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Technical Specification Section 6.9.1.7 (Salem)
Technical Specification Section 6.9.1.6 (Hope Creek)

APR 2 3 2010

LR-N10-0139

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Facility Operating License No. NPF-57
NRC Docket No. 50-354

Salem Nuclear Generating Station, Unit Nos. 1and 2
Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: 2009 Annual Radiological Environmental Operating Report

As required by Section 6.9.1.7 of Appendix A to Facility Operating Licenses DPR-70 and DPR-75 for Salem Generating Station Unit Nos. 1 and 2, and Section 6.9.1.6 of Appendix A to the Operating License NPF-57 for Hope Creek Generating Station, PSEG Nuclear hereby transmits one copy of the 2009 Annual Radiological Environmental Operating Report. This report summarizes the results of the radiological environmental surveillance program for 2009 in the vicinity of the Salem and Hope Creek Generating Stations. The result of this program for 2009 was specifically compared to the result of the pre-operational program.

There are no regulatory commitments contained in this correspondence.

IE25
NRR

If you have any questions or comments on this transmittal, please contact Jon Sears at (856) 339-1773.

Sincerely,

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Attachment - 2009 Annual Radiological Environmental Operating Report

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PSEG
Power LLC

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

For

Salem Generating Station, Unit 1: Docket No. 50-272
Salem Generating Station, Unit 2: Docket No. 50-311
Hope Creek Generating Station : Docket No. 50-354

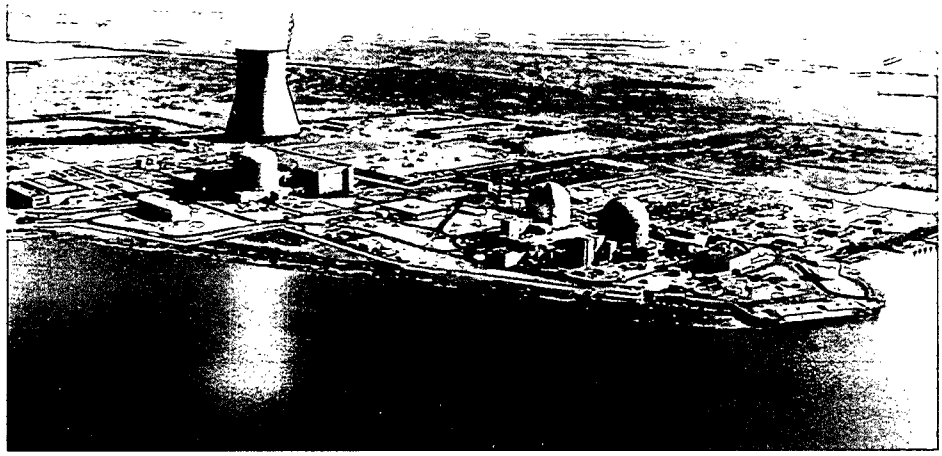
2009 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2009

Prepared by
PSEG POWER LLC
MAPLEWOOD TESTING SERVICES

APRIL 2010

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM



SALEM & HOPE CREEK
GENERATING STATIONS

2009 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2009

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SUMMARY

During normal operations of a nuclear power generating station there are releases of small amounts of radioactive material to the environment. To monitor and determine the effects of these releases a Radiological Environmental Monitoring Program (REMP) has been established for the environment around Artificial Island where the Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS) are located. The results of the REMP are published annually, providing a summary and interpretation of the data collected [10].

PSEG's Maplewood Testing Services (MTS) has been responsible for the collection and analysis of environmental samples during the period of January 1, 2009, through December 31, 2009, and the results are discussed in this report. During the period of August 10 through September 8, 2009, AREVA- NP Environmental Laboratory performed the analysis of various REMP samples. These samples are identified via footnotes in Appendix C tables. MTS diverted sample analysis to AREVA-NP E-Lab in order to best manage resources that were needed to respond to the New Jersey Department of Environmental Protection, Office of Quality Assurance (NJDEP-OQA) concerns with laboratory certification. PSEG Nuclear has provided oversight and assistance in addressing the NJDEP-OQA's concerns regarding laboratory certification.

The REMP was conducted in accordance with the SGS and HCGS Technical Specifications (TS) and Offsite Dose Calculation Manual (ODCM) [14,15, 17, 21]. The Lower Limit of Detection (LLD) values required by the Technical Specifications and ODCM were achieved for the 2009 reporting period. The REMP objectives were also met during this period. The data that was collected in 2009 assists in demonstrating that SGS and HCGS were operated in compliance with Technical Specifications and ODCM.

Most of the radioactive materials noted in this report are normally present in the environment, either naturally, such as potassium-40, or as a result of non-nuclear generating station activity, such as nuclear weapons, testing. Measurements made in the vicinity of SGS/HCGS were compared to background or control measurements and the preoperational REMP study performed before Salem Unit 1 became operational.

Samples of air particulates; air iodine; milk; surface, ground and drinking water; vegetables; fodder crops; fish; crabs; and sediment were collected and analyzed. External radiation dose measurements were also made in the vicinity of SGS/HCGS using thermoluminescent dosimeters (TLD).

From the results obtained, it can be concluded that the levels and fluctuations of radioactivity in environmental samples were as expected for an estuarine environment. The concentration of radioactive material in the environment that could be attributable to Salem and Hope Creeks stations operations was only a small fraction of the concentration of naturally occurring and man-made radioactivity. Since these results were comparable to the results obtained during the preoperational phase of the program [7,8,9], and with historical results collected since commercial operation [10], we can conclude that the operation of SGS and HCGS had no significant radiological impact on the environment.

To demonstrate compliance with Technical Specifications and ODCM (Sections 3/4.12.1 & 6.8.4.h –1,2,3) [14,15], samples were analyzed for one or more of the following: gamma emitting isotopes, tritium (H-3), iodine-131 (I-131), gross beta and gross alpha. The results of these analyses were used to assess the environmental impact of SGS and HCGS operations, thereby demonstrating compliance with Technical Specifications and ODCM (Section 3/4.11) and applicable Federal and State regulations [19,20,21], and to verify the adequacy of radioactive effluent control systems. The results provided in this report for the REMP are summarized below:

- There were a total of 1221 analyses on 865 environmental samples during 2009. Direct radiation dose measurements were made using 196 sets of thermoluminescent dosimeters (TLDs).

- In addition to the detection of naturally - occurring isotopes (i.e. Be-7, K-40, Radium and Th-232), trace levels of H-3, Cs-137 and Mn-54 were also detected. The tritium concentration detected in surface water samples was slightly above minimum detectable concentrations. The Cs-137 concentrations detected in two river sediments were below the ODCM LLD value of 180 pCi/kg-dry.

The Mn-54 concentration was slightly above MDC in one sediment sample collected near the HC south storm drain discharge line.

- Dose measurements made with quarterly TLDs at offsite locations around the SGS/HCGS site averaged 51 milliroentgen for the year 2009. The average of the dose measurements at the control locations (background) was 51 milliroentgen for the year. This was comparable to the levels prior to station operation which had an average of 55 milliroentgen per year for 1973 to 1976.

Appendix F contains the annual report on the status of the Radiological Groundwater Protection Program (RGPP) conducted at Salem and Hope Creek Stations. The RGPP was initiated by PSEG to determine whether groundwater at and in the vicinity of Salem and Hope Creek Stations had been adversely impacted by any release of radionuclides that was not previously identified. The RGPP is being implemented by PSEG in conjunction with a nuclear industry initiative and associated guidance. The results provided in Appendix F for the RGPP are summarized below:

Salem

- The 2009 results of the laboratory analysis indicated that tritium was detected in nine of thirteen RGPP monitoring wells at Salem and all results were less than 2300 pCi/L.

Hope Creek

- The 2009 results of the laboratory analysis indicated that tritium was detected in seven of thirteen RGPP monitoring wells at Hope Creek and all results were less than 8000 pCi/L.

The results are shown in Appendix F, in Tables 4A and 4B. The tritium concentrations measured in the onsite monitoring wells were below the U.S. Nuclear Regulatory Commission Reporting Levels.

PSEG Nuclear is continuing remedial actions for tritium identified in shallow groundwater at Salem Station, conducted in accordance with a Remedial Action Work Plan that was approved by the New Jersey Department of Environmental Protection – Bureau of Nuclear Engineering (NJDEP-BNE) in November 2004. The Groundwater Recovery System (GRS) is in operation, providing hydraulic control of the plume and effectively removing tritium contaminated groundwater. The tritium contaminated groundwater is disposed of in accordance with Salem Station's liquid radioactive waste disposal program. There is no evidence or indication that tritium contaminated water above Ground Water Quality Criteria (GWQC) levels [GWQC is <20,000 pCi/L] has migrated to the station boundary or the Delaware River.

THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Lower Alloways Creek Township, Salem County, New Jersey is the site of Salem (SGS) and Hope Creek (HCGS) Generating Stations. SGS consists of two operating pressurized water nuclear power reactors. Salem Unit One has a net rating of 1195 megawatt electric (MWe) and Salem Unit Two has a net rating of 1196 MWe. The licensed core power for both units is 3459 megawatt thermal (MWt). HCGS is a boiling water nuclear power reactor, which has a net rating of 1265 MWe (3840 MWt).

SGS/HCGS are located on a man-made peninsula on the east bank of the Delaware River. It was created by the deposition of hydraulic fill from dredging operations. The environment surrounding SGS/HCGS is characterized mainly by the Delaware River Estuary and Bay, extensive tidal marshlands, and low-lying meadowlands. These land types make up approximately 85% of the land area within five miles of the site. Most of the remaining land is used for agriculture [1,2]. More specific information on the demography, hydrology, meteorology, and land use of the area may be found in the Environmental Reports [1,2], Environmental Statements [3,4], and the Updated Final Safety Analysis Reports for SGS and HCGS [5,6].

Since 1968, a radiological environmental monitoring program (REMP) has been conducted at the SGS/HCGS Site [22]. Starting in December, 1972, more extensive radiological monitoring programs were initiated [7,8,9]. The operational REMP was initiated in December, 1976, when Salem Unit 1 achieved criticality. PSEG's Maplewood Testing Services (MTS) has been involved in the REMP since its inception. MTS is responsible for the collection of all radiological environmental samples and, from 1973 through June, 1983, conducted a quality assurance program in which duplicates of a portion of those samples analyzed by the primary laboratory were also analyzed by MTS.

From January, 1973, through June, 1983, Radiation Management Corporation (RMC) had primary responsibility for the analysis of all samples under the SGS/HCGS REMP and annual reporting of results.

RMC reports for the preoperational and operational phase of the program are referenced in this report [7, 8, 9]. On July 1, 1983, MTS assumed primary responsibility for the analysis of all samples (except TLDs) and the reporting of results. Teledyne Brown Engineering Environmental Services (TBE), assumed responsibility for third-party QA analyses and TLD processing. An additional vendor, Controls for Environmental Pollution Inc. (CEP), was retained to provide third-party QA analyses and certain non-routine analyses from May, 1988, until June 1, 1992. Currently, AREVA-NP, Inc. Environmental Laboratory (AREVA) is the third party QA vendor and the laboratory which performs the TLD processing. MTS reports for the operational phase from 1983 to 2008 are referenced in this report [10].

An overview of the 2009 REMP is provided in Table 1, Salem and Hope Creek Generating Stations Radiological Environmental Monitoring Program. Radioanalytical data from samples collected under this program were compared with results from the preoperational phase and historical results during operations. Differences between these periods were examined statistically to determine the effects of station operations. This report presents the results from January 1 through December 31, 2009, for the SGS/HCGS REMP.

OBJECTIVES

The objectives of the operational REMP are:

- To fulfill the requirements of the Radiological Surveillance sections of the Technical Specifications and ODCM for SGS/HCGS.

- To determine whether any significant increase occurred in the concentration of radionuclides in critical pathways.

- To determine if SGS or HCGS has caused an increase in the radioactive inventory of long-lived radionuclides.

- To detect any change in ambient gamma radiation levels.

- To verify that SGS and HCGS operations have no detrimental effects on the health and safety of the public or on the environment.

This report, as required by Section 6.9.1.7 of the Salem Technical Specifications [12] and ODCM [14] and Section 6.9.1.6 of the Hope Creek Technical Specifications [13] and ODCM [15], summarizes the findings of the 2009 REMP. Results from the formal 1973 through 1976 preoperational program were summarized by RMC and have been used for comparison with subsequent operational reports [8].

In order to meet the objectives, an operational REMP was developed. Samples of various media were selected for monitoring due to the radiological dose impact to human and other organisms. The selection of samples was based on: (1), established critical pathways for the transfer of radionuclides through the environment to man, and, (2), experience gained during the preoperational phase. Sampling locations were determined based on site meteorology, Delaware estuarine hydrology, local demography, and land uses.

Sampling locations were divided into two classes, indicator and control. Indicator stations are those which are expected to manifest station effects. Control samples are collected at locations which are believed to be unaffected by station operations, usually at 15 to 30 kilometers distance. Fluctuations in the levels of radionuclides and direct radiation at indicator stations are evaluated with respect to analogous fluctuations at control stations. Indicator and control station data are also evaluated relative to preoperational data.

Appendix A, Program Summary, describes and summarizes the analytical results in accordance with Section 6.9.1.7 of the Salem TS and Section 6.9.1.6 of the Hope Creek TS [25,26,27]. Appendix B, Sample Designation, describes the coding system which identifies sample type and location. Table B-1 On-site Sampling Locations lists the station codes, stations location, latitude, longitude, and the types of samples collected at each station.

These sampling stations are indicated on Maps B-1, Onsite Sampling Locations and B-2, Offsite Sampling Locations.

DATA INTERPRETATION

Results of analyses are grouped according to sample type and presented in Appendix C, Data Tables. All results above the Lower Limit of Detection (LLD) are at a confidence level of 2 sigma. This represents the range of values into which 95% of repeated analyses of the same sample should fall. As defined in U.S. Nuclear Regulatory Commission Regulatory Guide 4.8, LLD is the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability, with only 5% probability of falsely concluding that a blank observation represents a "real signal". LLD is normally calculated as 4.66 times the standard deviation of the background counting rate, or of the blank sample count, as appropriate, divided by counting efficiency, sample size, 2.22 (dpm per picocurie), the radiochemical yield when applicable, the radioactive decay constant and the elapsed time between sample collection and time of counting. The Minimum Detectable Concentration (MDC) is defined as the smallest concentration of radioactive material that can be detected at a given confidence level. The MDC differs from the LLD in that the MDC takes into consideration the interference caused by the presence of other nuclides while the LLD does not.

The grouped data were averaged and standard deviations calculated in accordance with Appendix B of Reference 16. Thus, the 2 sigma deviations of the averaged data represent sample and not analytical variability. For reporting and calculation of averages, any result occurring at or below the LLD is considered to be at that level. When a group of data was composed of 50% or more LLD values, averages were not calculated.

QUALITY ASSURANCE PROGRAM

MTS has a quality assurance program designed to ensure confidence in the analytical program. Approximately 10 -15% of the total analytical effort is spent on quality control, including process quality control, instrument quality control, interlaboratory cross-check analyses, and data review/evaluation.

The quality of the results obtained by MTS is ensured by the implementation of the Quality Assurance Program as described in the Maplewood Testing Services Quality Assurance Manual [11a], the Maplewood Testing Services Mechanical Division Quality Assurance/Control Plan [11b], and the Maplewood Testing Services Mechanical Division Environmental/Radiological Group Procedure Manual [11c].

The internal quality control activity of MTS includes the quality control of instrumentation, equipment and reagents, the use of reference standards in calibration, documentation of established procedures and computer programs, analysis of blank samples, and analysis of duplicate samples. The external quality control activity is implemented through participation in the Analytics Environmental Cross Check (ECC), AREVA and the Environmental Resource Associates (ERA) Interlaboratory Comparison Programs. MTS's internal QC results are evaluated in accordance with the NRC Resolution Criteria [18, 24]. This criteria is also used for the Analytics Environmental Crosscheck Program results. ERA's RadCheM™ Proficiency Testing (PT) studies have been evaluated by comparing MTS results to the acceptance limits and evaluation criteria contained in the NELAC standards, National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing list (October 2007). (The results of these three Interlaboratory Comparison Programs are listed in Tables D-1 through D-4 in Appendix D "Summary Of Results From Analytics, Environmental Resource Associates, AREVA E-Lab Interlaboratory Comparison Programs")

A total of 89 analysis results were obtained in the Cross Check, Interlaboratory Comparison and Proficiency Testing programs. Eighty-six (86) passed the applicable criteria, this translates to a 97% acceptance rate.

The Three medias and analysis which disagreed with the criteria were: water/gross alpha, water/gross beta, and water/ Zn-65 Gamma Spec. The cause for these disagreements and the corrective actions are provided below.

The result disagreement for the gross alpha in water analysis for the ERA PT Study was attributed to the incorrect alpha then beta counting mode being chosen in the MTS counting procedure for ERA PT samples.

(This was the first ERA PT sample counted after the new Eclipse V3.12 software was installed on our Tennelec GPC in November of 2008). When the PT sample was recounted later in the correct simultaneous counting mode, the gross alpha result from the recount was within the ERA's Acceptance Limits. All of the MTS Tennelec counting procedures were then checked to verify that the correct simultaneous counting mode box was chosen.

The result disagreement for the gross beta in the Analytics second quarter ECC was attributed to using the lower Sr-90 Beta Counting Efficiency and Calibration Curve derived in our Annual Calibration of the Tennelec XLB GPC in August 2009. This caused our sample results to be biased high. A re-calibration was done resulting in a higher counter efficiency and a recount of the ECC AB720 sample was then shown to be in agreement with the known value.

The result disagreement for the gamma spec Zinc-65 nuclide for the ERA RAD 77 water was attributable to the software calculated peak being broad and misshaped. The peak parameters were satisfactory at Full Width Half Max (FWHM). Only the Zn-65 nuclide was the outlier of the five spiked nuclides contained in this sample. MTS personnel considered this an isolated occurrence since additional ECC samples containing this nuclide were analyzed and found to be acceptable throughout this year.

The Quality Assurance program for environmental TLDs includes independent third party performance testing by the Pacific Northwest National Laboratory and internal performance testing conducted by the AREVA Laboratory Quality Assurance Officer.

Under these programs, sets of six dosimeters are irradiated to ANSI N545, Performance Testing and Procedural Specifications for Thermoluminescent Dosimetry (Environmental) [29], and submitted for processing as "unknowns." The bias and precision of TLD processing is measured against the guidance in U. S. Nuclear Regulatory Commission Regulatory Guide 4.13 Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications [23] and is trended over time to indicate changes in TLD processing performance.

The AREVA Lab conducted internal performance tests on environmental TLDs in 2009. These tests were conducted on fourteen separate sets of six environmental dosimeters. All of the fourteen TLD test sets passed the mean bias criteria.

Of the eighty-four individual measurements, all of the individual dosimeter evaluations met the E-LAB bias and precision tolerance limits (see Table D-5 "Percentage of Individual TLD Results That Met AREVA E-Lab Tolerance Limits").

The Pacific Northwest National Laboratory performed third party performance tests for the AREVA Lab. The third party dosimeters were irradiated and analyzed along with client dosimeters. Both sets of six dosimeters passed the mean bias criteria. The mean percent bias and standard deviation for the two groups of six dosimeters are shown in Table D-6 "Third Party TLD Testing Performance Results".

RESULTS AND DISCUSSION

The analytical results of the 2009 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2009 REMP are summarized in Appendix A, Program Summary. The data for individual samples are presented in Appendix C, Data Tables. The data are compared to the formal pre-operational environmental monitoring program data (1973-1976) and to historical data during operations. The data collected demonstrates that the SGS and HCGS REMP was conducted in compliance with the Technical Specifications and ODCM.

The REMP for the SGS/HCGS Site has historically included samples and analyses not specifically required by these Stations' Technical Specifications and ODCM. These analyses are referenced throughout the report as Management Audit samples. MTS continues to collect and analyze these samples in order to maintain personnel proficiency in performing these non-routine analyses. The summary tables in this report include these additional samples and analyses.

ATMOSPHERIC

Air particulates were collected on Schleicher-Schuell No. 25 glass fiber filters with low-volume air samplers.

Iodine was collected from the air by adsorption on triethylene-diamine (TEDA) impregnated charcoal cartridges connected in series after the air particulate filters. Air sample volumes were measured with calibrated dry-gas meters. The displayed volumes were corrected to standard temperature and pressure.

Air Particulates (Tables C-1, C-2)

Air particulate samples were collected weekly, at 6 locations. Each of the samples (see Program Deviations) collected for the year were analyzed for gross beta. Quarterly composites of the weekly samples from each station were analyzed for specific gamma emitters. Total air sampler availability for the 6 sampling stations in 2009 was 99.8 percent.

- Gross beta activity was detected in all of the indicator station samples collected at concentrations ranging from 6.7×10^{-3} to 34×10^{-3} pCi/m^3 and in all of the control station samples from 7.8×10^{-3} to 31×10^{-3} pCi/m^3. The average for both the indicator and control station samples was 18×10^{-3} pCi/m^3. The maximum preoperational level detected was 920×10^{-3} pCi/m^3, with an average of 74×10^{-3} pCi/m^3. Results for gross beta analysis from 1989 to current year are plotted on Figure 1 as quarterly averages. Included along with this plot, for purposes of comparison, is an inset depicting a continuation of this plot from the current year to 1973.

- Gamma spectroscopy, performed on each of the 24 quarterly composite samples analyzed, indicated the presence of the naturally-occurring radionuclides Be-7 and K-40. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

- Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in all 20 indicator station composites that were analyzed, at concentrations ranging from 62 x 10^{-3} to 106 x 10^{-3} pCi/m^3, with an average of 84 x 10^{-3} pCi/m^3. It was detected in the 4 control station composites ranging from 67 x 10^{-3} to 105 x 10^{-3} pCi/m^3, with an average of 85 x 10^{-3} pCi/m^3. The maximum preoperational level detected was 330 x 10^{-3} pCi/m^3, with an average of 109 x 10^{-3} pCi/m^3.

