radiological environmental program are:

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

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

c. To monitor and evaluate ambient radiation levels,

d. To verify that radioactivity and ambient radiation levels attributable to the plant are within the limits specified in the Technical Specifications (19) and the Environmental Radiation Protection Standards as set forth in 40 CFR Part 190.

## C.2 Sample Collection

The locations of the individual sampling stations are listed in Table A-1 and shown in Figure A-2. All samples were collected by consultants to, or personnel of, Baltimore Gas and Electric Company according to BG&E operating procedures (22). Radiochemical analyses were performed by RMC and BG&E.

Ambient radiation measurements were made by Baltimore Gas and Electric Company personnel in accordance with an operating procedure (25). These measurements were made with thermoluminescent dosimeters as previously described (10).

## C.3 Data Interpretation

Analytical data generated during the program are routinely evaluated. In the interpretation of the data several factors are important and are discussed here to avoid repetition in the sections that follow.

It is characteristic of environmental monitoring data that many results occur at or below the minimum detectable level (MDL). In this report, all results occurring at or below the relevant MDL are reported as being "less than" the MDL value.

Annual means, range and typical MDL's are presented for each type of analysis for every sample media. Results of individual analyses are also presented with applicable standard deviations.

In the case of gamma spectrometry, if no activity of a particular nuclide was found, no average was calculated for that nuclide.

## C.4 Program Exceptions

No milk samples were available during 1982, because there were no milk cows within five miles of the Plant.

No rooted aquatic plants were found during 1982.

Samples of crabs were unavailable during the first quarter of 1982.

Edible fish samples were unavailable during the first quarter of 1982, because the commercial pound nets south of Cove Point were not deployed during that period.

Bay water samples for January 1982 could not be collected, because the Bay was icy during that period.

## D. RESULTS AND DISCUSSIONS

All environmental samples were either analyzed by RMC laboratory procedures (23) or BG&E laboratory procedures (24). The analytical results for this reporting period, presented in Appendix B and also summarized on an annual basis in Table 2, have been divided into four catagories -- aquatic, atmospheric, terrestrial environment, and external radiation.

### D.1 Aquatic Environment

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

### D.1.a Bay Water

Monthly bay water samples were taken from two locations; the Plant Intake area (location 8), and the Plant Outfall area (location 7). These samples were analyzed for H-3, gamma emitters, and Sr-89 and Sr-90.

Monthly analyses for H-3 in these samples exhibited concentrations ranging from <121 to 572±114 pCi/l for location 7 and from <119 to 309±117 pCi/l for location 8. Most of the H-3 results observed in samples obtained from both locations were less than the minimum detectable limit. The few positive results observed in these samples are similar to the results observed in both the preoperational (6) and previous operational periods (18).

Monthly analyses for gamma emitters in these samples showed only the detectable concentration of Co-58 at 5.1±1.1 pCi/l in the May sample from location 7. The presence of Co-58 in this sample is probably plant related.

Quarterly analyses for radiostrontium showed a single detectable concentration of Sr-89 (viz., 1.3±1.2 pCi/l in the first quarter composite sample from location 8), and a single detectable concentration of Sr-90 (viz., 1.9±0.7 pCi/l in the second quarter composite sample from location 7). The detectable concentration of Sr-89 is similar in magnitude to that observed in prior operating periods (18) and may be related to plant operation. The Sr-90 concentration is comparable with concentrations observed during the preoperational (6) and previous operational (18) periods, and is probably due to residual fallout from past nuclear weapons testing.

### D.1.b Aquatic Organisms

Quarterly samples of aquatic organisms were taken from five locations; the pound nets south of Cove Point (location 1), Kenwood Beach (location 3), Rocky Point (location 4), Camp Conoy (location 5) and Plant Intake area (location 8). The edible portions of these samples were analyzed for gamma emitters, and samples of fish bones were analyzed for Sr-89 and Sr-90.

Quarterly analyses of some of the fish samples collected during the second and third quarters from location 1 showed detectable concentrations of Cs-137 in the range of 10±6 to 17±7 pCi/kg. This range of results is similar to the ranges previously observed in both the preoperational (6) and prior operational periods (18).

Quarterly analyses for gamma emitters in shellfish samples from all sites exhibited detectable concentrations of Ag-110m, primarily in the third and fourth quarters of the year. For crab samples the Ag-110m concentrations ranged from 17±6 to 69±14 pCi/kg, and for oysters the Ag-110m ranged from 11±5 to 532±24 pCi/kg, with the highest concentrations observed at location 5. In addition to Ag-110m, the activation products Co-58 (a single quarterly value of 21±10 pCi/kg) and Zn-65 (ranging from 53±17 to 73±27 pCi/kg) were also observed in oyster samples from location 5. The concentration levels of these radionuclides are similar to levels observed in previous years (15-18), and their presence is probably plant-related.

Quarterly radiostrontium analyses of the bones of fish samples showed no detectable concentrations of Sr-89. Strontium-90, on the other hand, was observed in most samples in the range of 1.5±1.3 to 4.4±4.1 pCi/kg. These results seem to fall into the same general pattern as observed in both the preoperational (6) and previous operational periods (18).

D.1.c Sediment

Quarterly sediment samples were taken from four locations; Camp Conoy (location 5), Long Beach (location 6), Plant Intake area (location 8), and Plant Outfall area (location 7). These samples were analyzed for gamma emitters and Sr-89 and Sr-90.

Quarterly analyses for gamma emitters in these samples revealed the presence of the following radionuclides: Cs-137 in all samples from all locations, ranging from 40±35 to 1005±86 pCi/kg; Co-60 in most of the samples from all locations, ranging from 38±22 to 380±91 pCi/kg; Nb-95, Zr-95, and Ce-144 sporadically present in samples obtained in the first quarter of the year; and Mn-54 present in the first quarter sample taken from location 6 at a concentration of 48±48 pCi/kg. The ranges of Cs-137 concentration exhibited are similar to the ranges observed in the preoperational (6) and previous operational (18) periods. In addition, the presence of Nb-95, Zr-95, and Ce-144 in samples obtained exclusively in the first quarter of the year is probably related to past nuclear weapons testing, since these radionuclides are typical of the "main fallout nuclides" and the pattern of their appearance follows the trends observed in the previous reporting periods (16-18). On the other hand, Mn-54 and Co-60 are among the activation products released in routine radioactive discharges. The concentrations of these activation products are similar to those observed in prior operational periods (18).

Quarterly radiostrontium analyses of the sediment samples showed only a single detectable concentration of Sr-89 (viz., 126±100 pCi/kg in the second quarter sample from location 8) and two detectable concentrations of Sr-90

(viz., 62±27 pCi/kg in the second quarter sample from location 6 and 40±38 pCi/kg in the second quarter sample from location 7). The Sr-89 result may be related to plant operation, whereas the Sr-90 results are similar to the results observed in both preoperational (6) and previous operational (18) periods and are most probably due to fallout from past nuclear weapons testing.

D.2 Atmospheric Environment

The atmospheric environment was monitored by analyzing samples of air particulate filters, silver zeolite cartridges, and precipitation samples. These samples were collected from various locations surrounding the plant.

D.2.a Air Particulate Filters

Weekly composite air filters were collected from seven locations; On Site (location 17), On Site (location 18), Knotty Pine (location 19), Lusby (location 20), Long Beach (location 21), Cove Point (location 22), and Taylors Island (location 23). These samples were analyzed for beta activity, gamma emitters, and Sr-89 and Sr-90.

Weekly analyses for beta activity on air particulate filters revealed that the annual range of data for each site was much lower than the ranges exhibited in previous years (16-18). This is most probably due to a gradual decrease of fallout from past nuclear weapons testing. The current ranges are similar to those observed prior to the first of a series of nuclear detonations conducted by the People's Republic of China (12). (The first test occurred on September 26, 1976.)

Monthly analyses for gamma emitters showed no detectable concentrations of any fission or activation by-products.

Quarterly radiostrontium analyses of air particulate filters exhibited the sporadic presence of both Sr-89 and Sr-90 in detectable concentrations which are at or very near the MDL for this type of analysis. Though these results may be related to past nuclear weapons testing, they may also be related in part to plant operation.

D.2.b Air Iodine

Weekly composite radioiodine samples were collected from five locations; On Site (location 17), On Site (location 18), Lusby (location 20), Cove Point (location 22), and Taylors Island (location 23).

Radioiodine analyses performed on the samples from all locations exhibited no detectable concentrations of I-131.

D.2.c Precipitation

Monthly composite precipitation samples were collected from one site, On Site (location IS), and were analyzed for gross beta, H-3, gamma emitters, and Sr-89 and Sr-90.

Monthly analyses for beta activity in precipitation samples revealed that the annual range of data for this location was less than the ranges of recent years (13-18) and similar to the ranges observed prior to the September 26, 1976, nuclear weapons testing conducted by the People's Republic of China (12).

Quarterly analyses for H-3 in composites of these samples revealed no detectable concentrations of this radionuclide.

Monthly analyses for gamma emitters showed no detectable concentration of any fission or activation products.

Quarterly radiostrontium analyses of the composited precipitation samples showed no detectable concentrations of Sr-89 and only a single detectable concentration of Sr-90 (viz., 0.5±0.3 pCi/l in the second quarter sample). This single detectable concentration is similar to the results observed in both the preoperational (6) and previous operational periods (18) and is most probably due to fallout from nuclear weapons testing.

D.3 Terrestrial Environment

The terrestrial environment was monitored by analyzing samples of vegetation, soil, and well water. These samples were collected from various sampling locations near the plant.

D.3.a Vegetation

Vegetation samples were collected from three locations; On Site (location 14), a nearby farm (location 15), and another nearby farm (location 16). These samples included corn, hay, tobacco, and wheat. They were analyzed for gamma emitters and Sr-89 and Sr-90.

Analyses for gamma emitters in these samples revealed the presence of detectable concentrations of Cs-137 in two of the vegetation samples (viz., 37±13 pCi/kg in the November tobacco sample from location 14 and 18±5 pCi/kg in the November soybean samples from location 16). These results are similar to what was observed in previous operational periods (18) and are probably the result of fallout from past nuclear weapons testing.

Radiostrontium analyses of vegetation samples showed three detectable concentrations of Sr-89 (viz., 31±10 pCi/kg in the July broccoli sample from location 14, 321±40 pCi/kg in the November hay sample from location 15 and 50±45 pCi/kg in the November hay sample from location 16). The analyses also showed detectable concentrations of Sr-90, ranging from 17±4 to 900±140 pCi/kg, in most of the samples analyzed. The Sr-89 results may be related to plant operation; whereas the Sr-90 results seem to fall within the same general patterns observed in previous years (16, 17, 18) and are most probably attributable to fallout from past weapons testing.