- Potassium-40 activity was detected in all 20 of the indicator station samples, with concentrations ranging from 9.0 x 10^{-3} to 15 x 10^{-3} pCi/m^3 and it was also detected in all 4 control station samples, at concentrations of 10 X 10^{-3} to 16 x 10^{-3} pCi/m^3. The average for all stations was 12 X 10^{-3} pCi/m^3. No preoperational data is available for comparison. However, the average of all positive values for all stations for the years 1988 to 2008 was 12 X10^{-3} pCi/m^3.

Air Iodine (Table C-3)

Iodine in filtered air samples was collected weekly, at 6 locations. Each of the samples collected (see Program Deviations) for the year was analyzed for I-131.

Iodine-131 was not detected above minimum detectable concentrations in any of the weekly samples analyzed. Minimum detectable concentrations for all the stations, both indicator and control, ranged from <1.1 x 10^{-3} to <9.9 x 10^{-3} pCi/m^3. The maximum preoperational level detected was 42 x 10^{-3} pCi/m^3.

DIRECT RADIATION

Ambient radiation levels in the environs were measured with a pair of Panasonic thermoluminescent dosimeters (TLDs) supplied and processed by AREVA NP E-Lab. Packets containing TLDs for quarterly exposure were placed in the owner-controlled area and around the Site at various distances and in each land based meteorological sector.

Emphasis was placed on special interest areas such as population centers, nearby residences, and schools.

Direct Radiation (Table C-4)

A total of 49 locations were monitored for direct radiation during 2009, including 12 on-site locations, 31 off-site locations within the 10 mile zone, and 6 control locations beyond 10 miles.

Each location gets a pair of Panasonic TLDS packaged together. This pair consist of 1 UD-801 TLD which contains 2 lithium and 2 calcium elements and 1 UD-814 TLD which contains 1 lithium and 3 calcium elernents. To calculate the stations exposure, AREVA averages the 5 calcium elements to obtain a more statistically valid result. Then they perform a T test to identify any outliers. These outliers are removed and would reduce the number of elements used. For these measurements, the rad and roentgen is considered equivalent to the rem, in accordance with 10CFR20.1004.

The average dose rate for the 31 quarterly off-site and 12 quarterly on-site indicator TLDs was 4.2 milliroentgen per standard month. The average control TLD dose rate was similar at 4.3 milliroentgen per standard month. The preoperational average for the quarterly TLD readings was 4.4 milliroentgen per standard month.

In Figure 2, the quarterly average radiation levels of the off-site indicator stations versus the control stations, are plotted for the period 1989 through 2009, with an inset graph depicting the period 1973 to 2009.

The results of the direct radiation measurements for 2009 confirmed that the radiation levels in the vicinity of the Salem and Hope Creek Generating Stations were similar to previous years.

TERRESTRIAL

Milk samples were taken semi-monthly when cows were on pasture and monthly when cows were not grazing on open pasture. Animals are considered on pasture from April to November of each year. Samples were collected in polyethylene containers and transported in ice chests with no preservatives added to the milk.

A well water sample was collected monthly. Separate raw and treated potable water samples were composited daily at the City of Salem Water and Sewer Department. All samples were collected in new polyethylene containers.

Locally grown vegetable and fodder crops were collected at the time of harvest from Management Audit sample locations. Ornamental and broad leaf cabbage and kale were collected from on-site gardens. MTS personnel planted, maintained and harvested these broad leaf crops in the late summer and fall from three locations on site and one across the river. All samples were weighed and packed in plastic bags.

Milk (Table C-5)

Milk samples were collected at 4 local dairy farms (2 farms in NJ and 2 in Delaware). Each sample was analyzed for I-131 and gamma emitters.

- Iodine-131 was not detected above minimum detectable concentration in any of the 80 samples analyzed. LLD's for both the indicator and the control station samples ranged from <0.1 to <1.0 pCi/L. The maximum preoperational level detected was 65 pCi/L which occurred following a period of atmospheric nuclear weapons tests. Results from 1989 to 2009 are plotted on Figure 3, with an inset graph depicting the period 1973 to 2009.

- Gamma spectroscopy performed on each of the 80 samples indicated the presence of the naturally-occurring radionuclides K-40 and RA-NAT.

All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

- Potassium-40 was detected in all 80 samples. Concentrations for the 60 indicator station samples ranged from 1240 to 1540 pCi/L, with an average of 1370 pCi/L. The 20 control station sample concentrations ranged from 1210 to 1790 pCi/L, with an average of 1340 pCi/L. The maximum preoperational level detected was 2000 pCi/L, with an average of 1437 pCi/L.

- RA-NAT was detected in two of the indicator station samples at concentrations of 5.8 and 8.5 pCi/L. It was not detected above the minimum detectable concentration in any of the control station samples. The preoperational samples had an average concentration of 3.8 pCi/L and a range of 1.5 to 11 pCi/L.

Well Water (Ground Water) (Tables C-6, C-7)

Although wells in the vicinity of SGS/HCGS are not directly affected by plant operations, water samples were collected monthly from one farm's well (3E1) during January through December of the year. This well is located upgradient of the stations aquifer. Samples from this well are considered Management Audit samples and each was analyzed for gross alpha, gross beta, tritium, and gamma emitters.

- Gross alpha activity was detected in one of the well water samples at a concentration of 0.5 pCi/L. LLD's ranged from <0.5 to 1.1 pCi/L. The maximum preoperational level detected was 9.6 pCi/L. There was no preoperational average determined for this analysis. The average of all positive results for gross alpha for well samples for the years 1988 to 2008 was 2 pCi/L.

- Gross beta activity was detected in 6 well water samples. Concentrations for the samples ranged from 0.7 to 8.8 pCi/L, with an average of 2.4 pCi/L.

Except for the January result, the 2009 gross beta results are lower than the previous years. In addition, the 2009 gross beta results were lower than the preoperational results which ranged from <2.1 to 38 pCi/L, with an average value of 9 pCi/L. The downward trend may be attributed to the farmer installing a water treatment system for this well in February, 2009.

- Tritium activity was not detected above the minimum detectable concentration in any of the well water samples. The MDC ranged from <124 to <144 pCi/L. The maximum preoperational level detected was 380 pCi/L. There was no preoperational average determined for this analysis. The average of all the positive tritium results from 1988 to 2008 was 218 pCi/L.

- Gamma spectroscopy performed on each of the 12 well water samples indicated the presence of the naturally-occurring radionuclides K-40 and RA-NAT. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

    - Potassium-40 was detected in 6 of the samples at concentrations ranging from 33 to 63 pCi/L with an average of 46 pCi/L. The maximum preoperational level detected was 30 pCi/L. There was no preoperational average determined for this analysis. The average of the positive K-40 results from 1988 to 2008 was 58 pCi/L.

    - RA-NAT was detected in 11 of the well water samples at concentrations ranging from 36 to 174 pCi/L with an average of 123 pCi/L. The maximum preoperational level detected was 2.0 pCi/L. There was no preoperational average determined for this analysis. These values are similar to those found in the past 20 years. The average of all the positive RA-NAT well results from 1988 through 2008 was 99.8 pC/L. These higher than preoperational results are due to a procedural change instituted in 1986 for water sample preparation.

This change results in less removal of radon (and its daughter products) from the sample, which causes the higher numbers recorded annually. It is reasonable to conclude that values currently observed are typical for this region. [28]

Potable Water (Drinking Water) (Tables C-8, C-9)

Both raw and treated potable water samples were collected and composited by The City of Salem Water and Sewer Department personnel. Each sample consisted of daily aliquots composited into a monthly sample. The raw water source for this plant is Laurel Lake and its adjacent wells. These are management audit samples as no liquid effluents discharged from SGS/HCGS will directly affect this pathway. Each of the 24 individual samples was analyzed for gross alpha, gross beta, tritium, iodine-131 and gamma emitters.

- Gross alpha activity was detected in 2 raw water samples at concentrations of 0.5 and 0.7 pCi/L. It was not detected in any of the treated water samples. Minimum detectable concentrations for the remaining 22 samples (both treated and raw) ranged from <0.3 to <0.8 pCi/L. The maximum preoperational level detected was 2.7 pCi/L. There was no preoperational average determined for this analysis. The average of all the positive alpha results from 1988 to 2008 was 1.1 pCi/L.

- Gross beta activity was detected in all 24 of the raw and treated water samples. The raw samples were at concentrations ranging from 2.3 to 5.6 pCi/L. Concentrations for the treated water ranged from 2.2 to 4.9 pCi/L. The average concentration for both raw and treated was 3.3 pCi/L. The maximum preoperational level detected was 9.0 pCi/L, with an average of 4.2 pCi/L.

- Tritium activity was not detected above minimum detectable concentration in any of the raw or treated potable water samples. MDC's for the raw and treated samples ranged from <125 to <145 pCi/L. The maximum preoperational level detected was 350 pCi/L, with an average of 179 pCi/L.

- Iodine-131 measurements were performed to an LLD of 1.0 pCi/L.

Iodine-131 measurements for all 24 samples were below the minimum detectable concentration. These values ranged from <0.1 to <1 pCi/L. There was no preoperational data available for comparison since I-131 was not analyzed as a specific nuclide until 1989. Since that time, all results have been below the MDC.

- Gamma spectroscopy performed on each of the 24 monthly water samples indicated the presence of the naturally-occurring radionuclides K-40, Th-232 and RA-NAT. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

  - The radionuclide K-40 was detected in 4 of the treated potable waters at concentrations ranging from 33 to 72 pCi/L. It was detected in 4 of the raw potable water samples at concentrations from 33 to 72 pCi/L. The average for both raw and treated results was 47 pCi/L. LLD's for the remaining 16 potable water samples were <9.6 to <51 pCi/L. There was no preoperational data available for comparison. The average of the positive K-40 results from 1988 to 2008 was 47 pCi/L.

  - The radionuclide Thorium-232 was detected in only one sample of raw potable water at a concentration of 12 pCi/L. LLD's for the remaining 23 potable samples were <1.6 to <16 pCi/L. There was no preoperational data available for comparison, however, the combined average for the positive potable water samples analyzed for Th-232 from 1988 to 2008 was 9.0 pCi/L which is comparable to this years value.

  - RA-NAT was detected in 7 of the treated potable waters at concentrations ranging from 4.8 to 88 pCi/L and an average of 24 pCi/L. It was not detected in any of the raw potable water samples. LLD's for the remaining 17 samples were <1.6 to <9.2 pCi/L. The maximum preoperational level detected was 1.4 pCi/L. There was no preoperational average determined for this analysis.

The higher results are due to the procedural change for sample preparation, as discussed in the Well Water section. The average of all the positive RA-NAT results from 1988 to 2008 was 28 pCi/L.

Vegetables (Table C-10)

Although vegetables in the region are not irrigated with water into which liquid plant effluents have been discharged, a variety of food products grown in the area for human consumption were sampled These samples were from 5 indicator stations (18 samples) and 4 control stations (15 samples). The vegetables from the local farms are collected as management audit samples.

In addition, cabbage and kale were grown from seed by MTS and planted at two on site locations. Vegetables grown on site are collected in lieu of having a milk farm within 5 km.(See Fodder Crops) All samples (vegetable and broadleaf) were analyzed for gamma emitters and included asparagus, cabbage, kale, sweet corn, peppers, and tomatoes. The results for these samples are discussed below:

- Gamma spectroscopy performed on each of the 33 samples indicated the presence of the naturally-occurring radionuclides K-40, RA-NAT and Be-7. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

    - Potassium-40 was detected in all 33 samples. Concentrations for the 18 indicator station samples ranged from 1340 to 4810 pCi/kg-wet and averaged 2370 pCi/kg-wet. Concentrations for the 15 control station samples ranged from 1090 to 2820 pCi/kg-wet, and averaged 1890 pCi/kg-wet. The average concentration detected for all samples, both indicator and control, was 2150 pCi/kg-wet. The maximum preoperational level detected was 4800 pCi/kg-wet, with an average of 2140 pCi/kg-wet.

- RA-NAT was not detected in any of the 18 indicator station samples. It was detected in two control locations (corn and pepper) at concentrations of 12 and 18 pCi/kg-wet. LLD's for the remaining 31 samples were <4.8 to <23 pCi/kg-wet. There was no preoperational data available for comparison. The combined average for the positive vegetable samples analyzed for RA-NAT from 1988 to 2008 was 30 pCi/kg-wet.

- Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in four of the indicator station samples at concentrations of 157 to 414 pCi/kg-wet and an average of 277 pCi/kg-wet. It was not detected is any of the control locations. No preoperational data is available for comparison. However, the combined average for the positive vegetable samples analyzed for Be-7 from 1988 to 2008 was 244 pCi/kg-wet.

Fodder Crops (Table C-11)

Although not required by the SGS or HCGS Technical Specifications and ODCM, 6 samples of crops normally used as cattle feed (silage and soybeans) were collected from three indicator stations (4 samples) and one control station (2 samples). It was determined that these products may be a significant element in the food-chain pathway. These fodder crops are collected as management audit samples and analyzed for gamma emitters. All four locations from which samples were collected this year are milk sampling stations.

In addition to the silage and soybean, ornamental cabbage was planted and maintained by MTS personnel at 3 locations on site and 1 in Delaware, at 3.9 miles. Two of these 4 samples (locations 1S1 and 16S1) were grown in the same area as the on-site vegetable samples as mentioned in Table C-10. The 4 ornamental cabbage samples were harvested in December. These broad leaf vegetation samples were collected since there are no longer any milk farms operating within the 5 km radius of SGS/HCGS. The closest milk farm (13E3) is located in Odessa, DE at 4.9 miles (7.88 km).

- Gamma spectroscopy performed on each of the 10 samples indicated the presence of the naturally-occurring radionuclides Be-7 and K-40.
  All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

  - Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in 3 of the indicator silage samples at concentrations from 422 to 732 pCi/kg-wet. It was detected in the control station silage sample at 1310 pCi/kg-wet. The maximum preoperational level detected for silage was 4700 pCi/kg-wet, with an average of 2000 pCi/kg-wet.

    Be-7 was not detected in either the indicator nor control station soybean samples. LLD results for these two samples were <88 and <95 pCi/kg-wet. The maximum preoperational level detected for soybean samples was 9300 pCi/kg-dry.

    Be-7 was detected in all 4 of the ornamental cabbage samples at concentrations of 160 to 482 pCi/kg-wet and an average of 310 pCi/kg-wet. There was no preoperational data available for comparison with this type of sample; on site vegetation was not available until 2005. However, the average for ornamental cabbage for the previous 4 years was 246 pCi/kg-wet.

  - Potassium-40 was detected in all 10 of the vegetation station samples. The combined average for the indicator station samples was 4620 pCi/kg-wet with the average concentrations from 2380 to 14800 pCi/kg-wet. The control station concentrations were 5130 and 13300 pCi/kg-wet with an average for of 9220 pCi/kg-wet.

    The average concentration of K-40 detected for the silage samples (3 indicator and 1 control) was 3580 pCi/kg-wet. Indicator station samples were at concentrations of 2480 to 3460 pCi/kg-wet while the control station had a concentration of 5130 pCi/kg-wet. Preoperational results averaged 7000 pCi/kg-wet.

K-40 results for the soybean samples (indicator and control) was 14050 pCi/kg-wet. Preoperational soybean results averaged 22000 pCi/kg-dry.

The average concentration of K-40 for the 4 ornamental cabbage samples was 3250 pCi/kg-wet. There was no preoperational data available for comparison with these samples as MTS started planting vegetation on site in 2005. However, the average K-40 concentration for ornamental cabbage for the previous 4 years was 3742 pCi/kg-wet.

AQUATIC

Environmental Consulting Services, Inc (ECSI) collected all aquatic samples (with the exception of the 6S2 shoreline sediment). This sample set includes edible fish, shoreline sediment, surface water and crab.

Surface water samples were collected offshore. The technicians collect the samples in new polyethylene containers that are rinsed twice with the sample medium prior to collection. The surface water samples are transported to MTS for analysis.

Edible fish are taken by gill nets while crabs are caught in commercial traps. These samples are then processed where the flesh is separated from the bone and shell. The flesh is placed in sealed containers and frozen before being transported in ice chests to MTS for analysis.

Sediment samples collected by ECSI were taken with a bottom grab sampler and frozen in sealed polyethylene containers before being transported in ice chests to MTS. For the river bottom sediment, a marine GPS locates the correct site and the sampling boat is maneuvered over the area until the correct amount of sample is obtained (grabbed) with the sediment dredge. Personnel from MTS collect and prepare location 6S2 shoreline sediment (an onsite location) for analysis at MTS. For this location, a square area, measuring 1 meter on each side is staked out and then divided into a grid of 9 smaller boxes, 3 per side.

A 1 inch deep scoop from the center of each of the small grids is taken. All the aliquots are combined and the total sample transported in the ice chest to MTS.

Surface Water (Tables C-12, C-13, C-14)

Surface water samples were collected monthly at 4 indicator stations and one control station in the Delaware estuary. One location (11A1) is at the outfall area (which is the area where liquid radioactive effluents from the Salem Station are discharged into the Delaware River), another is downstream from the outfall area (7E1), and another is directly west of the outfall area at the mouth of the Appoquinimink River (12C1). Two upstream locations are in the Delaware River (1F2) and at the mouth of the Chesapeake and Delaware Canal (16F1), the latter being sampled when the flow is from the Canal into the river.

Station 12C1, directly west, at the mouth of the Appoquinimink River, serves as the operational control. Location 12C1 was chosen as the control location because the physical characteristics of this station more closely resemble those of the outfall area than do those at the farther upstream location (1F2). As discussed in the pre-operational summary report, due to the tidal nature of this Delaware-River-Bay estuary, there are flow rate variations and variations in salinity levels. These variations will account for differences in concentrations of potassium and associated gross beta from K-40. All surface water samples were analyzed monthly for gross beta, tritium and gamma emitters.

- Gross beta activity was detected in 44 of the 48 indicator station samples ranging from 9 to 384 pCi/L, with an average of 74 pCi/L. Beta activity was detected in all 12 of the control station samples with concentrations ranging from 16 to 127 pCi/L, with an average of 53 pCi/L. The maximum preoperational level detected was 110 pCi/L, with an average of 32 pCi/L. Quarterly results for all locations are plotted on Figure 4, for the years 1989 to 2009, with an inset graph depicting the current period 1973 to 2009.

- Tritium activity was detected in 4 of the indicator station samples at concentrations from 154 to 340 pCi/L and an average of 246 pCi/L. These levels were only slightly above the minimum detectable concentration range.

Tritium was not detected in any of the control station samples. Minimum detectable concentrations for the remaining station samples, both indicator and control, ranged from <132 to <156 pCi/L. The maximum preoperational level detected was 600 pCi/L, with an average of 210 pCi/L. Positive results from 1989 to 2009 are plotted on Figure 5, with an inset graph depicting the period 1973 to 2009.

- Gamma spectroscopy performed on each of the 48 indicator station and 12 control station surface water samples indicated the presence of the naturally-occurring radionuclides K-40, Th-232 and RA-NAT. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

  - Potassium-40 was detected in all 48 samples of the indicator stations at concentrations ranging from 34 to 147 pCi/L and in all 12 of the control station samples ranging from 51 to 117 pCi/L. The average for the indicator station locations was 82 pCi/L, while the average for the control station locations was 70 pCi/L. The maximum preoperational level detected for K-40 was 200 pCi/L, with an average of 48 pCi/L.

  - Thorium-232 was detected in only 2 of the indicator station samples at concentrations of 10 and 13 pCi/L. It was not detected in any of the control station samples. LLD sensitivities for the rest of the station samples, both indicator and control, ranged from <2.1 to <11 pCi/L. There was no pre-operational data available for this nuclide. However, the combined average for the positive surface water samples analyzed for Th-232 from 1988 to 2008 was 8.5 pCi/kg-wet.

  - RA-NAT was detected in 9 of the indicator stations at concentrations from 5 to 11 pCi/L and an average of 7 pCi/L. It was detected in only 1 of the control location samples at 7 pCi/L. MDC's for the remaining station samples, both indicator and control, ranged from <1.5 to <4.5 pCi/L. The maximum preoperational level detected was 4 pCi/L with no average determined. All positive results for RA-NAT from 1988 to 2008 were averaged for a concentration of 7.7 pCi/L.

Fish (Table C-15)

Edible species of fish were collected semi-annually at 2 indicator (7E1, 11A1) and 1 control (12C1) station, and analyzed for gamma emitters in flesh.

Samples included channel catfish, white catfish, bluefish, white perch, summer flounder, black drum and striped bass. (See explanation of controls in the surface water section). The 4 indicator and 2 control station samples from both semi-annual collections, indicated the presence of the naturally-occurring radionuclides K-40 and RA-NAT. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

- Potassium-40 was detected in all 4 samples from the indicator stations at concentrations ranging from 3230 to 3430 pCi/kg-wet for an average of 3320 pCi/kg-wet. K-40 was detected in both samples from the control location at 2980 and 3350 pCi/kg-wet. The average for the control samples was 3165 pCi/kg-wet. The maximum preoperational level detected was 13000 pCi/kg-wet, with an average of 2900 pCi/kg-wet.

- RA-NAT was detected in only 1 sample from the second semi-annual collection. It was not detected in any of the indicator station samples. The control station positive result was at a concentration of 12 pCi/kg-wet. MDC's for the remaining 5 samples both indicator and control ranged from <5.9 to <14 pCi/kg-wet. The maximum preoperational level detected was 130 pCi/kg-wet, with no average determined. All positive results for RA-NAT from 1988 to 2008 were averaged for a concentration of 26 pCi/kg-wet.

Blue Crab (Table C-16)

Blue crab samples were collected twice during the season at 2 locations, 1 indicator and 1 control, and the edible portions were analyzed for gamma emitters. (See explanation of controls in the surface water section).

- Gamma spectroscopy performed on the flesh of the indicator station samples and the control station samples indicated the presence of the naturally-occurring radionuclides K-40 and RA-NAT. All other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

  - Potassium-40 was detected in both indicator station samples at concentrations of 1430 and 1560 pCi/kg-wet. It was detected in both control station samples at 1770 and 2300 pCi/kg-wet. The average for both the indicator and control station samples was 1770 pCi/kg-wet. The maximum preoperational level detected was 12000 pCi/kg-wet, with an average of 2835 pCi/kg-wet.

  - RA-NAT was detected in 1 of the indicator stations for the first semi-annual collection at a concentration of 21 pCi/kg-wet. It was detected in only 1 of the control location samples during the same collection at 18 pCi/kg-wet. Minimum detectable concentrations for the remaining station samples, both indicator and control for the second semi-annual collection, ranged from <19 to <20 pCi/kg-wet. The maximum preoperational level detected was 33 pCi/kg-wet with no average determined. All positive results for RA-NAT from 1988 to 2008 were averaged for a concentration of 27 pCi/kg-wet.

Sediment (Table C-17)

Sediment samples were collected semi-annually from 7 locations, including 6 indicator stations and 1 control station. (Location 6S2 is the only shoreline sediment and it is directly affected by tidal fluctuations) Each of the 14 samples was analyzed for gamma emitters. In addition to the naturally-occurring radionuclides K-40, Be-7, Th-232 and RA-NAT, trace amounts of Cs-137 were detected in two samples (16F1 and 11A1) and Mn-54 was detected in one sample (16A1). (See explanation of controls in the surface water section)

- Gamma spectroscopy was performed on each of the 12 indicator station samples and 2 control station samples. Except for the radionuclides listed above, all other gamma emitters searched for in the nuclide library used by nuclear plants were below the minimum detectable concentration.

  - Cesium-137 was detected in 2 of the indicator samples at concentrations of 52 and 63 pCi/kg-dry. It was not detected in either control location. MDC's for the remaining 12 samples, both indicator and control, ranged from <2.7 to <15 pCi/kg-dry. The maximum preoperational level detected was 400 pCi/kg-dry, with an average of 150 pCi/kg-dry. Positive results from 1989 to 2009 are plotted on Figure 6, with an inset graph depicting the current year back to 1977.

  - Manganese-54 was detected in one indicator station sample at a concentration of 27 pCi/kg-dry just above maximum MDC values. Mn-54 was not detected in any control station samples. The MDC range for both indicator and control samples was <3.1 to <25 pCi/kg-dry. There was no preoperational data available for this nuclide. All positive results for Mn-54 from 1988 to 2008 were averaged for a concentration of 30 pCi/kg-dry.

  - Beryllium-7 was detected in 1 of the indicator station samples at a concentration of 135 pCi/kg-dry. It was not detected in either control location above minimum detectable concentration. The maximum preoperational level detected was 2300 pCi/kg-dry. There was no preoperational average determined for this nuclide. All positive results for Be-7 from 1988 to 2008 were averaged for a concentration of 523 pCi/kg-dry.

  - Potassium-40 was detected in all 12 indicator station samples at concentrations ranging from 1290 to 16500 pCi/kg-dry, with an average of 7048 pCi/kg-dry. Concentrations detected in both of the control station samples were at 13500 and 15000 pCi/kg-dry.

The average for the control station samples was 14250 pCi/kg-dry. The maximum preoperational level detected was 21000 pCi/kg-dry, with an average of 15000 pCi/kg-dry.

- RA-NAT was detected in all 12 indicator station samples at concentrations ranging from 73 to 826 pCi/kg-dry, with an average of 426 pCi/kg-dry. Concentrations detected in both of the control station samples were at 537 and 563 pCi/kg-dry, with an average of 550 pCi/kg-dry. The average for both the indicator and control station samples was 443 pCi/kg-dry. The maximum pre-operational level detected was 1200 pCi/kg-dry, with an average of 760 pCi/kg-dry.

- Thorium-232 was detected in all 12 indicator station samples at concentrations ranging from 81 to 1110 pCi/kg-dry, with an average of 611 pCi/kg-dry. Concentrations detected in both of the control station samples were at 1000 and 1050 pCi/kg-dry, with an average of 1025 pCi/kg-dry. The average for both the indicator and control station samples was 670 pCi/kg-dry. The maximum pre-operational level detected was 1300 pCi/kg-dry, with an average of 840 pCi/kg-dry.

PROGRAM DEVIATIONS

Location 14G1 (11.8 miles WNW) air iodine & filter assembly was removed from the filter/cartidge assembly and then reinstalled back into the assembly on Feb. 17, 2009. The new filter and cartridge was inadvertently brought back to the Lab and analyzed. When the results on the filter were reviewed on February 19th the error in the filter/cartridge replacement was realized. MTS and PSEG Nuclear made the decision to extend the sampling period to two weeks. The justification was there would be no collection time lost and the sampling period would remain consistent between 144 to 192 hours, when divided by two weeks. Results for this location were comparable to the concentrations for the other five locations during the same sampling period. Corrective action was to verify the assembly has a new white filter showing, before leaving the serviced air sampler location, in order to prevent this program deviation from occurring in the future.

ANNOTATIONS TO PREVIOUS AREOR

The 2008 AREOR contained a typographical error. In table 1, the program overview, there was a typographical error regarding the sediment sample locations which omitted the location 16F1. The sediment sample locations have been, and continue to be, 6S2, 11A1, 15A1, 16A1, 12C1, 7E1, and 16F1, as consistently shown on Table B-1 in the 2006, 2007 and 2008 REMP reports. The tables with Concentration of Gamma Emitters (Tables C-17 or C-18) are also correct for each year and reflect the same sample points as in Table B-1. This error has been corrected in the 2009 AREOR.

HOPE CREEK TECHNICAL SPECIFICATION LIMIT FOR PRIMARY WATER IODINE CONCENTRATIONS

The Hope Creek primary water chemistry results for 2009 were reviewed. The specific activity of the primary coolant did not exceed 0.2 microcuries per gram Dose Equivalent I-131. Therefore, the iodine concentrations in the primary coolant did not exceed the Tech Spec limit specified in section 3.4.5.

CONCLUSIONS

The Radiological Environmental Monitoring Program for Salem and Hope Creek Generating Stations was conducted during 2009 in accordance with the SGS and HCGS Technical Specifications and ODCM. The LLD values required by the Technical Specifications and ODCM were achieved for this reporting period (See Appendix A and Appendix C). The objectives of the program were also met during this period. The data collected assists in demonstrating that SGS and HCGS were operated in compliance with Technical Specifications and ODCM requirements.

From the results obtained, it can be concluded that the levels and fluctuations of radioactivity in environmental samples were as expected for an estuarine environment. The concentration of radioactive material in the environment that could be attributable to Salem and Hope Creeks stations operations was only a small fraction of the concentration of naturally occurring and man-made radioactivity. Since these results were comparable to the results obtained during the preoperational phase of the program, which ran from 1973 to 1976, and with historical results collected since commercial operation, PSEG Nuclear Personnel have concluded that the operation of the Salem and Hope Creek Stations had no significant radiological impact on the environment.

TABLE 1

SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Program Overview)

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE/FREQUENCY* OF ANALYSIS
1. DIRECT RADIATION Thermoluminescent Dosimeters	Forty-nine routine monitoring stations with two or more dosimeters placed as follows: An inner ring of stations, one in each land based meteorological sector (not bounded by water) in the general area of the site boundary: 1S1, 2S2, 2S4, 3S1, 4S1, 5S1, 6S2, 7S1, 10S1, 11S1, 15S1, 16S1. An outer ring of stations, one in each land-based meteorological sector in the 5 - 11 km range (3.12 - 6.88 miles) from the site (not bounded by or over water): 4D2, 5D1, 10D1, 14D1, 15D1, 2E1, 3E1, 11E2, 12E1, 13E1, 16E1, 1F1, 3F2, 4F2, 5F1, 6F1, 9F1, 10F2, 11F1, 13F2, 14F2, 15F3. The balance of the stations to be placed in special interest areas such as population centers, nearby residences, and schools: 2F2, 2F5, 2F6, 3F3, 7F2, 12F1, 13F3, 13F4, 16F2, 1G3, 10G1, 16G1, 3H1. and in two areas to serve as control stations: 3G1, 14G1.	Quarterly	Gamma dose/ quarterly

TABLE 1 (cont'd)

SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE/FREQUENCY* OF ANALYSIS
2. ATMOSPHERIC	Samples from 6 locations:		
a. Air Particulate	1 sample from close to the Site Boundary : 5S1 3 Samples in different land based sectors: 1F1, 2F6, 5D1.	Continuous sampler operation with sample collection weekly or more frequently if required by dust loading	Gross Beta / weekly Gamma isotopic analysis / quarterly composite
b. Air Iodine	1 Sample from the vicinity of a community: 16E1. 1 Sample from a control location, as for example 15-30 km distant and in the least prevalent wind direction: 14G1.		Iodine-131 / weekly
3. TERRESTRIAL	Samples from milking animals in 3 locations within 5 km distance. If there are none, then, 1 sample from milking animals in each of 3 areas between 5 - 8 km (3.12 - 5 miles) distant: 13E3, 14F4, 2G3. (1)	Semi-monthly (when animals are on pasture)	Gamma scan / semi-monthly Iodine-131 / semi-monthly
a. Milk	1 Sample from milking animals at a control location 15 - 30 km distant (9.38 - 18.75 miles): 3G1.	Monthly (when animals are not on pasture)	Gamma scan / monthly Iodine-131 / monthly
b. Well Water (Ground)	Samples from one or two sources only if likely to be affected. (Although wells in the vicinity of SGS/HCGS are not directly affected by plant operations, we sample 3E1 farm's well, as management audit)	Monthly	Gamma Scan / monthly Gross alpha / monthly Gross beta / monthly Tritium / monthly

TABLE 1 (cont'd)

SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE/FREQUENCY* OF ANALYSIS
c. Potable Water (Drinking Water)	One sample of the nearest water supply affected by its discharge (No potable water samples are required as liquid effluents discharged from SGS/HCGS do not directly affect this pathway) However, for management audit samples, one raw and one treated sample from a public water supply (City of Salem Water and Sewer Department) is collected: 2F3	Monthly (composited daily)	Gross alpha / monthly Gross beta / monthly Tritium / monthly Gamma scan / monthly Iodine-131 / monthly
d. Vegetables	One sample of each principal class of food products from area that is irrigated by water in which liquid plant wastes have been discharged (The Delaware River at the location of SGS/HCGS is a brackish water source and is not used for irrigation of food products). Management audit samples are collected from various locations during harvest: 2F9, 2F10, 3F6, 3F7, 1G1, 2G2, 9G2, and 3H5. In addition, the vegetables cabbage and kale were harvested from two on-site locations: 1S1 and 16S1 (1).	Annually (at harvest)	Gamma scan/on collection
e. Fodder Crops	Broad leaf vegetation (ornamental cabbage) was planted & collected onsite in lieu of having a milk farm within 5 km of the Site (1): 10D1, 1S1, 15S1, 16S1. Although not required by SGS/HCGS ODCM, samples of crops normally used as cattle feed (silage-soybeans) were collected as management audit samples: 14F4, 3G1, 2G3, 13E3, 14G3.	Annually (at harvest)	Gamma scan/on collection

TABLE 1 (cont'd)

SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE/FREQUENCY* OF ANALYSIS
f. Soil	Although not required by SGS/HCGS ODCM, samples of soil are collected as management audit samples: 6S2, 2F9, 5F1, 10D1, 16E1, 13E3, 14F4, 2G3, 3G1 (Not sampled during 2009)	Every 3 years (2007-2010-2013)	Gamma scan/on collection
4. AQUATIC ENVIRONMENT a. Surface Water	One sample upstream: 1F2 One sample downstream: 7E1 One sample outfall: 11A1 One sample cross-stream (mouth of Appoquinimink River): 12C1 (2) And an additional location in the Chesapeake & Delaware Canal: 16F1	Monthly	Gross Beta/monthly Gamma scan/monthly Tritium/monthly**
b. Edible Fish	One sample of each commercially and recreationally important species in vicinity of plant discharge area: 11A1 One sample of same species in area not influenced by plant discharge: 12C1 (2) And an additional location downstream: 7E1	Semi-annually	Gamma scan (flesh)/ on collection
c. Blue Crabs	One sample of each commercially and recreationally important species in vicinity of plant discharge area: 11A1 One sample of same species in area not influenced by plant discharge: 12C1 (2)	Semi-annually	Gamma scan (flesh)/ on collection

TABLE 1 (cont'd)

SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE/FREQUENCY* OF ANALYSIS
d. Sediment	One sample from downstream area: 7E1 One sample from cross-stream area/One sample from a control location: 12C1[(2)] One sample from outfall area: 11A1 One sample from upstream, the C & D Canal: 16F1 One sample from shoreline area: 6S2 One sample from Cooling Tower Blowdown: 15A1 And an additional location of south storm drain discharge line: 16A1	Semi-annually	Gamma scan/on collection

* Except for TLDs, the quarterly analysis is performed on a composite of individual samples collected during the quarter.

** Tech Specs and ODCM require quarterly analysis but due to the tritium leak at Salem, it was decided to analyze surface waters on a monthly basis for tritium.

(1) While these milk locations are not within the 5 km range, they are the closest farms in the Site vicinity. Since broad leaf vegetation is acceptable in lieu of milk collections, MTS personnel planted and harvested ornamental cabbage (Brassica oleracea) at three locations on Site (1S1, 15S1, 16S1) and one across the river in Delaware (10D1). In addition, the vegetables cabbage and kale were grown from seed by MTS and then planted at two locations on Site (1S1 & 16S1).

(2) Station 12C1 was made the operational control (1975) for aquatic samples since the physical characteristics of this station more closely resemble those of the outfall area than do those at the upstream location originally chosen. This is due to the distance from Liston Point, which is the boundary between the Delaware River and Delaware Bay. As discussed extensively in the SGS/HCGS Pre-operational reports, the sampling locations further upstream show significantly lower background levels due to estuarine tidal flow.