D.3.b Soil

Soil samples were taken semiannually from three On Site locations; 11, 12, and 13. These samples were analyzed for gamma emitters and Sr-89 and Sr-90.

Analyses for gamma emitters revealed the presence of Cs-137 in most of these samples, ranging from 100±26 to 250±37 pCi/kg. In addition, a single detectable concentration of Nb-95 (52±31 pCi/kg) was observed in the sample from location 13 obtained during the first semiannual sampling period. Both of these radionuclides are probably due to the deposition of fallout from past nuclear weapons testing.

Radiostrontium analyses of the soil samples showed two detectable concentrations of Sr-89 (viz., 103±87 and 140±76 pCi/kg in the March samples from locations 11 and 13 respectively) and two detectable concentrations of Sr-90 (viz., 117±48 in the March sample from location 12 and 88±43 in the December sample from location 11). The Sr-89 results may be related to plant operation. The Sr-90 results are similar to the results observed in both the preoperational (6) and previous operational (18) periods and are probably related to fallout from past nuclear testing.

D.3.c Well Water

Quarterly well water samples were collected from five locations: Chesapeake Country Club (location 2), On Site (location 10), Long Beach (location 21), and White Sands Club (locations 25A and 25B). These samples were analyzed for H-3 and gamma emitters.

Quarterly analyses for H-3 and gamma emitters in these samples showed that no detectable concentrations of any fission or activation by-product were present.

D.4 External Radiation

Thermoluminescent dosimeters were collected monthly from 13 locations surrounding the plant, namely: Plant Outfall (location 7), On Site (location 17), On Site (location 18), Knotty Pine (location 19), Lusby (location 20), Long Beach (location 21), Cove Point (location 22), Taylors Island (location 23), On Site (location 24), White Sands Club Sign (location 25), St. Leonard (location 26), Solomons Island (location 27), and Bertha Church (location 28). The dosimeters were read for external radiation dose rates in mR.

The TLD data for each site are compiled in Table B-13 and are presented on an annual basis in Table 2. The means and ranges expressed in Table 2 were compared with the means and ranges for the span of years from 1978 to 1981 (15-18). This comparison revealed that the means and ranges for 1982 were similar to those observed in the four preceding years.

## E. CONCLUSION

Detectable concentrations of radionuclides were occasionally observed in samples from various locations during the year. Some of these observations may be attributed to the fallout from atmospheric nuclear weapons testing conducted in October 1980 and in previous years, and some may be directly related to the operation of the plant (e.g., H-3, Co-58, and Sr-89 in bay

water; Co-58, Zn-65, and Ag-110m in shellfish samples; Mn-54, Co-60 and Sr-89 in sediment; and Sr-89 in air filter, vegetation, and soil samples). In all cases, the concentrations observed are low and, consequently, would have insignificant radiological impact on the surrounding environment.

In order 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, and appropriate pathways. The results of these dose calculations indicate:

a. a maximum thyroid dose (via inhalation and garden vegetable pathways) of 0.22 mrem at location 14, which is less than 0.3% of the acceptable limit of 75 mrem/year as specified in 40 CFR 190 Environmental Radiation Protection Standards for Nuclear Power Operations;

b. a maximum whole body gamma dose of 0.034 mrem at location 18, which is less than 0.2% of the acceptable dose of 25 mrem/year (40 CFR 190);

c. a maximum whole body dose (via all liquid pathways) of 0.08 mrem, which is less than 0.5% of the acceptable limit of 25 mrem/year (40 CFR 190).

Thus it is concluded, based upon the levels of radioactivity observed and the various dose calculations performed, that the operation of Calvert Cliffs Nuclear Power Plant Units 1 and 2 during 1982 did not cause any significant changes in the radionuclide inventory of the surrounding environment or in the ambient radiation levels of critical pathways.

TABLE 1

SYNOPSIS OF THE 1982 CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
Docket Nos. 50-317/318

| SAMPLE TYPE | SAMPLING* FREQUENCY | NUMBER OF LOCATIONS | NUMBER COLLECTED | ANALYSIS | ANALYSIS* FREQUENCY | NUMBER PERFORMED |
|---|---|---|---|---|---|---|
| AQUATIC ENVIRONMENT | | | | | | |
| Bay Water | M | 2 | 22 | H-3 | M | 22 |
| | | | | Gamma (GeLi) | M | 22 |
| | | | | Sr-89 | QC | 8 |
| | | | | Sr-90 | QC | 8 |
| Fish(1) | Q | 1 | 8 | Flesh | | |
| | | | | Gamma (GeLi) | Q | 8 |
| | | | | Bones | | |
| | | | | Sr-89 | Q | 8 |
| | | | | Sr-90 | Q | 8 |
| Shell Fish(2) (Crabs, Oysters) | Q | 4 | 17 | Flesh | | |
| | | | | Gamma (GeLi) | Q | 17 |
| Bottom Sediments | Q | 4 | 16 | Gamma (GeLi) | Q | 16 |
| | | | | Sr-89 | Q | 16 |
| | | | | Sr-90 | Q | 16 |
| Rooted Aquatic Plant (3) | Spring & Fall | 1 | - | Gamma (GeLi) | 2/A | - |
| | | | | Sr-89 | 2/A | - |
| | | | | Sr-90 | 2/A | - |

TABLE 1 (CONTINUED)

SYNOPSIS OF THE 1982 CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
Docket Nos. 50-317/318

| SAMPLE TYPE | SAMPLING* FREQUENCY | NUMBER OF LOCATIONS | NUMBER COLLECTED | ANALYSIS | ANALYSIS* FREQUENCY | NUMBER PERFORMED |
|---|---|---|---|---|---|---|
| ATMOSPHERIC ENVIRONMENT | | | | | | |
| Air Iodine(4) | W | 5 | 260 | I-131 | W | 260 |
| Air Particulates(5) | W | 7 | 364 | Gross Beta | W | 364 |
| | | | | Gamma (GeLi) | MQ | 84 |
| | | | | Sr-89 | QC | 28 |
| | | | | Sr-90 | QC | 28 |
| Precipitation(6) | Continuous | 1 | 12 | H-3 | QC | 4 |
| | | | | Gross Beta | M | 12 |
| | | | | Gamma (GeLi) | M | 12 |
| | | | | Sr-89 | QC | 4 |
| | | | | Sr-90 | QC | 4 |
| TERRESTRIAL ENVIRONMENT | | | | | | |
| Vegetation(7) | At Harvest | 3 | 13 | Gamma (NaI) | A | 13 |
| | | | | Sr-89 | A | 13 |
| | | | | Sr-90 | A | 13 |
| Soil | SA | 3 | 6 | Gamma (GeLi) | SA | 6 |
| | | | | Sr-89 | SA | 6 |
| | | | | Sr-90 | SA | 6 |

TABLE 1 (CONTINUED)

SYNOPSIS OF THE 1982 CALVERT CLIFFS NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
Docket Nos. 50-317/318

| SAMPLE TYPE | SAMPLING* FREQUENCY | NUMBER OF LOCATIONS | NUMBER COLLECTED | ANALYSIS | ANALYSIS* FREQUENCY | NUMBER PERFORMED |
|---|---|---|---|---|---|---|
| TERRESTRIAL ENVIRONMENT (CONT.) | | | | | | |
| Ground Water | Q | 5 | 20 | H-3 | Q | 20 |
| | | | | Gamma (GeLi) | Q | 20 |
| External Radiation | M | 13 | 612 | TLD | M | 612 |

* W - weekly, M - monthly, Q - quarterly, SA - semi-annual, A - annual, C - composite

(1) Edible species are sampled when available.
(2) The location of crab samples may vary depending upon their availability.
(3) Sampling may be interrupted when no rooted aquatic plants are available.
(4) The collection devices contain silver zeolite.
(5) After a minimum decay period of 72 hrs, beta counts are performed. Gamma spectrometry is performed on monthly composites of weekly samples. Strontium-89 and -90 analyses are performed on quarterly composites of weekly samples.
(6) All analyses subject to sufficient sample collection.
(7) Predominant food crops (corn & small grains) are sampled when available.

TABLE 2

ANNUAL SUMMARY OF RADIOACTIVITY IN THE ENVIRONS
OF THE CALVERT CLIFFS NUCLEAR POWER PLANT
UNITS 1 AND 2 (JANUARY - DECEMBER, 1982)

Docket Nos. 50-317/318

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results | |
|---|---|---|---|---|---|
| | | | | Mean (f)* | Range*** |
| | | | | pCi/l | |
| Aquatic Environment | | | | | |
| Bay Water | 7 Plant Outfall | H-3 | 122 | 346 (2/11) | (119-572) |
| | | Sr-90 | 0.7 | 1.9 (1/4) | (<0.4-1.9) |
| | 8 Plant Intake | H-3 | 122 | 309 (1/11) | (<119-309) |
| | | Sr-89 | 2.0 | 1.3 (1/4) | (< 0.5-1.3) |
| | | | | pCi/Kg (Wet) | |
| Fish | | | | | |
| Bluefish | 1 Cove Point | Sr-90 | 5 | 4.5 (3/5) | - |
| | | Cs-137 | 13 | 14 (2/5) | (<13-17) |
| Flounder | 1 Cove Point | Sr-90 | 5 | 10 (1/1) | (<5-10) |
| Sea Trout | 1 Cove Point | Sr-90 | 5 | 2.8 (2/3) | - |
| | | Cs-137 | 13 | 10 (1/1) | - |
| | | | | pCi/Kg (Wet) | |
| Shellfish | | | | | |
| Crabs | 3 Kenwood Beach** | Ag-110m | 12 | 17 (1/4) | (<12-17) |
| Crabs | 4 Rocky Point | Ag-110m | 12 | 33 (2/4) | (<12-42) |
| Crabs | 8 Plant Intake | Ag-110m | 12 | 63 (2/4) | (<12-69) |

TABLE 2 (CONTINUED)