FIGURE 1
GROSS BETA ACTIVITY IN AIR PARTICULATE
1989 THROUGH 2009

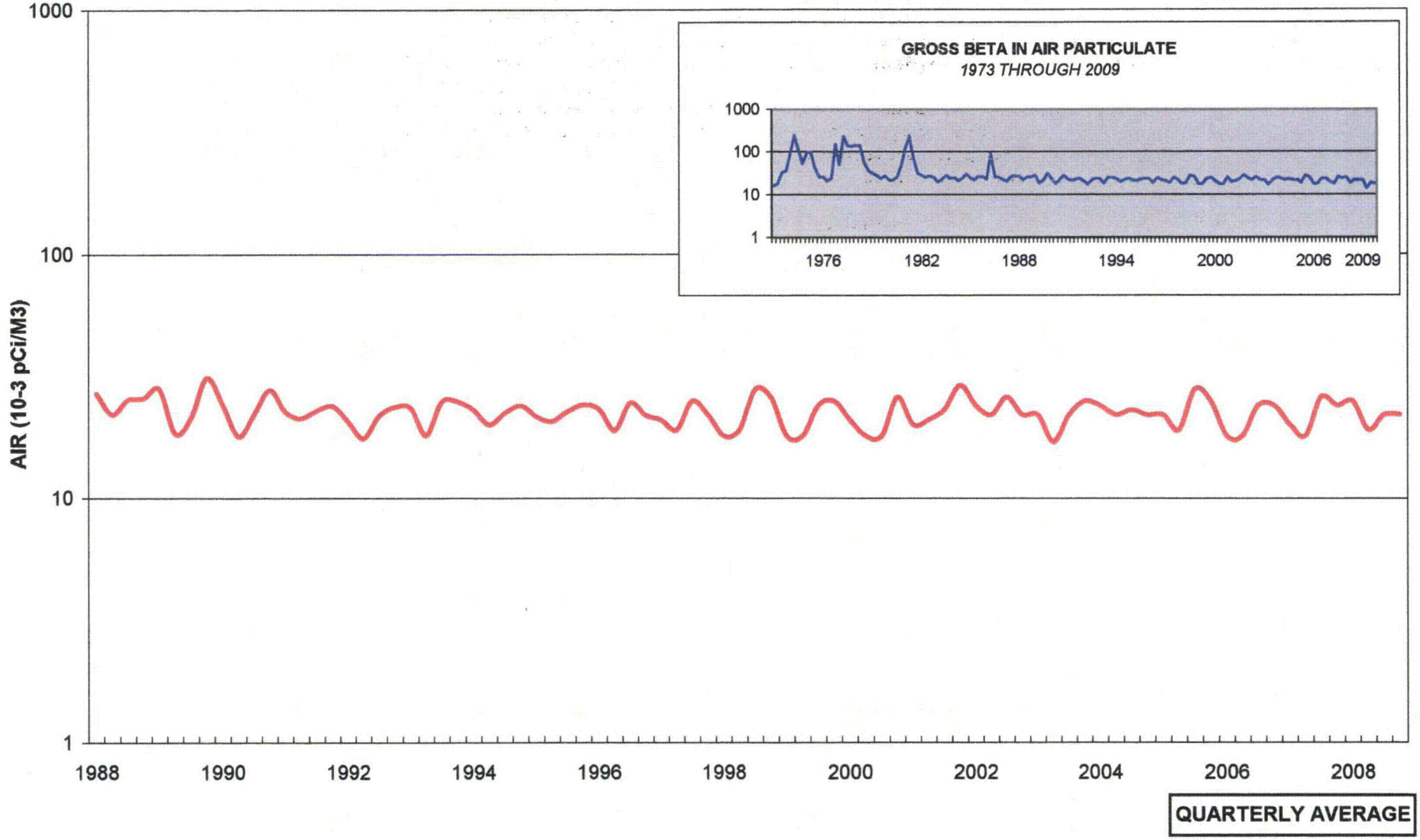


FIGURE 2
AMBIENT RADIATION - OFFSITE vs CONTROL STATION
1989 THROUGH 2009

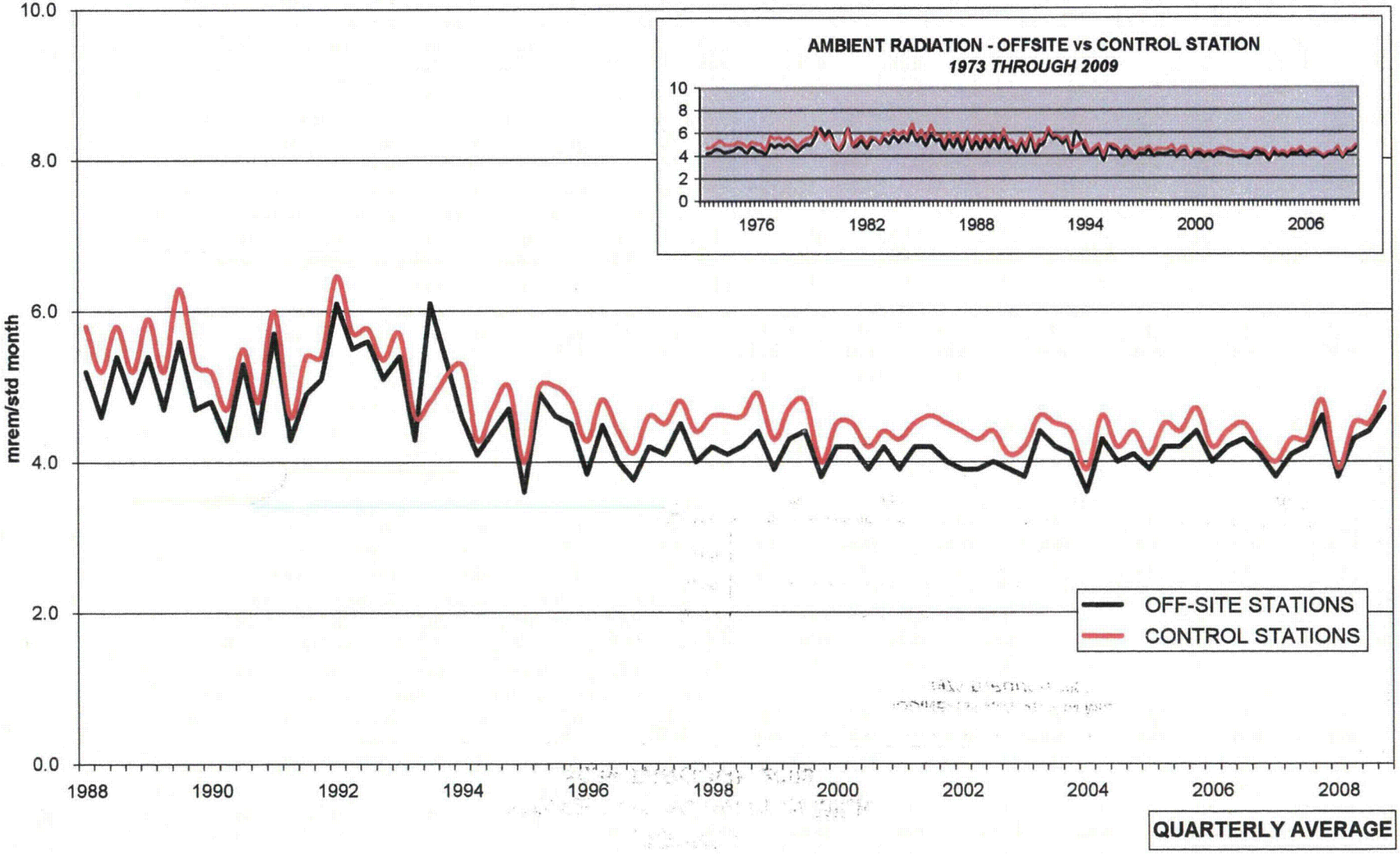


FIGURE 3
IODINE - 131 ACTIVITY IN MILK
1989 THROUGH 2009

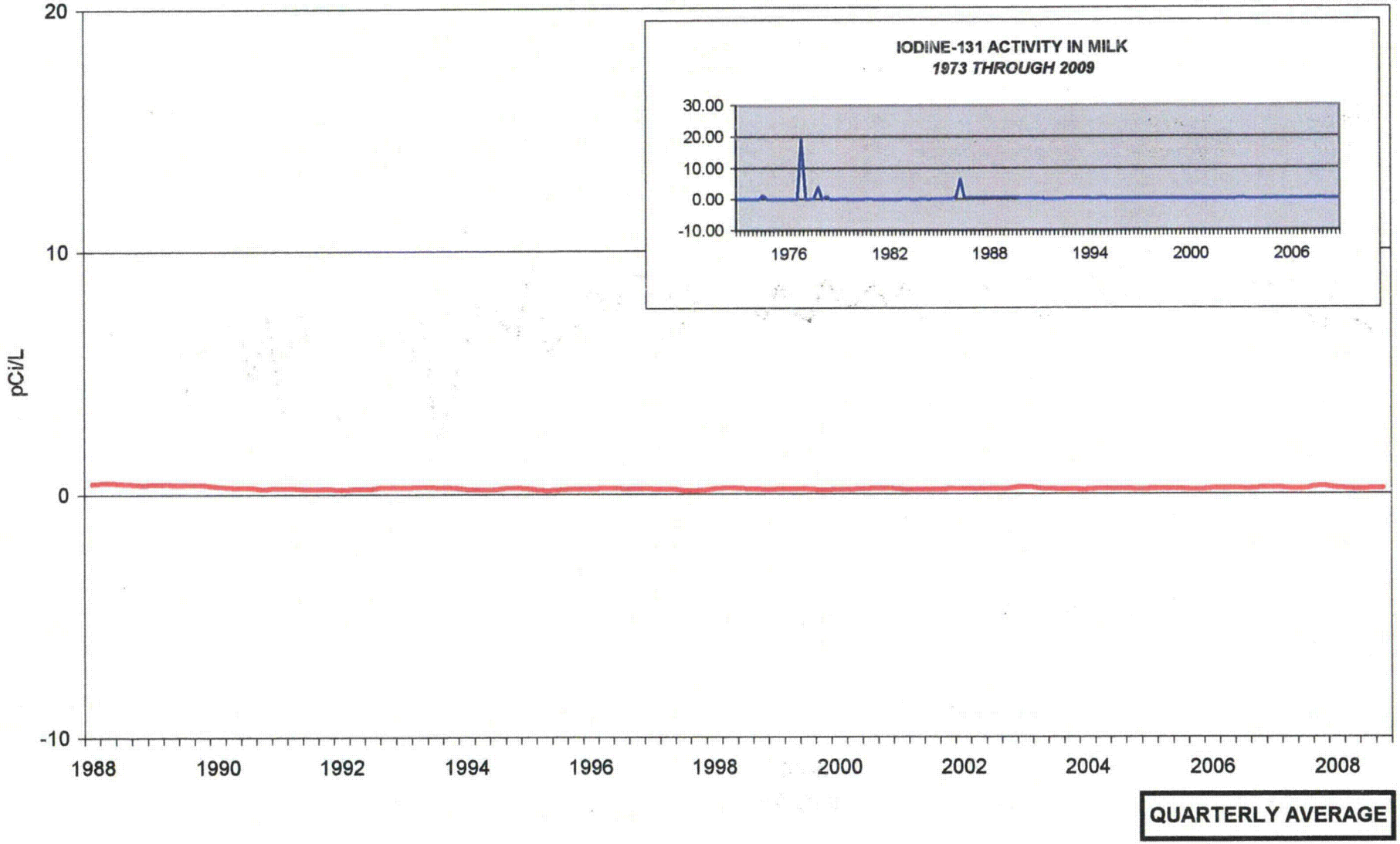


FIGURE 4
GROSS BETA ACTIVITY IN SURFACE WATER
1989 THROUGH 2009

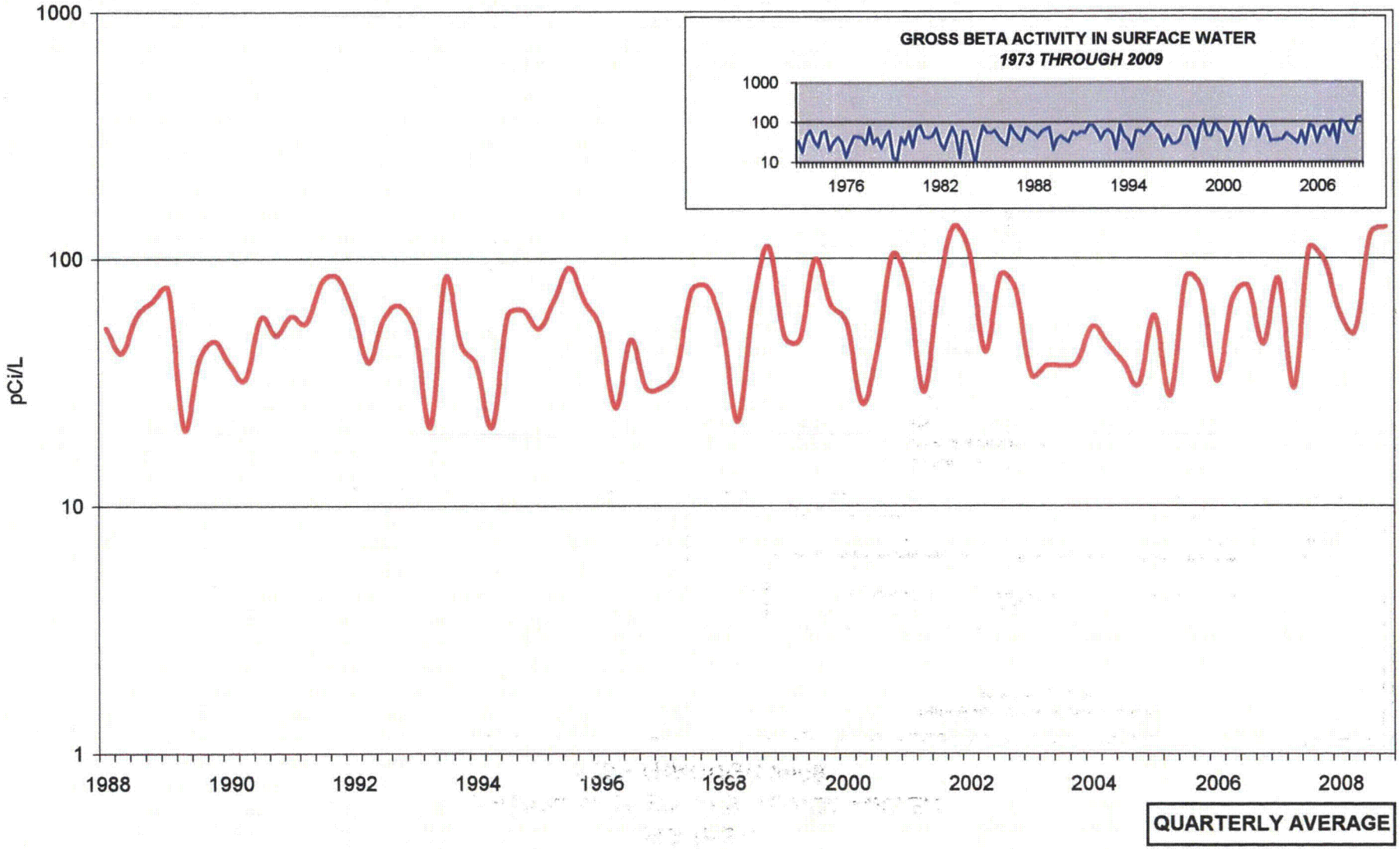


FIGURE 5
TRITIUM ACTIVITY IN SURFACE WATER
1989 THROUGH 2009

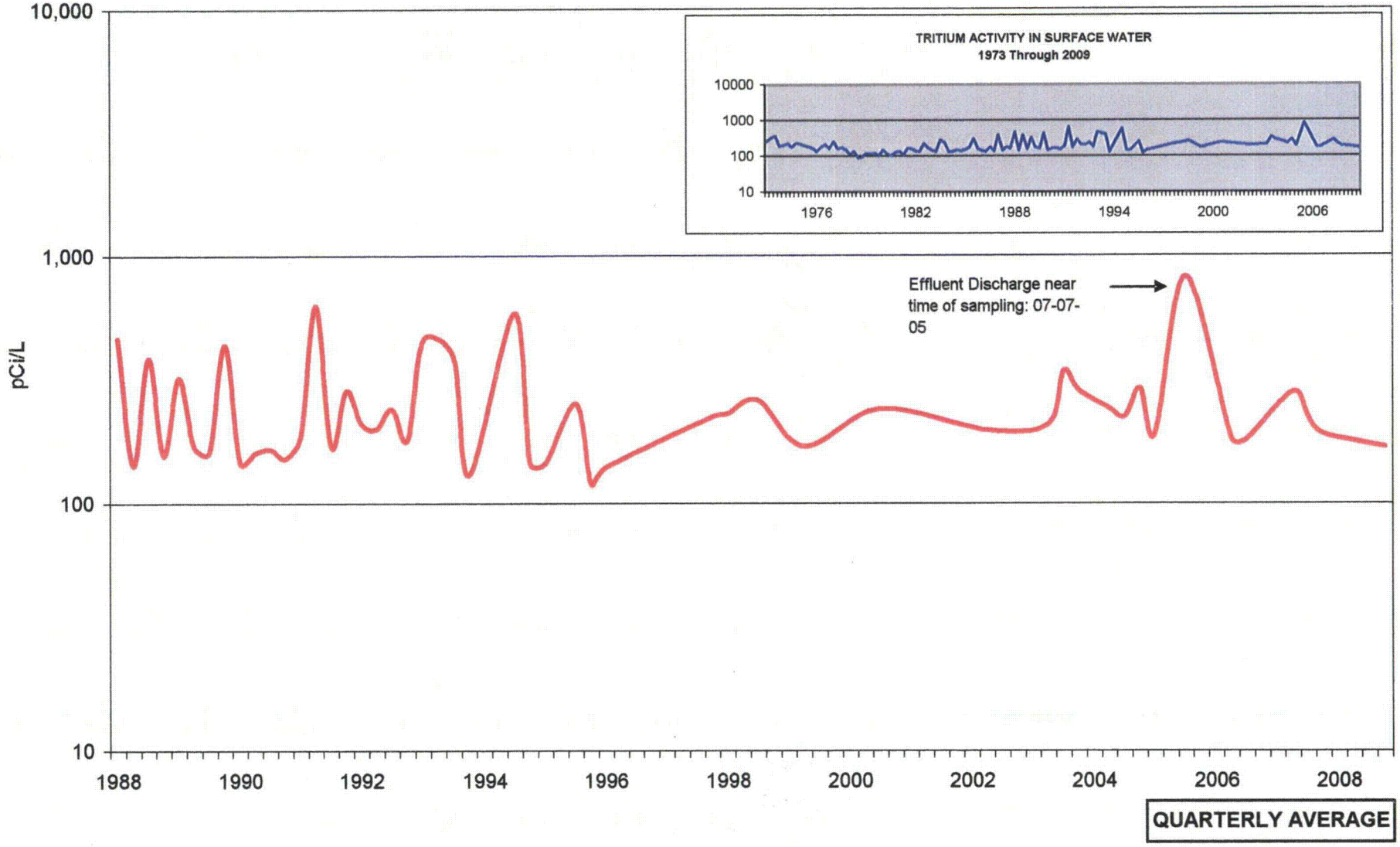
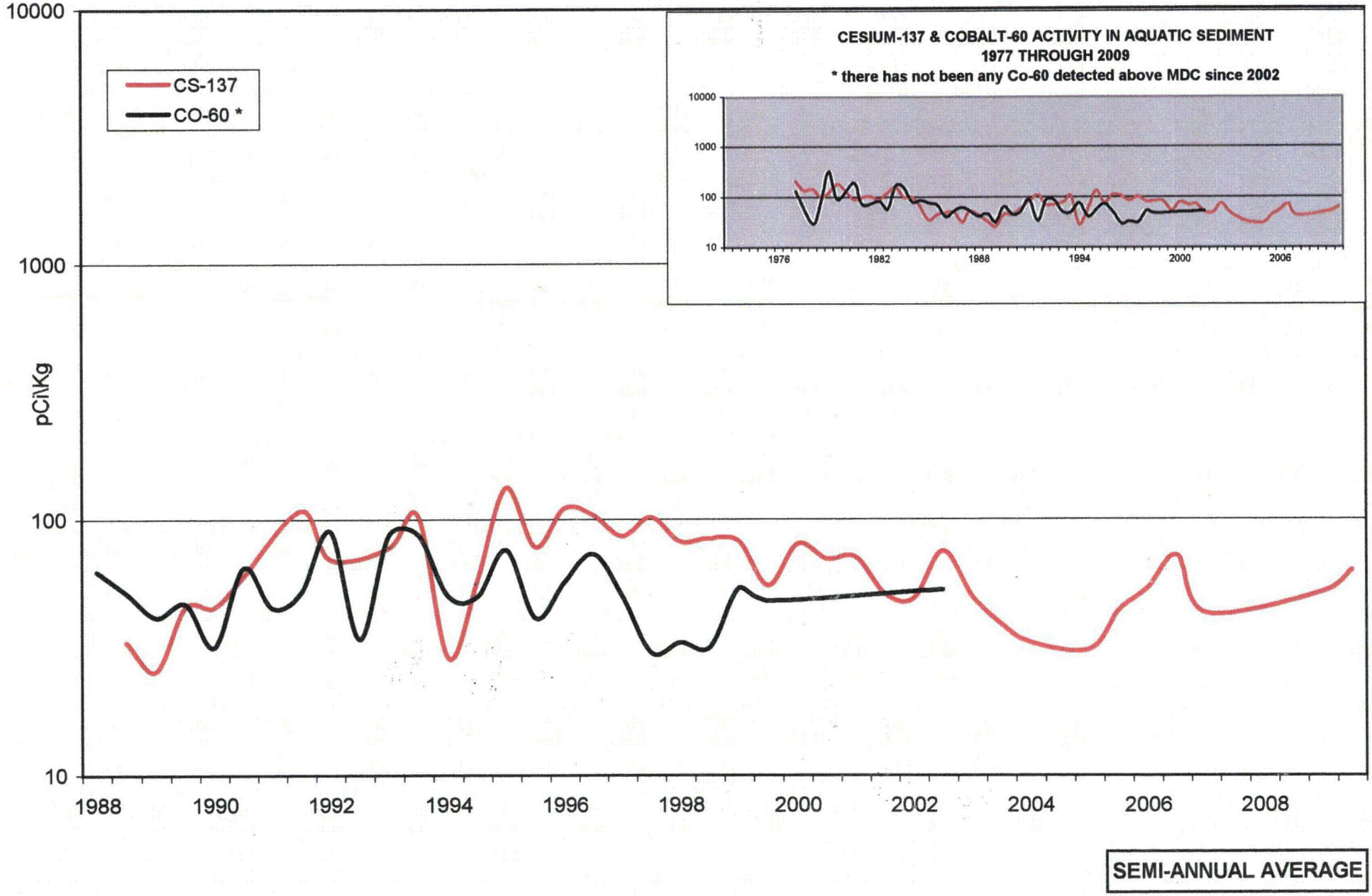


FIGURE 6
CESIUM-137 & COBALT-60 ACTIVITY IN AQUATIC SEDIMENT
1989 THROUGH 2009



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[2] Public Service Enterprise Group. "Environmental Report, Operating License Stage - Hope Creek Generating Station". 1983.

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[4] United States Atomic Energy Commission. "Final Environmental Statement - Hope Creek Generating Station", Docket No. 50-354. 1983.

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[10] Maplewood Testing Services. "Salem and Hope Creek Generating Stations' Radiological Environmental Monitoring Program - Annual Reports 1983 through 2008".

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[11b] Maplewood Testing Services. Mechanical Division "Quality Assurance / Control Plan". December 2009.

[11c] Maplewood Testing Services. Mechanical Division Environmental/Radiological Group "Procedures Manual". December 2009.

[12] Public Service Enterprise Group. "Salem Nuclear Generating Station Technical Specifications", Appendix A to Operating License No. DPR-70, 1976, Sections 6.8.4.h - 1,2,3 and 6.9.1.7.

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[13] Public Service Enterprise Group . "Hope Creek Generating Station Technical Specifications", Appendix A to Facility Operating License No. NPF-57, 1986, Sections 6.8.4.h – 1,2,3 and 6.9.1.6.

[14] Public Service Enterprise Group. "Offsite Dose Calculation Manual"- Salem Generating Station. Revision 24.

[15] Public Service Enterprise Group. "Offsite Dose Calculation Manual"- Hope Creek Generating Station. Revision 24.

[16] U.S. Environmental Protection Agency. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water." EPA-600/4-80-032, August 1980.

[17] U.S. Nuclear Regulatory Commission. "Environmental Technical Specifications For Nuclear Power Plants." Regulatory Guide 4.8, December 1975.

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APPENDIX A

PROGRAM SUMMARY

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RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SALEM GENERATING STATION DOCKET 50-272/-311
HOPE CREEK GENERATING STATION DOCKET NO. 50-354

SALEM COUNTY, NEW JERSEY JANUARY 1, 2009 to DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLE (UNIT OF MEASUREMENT)	Analysis And Total Number of Analyses Performed		Lower Limit of Detection (LLD)*	All Indicator Locations Mean (Range) **	Location with Highest Mean Name Distance and Direction	Mean (Range)	Control Location Mean (Range)	Number of Nonroutine Reported Measurements
I. AIRBORNE								
Air Particulates (10^{-3} pCi/m^3)	Beta	311	6.0	18 (260 /260) (6.7-34)	1F1 5.8 mi N	19 (52 /52) (6.7-34)	18 (51 /52) (7.8-31)	0
					5S1 0.86 mi E	19 (52 /52) (7-34)		
	Gamma Be7	24	2.0	84 (20 /20) (62-106)	1F1 5.8 mi N	87 (4 /4) (72-106)	85 (4 /4) (67-105)	0
	K-40	24	9.0	12 (20 /20) (9-15)	2F6 7.3 mi NNE	13 (4 /4) (9-15)	12 (4 /4) (10-16)	0
Air Iodine (10^{-3} pCi/m^3)	I-131	311	9.9	<LLD	-	<LLD	<LLD	0
II DIRECT								
Direct Radiation (mrad/std. month)	Quarterly Badges	196	-	4.2 (172 /172) (2.7-6.1)	1F1 5.8 mi N	5.6 (4 /4) (5.2-6.1)	4.3 (24 /24) (3.1-5.1)	0
III TERRESTRIAL								
Milk (pCi/L)	I-131	80	1.0	<LLD	-	<LLD	<LLD	0
	Gamma K-40	80	34	1370 (60 /60) (1240-1540)	14F4 7.6 mi WNW	1400 (20 /20) (1310-1470)	1340 (20 /20) (1210-1790)	0
	RA-NAT	80	5.5	7.2 (2 /60) (5.8-8.5)	2G3 12 mi NNE	8.5 (1 /20) (8.5-8.5)	<LLD	0

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MEDIUM OR PATHWAY SAMPLE (UNIT OF MEASUREMENT)	Analysis And Total Number of Analyses Performed		Lower Limit of Detection (LLD)*	All Indicator Locations Mean (Range) **	Location with Highest Mean Name Distance and Direction	Mean (Range)	Control Location Mean (Range)	Number of Nonroutine Reported Measurements
III TERRESTRIAL								
Well Water (pCi/L)	Alpha	12	1.2	0.5 (1 /12) (0.5-0.5)	3E1 4.1 mi NE	0.5 (1 /12) (0.5-0.5)	No Control Location	0
	Beta	12	1.1***	2.4 (6 /12) (0.7-8.8)	3E1 4.1 mi NE	2.4 (6 /12) (0.7-8.8)	No Control Location	0
	H-3	12	144	<LLD	-	<LLD	No Control Location	0
	Gamma							
	K-40	12	34	46 (6 /12) (33-63)	3E1 4.1mi NE	46 (6 /12) (33-63)	No Control Location	0
	RA-NAT	12	6.6	123 (11 /12) (36-174)	3E1 4.1mi NE	123 (11 /12) (36-174)	No Control Location	0
Potable Water (pCi/L)	Alpha	24	0.7	0.6 (2 /24) (0.5-0.7)	2F3 8.0 mi NNE	0.6 (2 /24) (0.5-0.7)	No Control Location	0
	Beta	24	1.0***	3.3 (24 /24) (2.2-5.6)	2F3 8.0 mi NNE	3.3 (24 /24) (2.2-5.6)	No Control Location	0
	H-3	24	145	<LLD	-	<LLD	No Control Location	0
	Gamma							
	K-40	24	34	47 (8 /24) (33-72)	2F3 8.0 mi NNE	47 (8 /24) (33-72)	No Control Location	0
	I-131	24	0.4	<LLD	-	<LLD	No Control Location	0
	RA-NAT	24	6.6	24 (7 /24) (4.8-88)	2F3 8.0 mi NNE	24 (7 /24) (4.8-88)	No Control Location	0
	Th-232	24	11	12 (1 /24) (12)	2F3 8.0 mi NNE	12 (1 /24) (12)	No Control Location	0
Fruit & Vegetables (pCi/Kg-wet)	Gamma							
	K-40	33	70	2370 (18 /18) (1340-4810)	16S1 0.57 mi NNW	3960 (2 /2) (3110-4810)	1890 (15 /15) (1090-2820)	0
	RA-NAT	33	22	<LLD	9G2 10.7 mi S	18 (1 /5) (18)	15 (2 /15) (12-18)	0

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MEDIUM OR PATHWAY SAMPLE (UNIT OF MEASUREMENT)	Analysis And Total Number of Analyses Performed		Lower Limit of Detection (LLD)*	All Indicator Locations Mean (Range) **	Location with Highest Mean Name Distance and Direction	Mean (Range)	Control Location Mean (Range)	Number of Nonroutine Reported Measurements
III TERRESTRIAL								
Fruit & Vegetables (pCi/Kg-wet)	Be-7	33	51	277 (4 /18) (157-414)	16S1 0.57 mi NNW	299 (2 /2) (183-414)	<LLD	0
Fodder Crops (pCi/Kg-wet)	Gamma Be-7	10	75	410 (7 /8) (160-732)	3G1 16.5 mi NE	1310 (1 /2) (1310)	1310 (1 /2) (1310-1310)	0
	K-40	10	32	4620 (8 /8) (2380-14800)	3G1 16.5 mi NE	9220 (2 /2) (5130-13300)	9220 (2 /2) (5130-13300)	0
IV AQUATIC								
Surface Water (pCi/L)	Beta	60	9.7	74 (44 /48) (9-384)	7E1 4.5 mi SE	139 (12 /12) (47-384)	53 (12 /12) (16-127)	0
	H-3	60	150	246 (4 /48) (154-340)	7E1 4.5 mi SE	331 (2 /12) (322-340)	<LLD	0
	Gamma K-40	60	34	82 (47 /48) (34-147)	7E1 4.5 mi SE	109 (12 /12) (62-147)	70 (12 /12) (51-117)	0
	RA-NAT	60	6.6	7 (9 /48) (5-11)	1F2 7.1 mi N	11 (1 /12) (11-11)	7 (1 /12) (7-7)	0
	Th-232	60	11.0	11 (2 /48) (10-13)	11A1 0.2 mi SW	13 (1 /12) (13)	<LLD	0
Blue Crabs (pCi/kg-wet)	Gamma K-40	4	55	1495 (2 /2) (1430-1560)	12C1 2.52 mi. WSW	2035 (2 /2) (1770-2300)	2035 (2 /2) (1770-2300)	0
	RA-NAT	4	24	21 (1 /2) (21)	11A1 0.2 mi. SW	21 (1 /2) (21)	18 (1 /2) (18)	0
Edible Fish (pCi/kg-wet)	Gamma K-40	6	55	3320 (4 /4) (3230-3430)	11A1 0.2 mi. SW	3410 (2 /2) (3390-3430)	3165 (2 /2) (2980-3350)	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SALEM GENERATING STATION DOCKET 50-272/-311
HOPE CREEK GENERATING STATION DOCKET NO. 50-354

SALEM COUNTY, NEW JERSEY JANUARY 1, 2009 to DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLE (UNIT OF MEASUREMENT)	Analysis And Total Number of Analyses Performed		Lower Limit of Detection (LLD)*	All Indicator Locations Mean (Range) **	Location with Highest Mean Name Distance and Direction		Control Location Mean (Range)	Number of Nonroutine Reported Measurements
IV AQUATIC								
Edible Fish (pCi/kg-wet)	RA-NAT	6	24	<LLD	12C1 2.5 mi. WSW	12 (1 /2) (12)	12 (1 /2) (12)	0
Sediment (pCi/kg-dry)	Gamma							
	Be-7	14	135	135 (1 /12) (135-135)	6S2 0.2 mi. ESE	135 (1 /2) (135-135)	<LLD	0
	K-40	14	55	7048 (12 /12) (1290-16500)	12C1 2.5 mi. WSW	14250 (2 /2) (13500-15000)	14250 (2 /2) (13500-15000)	0
	Co-60	14	21	<LLD	-	<LLD	<LLD	0
	Cs-137	14	15	58 (2 /12) (52-63)	11A1 0.2 mi. SW	63 (1 /2) (63)	<LLD	0
	Mn-54	14	25	27 (1 /12) (27)	16A1 0.7 mi. NNW	27 (1 /2) (27)	<LLD	0
	RA-NAT	14	5.0	426 (12 /12) (73-826)	7E1 4.5 mi. SE	663 (2 /2) (652-673)	550 (2 /2) (537-563)	0
	Th-232	14	8.1	611 (12 /12) (81-1110)	12C1 2.5 mi. WSW	1025 (2 /2) (1000-1050)	1025 (2 /2) (1000-1050)	0

* LLD listed is the lower limit of detection which we endeavored to achieve during this reporting period. In some instances nuclides were detected at concentrations above/below the LLD values shown.

** Mean calculated using values above LLD only. Fraction of measurements above LLD are in parentheses.

*** Typical LLD values.

APPENDIX B

SAMPLE DESIGNATION AND LOCATIONS

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APPENDIX B

SAMPLE DESIGNATION

The PSEG's Maplewood Testing Services identifies samples by a three part code. The first two letters are the program identification code. Because of the proximity of the Salem and Hope Creek Stations a common environmental surveillance program is being conducted. The identification code, "SA", has been applied to Salem and Hope Creek stations. The next three letters are for the media sampled.

AIO =	Air Iodine	IDM =	Immersion Dose (TLD)
APT =	Air Particulate	MLK =	Milk
ECH =	Hard Shell Blue Crab	PWR =	Potable Water (Raw)
ESF =	Edible Fish	PWT =	Potable Water (Treated)
ESS =	Sediment	SOL =	Soil
FPL =	Green Leaf Vegetables	SWA =	Surface Water
FPV =	Vegetables (Various)	VGT =	Fodder Crops (Various)
GAM =	Game (Muskrat)	WWA=	Well Water

The last four symbols are a location code based on direction and distance from a standard reference point. The reference point is located at the midpoint between the center of the Salem 1 and Salem 2 containments. Of these, the first two represent each of the sixteen angular sectors of 22.5 degrees centered about the reactor site. Sector one is divided evenly by the north axis and other sectors are numbered in a clockwise direction as follows:

1 = N	5 = E	9 = S	13 = W
2 = NNE	6 = ESE	10 = SSW	14 = WNW
3 = NE	7 = SE	11 = SW	15 = NW
4 = ENE	8 = SSE	12 = WSW	16 = NNW

The next digit is a letter which represents the radial distance from the reference point:

S =	On-site location	E =	4-5 miles off-site
A =	0-1 miles off-site	F =	5-10 miles off-site
B =	1-2 miles off-site	G =	10-20 miles off-site
C =	2-3 miles off-site	H =	>20 miles off-site
D =	3-4 miles off-site		

The last number is the station numerical designation within each sector and zone; e.g., 1,2,3,... For example, the designation SA-WWA-3E1 would indicate a sample in the Salem and Hope Creek program (SA), consisting of well water (WWA), which had been collected in sector number 3, centered at 45 degrees (north east) with respect to the midpoint between Salem 1 and 2 containments at a radial distance of 4 to 5 miles off-site, (therefore, radial distance E). The number 1 indicates that this is sampling station #1 in that particular sector.

TABLE B-1
SAMPLING LOCATIONS

Specific information about the individual sampling locations are given in Table B-1. Maps B-1 and B-2 show the locations of sampling stations with respect to the Site. A Portable Global Positioning System (GPS) was used to provide the coordinates of sampling locations.

STATION CODE	STATION LOCATION	LATITUDINAL DEG. MIN. FT	LONGITUDINAL DEG. MIN. FT	SAMPLE TYPE
1S1	0.57mi. N	39 - 28 - 260	75 - 32 - 222	IDM,VGT
2S2	0.4 mi. NNE; Lamp Pole 65 Near HC Switch Yard	39 - 28 - 98	75 - 32 - 10	IDM
2S4	0.6 mi. NNE	39 - 28 - 110	75 - 31 - 992	IDM
3S1	0.58 mi. NE	39 - 28 - 140	75 - 31 - 678	IDM
4S1	0.60 mi. ENE	39 - 28 - 023	75 - 31 - 544	IDM
5S1	0.86 mi. E; site access road	39 - 27 - 668	75 - 31 - 187	AIO,APT,IDM
6S2	0.23mi. ESE; area around Helicopter Pad	39 - 27 - 719	75 - 31 - 912	IDM,SOL,ESS
7S1	0.12 mi. SE; station personnel gate	39 - 27 - 720	75 - 32 - 15	IDM
10S1	0.14 mi. SSW; inlet cooling water bldg.	39 - 27 - 700	75 - 32 - 160	IDM
11S1	0.09 mi. SW; service water inlet bldg.	39 - 27 - 719	75 - 32 - 225	IDM
15S1	0.57 mi. NW	39 - 28 - 161	75 - 32 - 525	IDM,VGT
16S1	0.57 mi. NNW	39 - 28 - 215	75 - 32 - 432	IDM,VGT
11A1	0.2 mi. SW; outfall area	39 - 27 - 59	75 - 32 - 25	ECH,ESF,ESS,SWA
11A1A	0.15 mi. SE; Located at the plant barge slip	39 - 27 - 41	75 - 32 - 02	Alternate SWA
15A1	0.65 mi. NW; cooling tower blow down discharge line outfall	39 - 27 - 67	75 - 32 - 19	ESS
16A1	0.24 mi. NNW; south storm drain discharge line	39 - 28 - 24	75 - 32 - 58	ESS
12C1	2.5 mi. WSW; west bank of Delaware River	39 - 27 - 22	75 - 34 - 08	ECH,ESF,ESS,SWA
12C1A	3.7 mi. WSW; Located at the tip of Augustine Beach Boat Ramp	39 - 30 - 17	75 - 34 - 48	Alternate SWA
4D2	3.7 mi. ENE; Alloway Creek Neck Road	39 - 29 - 292	75 - 28 - 175	IDM
5D1	3.5 mi. E; local farm	39 - 28 - 396	75 - 28 - 334	AIO,APT,IDM
10D1	3.9 mi. SSW; Taylor's Bridge Spur	39 - 24 - 613	75 - 33 - 733	IDM,SOL,VGT
14D1	3.4 mi. WNW; Bay View, Delaware	39 - 29 - 26	75 - 35 - 521	IDM
15D1	3.8 mi. NW; Rt. 9, Augustine Beach	39 - 30 - 125	75 - 35 - 28	IDM

TABLE B-1 (cont'd)

STATION CODE	STATION LOCATION	LATITUDINAL DEG. MIN. FT	LONGITUDINAL DEG. MIN. FT	SAMPLE TYPE
2E1	4.4 mi. NNE; local farm	39 - 31 - 380	75 - 30 - 428	IDM
3E1	4.2 mi. NE; local farm	39 - 30 - 098	75 - 28 - 646	IDM,WWA
7E1	4.5 mi. SE; 1 mi. W of Mad Horse Creek	39 - 25 - 08	75 - 28 - 64	ESF,ESS,SWA
7E1A	8.87 mi. SE; Located at the end of Bayside Road	39 - 22 - 57	75 - 24 - 24	Alternate SWA
11E2	5.0 mi. SW; Rt. 9	39 - 24 - 328	75 - 35 - 546	IDM
12E1	4.4 mi. WSW; Thomas Landing	39 - 26 - 862	75 - 36 - 968	IDM
13E1	4.2 mi. W; Silver Run Road (Rt. 9)	39 - 27 - 989	75 - 36 - 735	IDM
13E3	5.0 mi. W; Local Farm, Odessa, DE	39 - 27 - 17	75 - 37 - 30	MLK,VGT,SOL
16E1	4.1 mi. NNW; Port Penn	39 - 30 - 762	75 - 34 - 580	AIO,APT,IDM,SOL
1F1	5.8 mi. N; Fort Elfsborg	39 - 32 - 693	75 - 31 - 124	AIO,APT,IDM
1F2	7.1 mi. N; midpoint of Delaware River	39 - 33 - 08	75 - 32 - 54	SWA
2F2	8.5 mi. NNE; Pole at Corner of 5th & Howell, Salem	39 - 34 - 522	75 - 28 - 120	IDM
2F3	8.0 mi. NNE; Salem Water Company	39 - 33 - 40	75 - 27 - 18	PWR,PWT
2F5	7.4 mi. NNE; Salem High School	39 - 33 - 448	75 - 28 - 514	IDM
2F6	7.3 mi. NNE; Southern Training Center	39 - 33 - 713	75 - 28 - 819	AIO,APT,IDM
2F9	7.5 mi. NNE; Local Farm , Tilbury Rd, Salem	39 - 33 - 55	75 - 29 - 30	FPV,FPL,SOL
2F10	9.2 mi. NNE; Local Farm, South Broadway (Rt. 49) Pennsville	39 - 35 - 35	75 - 29 - 35	FPV,FPL
3F2	5.1 mi. NE;Hancocks Bridge Municipal Bld	39 - 30 - 410	75 - 27 - 578	IDM
3F3	8.6 mi. NE; Quinton Township School	39 - 32 - 616	75 - 24 - 735	IDM
3F6	6.5 mi. NE; Local Farm, Salem/Hancocks Bridge Road	39 - 32 - 03	75 - 28 - 00	FPV,FPL
3F7	7.2 mi. NE; Local Farm, Beasley Neck Road, RD#3	39 - 32 - 07	75 - 25 - 46	FPV,FPL
4F2	6.0 mi. ENE; Mays Lane, Harmersville	39 - 29 - 953	75 - 26 - 076	IDM
5F1	6.5 mi. E; Canton	39 - 28 - 360	75 - 25 - 031	IDM,SOL
6F1	6.4 mi. ESE; Stow Neck Road	39 - 26 - 396	75 - 25 - 148	IDM
7F2	9.1 mi. SE; Bayside, New Jersey	39 - 22 - 971	75 - 24 - 261	IDM
9F1	5.3 mi. S; D.P.A.L. 48912-30217	39 - 23 - 042	75 - 32 - 95	IDM
10F2	5.8 mi. SSW; Rt. 9	39 - 23 - 034	75 - 34 - 152	IDM
11F1	6.2 mi. SW; Taylor's Bridge Delaware	39 - 24 - 766	75 - 37 - 632	IDM
12F1	9.4 mi. WSW; Townsend Elementary School	39 - 23 - 778	75 - 41 - 311	IDM
13F2	6.5 mi. W; Odessa, Delaware	39 - 27 - 297	75 - 39 - 372	IDM

TABLE B-1 (cont'd)

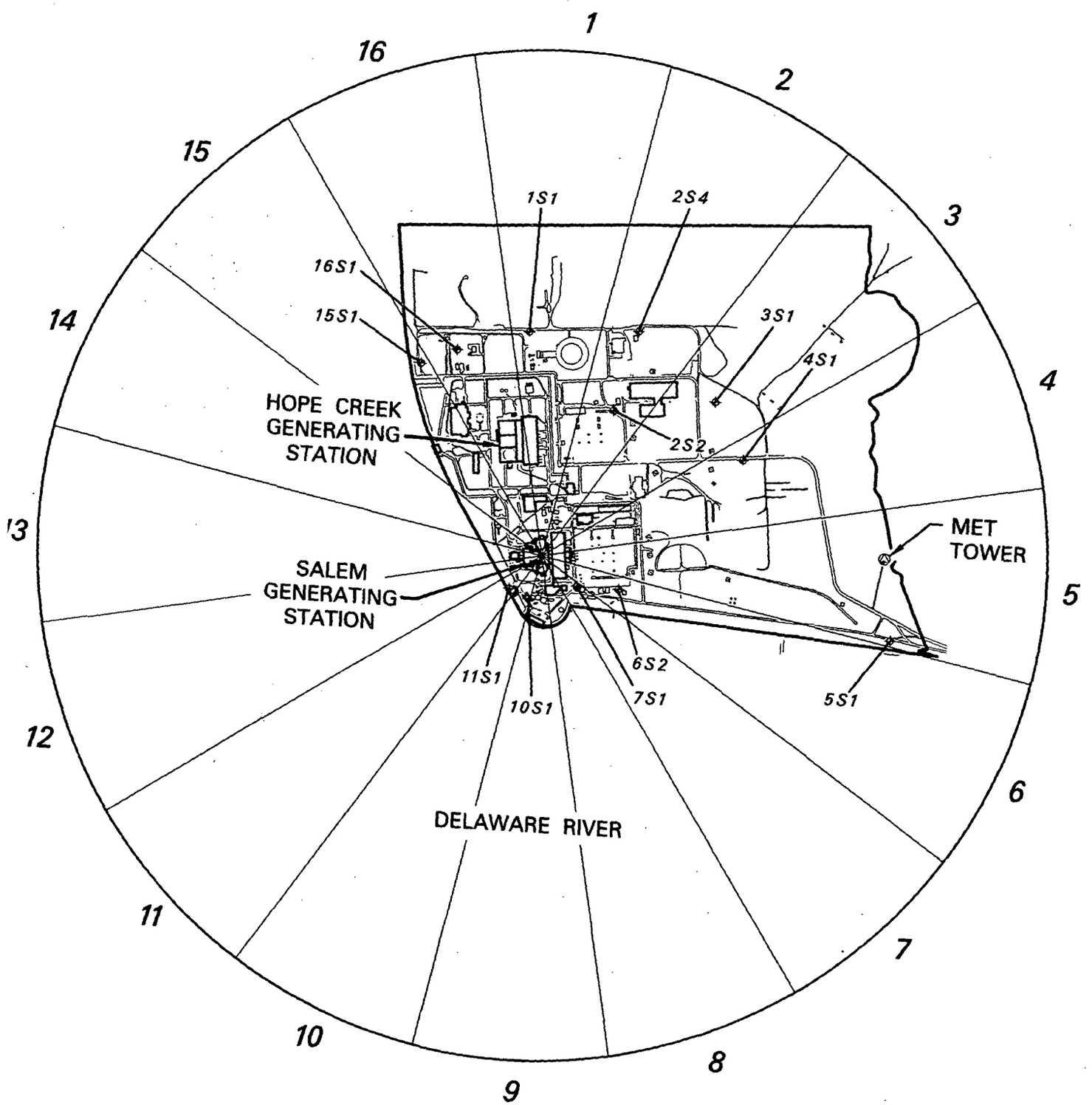
STATION CODE	STATION LOCATION	LATITUDINAL DEG. MIN. FT	LONGITUDINAL DEG. MIN. FT	SAMPLE TYPE
13F3	9.3 mi. W; Redding Middle School, Middletown, Delaware	39 - 27 - 215	75 - 42 - 543	IDM
13F4	9.8 mi. W; Middletown, Delaware	39 - 26 - 857	75 - 43 - 111	IDM
14F2	6.7 mi. WNW; Boyds Corner	39 - 29 - 979	75 - 39 - 042	IDM
14F4	7.6 mi. WNW; local farm	39 - 30 - 44	75 - 40 - 52	MLK,VGT,SOL
15F3	5.4 mi. NW	39 - 30 - 987	75 - 36 - 586	IDM
15F4	7.0 mi. NW; local farm; Port Penn Road; Delaware	39 - 31 - 21	75 - 38 - 31	FPV
16F1	6.9 mi. NNW; C&D Canal	39 - 33 - 55	75 - 34 - 25	ESS,SWA
16F1A	6.84 mi. NNW; Located at the C&D Canal tip	39 - 33 - 34	75 - 33 - 56	Alternate SWA
16F2	8.1 mi. NNW; Delaware City Public School	39 - 34 - 314	75 - 35 - 429	IDM
1G1	10.9 mi. NNE; Rte. 49, South Broadway	39 - 37 - 113	75 - 30 - 178	FPV
1G3	19 mi. N; N. Church St. Wilmington, Del (Old Swedish Church Yard Park)	39 - 44 - 287	75 - 32 - 512	IDM
2G2	13.5 mi. NNE; Local Farm; Pointers Auburn Road (Rt. 540), Salem, NJ 08079	39 - 38 - 19	75 - 26 - 10	FPV
2G3	11.8 mi. NNE; Local Milk Farm, Corner of Routes 540 & 45, Mannington, NJ	39 - 36 - 21	75 - 24 - 53	MLK,FPV,VGT,SOL
2G4	11.3 mi. NNE; large family garden; Rt 45 & Welchville Rd,Mannington, NJ	39 - 36 - 02	75 - 25 - 21	FPV
3G1	16.5 mi. NE; Milk Farm; Daretown-Alloway Road, Woodstown	39 - 35 - 913	75 - 16 - 804	IDM,MLK,VGT,SOL
9G1	10.3 mi. S; Local Farm, Woodland Beach Rd., Smyrna, Delaware	39 - 18 - 47	75 - 33 - 50	FPV
9G2	10.7 mi. S; Local Farm, Woodland Beach Road, Smyrna, Delaware	39 - 18 - 39	75 - 34 - 11	FPV,FPL
10G1	12 mi. SSW; Smyrna, Delaware	39 - 18 - 223	75 - 36 - 095	IDM
14G1	11.8 mi. WNW; Rte. 286/Bethel Church Road; Delaware	39 - 31 - 290	75 - 46 - 495	AIO,APT,IDM
16G1	15 mi. NNW; Across from Greater Wilmington Airport	39 - 40 - 637	75 - 35 - 570	IDM
3H1	32 mi. NE; National Park, New Jersey	39 - 51 - 599	75 - 11 - 96	IDM
3H5	25 mi. NE; Farm Market, Rt 77	39 - 41 - 040	75 - 12 - 380	FPL,FPV

NOTE: All station locations are referenced to the midpoint of the two Salem Units' Containments. The coordinates of this location are: Latitude N 39° - 27' - 46.5" and Longitude W 75° - 32' - 10.6".

All Vegetables(FPV & FPL) and Vegetation (VGT), are management audit samples. They are not required by the Salem & Hope Creek Stations' Tech Specs nor listed in the Station's ODCM. Vegetable samples are not always collected in consecutive years from the same farmer since they rotate the type of crop they grow.