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results Mean (f)* | Annual Results Range*** |
|---|---|---|---|---|---|
| | | | | pCi/Kg (Wet) | |
| Shellfish (continued) Oysters | 3 Kenwood Beach** | Ag-110m | 12 | 18 (2/4) | (<12-24) |
| Oysters | 5 Camp Conoy | Co-58 | 17 | 21 (1/4) | (<17-21) |
| | | Zn-65 | 34 | 64 (3/4) | (<34-73) |
| | | Ag-110m | 12 | 264 (4/4) | (<12-532) |
| | | | | pCi/Kg (Dry) | |
| Bottom Sediment | 5 Camp Conoy | Co-60 | 69 | 181 (4/4) | (<69-253) |
| | | Cs-137 | - | 358 (4/4) | - |
| | | Ce-144 | 184 | 831 (1/4) | (<184-831) |
| | 6 Long Beach** | Mn-54 | 44 | 48 (1/4) | (<44-48) |
| | | Co-60 | 69 | 206 (3/4) | (<69-292) |
| | | Sr-90 | 78 | 62 (1/4) | - |
| | | Cs-137 | - | 734 (4/4) | - |
| | 7 Plant Outfall | Co-60 | 69 | 90 (3/4) | (<69-107) |
| | | Sr-90 | 52 | 40 (1/4) | - |
| | | Nb-95 | 61 | 62 (1/4) | (<61-62) |
| | | Zr-95 | 83 | 273 (1/4) | (<83-273) |
| | | Cs-137 | - | 463 (4/4) | - |
| | | Ce-144 | 184 | 165 (1/4) | - |
| | 8 Plant Intake | Co-60 | 69 | 380 (1/4) | (<69-380) |
| | | Sr-89 | 171 | 126 (1/4) | - |
| | | Cs-137 | - | 246 (4/4) | - |

TABLE 2 (CONTINUED)

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results Mean (f)* | Annual Results Range*** |
|---|---|---|---|---|---|
| Atmospheric Environment | | | | $10^{-2}$ pCi/m$^3$ | |
| Air Particulates | 17 On Site | Gross Beta | 0.2 | 1.2 (50/52) | (<0.2-3.0) |
| | | Sr-90 | 0.3 | 0.2 (1/3) | - |
| | 18 On Site | Gross Beta | 0.2 | 1.3 (51/52) | (<0.2-2.6) |
| | | Sr-89 | 0.6 | 0.3 (1/4) | - |
| | 19 On Site | Gross Beta | 0.2 | 1.4 (52/52) | (<0.2-3.0) |
| | | Sr-89 | 0.3 | 0.4 (1/4) | (<0.3-0.4) |
| | 20 Lusby | Gross Beta | 0.2 | 1.4 (51/52) | (<0.2-3.0) |
| | 21 Long Beach | Gross Beta | 0.2 | 1.3 (52/52) | (<0.2-3.2) |
| | | Sr-89 | 0.5 | 0.2 (1/3) | - |
| | | Sr-90 | 0.2 | 0.2 (1/3) | - |
| | 22 Cove Point | Gross Beta | 0.2 | 1.6 (52/52) | (<0.2-3.2) |
| | | Sr-90 | 0.3 | 0.3 (1/3) | - |
| | 23 Taylors Island** | Gross Beta | 0.2 | 1.2 (51/52) | (<0.2-3.1) |
| | | Sr-89 | 0.5 | 0.5 (1/4) | - |
| Precipitation | | | | pCi/l | |
| | IS On Site | Gross Beta | 0.2 | 6.1 (12/12) | (<0.2-11) |
| | | Sr-90 | 0.5 | 0.5 (1/4) | - |

TABLE 2 (CONTINUED)

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results Mean (f)* | Annual Results Range*** |
|---|---|---|---|---|---|
| Terrestrial Environment | | | | | |
| Vegetation | | | | pCi/Kg (Wet) | |
| Lettuce | 14 Old Bay Farm | Sr-90 | 8 | 795 (1/1) | (<8-795) |
| Broccoli | 14 Old Bay Farm | Sr-89 | 75 | 31 (1/1) | - |
| Cabbage | 14 Old Bay Farm | Sr-90 | 8 | 17 (1/1) | (<8-17) |
| Swiss Chard | 14 Old Bay Farm | Sr-90 | 8 | 57 (2/2) | (<8-66) |
| Tobacco | 14 Old Bay Farm | Sr-90 | 8 | 35 (1/1) | (<8-35) |
| | | Cs-137 | 17 | 37 (1/1) | (<17-37) |
| Hay | 14 Old Bay Farm | Sr-90 | 8 | 135 (1/1) | (<8-135) |
| Hay | 15 Farm | Sr-89 | 75 | 321 (1/1) | (<75-321) |
| | | Sr-90 | 8 | 143 (1/1) | (<8-143) |
| Tobacco | 15 Farm | Sr-90 | 8 | 900 (1/1) | (<8-900) |
| Hay | 16 Farm | Sr-89 | 75 | 50 (1/1) | - |
| | | Sr-90 | 8 | 135 (1/1) | (<8-135) |
| Soybean | 16 Farm | Sr-90 | 8 | 127 (1/1) | (<8-127) |
| | | Cs-137 | 17 | 18 (1/1) | (<17-18) |
| Tobacco | 16 Farm | Sr-90 | 8 | 28 (1/1) | (<8-28) |

TABLE 2 (CONTINUED)

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results Mean (f)* | Annual Results Range*** |
|---|---|---|---|---|---|
| Terrestrial Environment (Continued) | | | | | |
| Soil | | | | pCi/Kg (Dry) | |
| | 11 On Site | Sr-89 | <71 | 103 (1/2) | (<71-103) |
| | | Sr-90 | <47 | 88 (1/2) | (<47-88) |
| | | Cs-137 | - | 196 (2/2) | - |
| | 12 On Site | Sr-90 | <27 | 117 (1/2) | (<27-117) |
| | | Cs-137 | - | 100 (1/2) | - |
| | 13 On Site | Sr-89 | <51 | 140 (1/2) | (<51-140) |
| | | Nb-95 | <35 | 52 (1/2) | (<35-52) |
| | | Cs-137 | - | 192 (2/2) | - |
| | | Ce-144 | 142 | 427 (1/1) | (<142-427) |
| External Radiation | | | | Mr/30 days | **** |
| | 7 Plant Outfall | | | 3.04 (10/12) | (2.45-3.65) |
| | 17 On Site | | | 4.63 (12/12) | (4.37-5.21) |
| | 18 On Site | | | 4.28 (12/12) | (3.77-5.10) |
| | 19 Knotty Pine | | | 3.87 (12/12) | (3.55-4.32) |
| | 20 Lusby | | | 3.92 (12/12) | (3.63-4.31) |
| | 21 Flag Harbor | | | 4.09 (12/12) | (3.72-4.69) |
| | 22 Cove Point | | | 3.91 (12/12) | (3.54-4.57) |

TABLE 2 (CONTINUED)

| Sample Type | Site | Radioactivity | Typical MDL's | Annual Results Mean (f)* | Annual Results Range*** |
|---|---|---|---|---|---|
| External Radiation (continued) | | | | Mr/30 days | **** |
| | 23 Taylors Island** | | | 5.36 (12/12) | (4.79-6.50) |
| | 24 On Site | | | 4.99 (12/12) | (4.59-5.60) |
| | 25 White Sands Club Sign | | | 4.59 (11/12) | (4.35-4.86) |
| | 26 St. Leonard | | | 4.02 (12/12) | (3.69-4.44) |
| | 27 Solomons | | | 3.80 (12/12) | (3.44-4.20) |
| | 28 Bertha | | | 4.33 (12/12) | (3.99-5.06) |

* Mean emcompasses only detectable quantities; fractions in parenthesis represent the proportion of detectable quantities to total quantities in a data set. For External Radiation, the fractions represent the proportion of TLD's recovered to the total placed in the field.
** Control locations.
*** Minimum observable to maximum observed.
**** Minimum to maximum observed.

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# APPENDIX A

Appendix A contains information concerning the environmental samples which were collected during the period January 1, 1982 - December 31, 1982.

Sampling locations and specific information about the individual locations are given in Table A-1. Figure A-2 shows the locations of sampling stations with respect to the plant site. Figure A-1 shows the location of the Calvert Cliffs Nuclear Power Plant with respect to Southern Maryland and the Chesapeake Bay.

TABLE A-1
LOCATIONS OF ENVIRONMENTAL SAMPLING STATIONS
FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT

Docket Nos. 50-317/318

| STATION | DESCRIPTION | DISTANCE* (FEET) | DIRECTION (SECTOR) |
|---|---|---|---|
| 1 | Pound Nets South of Cove Point | 38,000 | SE |
| 2 | Chesapeake Country Club | 20,000 | SSE |
| 3 | Kenwood Beach | 35,000 | NNW |
| 4 | Rocky Point | 10,000 | NNW |
| 5 | Camp Conoy | 3,000 | SE |
| 6 | Long Beach | 15,000 | NNW |
| 7 | Plant Outfall Area | 2,500 | NE |
| 8 | Plant Intake Area | 5,000 | E |
| 10 | Onsite Well | 600 | SE |
| 11 | On Site | 1,300 | WNW |
| 12 | On Site | 1,600 | WSW |
| 13 | On Site | 2,400 | SSE |
| 14 | Cultivated Field on Site | 1,200 | W |
| 15 | Farm | 24,000 | WSW |
| 16 | Farm | 22,000 | SW |
| 17 | On Site | 1,200 | NW |
| 18 | On Site | 2,000 | SE |
| 19 | Knotty Pine** | 8,900 | WSW |
| 20 | Lusby | 9,900 | SSW |
| 21 | Long Beach | 14,000 | NW |
| 22 | Cove Point | 24,000 | SE |
| 23 | Taylors Island | 40,000 | ENE |
| 24 | On Site | 1,800 | NW |
| 25 | White Sands Club Sign | 7,300 | WSW |
| 26 | St. Leonard | 27,000 | NW |
| 27 | Solomons | 42,000 | S |
| 28 | Bertha | 17,000 | S |
| 29 | Flag Ponds | 7,500 | NW |
| 30 | Store (Lusby) | 9,900 | SSW |
| 1S | On Site | 1,400 | SSW |
| PS | Plant Site | 4,600 | NNW |

*Distance measured from plant vent.

** This location is now under a new management with a new name . . . "Giovanni's".

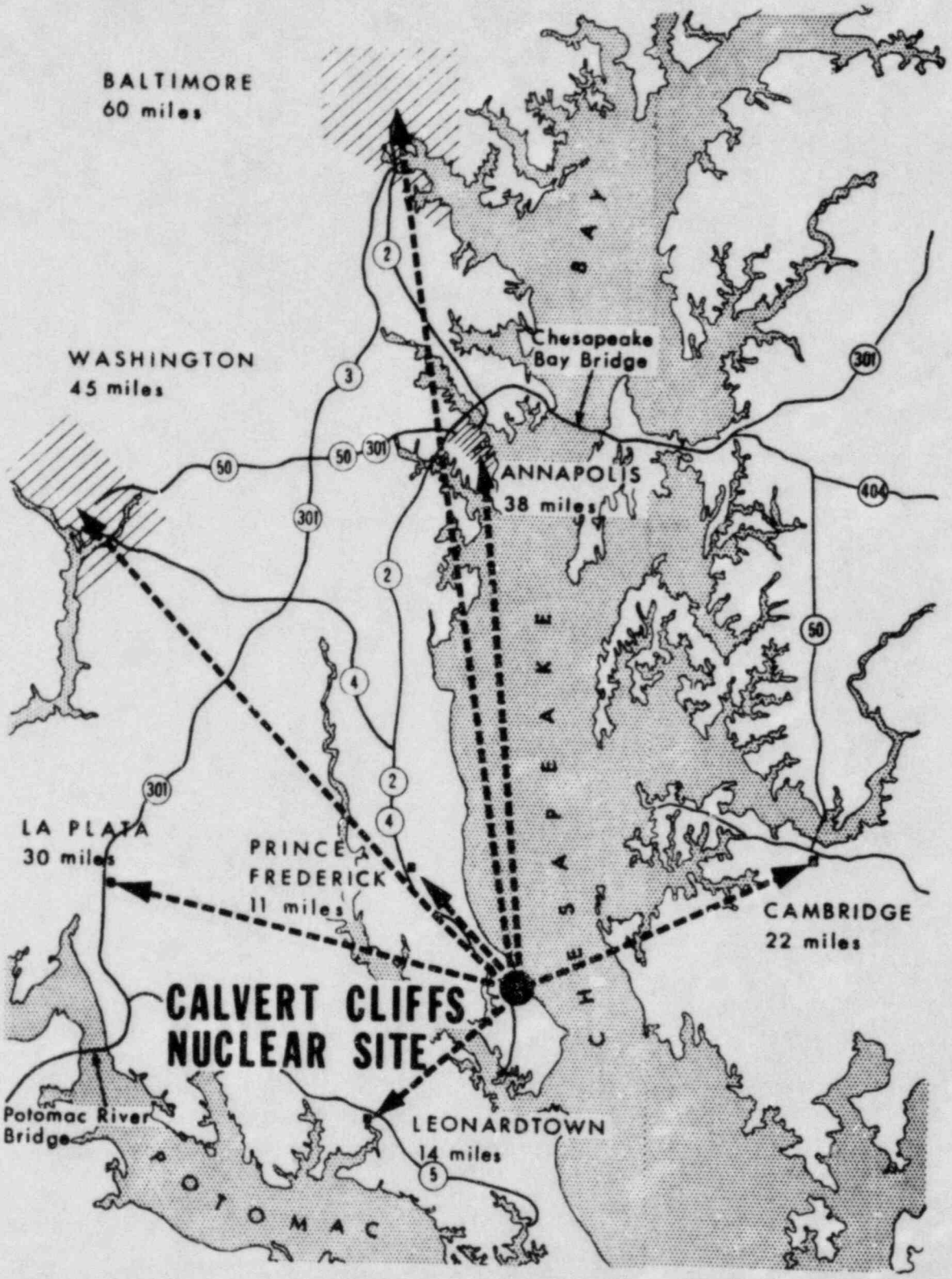


FIGURE A-1

Map of Southern Maryland and Chesapeake Bay Showing
Location of Calvert Cliffs Nuclear Power Plant

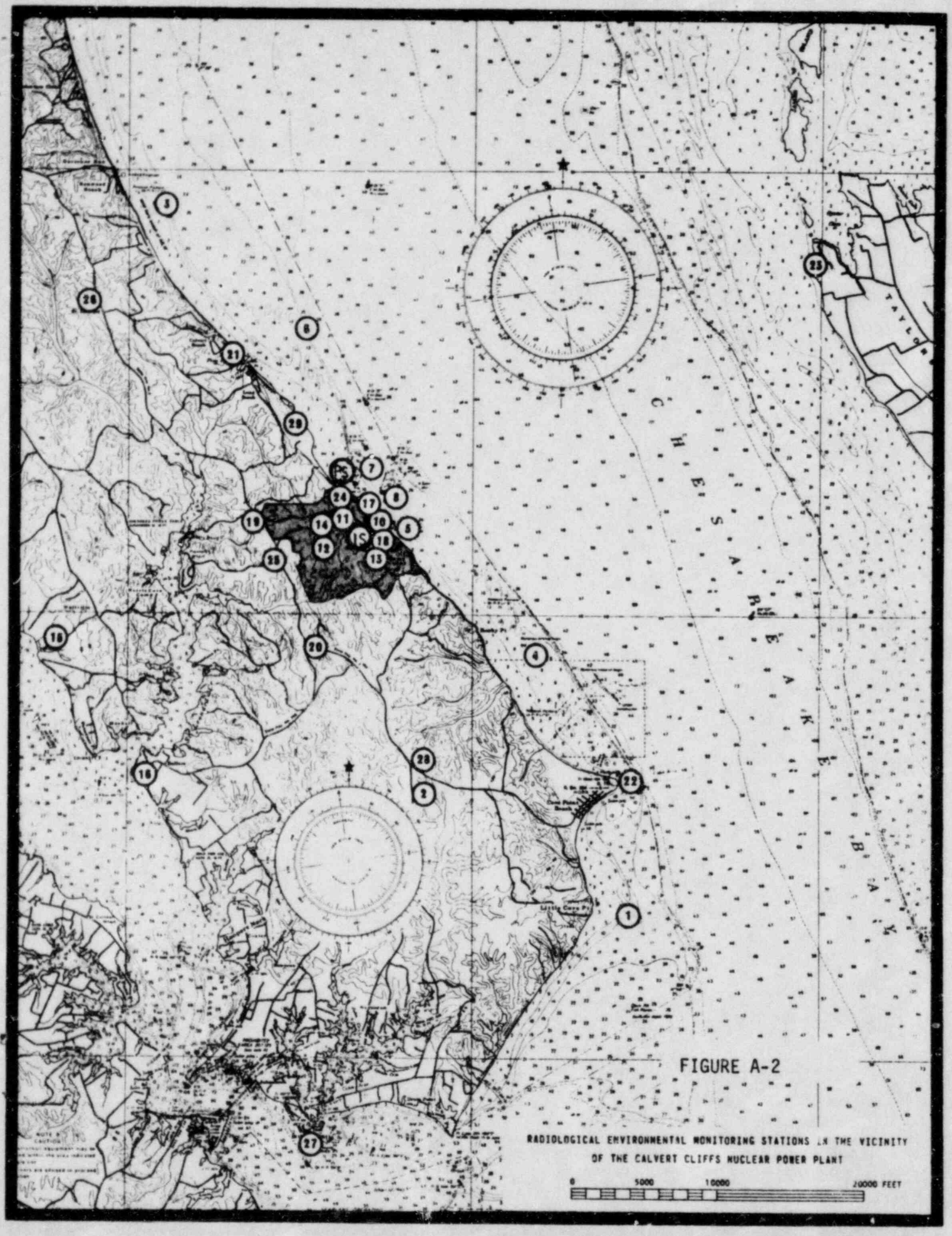


FIGURE A-2

RADIOLOGICAL ENVIRONMENTAL MONITORING STATIONS IN THE VICINITY OF THE CALVERT CLIFFS NUCLEAR POWER PLANT

# APPENDIX B

## Data Tables

Appendix B is a presentation of the analytical results of the 1982 Calvert Cliffs Nuclear Power Plant Radiological Environmental Monitoring Program.

TABLE B-1
CONCENTRATIONS OF TRITIUM, GAMMA EMITTERS, AND
STRONTIUM-89 AND -90 IN BAY WATER
(Results in Units of pCi/l ± 2σ)

| Date | Station No. | H-3 | Gamma Emitters | Sr-89* | Sr-90* |
|---|---|---|---|---|---|
| 1/82 | 7 | ** | ** | | |
| | 8 | ** | ** | | |
| 2/19/82 | 7 | <121 | *** | <3.5 | <1.6 |
| | 8 | <120 | *** | 1.3±1.2 | <0.6 |
| 3/10/82 | 7 | <121 | *** | | |
| | 8 | <119 | *** | | |
| 4/22/82 | 7 | <121 | *** | | |
| | 6 | <122 | *** | | |
| 5/17/82 | 7 | 572±114 | *** | <3.7 | 1.9±0.7 |
| | 8 | <120 | *** | <2.8 | <1.1 |
| 6/22/82 | 7 | <121 | *** | | |
| | 8 | <120 | *** | | |
| 7/20/82 | 7 | 119±114 | *** | | |
| | 8 | 309±117 | *** | | |
| 8/23/82 | 7 | <121 | *** | <1.5 | <0.4 |
| | 8 | <121 | *** | <1.5 | <0.4 |
| 9/20/82 | 7 | <121 | *** | | |
| | 8 | <123 | *** | | |
| 10/27/82 | 7 | <122 | *** | | |
| | 8 | <123 | *** | | |
| 11/16/82 | 7 | <122 | *** | <0.4 | <0.4 |
| | 8 | <123 | *** | <0.5 | <0.4 |
| 12/14/82 | 7 | <124 | *** | | |
| | 8 | <124 | *** | | |

*Analyses done in quarterly composites of monthly samples.
**Samples unavailable.
***Cobalt-58 was observed in the May sample from location 7 at a concentration of 5.1±1.1 pCi/l. Naturally occurring K-40 was observed in all samples. All other gamma emitters not cited were < MDL; typical MDL's are given in Table B-12.

TABLE B-2
CONCENTRATIONS OF GAMMA EMITTERS* AND STRONTIUM-89
AND -90 IN FLESH AND BONES OF FISH
(Results in Units of pCi/kg $\pm$ 2$\sigma$)

| Station No. | Sample Date | Sample Type | Cs-137 | Sr-89 | Sr-90 |
|---|---|---|---|---|---|
| 1 (Pound Nets South of Cove Point) | First Quarter | ** | ** | ** | ** |
| 1 | 6/15/82 | Bluefish | 17±7 | <38 | <5.5 |
| 1 | 7/06/82 | Bluefish | <MDL | <31 | 4.1±3.8 |
| | | Sea Trout | <MDL | <48 | <6.4 |
| | 8/09/82 | Bluefish | 11±5 | <14 | 4.4±4.1 |
| | | Sea Trout | 10±6 | <25 | 1.5±1.3 |
| 1 | 10/12/82 | Bluefish | <MDL | <17 | 5±4 |
| | | Flounder | <MDL | <19 | 10±4 |
| | | Weakfish | <MDL | <18 | <3.8 |

*Naturally occurring K-40 was observed in all samples. All other gamma emitters not cited were <MDL; typical MDL's are given in Table B-12.