MAP B-1

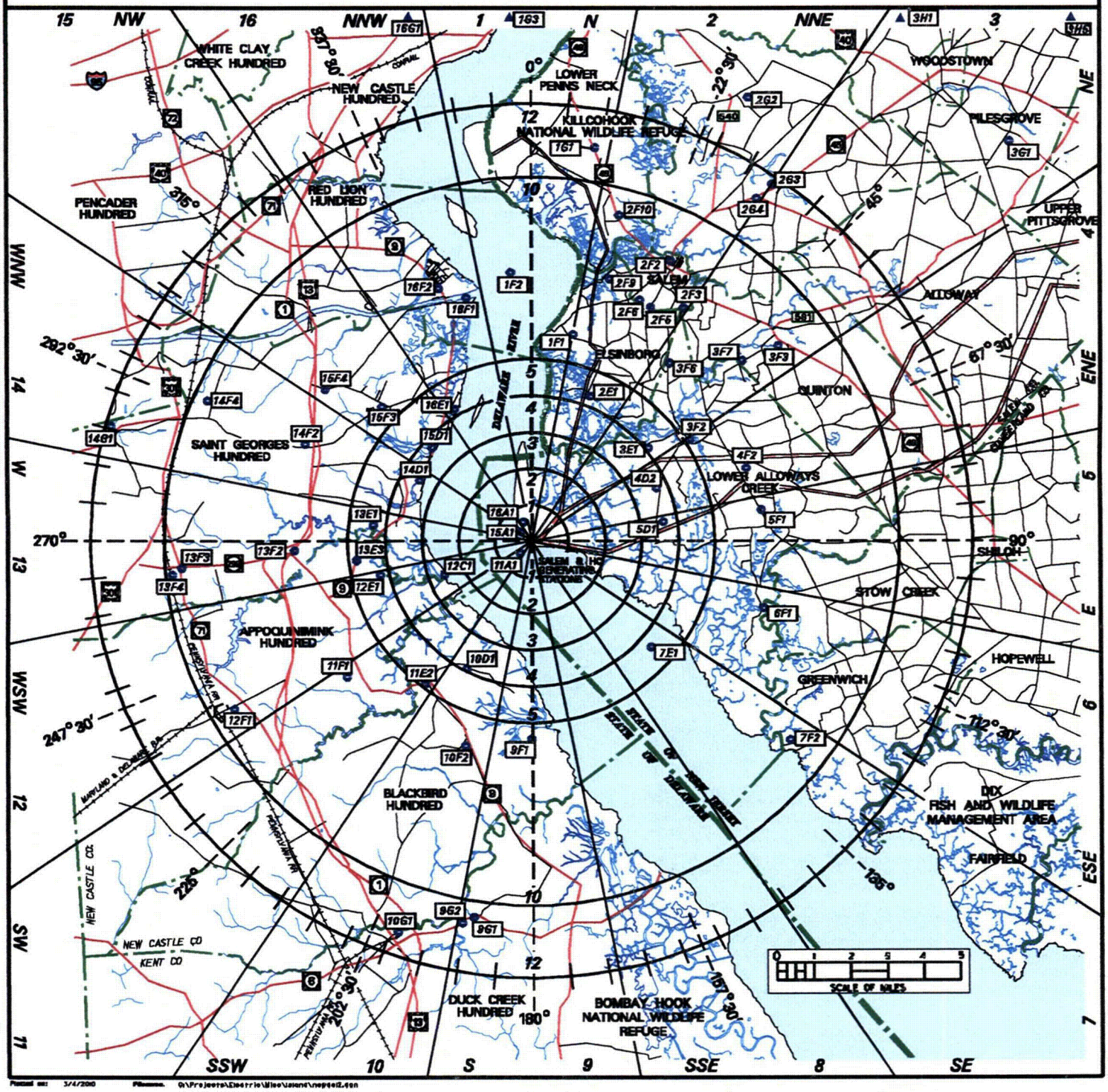
SALEM AND HOPE CREEK GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
ON-SITE SAMPLING LOCATIONS



on: 3/5/2010 Filename: G:\Projects\Electric\Misc\Island\newdel3.dgn

MAP B-2

SALEM AND HOPE CREEK (HC) GENERATING STATIONS
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OFF-SITE SAMPLING LOCATION



APPENDIX C

DATA TABLES

APPENDIX C

DATA TABLES

Appendix C presents the analytical results of the 2009 Radiological Environmental Monitoring Program for the period of January 1 to December 31, 2009.

DATA TABLES (cont'd.)

Table C-1

2009 CONCENTRATIONS OF GAMMA EMITTERS*
IN QUARTERLY COMPOSITES OF AIR PARTICULATES

Results in Units of 10^{-3} pCi/m^3 +/- 2 sigma

STATION ID	Sampling Period Start		Stop	<--- Gamma Emitters---> Be-7	K-40
SA-APT-5S1	12/29/2008	to	3/30/2009	99±5	15±3
SA-APT-1F1	12/29/2008	to	3/30/2009	106±5	10±3
SA-APT-2F6	12/29/2008	to	3/30/2009	96±5	15±3
SA-APT-5D1	12/29/2008	to	3/30/2009	99±5	14±3
SA-APT-16E1	12/29/2008	to	3/30/2009	99±5	13±3
SA-APT-14G1(C)	12/29/2008	to	3/30/2009	105±6	10±3
SA-APT-5S1	3/30/2009	to	6/29/2009	91±5	8±3
SA-APT-1F1	3/30/2009	to	6/29/2009	81±4	10±2
SA-APT-2F6	3/30/2009	to	6/29/2009	92±5	13±3
SA-APT-5D1	3/30/2009	to	6/29/2009	85±5	12±3
SA-APT-16E1	3/30/2009	to	6/29/2009	79±5	13±4
SA-APT-14G1(C)	3/30/2009	to	6/29/2009	91±5	14±4
SA-APT-5S1	6/29/2009	to	9/28/2009	81±6	14±4
SA-APT-1F1	6/29/2009	to	9/28/2009	88±6	14±3
SA-APT-2F6	6/29/2009	to	9/28/2009	85±5	13±3
SA-APT-5D1	6/29/2009	to	9/28/2009	87±5	10±3
SA-APT-16E1	6/29/2009	to	9/28/2009	84±5	14±3
SA-APT-14G1(C)	6/29/2009	to	9/28/2009	78±5	11±3
SA-APT-5S1	9/28/2009	to	12/29/2009	64±4	10±3
SA-APT-1F1	9/28/2009	to	12/29/2009	72±4	10±3
SA-APT-2F6	9/28/2009	to	12/29/2009	63±4	9±2
SA-APT-5D1	9/28/2009	to	12/29/2009	70±4	14±3
SA-APT-16E1	9/28/2009	to	12/29/2009	62±4	10±2
SA-APT-14G1(C)	9/28/2009	to	12/29/2009	67±5	16±4
AVERAGE				84±26	12±4

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18.
(C) Control Station

TABLE C-2

2009 CONCENTRATIONS OF GROSS BETA EMITTERS IN AIR PARTICULATES

Results in Units of 10^{-3} pCi/m^3 +/- 2 sigma

	<---------- STATION ID ---------->						
MONTH	Control SA-APT-14G1	SA-APT-16E1	SA-APT-1F1	SA-APT-2F6	SA-APT-5D1	SA-APT-5S1	AVERAGE
January	24±2	26±2	25±2	26±2	24±2	26±2	25±2
	21±2	19±2	19±2	20±2	16±2	24±2	20±6
	22±2	21±2	20±2	23±2	24±2	25±2	22±4
	31±2	27±2	31±2	32±2	27±2	34±2	30±5
	24±2	23±2	31±2	29±2	24±2	28±2	26±7
February	20±2	21±2	27±2	20±2	21±2	26±2	23±6
	(1)	13±2	17±2	17±2	16±2	18±2	16±4
	18±1	17±2	20±2	19±2	21±2	20±2	19±3
	19±2	18±2	24±2	24±2	23±2	22±2	22±5
March	25±2	25±2	28±3	26±3	24±3	25±2	26±3
	21±2	20±2	21±2	15±2	21±2	24±2	20±6
	23±2	21±2	26±2	21±2	22±2	27±2	23±5
	11±2	10±2	8±2	11±2	12±2	9±2	10±3
April	13±2	11±2	14±2	14±2	12±2	13±2	13±2
	22±2	18±2	21±2	20±2	17±2	22±2	20±4
	19±2	19±2	20±2	19±2	20±2	25±2	20±4
	17±2	15±2	19±2	15±2	15±2	17±2	16±4
May	17±2	16±2	17±2	20±2	19±2	20±2	18±3
	11±2	9±1	10±2	10±2	9±2	9±2	9±2
	15±2	10±2	16±2	14±2	14±2	15±2	14±4
	16±2	13±2	19±2	17±2	14±2	16±2	16±4
	11±2	9±2	9±2	9±1	8±1	7±1	9±2
June	11±2	11±2	8±2	14±2	12±2	16±3	12±6
	11±2	12±2	14±2	12±2	11±2	12±2	12±2
	8±2	7±2	7±2	7±2	7±2	7±2	7±1
	16±2	14±2	17±2	17±2	16±2	16±2	16±2

TABLE C-2

2009 CONCENTRATIONS OF GROSS BETA EMITTERS IN AIR PARTICULATES

Results in Units of 10^{-3} pCi/m^3 +/- 2 sigma

		<---------- STATION ID ---------->					
MONTH	Control SA-APT-14G1	SA-APT-16E1	SA-APT-1F1	SA-APT-2F6	SA-APT-5D1	SA-APT-5S1	AVERAGE
July	15±2	17±2	14±2	13±2	16±2	16±2	15±3
	11±2	13±2	13±3	11±2	13±2	13±2	12±2
	23±2	19±2	20±2	21±2	21±2	22±2	21±3
	15±2	18±2	16±2	18±2	15±2	15±2	16±3
	10±2	13±2	14±2	17±2	12±2	13±2	13±4
August (2)	21±2	25±2	22±2	17±2	23±2	24±2	22±6
	27±4	26±4	34±4	28±4	27±4	34±4	29±7
	25±4	23±4	19±4	20±4	21±4	23±4	22±5
	18±4	17±4	19±4	18±4	13±4	21±4	18±6
September (2)	23±5	22±5	19±5	28±6	25±5	25±5	24±6
	13±2	14±2	20±2	12±2	13±2	17±2	15±6
	23±2	21±2	22±2	19±2	20±2	18±2	21±4
	17±2	14±2	13±2	16±2	14±2	15±2	15±3
October	17±2	17±2	17±2	16±2	14±2	17±2	16±2
	16±2	15±2	15±2	16±2	15±2	20±2	16±4
	16±2	13±2	15±2	15±2	14±2	14±2	14±2
	24±2	21±2	24±2	24±2	20±2	21±2	22±3
	10±2	11±2	11±2	12±2	12±2	13±2	11±2
November	19±2	18±2	18±2	20±2	17±2	15±2	18±3
	20±2	15±2	19±2	21±2	18±2	21±2	19±4
	19±2	17±2	20±2	17±2	18±2	18±2	18±2
	16±2	14±2	15±2	16±2	15±2	17±2	15±2
December	13±2	14±2	16±2	14±2	13±2	16±2	14±2
	27±2	22±2	28±2	31±2	23±2	30±2	27±8
	23±2	21±2	25±2	20±2	19±2	23±2	22±4
	15±2	14±2	15±2	17±2	17±2	14±2	15±3
AVERAGE	18±11	17±10	19±12	18±11	17±10	19±12	18±11
					GRAND AVERAGE		18±11

(1) Location 14G1 result was for the two week duration of 2/9-23/09. See Program Deviations.
(2) All weekly samples from 8/10-9/08/09 were analyzed by AREVA-NP Laboratory.

TABLE C-3

2009 CONCENTRATIONS OF IODINE-131* IN FILTERED AIR

Results in Units of 10^{-3} pCi/m^3

	<---------- STATION ID ---------->					
MONTH	Control SA-AIO-14G1	SA-AIO-16E1	SA-AIO-1F1	SA-AIO-2F6	SA-AIO-5D1	SA-AIO-5S1
January	<1.8	<4.1	<3.8	<5.7	<3.1	<3.2
	<2.1	<2	<2	<4.8	<2.8	<2.5
	<2.8	<5.1	<2.3	<3.7	<2.1	<3.1
	<4.8	<3.7	<2.2	<2.2	<2.5	<4
	<3.8	<5.5	<3.2	<4.1	<4.4	<2.5
February	<2.1	<4.4	<3.7	<2	<2.2	<2.3
	(1)	<3.2	<2.2	<2.8	<5.2	<4.3
	<2.1	<5.7	<2.9	<4.8	<4.1	<6
	<4.2	<2.3	<2.7	<1.2	<2.6	<2.2
March	<3	<3.5	<2.4	<5.8	<4.3	<3.9
	<1.7	<1.5	<2.5	<1.6	<2.7	<2.5
	<4.1	<3.5	<1.8	<3.2	<2.9	<3.1
	<3.7	<3	<1.8	<2.3	<3.5	<1.9
April	<2	<3.5	<3.4	<2.1	<4.1	<4.8
	<4.4	<2.7	<1.6	<3.6	<5	<2.9
	<3.3	<5.5	<1.9	<1.5	<4	3.1
	<3.4	<6.3	<3.9	<3.1	<4	<3.6
May	<3.1	<3.7	<3.7	<1.6	<5.2	<4.2
	<2.3	<2	<5.8	<8.1	<2.1	<2.9
	<3.3	<4	<1.7	<5.2	<1.5	<3.2
	<2.5	<2.3	<1.5	<4.8	<6	<2.2
	<4	<1.6	<4.1	<3.7	<5.1	<2.1
June	<5.2	<4.8	<3.3	<4.5	<5.4	<5.5
	<4.7	<2	<1.7	<2.5	<3.3	<2
	<4	<4.2	<3.4	<2	<1.9	<2.5
	<4.9	<2.6	<2	<4.7	<3.5	<2

TABLE C-3

2009 CONCENTRATIONS OF IODINE-131* IN FILTERED AIR

Results in Units of 10^{-3} pCi/m^3

	<---------- STATION ID ---------->					
MONTH	**Control SA-AIO-14G1**	**SA-AIO-16E1**	**SA-AIO-1F1**	**SA-AIO-2F6**	**SA-AIO-5D1**	**SA-AIO-5S1**
July	<2.3	<3.4	<2.4	<1.4	<2.6	<2.1
	<6.1	<2.2	<2.9	<9.7	<8.2	<6.6
	<1.7	<1.9	<3.7	<2.1	<2.6	<4.1
	<4.1	<4.9	<3.7	<3.9	<2.7	<2
	<2.2	<3.8	<4.8	<1.9	<2.3	<5.9
August (2)	<2.6	<2.4	<4.8	<7.6	<2.8	<1.9
	<9.1	<8.5	<9.1	<8.9	<9	<8.6
	<8.1	<9.5	<9.4	<8.7	<9.9	<9.5
	<9.7	<9.9	<9.2	<9.3	<9.4	<9.8
September (2)	<9.8	<9.2	<8.2	<9.5	<9.6	<9.7
	<6.2	<5.2	<4.1	<4.6	<5.3	<1.6
	<2.2	<1.3	<1.6	<1.7	<2.7	<3.3
	<3.9	<1.5	<3	<2.3	<4.2	<3.5
October	<2.5	<4.8	<2.7	<4.4	<5.1	<3.7
	<3.9	<2.2	<1.7	<3.8	<2.3	<3.2
	<2.7	<2.3	<2.8	<3.2	<5.3	<2.8
	<4.3	<3.2	<3.9	<6	<3	<3.6
	<5.4	<8.1	<5.8	<2.7	<4.2	<3.2
November	<4.3	<1.7	<2.1	<6.3	<2.3	<2.6
	<3.3	<3	<4.5	<4	<2.5	<5.1
	<2.2	<1.6	<2.1	<4.6	<2.7	<5.2
	<5.7	<1.9	<2.5	<3.9	<3.6	<1.9
December	<2.7	<1.7	<3.6	<2	<4.4	<1.1
	<4.1	<3.9	<5.4	<2.6	<2.8	<2.8
	<3.6	<4	<1.7	<2.2	<2.7	<2
	<1.5	<2.3	<2.7	<4.3	<4.3	<3.1

* I-131 results are corrected for decay to sample stop date.

(1) Location 14G1 result was for the two week duration of 2/9-23/09. See Program Deviation.

(2) Weekly AIO Samples from 8/10-9/08/09 were analyzed by AREVA-NP Laboratory.

TABLE C-4

2009 DIRECT RADIATION MEASUREMENTS - QUARTERLY TLD RESULTS

Results in mR/standard month* +/- 2 sigma

STATION ID	JAN to MAR	APR to JUN	JUL to SEP	OCT to DEC	** QTR ELEMENTS AVG
SA-IDM-1S1	4.4±0.6	4.8±0.4	4.8±0.5	5.2±0.5	4.8±0.6
SA-IDM-2S2	4.7±0.5	5.3±0.4	5.0±0.6	5.4±0.7	5.1±0.6
SA-IDM-2S4	3.9±0.4	4.3±0.4	3.8±0.6	4.1±0.4	4.0±0.5
SA-IDM-3S1	2.9±0.4	3.4±0.6	3.2±0.4	3.7±0.4	3.3±0.7
SA-IDM-4S1	3.8±0.4	4.2±0.5	3.9±0.7	4.2±0.4	4.0±0.4
SA-IDM-5S1	3.2±0.4	3.6±0.3	3.5±0.4	3.9±0.4	3.6±0.6
SA-IDM-6S2	4.9±0.7	5.5±0.6	5.0±0.6	5.2±0.4	5.2±0.5
SA-IDM-7S1	5.2±0.5	6.0±0.5	5.3±0.9	5.6±0.5	5.5±0.7
SA-IDM-10S1	3.4±0.4	4.0±0.3	3.5±0.6	4.7±0.6	3.9±1.2
SA-IDM-11S1	3.0±0.5	3.8±0.4	3.3±0.4	4.4±0.5	3.6±1.3
SA-IDM-15S1	3.3±0.3	3.7±0.4	3.4±0.4	3.7±0.3	3.5±0.4
SA-IDM-16S1	4.0±0.5	4.5±0.3	4.1±0.4	4.7±0.4	4.3±0.7
SA-IDM-4D2	4.2±0.5	4.9±0.4	4.3±0.5	4.7±0.5	4.5±0.6
SA-IDM-5D1	3.6±0.4	4.2±0.3	3.7±0.5	4.1±0.5	3.9±0.6
SA-IDM-10D1	4.3±0.4	4.7±0.3	4.8±0.6	4.9±0.8	4.7±0.6
SA-IDM-14D1	3.7±0.4	4.6±0.8	3.8±0.5	4.3±0.6	4.1±0.8
SA-IDM-15D1	4.4±0.5	4.7±0.5	4.4±0.6	4.8±0.4	4.6±0.4
SA-IDM-2E1	3.9±0.4	4.4±0.3	4.1±0.5	4.4±0.5	4.2±0.5
SA-IDM-3E1	3.1±0.4	3.6±0.3	3.4±0.4	3.6±0.3	3.4±0.4
SA-IDM-11E2	4.3±0.4	4.8±0.4	4.4±0.6	4.8±0.6	4.6±0.6
SA-IDM-12E1	4.3±0.6	4.8±0.4	4.5±0.7	4.9±0.5	4.6±0.5
SA-IDM-13E1	3.4±0.5	3.8±0.5	3.5±0.6	4.0±0.6	3.7±0.6
SA-IDM-16E1	4.2±0.4	4.5±0.4	4.7±0.5	4.6±0.6	4.5±0.4
SA-IDM-1F1	5.2±0.5	6.1±0.7	5.6±0.5	5.6±0.6	5.6±0.7
SA-IDM-2F2	3.3±0.4	3.7±0.6	3.6±0.6	3.8±0.6	3.6±0.4
SA-IDM-2F5	4.1±0.5	4.5±0.5	4.3±0.8	4.5±0.4	4.3±0.4
SA-IDM-2F6	3.7±0.4	4.2±0.6	4.0±0.5	4.1±0.3	4.0±0.4
SA-IDM-3F2	3.5±0.4	3.8±0.4	3.8±0.5	3.9±0.3	3.7±0.4
SA-IDM-3F3	3.5±0.3	3.8±0.4	3.8±0.5	4.0±0.5	3.8±0.4
SA-IDM-4F2	3.2±0.3	3.9±0.4	3.6±0.4	3.9±0.5	3.6±0.7
SA-IDM-5F1	3.5±0.4	4.1±0.4	3.8±0.5	4.0±0.5	3.8±0.5
SA-IDM-6F1	2.9±0.5	3.3±0.3	3.0±0.7	3.4±0.4	3.2±0.4
SA-IDM-7F2	4.2±0.4	3.0±0.4	2.9±0.4	2.9±0.3	3.3±1.3
SA-IDM-9F1	4.5±0.5	5.0±0.4	4.8±0.5	5.1±0.5	4.8±0.5
SA-IDM-10F2	2.7±0.3	4.5±0.4	4.4±0.5	4.8±0.5	4.1±1.9
SA-IDM-11F1	4.3±0.5	3.8±0.5	4.3±0.4	5.0±0.5	4.3±1.0
SA-IDM-12F1	4.1±0.5	4.5±0.4	4.2±0.6	4.5±0.4	4.3±0.4
SA-IDM-13F2	3.9±0.6	4.4±0.5	4.1±0.5	4.5±0.5	4.2±0.5
SA-IDM-13F3	4.1±0.5	4.5±0.3	4.2±0.5	4.6±0.5	4.4±0.4
SA-IDM-13F4	4.6±0.4	5.1±0.4	4.7±0.5	5.0±0.5	4.8±0.5
SA-IDM-14F2	4.5±0.4	4.8±0.7	4.7±0.6	5.5±0.6	4.9±0.9
SA-IDM-15F3	4.3±0.5	4.9±0.6	4.7±0.5	5.1±0.4	4.7±0.6
SA-IDM-16F2	3.6±0.5	4.4±0.4	3.8±0.5	4.2±0.5	4.0±0.7
SA-IDM-1G3 (C)	4.9±0.7	4.8±0.6	4.0±0.6	4.6±0.4	4.6±0.8
SA-IDM-3G1 (C)	4.0±0.4	4.7±0.4	4.3±0.6	4.6±0.6	4.4±0.6
SA-IDM-10G1(C)	4.1±0.5	4.6±0.5	4.4±0.5	4.8±0.4	4.5±0.6
SA-IDM-14G1(C)	4.1±0.5	4.9±0.4	4.4±0.6	4.8±1.0	4.5±0.8
SA-IDM-16G1(C)	3.7±0.4	4.1±0.4	3.8±0.4	4.2±0.5	4.0±0.5
SA-IDM-3H1 (C)	3.1±0.5	3.7±0.3	3.4±0.7	4.0±0.3	3.5±0.7
AVERAGE	3.9±1.2	4.4±1.3	4.1±1.2	4.5±1.2	
			GRAND AVG		4.2±1.3