**Samples unavailable.

TABLE B-3
CONCENTRATIONS OF GAMMA EMITTERS* IN
SHELLFISH SAMPLES
(Results in Units of pCi/kg (Wet) ± 2σ)

| Station No. | Sample Date | Sample Type | Co-58 | Zn-65 | Ag-110m |
|---|---|---|---|---|---|
| 3 | First | | | | |
| (Kenwood | Quarter | Crabs | ** | ** | ** |
| Beach | 3/10/82 | Oysters | <MDL | <MDL | <MDL |
| Control | 6/15/82 | Crabs | <MDL | <MDL | <MDL |
| Location) | 6/01/82 | Oysters | <MDL | <MDL | <MDL |
| | 8/15/82 | Crabs | <MDL | <MDL | 17±6 |
| | 8/27/82 | Oysters | <MDL | <MDL | 12±6 |
| | 10/05/82 | Crabs | <MDL | <MDL | <MDL |
| | 11/18/82 | Oysters | <MDL | <MDL | 24±10 |
| 4 | First | | | | |
| (Rocky | Quarter | Crabs | ** | ** | ** |
| Point) | 6/15/82 | Crabs | <MDL | <MDL | <MDL |
| | 8/15/82 | Crabs | <MDL | <MDL | 42±11 |
| | 10/05/82 | Crabs | <MDL | <MDL | 24±12 |
| 5 | 3/10/82 | Oysters | <MDL | <MDL | 14±5 |
| (Camp | 6/01/82 | Oysters | <MDL | 53±17 | 11±5 |
| Conoy) | 8/27/82 | Oysters | 21±10 | 73±27 | 496±19 |
| | 11/18/82 | Oysters | <MDL | 65±27 | 532±24 |
| 8 | First | | | | |
| (Plant | Quarter | Crabs | ** | ** | ** |
| Intake) | 6/15/82 | Crabs | <MDL | <MDL | <MDL |
| | 8/15/82 | Crabs | <MDL | <MDL | 57±16 |
| | 10/05/82 | Crabs | <MDL | <MDL | 69±14 |

*Naturally occurring K-40 observed in all samples. All other gamma emitters not cited were <MDL; typical MDL's are given in Table B-12.

**Samples unavailable.

TABLE B-4
CONCENTRATIONS OF GAMMA EMITTERS* AND
STRONTIUM-89 AND -90 IN BOTTOM SEDIMENT
(Results in Units of pCi/kg (Dry) ± 2σ)

| Station No. | Date | Sr-89 | Sr-90 | Mn-54 | Co-60 | Nb-95 | Zr-95 | Cs-137 | Ce-144 |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 3/10/82 | <160 | <69 | <MDL | 253±64 | <MDL | <MDL | 441±65 | 831±196 |
| (Camp | 6/01/82 | <199 | <57 | <MDL | 211±50 | <MDL | <MDL | 271±44 | <MDL |
| Conoy) | 9/24/82 | <211 | <54 | <MDL | 220±66 | <MDL | <MDL | 619±84 | <MDL |
| | 10/27/82 | <174 | <56 | <MDL | 38±22 | <MDL | <MDL | 99±29 | <MDL |
| 6 | 3/10/82 | <243 | <109 | 48±48 | 130±57 | <MDL | <MDL | 617±70 | <MDL |
| (Long | 6/01/82 | <204 | 62±27 | <MDL | <MDL | <MDL | <MDL | 765±80 | <MDL |
| Beach | 9/24/82 | <228 | <58 | <MDL | 196±60 | <MDL | <MDL | 876±92 | <MDL |
| Control Location) | 10/27/82 | <197 | <66 | <MDL | 292±77 | <MDL | <MDL | 677±75 | <MDL |
| 7 | 3/10/82 | <146 | <56 | <MDL | 107±55 | 62±59 | 273±108 | 458±55 | 165±152 |
| (Plant | 6/01/82 | <202 | 40±38 | <MDL | 72±48 | <MDL | <MDL | 350±52 | <MDL |
| Outfall) | 9/24/82 | <208 | <52 | <MDL | <MDL | <MDL | <MDL | 1005±86 | <MDL |
| | 10/27/82 | <115 | <49 | <MDL | 91±37 | <MDL | <MDL | 40±35 | <MDL |
| 8 | 3/10/82 | <254 | <28 | <MDL | <MDL | <MDL | <MDL | 155±31 | <MDL |
| (Plant | 6/01/82 | 126±100 | <38 | <MDL | <MDL | <MDL | <MDL | 259±40 | <MDL |
| Intake) | 9/24/82 | <143 | <35 | <MDL | <MDL | <MDL | <MDL | 45±24 | <MDL |
| | 10/24/82 | <117 | <50 | <MDL | 380±91 | <MDL | <MDL | 524±71 | <MDL |

*Naturally occurring K-40, Ra-226, and Th-232 were observed in samples. All other emitters were <MDL; typical MDL's are given in Table B-12.

TABLE B-5
CONCENTRATIONS OF I-131 IN FILTERED AIR
(Results in Units of $10^{-3}$ pCi/$m^3$ ± 2σ)

| Start Date | Stop Date | On Site #17 | On Site #18 | Lusby #20 | Cove Point #22 | Taylors Island* #23 |
|---|---|---|---|---|---|---|
| 1/04/82 | 1/11/82 | <3.9 | ** | <4.0 | <6.0 | <2.9 |
| 1/11/82 | 1/18/82 | <4.2 | <4.0 | <3.9 | <6.1 | <3.9 |
| 1/18/82 | 1/25/82 | <3.6 | <4.4 | <3.9 | <4.7 | <3.7 |
| 1/25/82 | 2/01/82 | <4.0 | <4.2 | <4.1 | <6.3 | <4.0 |
| 2/01/82 | 2/08/82 | <3.9 | <4.1 | <3.4 | <6.2 | <4.7 |
| 2/08/82 | 2/16/82 | <3.7 | <3.5 | <3.6 | <5.3 | <4.2 |
| 2/16/82 | 2/22/82 | <4.5 | <4.5 | <4.7 | <7.0 | <4.1 |
| 2/22/82 | 3/01/82 | <3.9 | <3.8 | <4.0 | <5.9 | <4.5 |
| 3/01/82 | 3/08/82 | <3.0 | <4.1 | <3.8 | <6.1 | <5.0 |
| 3/08/82 | 3/15/82 | <3.9 | <3.4 | <3.9 | <4.0 | <4.7 |
| 3/15/82 | 3/22/82 | <3.9 | <4.1 | <4.1 | <6.1 | <4.5 |
| 3/22/82 | 3/29/82 | <4.0 | <4.1 | <4.0 | <6.0 | <3.9 |
| 3/29/82 | 4/05/82 | <4.0 | <4.0 | <4.0 | <6.6 | <5.2 |
| 4/05/82 | 4/12/82 | <4.4 | <4.1 | <4.4 | <6.4 | <4.3 |
| 4/12/82 | 4/19/82 | <4.3 | <3.6 | <4.0 | <6.7 | <5.9 |
| 4/19/82 | 4/26/82 | <3.8 | <3.6 | <4.5 | <6.7 | <6.3 |
| 4/26/82 | 5/03/82 | <4.0 | <4.5 | <4.2 | <6.1 | <6.2 |
| 5/03/82 | 5/10/82 | <4.4 | <4.3 | <4.2 | <6.6 | <6.0 |
| 5/10/82 | 5/17/82 | <4.2 | <4.1 | <3.7 | <6.1 | <3.2 |
| 5/17/82 | 5/24/82 | <3.6 | <3.9 | <3.9 | <6.1 | <3.5 |
| 5/24/82 | 6/01/82 | <4.6 | <4.0 | <3.1 | <4.9 | <3.9 |
| 6/01/82 | 6/07/82 | <5.0 | <5.5 | <5.0 | <7.9 | <3.7 |
| 6/07/82 | 6/14/82 | <4.3 | <4.4 | <4.7 | <6.1 | <3.6 |
| 6/14/82 | 6/21/82 | <3.7 | <6.5 | <4.2 | <6.1 | <3.8 |
| 6/21/82 | 6/28/82 | <4.8 | <4.6 | <4.2 | <6.1 | <3.9 |
| 6/28/82 | 7/05/82 | <3.7 | <3.6 | <3.7 | <2.7 | <3.7 |
| 7/05/82 | 7/12/82 | <4.8 | <4.7 | <5.2 | <5.5 | <4.3 |
| 7/12/82 | 7/19/82 | <4.5 | <4.0 | <4.6 | <4.7 | <3.9 |
| 7/19/82 | 7/26/82 | <4.9 | <3.9 | <4.7 | <4.7 | <4.2 |
| 7/26/82 | 8/02/82 | <4.2 | <4.0 | <4.0 | <4.7 | <4.0 |
| 8/02/82 | 8/09/82 | <4.3 | <3.1 | <4.6 | <4.5 | <4.2 |
| 8/09/82 | 8/16/82 | <4.4 | <3.6 | <4.0 | <4.4 | <4.3 |
| 8/16/82 | 8/23/82 | <4.4 | <4.1 | <4.4 | <4.6 | <4.1 |
| 8/23/82 | 8/30/82 | <4.4 | <4.0 | <4.2 | <4.6 | <4.2 |
| 8/30/82 | 9/06/82 | <3.9 | <3.5 | <3.8 | <4.1 | <4.4 |
| 9/06/82 | 9/13/82 | <6.7 | <4.5 | <4.9 | <5.2 | <4.5 |
| 9/13/82 | 9/20/82 | <4.5 | <4.0 | <3.6 | <4.9 | <4.3 |
| 9/20/82 | 9/27/82 | <4.8 | <4.1 | <4.3 | <4.5 | <4.3 |
| 9/27/82 | 10/04/82 | <4.4 | <4.2 | <4.2 | <4.9 | <4.3 |

TABLE B-5 (CONTINUED)
CONCENTRATIONS OF I-131 IN FILTERED AIR
(Results in Units of $10^{-3}$ pCi/$m^3$ ± 2σ)

| Start Date | Stop Date | On Site #17 | On Site #18 | Lusby #20 | Cove Point #22 | Taylors Island* #23 |
|---|---|---|---|---|---|---|
| 10/04/82 | 10/11/82 | <4.6 | <4.2 | <4.3 | <4.4 | <4.6 |
| 10/11/82 | 10/18/82 | <4.6 | <4.1 | <4.3 | <4.6 | <4.5 |
| 10/18/82 | 10/25/82 | <4.8 | <4.3 | <4.6 | <4.7 | <4.4 |
| 10/25/82 | 11/01/82 | <4.7 | <4.6 | <4.3 | <4.9 | <4.7 |
| 11/01/82 | 11/08/82 | <4.8 | <4.2 | <5.0 | <4.6 | <4.3 |
| 11/08/82 | 11/15/82 | <5.6 | <4.4 | <5.7 | <4.6 | <4.5 |
| 11/15/82 | 11/22/82 | <5.1 | <3.7 | <4.8 | <4.8 | <4.5 |
| 11/22/82 | 11/29/82 | <4.5 | <3.5 | <6.1 | <4.9 | <4.7 |
| 11/29/82 | 12/06/82 | <4.6 | <3.6 | <4.9 | <5.0 | <3.9 |
| 12/06/82 | 12/13/82 | <4.6 | <3.9 | <5.1 | <4.9 | <3.9 |
| 12/13/82 | 12/20/82 | <4.7 | <3.7 | <4.6 | <5.1 | <3.6 |
| 12/20/82 | 12/27/82 | <4.5 | <3.4 | <4.3 | <5.1 | <4.0 |
| 12/27/82 | 1/03/83 | <4.7 | <3.9 | <4.1 | <4.7 | <3.8 |

*Control location.
**Air sampler malfunction.

TABLE B-6
CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES
(Results in Units of $10^{-2}$ pCi/$m^3$ ± 2σ)

| Start Date | Stop Date | On Site #17 | On Site #18 | Knotty Pine #19 | Lusby #20 | Long Beach #21 | Cove Point #22 | Taylors Island* #23 |
|---|---|---|---|---|---|---|---|---|
| 1/04/82 | 1/11/82 | 3.0±0.3 | 2.6±0.6 | 2.9±0.3 | 2.8±0.3 | 1.9±0.2 | 2.7±0.4 | 1.4±0.2 |
| 1/11/82 | 1/18/82 | 2.5±0.3 | 2.5±0.3 | 2.5±0.3 | 2.4±0.3 | 2.0±0.2 | 2.7±0.3 | 1.1±0.2 |
| 1/18/82 | 1/25/82 | 2.6±0.3 | 2.6±0.3 | 2.9±0.3 | 2.7±0.3 | 2.6±0.3 | 3.2±0.4 | 1.6±0.3 |
| 1/25/82 | 2/01/82 | 2.0±0.3 | 2.4±0.3 | 2.4±0.3 | 2.2±0.3 | 1.4±0.3 | 2.6±0.4 | 1.0±0.2 |
| 2/01/82 | 2/08/82 | 1.9±0.3 | 1.6±0.3 | 2.1±0.2 | 2.1±0.3 | 1.4±0.2 | 1.6±0.4 | 2.1±0.3 |
| 2/08/82 | 2/16/82 | 2.4±0.3 | 2.6±0.3 | 3.2±0.3 | 3.0±0.3 | 2.4±0.2 | 2.4±0.4 | 1.1±0.2 |
| 2/16/82 | 2/22/82 | 1.4±0.3 | 1.3±0.3 | 1.5±0.3 | 1.5±0.3 | 1.3±0.2 | 1.7±0.4 | 0.7±0.2 |
| 2/22/82 | 3/01/82 | 1.7±0.3 | 1.6±0.2 | 1.9±0.2 | 1.8±0.3 | 1.5±0.2 | 1.8±0.4 | 1.1±0.3 |
| 3/01/82 | 3/08/82 | 1.6±0.3 | 1.6±0.3 | 1.5±0.2 | 1.7±0.3 | 1.3±0.2 | 1.8±0.4 | 1.0±0.3 |
| 3/08/82 | 3/15/82 | 1.9±0.3 | 2.4±0.3 | 2.5±0.3 | 2.2±0.3 | 1.7±0.2 | 2.1±0.4 | 1.0±0.3 |
| 3/15/82 | 3/22/82 | 0.8±0.2 | 0.7±0.2 | 0.8±0.2 | 1.0±0.2 | 0.6±0.2 | 0.8±0.3 | 0.8±0.3 |
| 3/22/82 | 3/29/82 | 1.5±0.3 | 1.6±0.3 | 1.2±0.2 | 1.8±0.3 | 1.7±0.2 | 1.9±0.4 | 0.9±0.3 |
| 3/29/82 | 4/05/82 | 1.9±0.3 | 1.3±0.2 | 2.1±0.2 | 1.4±0.2 | 1.7±0.2 | 2.3±0.4 | 0.9±0.3 |
| 4/05/82 | 4/12/82 | 1.9±0.3 | 2.2±0.3 | 2.2±0.3 | 2.7±0.3 | 2.0±0.2 | 2.3±0.4 | 1.2±0.3 |
| 4/12/82 | 4/19/82 | 1.2±0.2 | 1.4±0.2 | 1.8±0.3 | 1.5±0.2 | 1.3±0.2 | 2.0±0.4 | 0.8±0.3 |
| 4/19/82 | 4/26/82 | 1.3±0.3 | 1.4±0.2 | 1.5±0.2 | 1.9±0.3 | 1.2±0.2 | 2.3±0.4 | 1.1±0.3 |
| 4/26/82 | 5/03/82 | 1.7±0.3 | 1.9±0.3 | 1.9±0.3 | 1.8±0.3 | 1.6±0.2 | 2.1±0.4 | 1.6±0.4 |
| 5/03/82 | 5/10/82 | 1.2±0.2 | 1.1±0.2 | 1.4±0.2 | 1.4±0.2 | 1.2±0.2 | 1.8±0.4 | 1.1±0.3 |
| 5/10/82 | 5/17/82 | 1.2±0.2 | 1.4±0.2 | 1.3±0.2 | 1.1±0.2 | 1.0±0.2 | 1.7±0.4 | 1.7±0.3 |
| 5/17/82 | 5/24/82 | 0.7±0.2 | 1.1±0.2 | 0.8±0.2 | 0.9±0.2 | 0.8±0.2 | 1.3±0.3 | 0.8±0.2 |
| 5/24/82 | 6/01/82 | 0.8±0.2 | 1.1±0.2 | 0.7±0.2 | 0.9±0.2 | 0.5±0.2 | 1.0±0.3 | 0.4±0.2 |
| 6/01/82 | 6/07/82 | 0.2±0.2 | <0.3 | 0.4±0.2 | 0.8±0.3 | 0.3±0.2 | 0.6±0.4 | 0.5±0.2 |
| 6/07/82 | 6/14/82 | 0.4±0.2 | 0.8±0.2 | 0.6±0.2 | 0.7±0.3 | 0.4±0.2 | 0.7±0.3 | <0.2 |
| 6/14/82 | 6/21/82 | 0.8±0.2 | 0.8±0.3 | 0.8±0.2 | 0.9±0.3 | 0.5±0.2 | 1.2±0.3 | 0.7±0.2 |
| 6/21/82 | 6/28/82 | 1.1±0.3 | 1.9±0.3 | 1.1±0.2 | 1.1±0.3 | 0.7±0.2 | 1.7±0.4 | 1.1±0.2 |
| 6/28/82 | 7/05/82 | 0.8±0.2 | 1.0±0.2 | 0.7±0.2 | 0.9±0.2 | 0.6±0.2 | 0.8±0.2 | 0.6±0.2 |
| 7/05/82 | 7/12/82 | 0.6±0.2 | 0.5±0.2 | 0.6±0.2 | 0.6±0.3 | 0.8±0.2 | 0.9±0.3 | 0.6±0.2 |
| 7/12/82 | 7/19/82 | 0.8±0.2 | 0.9±0.2 | 0.8±0.2 | 1.2±0.2 | 0.6±0.2 | 1.2±0.2 | 0.7±0.2 |
| 7/19/82 | 7/26/82 | 1.0±0.3 | 1.1±0.2 | 1.6±0.2 | 1.1±0.3 | 0.4±0.2 | 1.1±0.3 | 0.9±0.2 |
| 7/26/82 | 8/02/82 | 0.7±0.2 | 0.9±0.2 | 1.0±0.2 | 0.9±0.2 | 0.8±0.2 | 1.8±0.3 | 0.9±0.2 |
| 8/02/82 | 8/09/82 | 1.0±0.3 | 0.9±0.2 | 1.0±0.2 | 1.4±0.3 | 0.7±0.2 | 1.4±0.3 | 0.9±0.2 |
| 8/09/82 | 8/16/82 | 1.1±0.2 | 0.9±0.2 | 0.8±0.2 | 1.1±0.2 | 0.8±0.2 | 1.7±0.3 | 1.8±0.3 |
| 8/16/82 | 8/23/82 | 1.0±0.3 | 1.1±0.2 | 0.9±0.2 | 1.0±0.3 | 0.4±0.2 | 1.2±0.3 | 1.4±0.3 |
| 8/23/82 | 8/30/82 | 1.2±0.2 | 1.3±0.3 | 0.9±0.2 | 1.5±0.3 | 0.6±0.2 | 1.7±0.3 | 1.4±0.3 |
| 8/30/82 | 9/06/82 | 1.1±0.2 | 1.1±0.2 | 0.9±0.2 | 1.2±0.2 | 0.5±0.2 | 1.4±0.3 | 1.4±0.3 |
| 9/06/82 | 9/13/82 | 1.2±0.3 | 1.0±0.3 | 0.9±0.2 | 1.2±0.2 | 0.8±0.2 | 1.6±0.3 | 2.2±0.3 |
| 9/13/82 | 9/20/82 | 1.2±0.2 | 1.2±0.2 | 0.9±0.2 | 0.9±0.2 | 1.2±0.2 | 1.9±0.3 | 2.0±0.3 |
| 9/20/82 | 9/27/82 | 0.6±0.2 | 0.9±0.2 | 1.8±0.2 | 1.9±0.3 | 1.0±0.3 | 0.7±0.2 | 0.8±0.2 |
| 9/27/82 | 10/04/82 | 1.1±0.3 | 0.8±0.2 | 0.9±0.2 | 0.9±0.2 | 0.6±0.2 | 1.2±0.3 | 1.5±0.3 |