* Results are reported in millroentgen (mR) with the standard month = 30.4 days.
** Quarterly Element TLD results by AREVA - NP Environmental Laboratory.
(C) Control Station

TABLE C-5

2009 CONCENTRATIONS OF IODINE-131* AND GAMMA EMITTERS** IN MILK

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING PERIOD*** START	STOP	I-131	<---- GAMMA EMITTERS ----> K-40	RA-NAT
SA-MLK-2G3	1/4/2009	1/5/2009	<0.2	1360 ±74	<3
SA-MLK-13E3	1/4/2009	1/5/2009	<0.2	1410 ±69	<3
SA-MLK-14F4	1/4/2009	1/5/2009	<0.1	1350 ±70	<3.2
SA-MLK-3G1 (C)	1/4/2009	1/5/2009	<0.3	1360 ±75	<3.1
SA-MLK-2G3	2/1/2009	2/2/2009	<0.2	1350 ±73	<3.5
SA-MLK-13E3	2/1/2009	2/2/2009	<0.2	1350 ±73	<3.4
SA-MLK-14F4	2/1/2009	2/2/2009	<0.2	1440 ±69	<3.1
SA-MLK-3G1 (C)	2/1/2009	2/2/2009	<0.2	1290 ±70	<3
SA-MLK-2G3	3/2/2009	3/3/2009	<0.2	1270 ±73	<3.4
SA-MLK-13E3	3/2/2009	3/3/2009	<0.2	1380 ±72	<2.8
SA-MLK-14F4	3/2/2009	3/3/2009	<0.2	1370 ±78	<2.9
SA-MLK-3G1 (C)	3/2/2009	3/3/2009	<0.2	1340 ±71	<3.1
SA-MLK-2G3	4/5/2009	4/6/2009	<0.2	1240 ±65	<3.9
SA-MLK-13E3	4/5/2009	4/6/2009	<0.2	1360 ±70	<4.3
SA-MLK-14F4	4/5/2009	4/6/2009	<0.2	1370 ±54	<2.8
SA-MLK-3G1 (C)	4/5/2009	4/6/2009	<0.2	1360 ±74	<3
SA-MLK-2G3	4/19/2009	4/20/2009	<0.2	1250 ±73	<5.5
SA-MLK-13E3	4/19/2009	4/20/2009	<0.2	1290 ±73	<3.3
SA-MLK-14F4	4/19/2009	4/20/2009	<0.2	1420 ±72	<3.2
SA-MLK-3G1 (C)	4/19/2009	4/20/2009	<0.2	1230 ±63	<3.6
SA-MLK-2G3	5/3/2009	5/4/2009	<0.2	1280 ±73	8.5 ±3
SA-MLK-13E3	5/2/2009	5/3/2009	<0.2	1430 ±76	5.8 ±2
SA-MLK-14F4	5/3/2009	5/4/2009	<0.2	1420 ±72	<4
SA-MLK-3G1 (C)	5/3/2009	5/4/2009	<0.2	1330 ±74	<3.2
SA-MLK-2G3	5/17/2009	5/18/2009	<0.2	1360 ±66	<3.8
SA-MLK-13E3	5/17/2009	5/18/2009	<0.2	1270 ±67	<3.8
SA-MLK-14F4	5/17/2009	5/18/2009	<0.2	1380 ±72	<3.2
SA-MLK-3G1 (C)	5/17/2009	5/18/2009	<0.2	1330 ±73	<2.8
SA-MLK-2G3	6/1/2009	6/2/2009	<0.2	1280 ±69	<3.5
SA-MLK-13E3	6/1/2009	6/2/2009	<0.2	1360 ±68	<3.7
SA-MLK-14F4	6/1/2009	6/2/2009	<0.2	1420 ±75	<3
SA-MLK-3G1 (C)	6/1/2009	6/2/2009	<0.2	1320 ±72	<3.1
SA-MLK-2G3	6/14/2009	6/15/2009	<0.2	1310 ±70	<4.1
SA-MLK-13E3	6/14/2009	6/15/2009	<0.2	1380 ±73	<3
SA-MLK-14F4	6/14/2009	6/15/2009	<0.2	1360 ±77	<2.9
SA-MLK-3G1 (C)	6/14/2009	6/15/2009	<0.2	1480 ±75	<3.1
SA-MLK-2G3	7/5/2009	7/6/2009	<0.3	1330 ±72	<3.3
SA-MLK-13E3	7/5/2009	7/6/2009	<0.3	1390 ±73	<2.9
SA-MLK-14F4	7/5/2009	7/6/2009	<0.3	1450 ±75	<3.1
SA-MLK-3G1 (C)	7/5/2009	7/6/2009	<0.3	1290 ±71	<4.1
SA-MLK-2G3	7/19/2009	7/20/2009	<0.3	1390 ±70	<4.1
SA-MLK-13E3	7/19/2009	7/20/2009	<0.2	1400 ±73	<3.1
SA-MLK-14F4	7/19/2009	7/20/2009	<0.2	1440 ±76	<2.6
SA-MLK-3G1 (C)	7/19/2009	7/20/2009	<0.3	1270 ±75	<2.6

TABLE C-5

2009 CONCENTRATIONS OF IODINE-131* AND GAMMA EMITTERS** IN MILK

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING PERIOD *** START	STOP	I-131	<---- GAMMA EMITTERS ----> K-40	RA-NAT
SA-MLK-2G3	8/2/2009	8/3/2009	<0.3	1330 ±73	<3.6
SA-MLK-13E3	8/2/2009	8/3/2009	<0.2	1350 ±73	<2.9
SA-MLK-14F4	8/2/2009	8/3/2009	<0.2	1460 ±74	<3.4
SA-MLK-3G1 (C)	8/2/2009	8/3/2009	<0.3	1310 ±72	<4.2
SA-MLK-2G3 (1)	8/16/2009	8/17/2009	<0.8	1540 ±170	<18
SA-MLK-13E3	8/16/2009	8/17/2009	<0.8	1520 ±140	<16
SA-MLK-14F4	8/16/2009	8/17/2009	<1	1380 ±120	<9.4
SA-MLK-3G1 (C)	8/16/2009	8/17/2009	<1	1290 ±220	<21
SA-MLK-2G3 (1)	9/7/2009	9/8/2009	<1	1520 ±190	<21
SA-MLK-13E3	9/7/2009	9/8/2009	<0.9	1480 ±110	<9.5
SA-MLK-14F4	9/7/2009	9/8/2009	<0.9	1470 ±210	<20
SA-MLK-3G1 (C)	9/7/2009	9/8/2009	<1	1790 ±150	<24
SA-MLK-2G3	9/20/2009	9/21/2009	<0.2	1330 ±69	<3.7
SA-MLK-13E3	9/20/2009	9/21/2009	<0.2	1480 ±79	<2.8
SA-MLK-14F4	9/20/2009	9/21/2009	<0.3	1370 ±74	<3.8
SA-MLK-3G1 (C)	9/20/2009	9/21/2009	<0.2	1340 ±72	<4.9
SA-MLK-2G3	10/4/2009	10/5/2009	<0.2	1400 ±75	<3.1
SA-MLK-13E3	10/4/2009	10/5/2009	<0.3	1320 ±73	<2.9
SA-MLK-14F4	10/4/2009	10/5/2009	<0.2	1310 ±68	<3.8
SA-MLK-3G1 (C)	10/4/2009	10/5/2009	<0.3	1210 ±68	<3.6
SA-MLK-2G3	10/25/2009	10/26/2009	<0.2	1240 ±68	<5.8
SA-MLK-13E3	10/25/2009	10/26/2009	<0.2	1390 ±74	<4.5
SA-MLK-14F4	10/25/2009	10/26/2009	<0.2	1420 ±75	<3.1
SA-MLK-3G1 (C)	10/25/2009	10/26/2009	<0.2	1310 ±73	<3.1
SA-MLK-2G3	11/1/2009	11/2/2009	<0.2	1350 ±74	<3.6
SA-MLK-13E3	11/1/2009	11/2/2009	<0.3	1290 ±69	<3.8
SA-MLK-14F4	11/1/2009	11/2/2009	<0.2	1320 ±70	<5.1
SA-MLK-3G1 (C)	11/1/2009	11/2/2009	<0.3	1360 ±71	<4.4
SA-MLK-2G3	11/15/2009	11/16/2009	<0.3	1330 ±73	<3.9
SA-MLK-13E3	11/15/2009	11/16/2009	<0.2	1490 ±80	<2.6
SA-MLK-14F4	11/15/2009	11/16/2009	<0.2	1370 ±74	<3
SA-MLK-3G1 (C)	11/15/2009	11/16/2009	<0.3	1320 ±71	<3.3
SA-MLK-2G3	12/6/2009	12/7/2009	<0.2	1290 ±71	<3.7
SA-MLK-13E3	12/6/2009	12/7/2009	<0.2	1380 ±72	<5.4
SA-MLK-14F4	12/6/2009	12/7/2009	<0.2	1390 ±70	<4.1
SA-MLK-3G1 (C)	12/6/2009	12/7/2009	<0.3	1240 ±69	<3.7
AVERAGE			-	1360 ±170	-

* Iodine-131 results are corrected for decay to stop date of collection period & analyzed to an LLD of 1.0 pCi/L.

** All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18

*** Monthly sample collected during Jan., Feb., March and Dec., when animals are not on pasture.

(C) Control Station

(1) Results from August 16th through September 8th for all locations by AREVA-NP Laboratory

TABLE C-6

2009 CONCENTRATIONS OF GROSS ALPHA AND GROSS BETA EMITTERS, AND TRITIUM IN WELL WATER (Ground Water)*

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING DATE	GROSS ALPHA	GROSS BETA	TRITIUM
SA-WWA-3E1	1/26/2009	<0.5	8.8±0.8	<143
SA-WWA-3E1	2/23/2009	<0.8	1.7±0.6	<138
SA-WWA-3E1	3/30/2009	0.5±0.4	<0.7	<136
SA-WWA-3E1	4/27/2009	<1.1	<1.3	<134
SA-WWA-3E1	5/26/2009	<0.8	1.4±0.7	<136
SA-WWA-3E1	6/29/2009	<0.9	<1.4	<132
SA-WWA-3E1	7/27/2009	<0.6	<1.2	<130
SA-WWA-3E1	8/31/2009	<0.7	0.9±0.6	<132
SA-WWA-3E1	9/28/2009	<0.7	<0.9	<136
SA-WWA-3E1	10/26/2009	<0.5	<0.9	<139
SA-WWA-3E1	11/30/2009	<0.8	0.7±0.5	<124
SA-WWA-3E1	12/29/2009	<0.7	1±0.6	<144
AVERAGE		-	-	-

* Management Audit Sample : not required by ODCM.

TABLE C-7

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN WELL WATER**

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING DATE	<-----GAMMA EMITTERS -----> K-40	RA-NAT
SA-WWA-3E1	1/26/2009	63±28	172±4
SA-WWA-3E1	2/23/2009	<17	154±6
SA-WWA-3E1	3/30/2009	<15	124±4
SA-WWA-3E1	4/27/2009	40±20	139±4
SA-WWA-3E1	5/26/2009	33±14	151±6
SA-WWA-3E1	6/29/2009	<19	108±5
SA-WWA-3E1	7/27/2009	51±22	174±6
SA-WWA-3E1 (1)	8/31/2009	<46	<7.8
SA-WWA-3E1	9/28/2009	33±14	36±4
SA-WWA-3E1	10/26/2009	54±14	39±4
SA-WWA-3E1	11/30/2009	<24	128±6
SA-WWA-3E1	12/29/2009	<15	128±6
AVERAGE		-	113±111

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18.
** Management Audit Samples: not required by ODCM.
(1) Results for August gamma sample by AREVA-NP Environmental Laboratory.

TABLE C-8

2009 CONCENTRATIONS OF GROSS ALPHA AND GROSS BETA EMITTERS AND TRITIUM IN RAW AND TREATED POTABLE WATER (2F3)*

Results in Units of pCi/L +/- 2 sigma

TYPE	SAMPLING PERIOD	GROSS ALPHA	GROSS BETA	TRITIUM
RAW	1/1-31/2009	0.5±0.3	3.1±0.6	<141
TREATED	1/1-31/2009	<0.3	2.6±0.6	<141
RAW	2/1-28/2009	<0.4	2.3±0.5	<134
TREATED	2/1-28/2009	<0.4	2.7±0.6	<139
RAW	3/1-31/2009	<0.3	2.4±0.5	<136
TREATED	3/1-31/2009	<0.3	2.3±0.5	<135
RAW	4/1-30/2009	<0.6	3.9±0.9	<133
TREATED	4/1-30/2009	<0.8	4.7±1	<134
RAW	5/1-31/2009	<0.5	5.6±0.9	<139
TREATED	5/1-31/2009	<0.7	4.9±0.9	<135
RAW	6/1-30/2009	<0.5	3.1±0.6	<132
TREATED	6/1-30/2009	<0.5	4.4±1	<126
RAW	7/1-31/2009	<0.4	3.2±0.8	<137
TREATED	7/1-31/2009	<0.4	3.3±0.8	<133
RAW	8/1-31/2009	<0.4	3.2±0.6	<135
TREATED	8/1-31/2009	<0.4	2.7±0.6	<133
RAW	9/1-30/2009	<0.3	3.1±0.5	<135
TREATED	9/1-30/2009	<0.5	4±0.7	<135
RAW	10/1-31/2009	<0.3	2.3±0.5	<145
TREATED	10/1-31/2009	<0.3	2.2±0.5	<142
RAW	11/1-30/2009	0.7±0.4	3.3±0.6	<125
TREATED	11/1-30/2009	<0.6	3.6±0.6	<125
RAW	12/1-31/2009	<0.4	2.6±0.5	<140
TREATED	12/1-31/2009	<0.4	2.6±0.5	<143
AVERAGE				
RAW		-	3.2±1.8	-
TREATED		-	3.3±1.9	-
GRAND AVERAGE		-	3.3±1.8	-

* Managemnent Audit Sample: not required by ODCM.

TABLE C-9

2009 CONCENTRATIONS OF IODINE-131* AND GAMMA EMITTERS**
IN RAW AND TREATED POTABLE WATER (2F3)***

Results in Units of pCi/L +/- 2 sigma

TYPE	SAMPLING PERIOD	I-131	<--------GAMMA EMITTERS --------> K-40	RA-NAT	Th-232
RAW	1/1-31/2009	<0.3	<16	<2	<5.3
TREATED	1/1-31/2009	<0.2	<13	4.8±2	<4.6
RAW	2/1-28/2009	<0.3	<16	<1.9	<4.4
TREATED	2/1-28/2009	<0.3	<19	<1.8	<4.2
RAW	3/1-31/2009	<0.1	40±18	<3	<7.4
TREATED	3/1-31/2009	<0.3	<9.6	<1.6	<11
RAW	4/1-30/2009	<0.2	<17	<2	<3.9
TREATED	4/1-30/2009	<0.3	<26	8.6±2	<1.6
RAW	5/1-31/2009	<0.2	43±14	<2.2	<4.5
TREATED	5/1-31/2009	<0.2	48±17	24±3	<4.4
RAW	6/1-30/2009	<0.3	<39	<1.7	12±5
TREATED	6/1-30/2009	<0.1	62±18	7.4±1	<13
RAW	7/1-31/2009	<0.3	<16	<2.2	<4.4
TREATED	7/1-31/2009	<0.3	<36	14±2	<10
RAW (1)	8/1-31/2009	<1	<51	<9.2	<16
TREATED (1)	8/1-31/2009	<0.9	<30	<5	<8.4
RAW	9/1-30/2009	<0.2	34±11	<2	<11
TREATED	9/1-30/2009	<0.2	45±12	20±2	<11
RAW	10/1-31/2009	<0.4	<16	<2.4	<4.3
TREATED	10/1-31/2009	<0.1	<23	<2.3	<4.5
RAW	11/1-30/2009	<0.2	<16	<2.3	<4.3
TREATED	11/1-30/2009	<0.3	<18	88±3	<4.2
RAW	12/1-31/2009	<0.3	72±18	<2.4	<4.3
TREATED	12/1-31/2009	<0.4	33±12	<2.4	<4.3
AVERAGES					
RAW		-	-	-	-
TREATED		-	-	-	-
GRAND AVERAGE		-	-	-	-

* Iodine-131 analyzed to an LLD of 1.0 pCi/L.
** All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18
*** Management Audit Sample: not required by ODCM.
(1) Results for August sample by AREVA-NP Environmental Laboratory.

TABLE C-10

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN VEGETABLES**
Results in Units of pCi/kg (Wet) +/- 2 sigma

STATION ID	SAMPLING DATE	SAMPLE TYPE	<--------- GAMMA EMITTERS ---------> K-40	RA-NAT	Be-7
SA-FPV-2F9	5/16/2009	Asparagus	1820±153	<11	<23
SA-FPV-3F6 (C)	5/16/2009	Asparagus	1580±135	<9.1	<22
SA-FPL-2G2 (C)	5/16/2009	Asparagus	1720±141	<9.4	<30
AVERAGE			1710±240	-	-
SA-FPL-2F9	6/19/2009	Cabbage	2160±153	<5	<54
SA-FPL-3H5 (C)	6/28/2009	Cabbage	2820±188	<8	<42
SA-FPL-3F6	7/6/2009	Cabbage	2010±163	<7.5	<36
SA-FPL-3F7	7/28/2009	Cabbage	2370±164	<6.3	<38
SA-FPL-9G2	7/28/2009	Cabbage	2520±177	<7.1	<31
SA-FPL-1S1	9/28/2009	Cabbage	2440±120	<4.9	157±37
SA-FPL-16S1	9/28/2009	Cabbage	3110±116	<4.8	183±27
AVERAGE			2490±750	-	-
SA-FPL-1S1	9/28/2009	Kale	4570±191	<7.4	353±54
SA-FPL-16S1	9/28/2009	Kale	4810±158	<6.1	414±37
AVERAGE			4690±340	-	384±86
SA-FPV-3H5 (C)	6/28/2009	Corn	2470±170	<6.7	<58
SA-FPV-2F9	7/2/2009	Corn	2160±164	<6.8	<31
SA-FPV-2G2 (C)	7/17/2009	Corn	2210±150	<7.2	<29
SA-FPV-2F10	7/28/2009	Corn	2530±170	<8.4	<29
SA-FPV-9G2 (C)	7/28/2009	Corn	2030±145	<23	<27
SA-FPV-1G1 (C)	7/28/2009	Corn	1990±133	12±6	<19
AVERAGE			2230±450	-	-
SA-FPV-2F9	7/2/2009	Peppers	1340±137	<10	<25
SA-FPV-2G2 (C)	7/17/2009	Peppers	1400±146	<12	<35
SA-FPV-3F7	7/28/2009	Peppers	1510±136	<8.5	<29
SA-FPV-9G2 (C)	7/28/2009	Peppers	1370±139	18±6	<29
SA-FPV-2F10	7/28/2009	Peppers	1610±162	<13	<32
SA-FPV-1G1 (C)	7/28/2009	Peppers	1090±129	<13	<29
AVERAGE			1390±350	-	-
SA-FPV-3H5 (C)	6/28/2009	Tomatoes	1460±129	<6.4	<26
SA-FPV-9G2 (C)	6/28/2009	Tomatoes	1920±139	<11	<20
SA-FPV-2F9	7/2/2009	Tomatoes	2520±185	<8.4	<32
SA-FPV-2G2 (C)	7/17/2009	Tomatoes	2000±154	<6.7	<14
SA-FPV-2F10	7/28/2009	Tomatoes	2340±150	<10	<25
SA-FPV-3F7	7/28/2009	Tomatoes	2030±146	<12	<21
SA-FPV-9G2 (C)	7/28/2009	Tomatoes	1630±134	<6.6	<26
SA-FPV-1G1 (C)	7/28/2009	Tomatoes	1700±129	<7.6	<42
SA-FPV-3F6	7/28/2009	Tomatoes	1830±128	<16	<22
AVERAGE			1940±670	-	-
GRAND AVERAGE			2150±1600	-	-

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18.
** Management Audit Sample: not required by ODCM.
(C) Control Station
(1) On site cabbage and kale grown from seeds and planted by MTS Personnel.