TABLE B-6 (CONTINUED)
CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES
(Results in Units of $10^{-2}$ pCi/$m^3$ ± 2σ)

| Start Date | Stop Date | On Site #17 | On Site #18 | Knotty Pine #19 | Lusby #20 | Long Beach #21 | Cove Point #22 | Taylors Island* #23 |
|---|---|---|---|---|---|---|---|---|
| 10/04/82 | 10/11/82 | 1.8±0.3 | 1.5±0.3 | 1.0±0.2 | 1.3±0.3 | 1.3±0.2 | 2.4±0.3 | 2.3±0.3 |
| 10/11/82 | 10/18/82 | 2.1±0.3 | 0.9±0.2 | 0.8±0.2 | 2.4±0.3 | 0.4±0.2 | 1.2±0.3 | 1.1±0.2 |
| 10/18/82 | 10/25/82 | 0.4±0.2 | 0.5±0.2 | 1.4±0.2 | 1.3±0.3 | 0.7±0.3 | 0.7±0.2 | 0.8±0.2 |
| 10/25/82 | 11/01/82 | 1.4±0.3 | 1.9±0.3 | 3.0±0.3 | 2.1±0.3 | 3.2±0.3 | 2.5±0.3 | 3.1±0.3 |
| 11/01/82 | 11/08/82 | 0.4±0.2 | 1.0±0.2 | 1.2±0.2 | 0.4±0.2 | 2.3±0.2 | 1.1±0.3 | 1.0±0.3 |
| 11/08/82 | 11/15/82 | 0.7±0.3 | 0.8±0.2 | 1.2±0.2 | 0.7±0.3 | 2.7±0.3 | 1.2±0.3 | 0.9±0.2 |
| 11/15/82 | 11/22/82 | <0.2 | 1.0±0.2 | 1.4±0.2 | <0.2 | 1.7±0.2 | 1.0±0.3 | 2.1±0.3 |
| 11/22/82 | 11/29/82 | 0.5±0.2 | 1.0±0.2 | 1.4±0.2 | 0.8±0.3 | 1.5±0.2 | 0.9±0.3 | 0.8±0.2 |
| 11/29/82 | 12/06/82 | <0.2 | 0.7±0.2 | 1.5±0.3 | 0.5±0.3 | 1.3±0.2 | 0.6±0.3 | 1.0±0.2 |
| 12/06/82 | 12/13/82 | 1.7±0.3 | 1.4±0.2 | 1.8±0.2 | 1.2±0.3 | 1.9±0.2 | 1.4±0.3 | 1.6±0.2 |
| 12/13/82 | 12/20/82 | 0.6±0.2 | 1.2±0.2 | 1.6±0.2 | 1.2±0.3 | 1.7±0.2 | 1.2±0.3 | 1.3±0.2 |
| 12/20/82 | 12/27/82 | 0.7±0.2 | 1.5±0.2 | 1.5±0.2 | 1.6±0.3 | 1.7±0.2 | 1.2±0.3 | 1.5±0.2 |
| 12/27/82 | 1/03/83 | 0.7±0.2 | 1.5±0.3 | 1.7±0.2 | 1.6±0.3 | 2.0±0.2 | 1.5±0.3 | 1.5±0.3 |

*Control location.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS
STRONTIUM-89 AND -90 IN AIR PARTICULATES
(Results in Units of $10^{-3}$ pCi/$m^3$ ± 2σ)

| Station No. | Date | Sr-89* | Sr-90* | Gamma Emitters |
|---|---|---|---|---|
| 17 | 1/82 | | | ** |
| (On Site) | 2/82 | *** | *** | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | <0.4 | 0.2±0.2 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.7 | <0.3 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | <0.5 | <0.3 | ** |
| | 12/82 | | | ** |
| 18 | | | | |
| (On Site) | 1/82 | | | ** |
| | 2/82 | 0.3±0.3 | <0.2 | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | <0.5 | <0.2 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.8 | <0.4 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | <0.6 | <0.3 | ** |
| | 12/82 | | | ** |
| 19 | 1/82 | | | ** |
| (Knotty | 2/82 | 0.4±0.3 | <0.1 | ** |
| Pine) | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | <0.4 | <0.2 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.3 | <0.2 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | 0.3 | 0.2 | ** |
| | 12/82 | | | ** |
| 20 | 1/82 | | | ** |
| (Lusby) | 2/82 | <0.3 | <0.2 | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |

TABLE B-7 (CONTINUED)
CONCENTRATIONS OF GAMMA EMITTERS
STRONTIUM-89 AND -90 IN AIR PARTICULATES
(Results in Units of $10^{-3}$ pCi/$m^3$ ± 2σ)

| Station No. | Date | Sr-89* | Sr-90* | Gamma Emitters |
|---|---|---|---|---|
| 20 (Lusby) (Con't) | 5/82 | <0.3 | <0.2 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.5 | <0.3 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | <0.5 | <0.2 | ** |
| | 12/82 | | | ** |
| 21 (Long Beach) | 1/82 | | | ** |
| | 2/82 | *** | *** | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | 0.2±0.2 | <0.1 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.7 | <0.2 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | <0.3 | 0.2±0.2 | ** |
| | 12/82 | | | ** |
| 22 (Cove Point) | 1/82 | | | ** |
| | 2/82 | *** | *** | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | <0.5 | 0.3±0.3 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.8 | <0.2 | ** |
| | 9/82 | | | ** |
| | 10/82 | | | ** |
| | 11/82 | <0.5 | <0.3 | ** |
| | 12/82 | | | ** |
| 23 (Taylors Island Control Location) | 1/82 | | | ** |
| | 2/82 | <0.3 | <0.2 | ** |
| | 3/82 | | | ** |
| | 4/82 | | | ** |
| | 5/82 | 0.5±0.4 | <0.2 | ** |
| | 6/82 | | | ** |
| | 7/82 | | | ** |
| | 8/82 | <0.7 | <0.2 | ** |

TABLE B-7 (CONTINUED)
CONCENTRATIONS OF GAMMA EMITTERS
STRONTIUM-89 AND -90 IN AIR PARTICULATES
(Results in Units of $10^{-3}$ pCi/$m^3$ ± 2σ)

| Station No. | Date | Sr-89* | Sr-90* | Gamma Emitters |
|---|---|---|---|---|
| 23 | 9/82 | | | ** |
| (Taylors | 10/82 | | | ** |
| Island | 11/82 | <0.4 | <0.2 | ** |
| Control | 12/82 | | | ** |
| Location) | | | | |

*Quarterly composites of weekly samples.
**Naturally occurring K-40 and Be-7 were observed in most samples. All other gamma emitters not cited were MDL; typical MDL's are given in Table B-12.
***Samples lost during analysis.

TABLE B-8
CONCENTRATIONS OF BETA, TRITIUM, GAMMA EMITTERS*
AND STRONTIUM-89 AND -90 IN PRECIPITATION--STATION IS (ON SITE)
(Results in Units of pCi/l ± 2σ)

| Date | Beta | H-3** | Sr-89** | Sr-90** |
|---|---|---|---|---|
| 1/82 | 11±1 | | | |
| 2/82 | 9.7±1.0 | <120 | <1.0 | <0.7 |
| 3/82 | 6.7±0.7 | | | |
| 4/82 | 4.8±0.6 | | | |
| 5/82 | 6.1±0.6 | <118 | <1.4 | 0.5±0.3 |
| 6/82 | 5.8±0.6 | | | |
| 7/82 | 5.3±0.7 | | | |
| 8/82 | 5.9±0.6 | <129 | <1.0 | <0.3 |
| 9/82 | 2.9±0.5 | | | |
| 10/82 | 8.6±0.9 | | | |
| 11/82 | 3.1±0.6 | <124 | <0.5 | <0.4 |
| 12/82 | 3.4±0.6 | | | |

*Naturally occurring Be-7 was observed in most samples. All other gamma emitters not cited were < MDL; typical MDL's are given in Table B-12.

**Quarterly analyses of composited monthly samples.

TABLE B-9
CONCENTRATIONS OF GAMMA EMITTERS* AND
STRONTIUM-89 AND -90 IN VEGETATION
(Results in Units of pCi/kg (Wet) ± 2σ)

| Station No. | Sample Date | Sample Type | Isotope Observed | Concentration |
|---|---|---|---|---|
| 14 | 7/08/82 | Lettuce | Sr-89 | <98 |
| | | | Sr-90 | 795±80 |
| 14 | 7/12/82 | Broccoli | Sr-89 | 31±10 |
| | | | Sr-90 | <9 |
| 14 | 7/12/82 | Cabbage | Sr-89 | <16 |
| | | | Sr-90 | 17±4 |
| 14 | 7/12/82 | Swiss Chard | Sr-89 | <44 |
| | | | Sr-90 | 66±8 |
| 14 | 9/08/82 | Swiss Chard | Sr-89 | <120 |
| | | | Sr-90 | 48±12 |
| 14 | 11/12/82 | Tobacco | Sr-89 | <39 |
| | | | Sr-90 | 35±18 |
| | | | Cs-137 | 37±13 |
| 14 | 12/02/82 | Hay | Sr-89 | <38 |
| | | | Sr-90 | 135±15 |
| 15 | 11/12/82 | Hay | Sr-89 | 321±40 |
| | | | Sr-90 | 143±14 |
| 15 | 11/12/82 | Silage | Sr-89 | <17 |
| | | | Sr-90 | <6 |
| 15 | 11/12/82 | Tobacco | Sr-89 | <355 |
| | | | Sr-90 | 900±140 |
| 16 | 11/12/82 | Hay | Sr-89 | 50±45 |
| | | | Sr-90 | 135±15 |
| 16 | 11/12/82 | Soybean | Sr-89 | <37 |
| | | | Sr-90 | 127±14 |
| | | | Cs-137 | 18±5 |
| 16 | 11/12/82 | Tobacco | Sr-89 | <31 |
| | | | Sr-90 | 28±15 |

*Naturally occurring K-40 was observed in all samples. All other gamma emitters not cited were <MDL; typical MDL's are given in Table B-12.

TABLE 10
CONCENTRATIONS OF GAMMA EMITTERS* AND
STRONTIUM-89 AND -90 IN SOIL
(Results in pCi/kg (Dry) ± 2σ)

| Date | 3/24/82 | | | 12/17/82 | | |
|---|---|---|---|---|---|---|
| Station No. | 11 (On Site) | 12 (On Site) | 13 (On Site) | 11 (On Site) | 12 (On Site) | 13 (On Site) |
| Sr-89 | 103±87 | <116 | 140±76 | <71 | <41 | <51 |
| Sr-90 | <47 | 117±48 | <45 | 88±43 | <27 | <35 |
| Nb-95 | <MDL | <MDL | 52±31 | <MDL | <MDL | <MDL |
| Cs-137 | 201±34 | 100±26 | 250±37 | 190±39 | <MDL | 134±28 |
| Ce-144 | <MDL | <MDL | 427±114 | <MDL | <MDL | <MDL |

*Naturally occurring Ra-226, Th-232, and K-40 were observed in all samples. All other gamma emitters not cited were <MDL; typical MDL's are given in Table B-12.

TABLE B-11
CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS
IN GROUND WATER
(Results in pCi/l ± 2σ)

| Station No. | Date | H-3 | Gamma Emitters |
|---|---|---|---|
| 2** (Chesapeake Country Club) | 3/24/82 | <122 | * |
| | 6/28/82 | <119 | * |
| | 8/30/82 | <129 | * |
| | 12/17/82 | <125 | * |
| 10 (On Site Well) | 3/24/82 | <121 | * |
| | 6/28/82 | <120 | * |
| | 8/30/82 | <129 | * |
| | 12/17/82 | <124 | * |
| 21 (Long Beach) | 3/24/82 | <121 | * |
| | 6/28/82 | <121 | * |
| | 8/30/82 | <129 | * |
| | 12/17/82 | <123 | * |
| 25A** (White Sands Club) | 3/24/82 | <121 | * |
| | 6/28/82 | <120 | * |
| | 8/30/82 | <129 | * |
| | 12/17/82 | <123 | * |
| 25B** (White Sands Club) | 3/24/82 | <121 | * |
| | 6/28/82 | <120 | * |
| | 8/30/82 | <130 | * |
| | 12/17/82 | <123 | * |

*Naturally occurring K-40 was observed in most samples. All other gamma emitters not cited were <MDL; typical MDL's are given in Table B-12.

**Control location.

TABLE B-12
TYPICAL MDL's FOR GAMMA SPECTROMETRY

| Selected Nuclides | Baywater pCi/l | Fish pCi/kg (Wet) | Shellfish pCi/kg (Wet) | Sediment pCi/kg (Dry) |
|---|---|---|---|---|
| Na-22 | 1.3 | 14 | 16 | 46 |
| Cr-51 | 14 | 72 | 188 | 449 |
| Mn-54 | 1.0 | 11 | 12 | 44 |
| Co-58 | 1.2 | 17 | 17 | 44 |
| Fe-59 | 3.2 | 44 | 48 | 114 |
| Co-60 | 1.4 | 16 | 19 | 69 |
| Zn-65 | 2.5 | 29 | 34 | 104 |
| Nb-95 | 1.7 | 24 | 26 | 61 |
| Zr-95 | 2.1 | 26 | 26 | 83 |
| RuRh-106 | 9.0 | 76 | 109 | 333 |
| Ag-110m | 1.1 | 11 | 12 | 40 |
| Te-129m | 1.3 | 17 | 19 | 45 |
| I-131 | 8.7 | 34 | 49 | 210 |
| Cs-134 | 1.2 | 11 | 12 | 45 |
| Cs-137 | 1.1 | 13 | 11 | - |
| Ba-140 | 11 | 50 | 71 | 265 |
| La-140 | 4.5 | 26 | 50 | 155 |
| Ce-144 | 7.4 | 32 | 37 | 184 |

TABLE B-12 (CONTINUED)
TYPICAL MDL's FOR GAMMA SPECTROMETRY

| Selected Nuclides | Particulates $10^{-3}$ pCi/m$^3$ | Precipitation pCi/l | Vegetation pCi/kg (Wet) | Soil pCi/kg (Dry) | Well Water pCi/l |
|---|---|---|---|---|---|
| Na-22 | 2.1 | 3.6 | 26 | 33 | 1.4 |
| Cr-51 | 26 | 59 | 149 | 248 | 21 |
| Mn-54 | 1.8 | 3.4 | 18 | 30 | 1.0 |
| Co-58 | 2.3 | 4.4 | 19 | 31 | 1.3 |
| Fe-59 | 5.2 | 8.0 | 64 | 68 | 4.5 |
| Co-60 | 1.9 | 4.5 | 29 | 40 | 0.9 |
| Zn-65 | 4.5 | 6.5 | 54 | 69 | 2.4 |
| Nb-95 | 2.4 | 8.0 | 23 | 35 | 2.0 |
| Zr-95 | 2.9 | 8.6 | 35 | 53 | 2.5 |
| RuRh-106 | 15 | 33 | 132 | 247 | 8.4 |
| Ag-110m | 1.8 | 3.6 | 14 | 27 | 1.0 |
| Te-129m | 28 | 5.0 | 18 | 26 | 1.7 |
| I-131 | 31 | 47 | 46 | 53 | 3.9 |
| Cs-134 | 1.9 | 3.2 | 18 | 37 | 1.1 |
| Cs-137 | 1.9 | 3.2 | 17 | - | 1.0 |
| Ba-140 | 28 | 45 | 82 | 106 | 24 |
| La-140 | 15 | 28 | 36 | 59 | 11 |
| Ce-144 | 6.6 | 24 | 40 | 142 | 6.9 |

TABLE B-13
EXTERNAL RADIATION
(Results in Units of mR/30 Days ± σ)

| | | |
|---|---|---|
| Location #7 | Jan. * | Jul. 2.73±0.08 |
| | Feb. 3.21±0.16 | Aug. 2.45±0.31 |
| | Mar. 3.23±0.11 | Sep. 2.95±0.27 |
| | Apr. ** | Oct. 3.65±0.15 |
| | May 3.18±0.02 | Nov. 2.91±0.26 |
| | Jun. 3.16±0.25 | Dec. 2.95±0.21 |
| Location #17 | Jan. 4.42±0.10 | Jul. 4.38±0.14 |
| | Feb. 4.85±0.29 | Aug. 4.52±0.31 |
| | Mar. 4.81±0.13 | Sep. 4.37±0.03 |
| | Apr. 4.78±0.02 | Oct. 5.21±0.34 |
| | May 4.46±0.07 | Nov. 4.42±0.10 |
| | Jun. 4.37±0.34 | Dec. 4.92±0.26 |
| Location #18 | Jan. 3.91±0.27 | Jul. 4.25±0.45 |
| | Feb. 4.50±0.05 | Aug. 4.08±0.16 |
| | Mar. 4.56±0.17 | Sep. 4.15±0.09 |
| | Apr. 4.46±0.11 | Oct. 5.10±0.12 |
| | May 4.24±0.02 | Nov. 4.23±0.05 |
| | Jun. 4.06±0.07 | Dec. 3.77±0.77 |
| Location #19 | Jan. 3.97±0.21 | Jul. 3.87±0.13 |
| | Feb. 4.32±0.16 | Aug. 3.61±0.15 |
| | Mar. 3.96±0.22 | Sep. 3.77±0.01 |
| | Apr. 3.88±0.11 | Oct. 4.17±0.04 |
| | May 3.73±0.17 | Nov. 3.80±0.10 |
| | Jun. 3.55±0.12 | Dec. 3.83±0.09 |
| Location #20 | Jan. 3.97±0.13 | Jul. 3.81±0.46 |
| | Feb. 4.12±0.33 | Aug. 3.64±0.22 |
| | Mar. 4.13±0.11 | Sep. 3.71±0.38 |
| | Apr. 4.15±0.24 | Oct. 4.31±0.27 |
| | May 3.94±0.24 | Nov. 3.92±0.28 |
| | Jun. 3.63±0.19 | Dec. 3.76±0.07 |
| Location #21 | Jan. 3.72±0.11 | Jul. 3.93±0.26 |
| | Feb. 4.69±0.62 | Aug. 4.01±0.21 |
| | Mar. 4.12±0.11 | Sep. 3.88±0.17 |
| | Apr. 4.17±0.05 | Oct. 4.45±0.28 |
| | May 3.90±0.20 | Nov. 3.84±0.17 |
| | Jun. 3.96±0.19 | Dec. 4.39±0.78 |
| Location #22 | Jan. 3.81±0.23 | Jul. 3.65±0.05 |
| | Feb. 4.35±0.14 | Aug. 3.83±0.06 |
| | Mar. 4.24±0.21 | Sep. 3.61±0.60 |
| | Apr. 4.08±0.19 | Oct. 4.57±0.25 |
| | May 3.90±0.04 | Nov. 3.54±0.48 |
| | Jun. 3.71±0.16 | Dec. 3.60±0.22 |

TABLE B-13 (CONTINUED)
EXTERNAL RADIATION
(Results in Units of mR/30 Days ± σ)

| | | |
|---|---|---|
| Location #23 | Jan. 4.79±0.05 | Jul. 5.25±0.10 |
| | Feb. 5.15±0.01 | Aug. 5.19±0.34 |
| | Mar. 5.58±0.21 | Sep. 5.56±0.21 |
| | Apr. 5.21±0.07 | Oct. 6.50±0.40 |
| | May 5.27±0.34 | Nov. 5.70±0.22 |
| | Jun. 5.32±0.11 | Dec. 4.81±0.16 |
| Location #24 | Jan. 4.59±0.09 | Jul. 4.89±0.17 |
| | Feb. 5.24±0.08 | Aug. 4.71±0.16 |
| | Mar. 5.14±0.27 | Sep. 5.14±0.24 |
| | Apr. 5.36±0.20 | Oct. 5.60±0.17 |
| | May 4.91±0.18 | Nov. 4.71±0.29 |
| | Jun. 4.60±0.22 | Dec. 5.03±0.13 |
| Location #25 | Jan. 4.36±0.01 | Jul. Stolen |
| | Feb. 4.84±0.28 | Aug. 4.43±0.02 |
| | Mar. 4.71±0.22 | Sep. 4.77±0.15 |
| | Apr. 4.85±0.34 | Oct. 4.86±0.13 |
| | May 4.39±0.03 | Nov. 4.45±0.20 |
| | Jun. 4.35±0.02 | Dec. 4.46±0.18 |
| Location #26 | Jan. 3.84±0.02 | Jul. 3.69±0.06 |
| | Feb. 4.32±0.15 | Aug. 4.02±0.06 |
| | Mar. 4.34±0.28 | Sep. 3.72±0.09 |
| | Apr. 4.03±0.17 | Oct. 4.44±0.05 |
| | May 3.90±0.04 | Nov. 3.97±0.39 |
| | Jun. 4.11±0.33 | Dec. 3.89±0.29 |
| Location #27 | Jan. 3.66±0.15 | Jul. 3.44±0.17 |
| | Feb. 4.20±0.15 | Aug. 3.58±0.23 |
| | Mar. 4.00±0.03 | Sep. 3.57±0.09 |
| | Apr. 4.01±0.15 | Oct. 4.20±0.36 |
| | May 3.75±0.12 | Nov. 3.90±0.11 |
| | Jun. 3.74±0.23 | Dec. 3.59±0.12 |
| Location #28 | Jan. 4.17±0.06 | Jul. 4.13±0.68 |
| | Feb. 4.56±0.34 | Aug. 3.99±0.27 |
| | Mar. 4.41±0.30 | Sep. 4.39±0.02 |
| | Apr. 4.14±0.18 | Oct. 5.06±0.25 |
| | May 4.51±0.18 | Nov. 4.27±0.07 |
| | Jun. 4.22±0.17 | Dec. 4.05±0.12 |

*TLD unavailable due to inclement weather.
**TLD unavailable due to equipment failure.