TABLE C-11

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN FODDER CROPS **

Results in Units of pCi/kg (wet) +/- 2 sigma

STATION ID	SAMPLING DATE	SAMPLE TYPE	<-----GAMMA EMITTERS ----> Be-7	K-40
SA-VGT-1S1	12/29/2009	Ornamental Cabbage	256±42	3200±249
SA-VGT-10D1	12/29/2009	Ornamental Cabbage	482±56	3630±170
SA-VGT-15S1	12/29/2009	Ornamental Cabbage	342±56	3780±183
SA-VGT-16S1	12/29/2009	Ornamental Cabbage	160±26	2380±107
AVERAGE			310±270	3250±1260
SA-VGT-2G3	10/12/2009	Silage	732±68	3460±175
SA-VGT-3G1 (C)	10/12/2009	Silage	1310±103	5130±241
SA-VGT-13E3	10/12/2009	Silage	422±51	2480±130
SA-VGT-14F4	10/12/2009	Silage	477±50	3260±146
AVERAGE			740±810	3580±2230
SA-VGT-14F4	11/20/2009	Soybeans	<88	14800±268
SA-VGT-3G1 (C)	11/18/2009	Soybeans	<95	13300±257
AVERAGE			-	14050±2121
GRAND AVERAGE			440±730	5130±13300

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18.
** Management Audit Sample: not required by ODCM.
(C) Control Station

TABLE C-12

2009 CONCENTRATIONS OF GROSS BETA EMITTERS IN SURFACE WATER

Results in Units of pCi/L +/- 2 sigma

SAMPLING DATE	STATION ID SA-SWA-11A1	SA-SWA-12C1 (Control)	SA-SWA-16F1	SA-SWA-1F2	SA-SWA-7E1	AVERAGE
January	38±9	16±7	<11	<11	65±10	27±50
February	106±12	69±10	52±9	40±8	99±12	73±58
March	73±12	55±10	50±10	36±9	95±13	62±45
April	20±7	20±7	15±7	11±6	47±8	23±28
May	59±12	58±12	37±11	25±11	123±16	60±76
June	76±13	48±11	35±11	23±10	123±15	61±80
July	119±15	67±12	51±12	37±11	174±18	90±113
August	33±7	19±7	<10	<10	71±9	28±52
September	166±19	127±15	50±9	32±8	384±34	152±282
October	89±10	69±9	46±8	36±7	215±19	91±145
November	102±11	53±8	31±6	21±6	200±17	81±147
December	25±6	31±6	27±6	9±5	71±8	32±46
AVERAGE	75±87	53±61	34±34	24±25	139±189	
				GRAND AVERAGE		65±126

TABLE C-13

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING DATE	<---------GAMMA EMITTERS---------> K-40	RA-NAT	Th-232
SA-SWA-1F2	1/5/2009	50±13	<1.8	<4
SA-SWA-7E1	1/5/2009	90±18	<1.8	<4
SA-SWA-11A1	1/5/2009	80±20	<4.5	<4.4
SA-SWA-12C1(C)	1/5/2009	62±13	<2.2	<5
SA-SWA-16F1	1/5/2009	53±19	<2.4	<4.7
SA-SWA-1F2	2/6/2009	85±14	<2.1	<4.4
SA-SWA-7E1	2/6/2009	103±19	5±2	<3.7
SA-SWA-11A1	2/6/2009	126±22	<2.1	<5.1
SA-SWA-12C1 (C)	2/6/2009	96±17	<1.8	<4.4
SA-SWA-16F1	2/6/2009	94±19	<1.5	<3.7
SA-SWA-1F2	3/5/2009	71±14	<1.6	<4.3
SA-SWA-7E1	3/5/2009	142±22	<1.6	<6.8
SA-SWA-11A1	3/5/2009	122±20	<2	<4.5
SA-SWA-12C1(C)	3/5/2009	61±16	<1.8	<4.5
SA-SWA-16F1	3/5/2009	97±21	5.6±1	<7.4
SA-SWA-1F2	4/9/2009	48±14	<1.6	<4.4
SA-SWA-7E1	4/9/2009	101±21	6.3±1	<9.2
SA-SWA-11A1	4/9/2009	62±15	<1.5	13±4
SA-SWA-12C1(C)	4/9/2009	59±14	<2.4	<4.8
SA-SWA-16F1	4/9/2009	67±15	<2.5	<4.7
SA-SWA-1F2	5/4/2009	60±20	<1.8	<11
SA-SWA-7E1	5/4/2009	89±21	<1.7	<4.5
SA-SWA-11A1	5/4/2009	93±21	6.8±1	<8.9
SA-SWA-12C1(C)	5/4/2009	51±15	<2.4	<4.6
SA-SWA-16F1	5/4/2009	42±17	<2.4	<4.5
SA-SWA-1F2	6/1/2009	56±16	<1.8	<4.2
SA-SWA-7E1	6/1/2009	72±19	<2.2	<5.7
SA-SWA-11A1	6/1/2009	95±17	<2.6	<4.1
SA-SWA-12C1(C)	6/1/2009	71±16	<1.7	<11
SA-SWA-16F1	6/1/2009	55±14	<1.7	<4.1
SA-SWA-1F2	7/9/2009	<23	<1.8	<4.8
SA-SWA-7E1	7/9/2009	127±17	<1.6	<2.8
SA-SWA-11A1	7/9/2009	100±21	5.9±1	<9
SA-SWA-12C1(C)	7/9/2009	81±14	<2.6	<4.2
SA-SWA-16F1	7/9/2009	73±17	<2.6	<4

TABLE C-13

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER

Results in Units of pCi/L +/- 2 sigma

STATION ID	SAMPLING DATE	<----------GAMMA EMITTERS----------> K-40	RA-NAT	Th-232
SA-SWA-1F2	8/6/2009	57±14	<3.5	<3.9
SA-SWA-7E1	8/6/2009	112±20	<2.5	<4.3
SA-SWA-11A1	8/6/2009	82±16	<1.7	<8.8
SA-SWA-12C1(C)	8/6/2009	58±16	7±2	<8.3
SA-SWA-16F1	8/6/2009	72±17	<1.7	<4.7
SA-SWA-1F2	9/8/2009	75±16	<1.8	<4.5
SA-SWA-7E1	9/8/2009	147±22	<1.8	<5.1
SA-SWA-11A1	9/8/2009	144±22	6.7±2	<8.9
SA-SWA-12C1(C)	9/8/2009	117±16	<2.3	<4.5
SA-SWA-16F1	9/8/2009	81±13	<2.7	<4.5
SA-SWA-1F2	10/9/2009	57±13	<2.6	<4.5
SA-SWA-7E1	10/9/2009	127±21	6.3±2	10±4
SA-SWA-11A1	10/9/2009	63±18	<2.3	<4.4
SA-SWA-12C1(C)	10/9/2009	58±17	<2.6	<4.6
SA-SWA-16F1	10/9/2009	35±15	<2.3	<4.7
SA-SWA-1F2	11/2/2009	63±13	<2.3	<4.6
SA-SWA-7E1	11/2/2009	137±20	<1.6	<2.1
SA-SWA-11A1	11/2/2009	77±18	<2.7	<4.1
SA-SWA-12C1 (C)	11/2/2009	74±15	<2.7	<4.4
SA-SWA-16F1	11/2/2009	69±16	<2.6	<4.9
SA-SWA-1F2	12/8/2009	72±18	11±3	<4.9
SA-SWA-7E1	12/8/2009	62±18	<2.3	<4.6
SA-SWA-11A1	12/8/2009	55±15	6.9±2	<3.9
SA-SWA-12C1(C)	12/8/2009	58±21	<1.6	<3.3
SA-SWA-16F1	12/8/2009	34±17	<1.6	<4.9
AVERAGE		79±58	-	-

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18
(C) Control Station

TABLE C-14

2009 CONCENTRATIONS OF TRITIUM IN SURFACE WATER

Results in Units of pCi/L +/- 2 sigma

SAMPLING PERIOD	STATION ID					
	SA-SWA-11A1	SA-SWA-12C1 (Control)	SA-SWA-16F1	SA-SWA-1F2	SA-SWA-7E1	AVERAGE
January	<142	<142	<141	<142	<142	-
February	<155	<143	<152	<156	<147	-
March	<136	<143	<142	<143	<140	-
April	<157	<135	<146	<151	340±97	-
May	<133	<133	<132	<132	<132	-
June	168±92	<143	<144	<147	<144	-
July	<143	<144	<142	<141	<141	-
August	<143	<143	<140	<141	<145	-
September	<133	<140	<132	<132	<133	-
October	154±93	<135	<134	<136	322±93	-
November	<141	<142	<145	<140	<142	-
December	<134	<134	<134	<137	<138	-

TABLE C-15

2009 CONCENTRATIONS OF GAMMA EMITTERS** IN EDIBLE FISH

Results in Units of pCi/kg (wet) +/- 2 sigma

STATION ID	SAMPLING PERIOD	<---- GAMMA EMITTERS ----> (FLESH) K-40	RA-NAT
SA-ESF-7E1	7/28/2009	3230±180	<5.9
SA-ESF-11A1	7/8-30/2009	3390±170	<8.1
SA-ESF-12C1 (C)	7/8-14/2009	2980±190	<6
AVERAGE		3200±410	-
SA-ESF-7E1	10/22-26/2009	3240±170	<14
SA-ESF-11A1	10/22-26/2009	3430±180	<8.6
SA-ESF-12C1 (C)	10/22-26/2009	3350±180	12±5
AVERAGE		3340±190	-
GRAND AVERAGE		3270±330	-

** All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18
(C) Control Station

TABLE C-16

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN CRABS

Results in Units of pCi/kg (wet) +/- 2 sigma

STATION ID	SAMPLING PERIOD	<---- GAMMA EMITTERS ----> (FLESH) K-40	RANAT
SA-ECH-11A1	7/7-7/15/2009	1430±130	21±7
SA-ECH-12C1 (C)	7/7-7/15/2009	2300±160	18±6
AVERAGE		1870±1230	20±4
SA-ECH-11A1 (1)	8/24-8/28/09	1560±640	<19
SA-ECH-12C1 (C) (1)	8/24-8/28/09	1770±730	<21
AVERAGE		1670±300	-
GRAND AVERAGE		1770±770	-

* All other gamma emitters searched for were <LLD; Typical LLDs are given in Table C-18.

(C) Control Station

(1) Second semi-annual collection: 8/24-8/28/09 gamma samples analyzed by AREVA

TABLE C-17

2009 CONCENTRATIONS OF GAMMA EMITTERS* IN SEDIMENT

Results in Units of pCi/kg (dry) +/- 2 sigma

STATION ID	SAMPLING DATE	Be-7	K-40	Co-60	Cs-137	Mn-54	RA-NAT	Th-232
SA-ESS-6S2	6/30/2009	<59	1460±113	<4.1	<2.7	<3.1	73±7	88±20
SA-ESS-7E1	6/25/2009	<129	11100±306	<13	<15	<13	652±21	838±43
SA-ESS-11A1	6/25/2009	<74	7060±287	<6	<11	<14	346±14	545±44
SA-ESS-15A1	6/25/2009	<76	3710±185	<6.1	<7	<10	233±11	360±34
SA-ESS-16A1	6/25/2009	<111	8150±259	<20	<6.3	27±10	826±29	1110±48
SA-ESS-12C1 (C)	6/25/2009	<103	15000±377	<9.1	<8.8	<8.1	563±20	1000±56
SA-ESS-16F1	6/25/2009	<81	16500±462	<11	52±14	<6.1	583±22	1090±63
AVERAGE			9000±11130	-	-	-	468±523	719±792
SA-ESS-6S2	11/5/2009	135±42	1290±97	<2.3	<3.3	<11	86±9	81±16
SA-ESS-7E1	10/28/2009	<77	9330±285	<6.4	<8.5	<16	673±20	744±48
SA-ESS-11A1	10/28/2009	<80	13900±393	<5.5	63±10	<25	643±23	1070±59
SA-ESS-15A1	10/28/2009	<98	3580±167	<6.1	<4.8	<4.1	285±12	385±31
SA-ESS-16A1	10/28/2009	<68	4340±221	<15	<4.7	<5.8	418±28	610±63
SA-ESS-12C1 (C)	10/28/2009	<78	13500±373	<21	<7.1	<11	537±19	1050±71
SA-ESS-16F1	10/28/2009	<55	4160±187	<5.8	<5.2	<4.6	289±12	413±42
AVERAGE		-	7160±10150	-	-	-	419±428	622±726
GRAND AVERAGE		-	8080±10410	-	-	-	443±462	670±740

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-18
(C) Control Station

TABLE C-18

2009 MAPLEWOOD TESTING SERVICES
LLDs FOR GAMMA SPECTROSCOPY

SAMPLE TYPE:	<----------AIR---------->		<----------WATER---------->		<----------MILK---------->	
	IODINE	PARTICULATES	GAMMA SCAN	IODINE	GAMMA SCAN	IODINE
ACTIVITY:	10-3 pCi/m3	10-3 pCi/m3	pCi/L	pCi/L	pCi/L	pCi/L .
GEOMETRY:	47 ML	13 FILTERS	3.5 LITERS	100 ML	3.5 LITERS	100 ML
COUNT TIME:	120 MINS	500 MINS	1000 MINS	1000 MINS	500 MINS	1000 MINS
DELAY TO COUNT:	2 DAYS	5 DAYS	7 DAYS	3 DAYS	2 DAYS	2 DAYS
NUCLIDES						
BE-7	-	2	12	-	21	-
NA-22	-	0.5	2.7	-	5.7	-
K-40	-	9	34	-	34	-
CR-51	-	3.1	19	-	19	-
MN-54	-	0.44	1.5	-	3.9	-
CO-58	-	0.4	2.2	-	4.2	-
FE-59	-	0.75	5.5	-	9.7	-
CO-60	-	0.44	3.4	-	5.7	-
ZN-65	-	0.55	4.5	-	14	-
ZRNB-95	-	0.6	3.7	-	6.9	-
MO-99	-	88	77	-	76	-
RU-103	-	0.23	1	-	2.6	-
RU-106	-	1.9	20	-	35	-
AG-110M	-	0.33	2	-	4.6	-
SB-125	-	0.56	3.3	-	6.5	-
TE-129M	-	11	57	-	103	-
I-131	9.9	0.8	4.2	0.39	2.7	0.34
TE-132	-	3.5	3.6	-	6.2	-
BA-133	-	0.26	2.0	-	2.2	-
CS-134	-	0.33	1.7	-	2	-
CS-136	-	0.54	1.4	-	3.6	-
CS-137	-	0.35	1.6	-	3.7	-
BALA-140	-	1.4	5.4	-	7.6	-
CE-141	-	0.26	2.4	-	2.8	-
CE-144	-	0.97	7.7	-	12	-
RA-NAT	-	0.71	3.6	-	5.5	-
TH-232	-	1.8	11	-	17	-

TABLE C-18 (Cont'd)

2009 MAPLEWOOD TESTING SERVICES
LLDs FOR GAMMA SPECTROSCOPY

SAMPLE TYPE:	FOOD PRODUCTS GAMMA SCAN	VEGETATION GAMMA SCAN	FISH & CRAB GAMMA SCAN	SEDIMENT GAMMA SCAN
ACTIVITY:	pCi/kg WET	pCi/kg WET	pCi/kg WET	pCi/kg DRY
GEOMETRY:	500 ml	3.5 LITER	500 ml	500 ml
COUNT TIME:	500 MINS	500 MINS	500 MINS	500 MINS
DELAY TO COUNT:	3 DAYS	7 DAYS	5 DAYS	30 DAYS
NUCLIDES				
BE-7	55	75	47	135
NA-22	10	7.1	8.2	26
K-40	70	32	55	55
CR-51	44	40	37	186
MN-54	9.4	4.4	5.2	27
CO-58	6.4	5.1	9.1	7.8
FE-59	13	10	17	39
CO-60	13	9.7	11	21
ZN-65	21	20	10	27
ZRNB-95	10	6.4	12	33
MO-99	206	318	418	133000
RU-103	3.8	6.4	4.2	11
RU-106	56	58	45	69
AG-110M	11	6.6	8.9	21
SB-125	12	10	8.9	30
TE-129M	262	144	168	459
I-131	11	9.6	36	120
TE-132	62	28	88	5620
BA-133	7.9	5.4	3.8	9.2
CS-134	8.7	5	3.6	7.4
CS-136	12	7.7	25	46
CS-137	14	18	9.4	15
BALA-140	31	30	50	135
CE-141	8.9	15	6.8	30
CE-144	22	19	17	41
RA-NAT	22	13	14	5
TH-232	51	29	39	8.1

TABLE C-19

2009 MAPLEWOOD TESTING SERVICES
LLDs FOR GROSS ALPHA, GROSS BETA AND TRITIUM
IN AIR AND WATER

SAMPLE TYPE: ACTIVITY:	AIR PARTICULATES pCi/m^3	WELL/POTABLE WATERS pCi/L	SURFACE WATERS pCi/L
Gross Alpha	-	1.1	-
Gross Beta	(1)	1.4	11
Tritium	-	145	156

(1) There were no air particulate gross beta results that were below LLD. All results were positive.
(2) The Salem/Hope Creek ODCM LLD value is for drinking water. MTS has set a value of 10 pCi/L for surface water LLDs to meet.

APPENDIX D

SUMMARY OF RESULTS FROM ANALYTICS, ENVIRONMENTAL RESOURCE ASSOCIATES, AND AREVA E – LAB INTERLABORATORY COMPARISON PROGRAMS

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APPENDIX D

SUMMARY OF RESULTS FOR ANALYTICS, ENVIRONMENTAL RESOURCE ASSOCIATES, AND AREVA E-LAB INTERLABORATORY COMPARISON PROGRAM

Appendix D presents a summary of the analytical results for the 2009 Analytics and Environmental Resource Associates (ERA) Interlaboratory Comparison Program plus the TLD QA Data for AREVA E-LAB.

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TABLE D-1

RESULTS FOR ANALYTICS ENVIRONMENTAL CROSS CHECK PROGRAM

Gross Alpha and Gross Beta Emitters In Water (pCi/L), Iodine In Air Samples (pCi/m^3), Gross Beta In Air Particulate Filter (pCi/m^3), And Tritium Analysis In Water (pCi/L)

Date MM-YY	MTS Sample Code	Sample Media	Nuclide	MTS Reported Value	Known Value	Resolution	Ratio MTS/ Analytics	Evaluation
03-2009	B711	APT	Beta	81	75	60	1.09	Acceptable
03-2009	H712	WAT	H-3	4422	4480	60	0.99	Acceptable
03-2009	I715	AIO	I-131	77	79	60	0.97	Acceptable
06-2009	B719	APT	Beta	81.7	87	60	0.94	Acceptable
06-2009	AB720	WAT	Alpha	287.6	281	60	1.02	Acceptable
			Beta	206.1	141	60	1.46	Disagree
06-2009	I721	AIO	I-131	94.6	95	60	0.99	Acceptable
06-2009	H723	WAT	H-3	13174	13300	60	0.99	Acceptable
09-2009	I726	AIO	I-131	92.9	91.6	60	1.02	Acceptable
09-2009	H728	WAT	H-3	13799	14100	60	0.98	Acceptable
09-2009	AB729	WAT	Alpha	349	324	60	1.08	Acceptable
			Beta	340	287	60	1.18	Acceptable
01-2010	AB734	WAT	Alpha	279	258	60	1.08	Acceptable
			Beta	284	230	60	1.24	Acceptable
01-2010	I735	AIO	I-131	92	93	60	0.99	Acceptable
01-2010	H733	WAT	H-3	13514	14200	60	0.95	Acceptable
01-2010	B737	APT	Beta	108	97	60	1.12	Acceptable

TABLE D-2

RESULTS FOR ANALYTICS ENVIRONMENTAL CROSS CHECK PROGRAM

Gamma Emitters in Water And Milk (pCi/L)

Date MM-YY	MTS Sample Code	Sample Media	Nuclide	MTS Reported Value	Known Value	Resolution	Ratio MTS/ Analytics	Evaluation
03-2009	G713	WAT	Cr-51	388	387	60	1.00	Acceptable
			Mn-54	170	162	60	1.05	Acceptable
			Co-58	154	151	60	1.02	Acceptable
			Fe-59	136	127	60	1.07	Acceptable
			Co-60	189	180	60	1.05	Acceptable
			Zn-65	211	197	60	1.07	Acceptable
			I-131	69	69	60	1.01	Acceptable
			Cs-134	112	119	60	0.94	Acceptable
			Cs-137	149	141	60	1.06	Acceptable
			Ce-141	123	120	60	1.02	Acceptable
03-2009	G716	MILK	Cr-51	306	305	60	1.00	Acceptable
			Mn-54	131	125	60	1.02	Acceptable
			Co-58	118	119	60	0.99	Acceptable
			Fe-59	107	100	60	1.07	Acceptable
			Co-60	148	142	60	1.04	Acceptable
			Zn-65	161	156	60	1.03	Acceptable
			I-131	80	79	60	1.01	Acceptable
			Cs-134	88	94	60	0.94	Acceptable
			Cs-137	113	111	60	1.02	Acceptable
			Ce-141	92	95	60	0.96	Acceptable
01-2010	G736	WAT	Cr-51	253	244	60	1.04	Acceptable
			Mn-54	206	197	60	1.04	Acceptable
			Co-58	176	173	60	1.02	Acceptable
			Fe-59	127	115	60	1.10	Acceptable
			Co-60	308	305	60	1.01	Acceptable
			Zn-65	380	373	60	1.02	Acceptable
			I-131	101	103	60	0.98	Acceptable
			Cs-134	282	295	60	0.95	Acceptable
			Cs-137	227	216	60	1.05	Acceptable
			Ce-141	105	104	60	1.01	Acceptable

TABLE D-3

RESULTS FOR ANALYTICS ENVIRONMENTAL CROSS CHECK PROGRAM

Gamma Emitters in Soil (pCi/g-dry) And Air Particulate Samples (pCi/m^3)

Date MM-YY	MTS Sample Code	Sample Media	Nuclide	MTS Reported Value	Known Value	Resolution	Ratio MTS/ Analytics	Evaluation
03-2009	G714	Soil	Cr-51	0.528	0.517	60	1.02	Acceptable
			Mn-54	0.232	0.216	60	1.08	Acceptable
			Co-58	0.206	0.202	60	1.02	Acceptable
			Fe-59	0.189	0.169	60	1.12	Acceptable
			Co-60	0.254	0.241	60	1.05	Acceptable
			Zn-65	0.275	0.264	60	1.04	Acceptable
			Cs-134	0.141	0.159	60	0.89	Acceptable
			Cs-137	0.294	0.283	60	1.04	Acceptable
			Ce-141	0.166	0.161	60	1.03	Acceptable
06-2009	G722	APT	Cr-51	272	269	60	1.01	Acceptable
			Mn-54	95	92	60	1.03	Acceptable
			Co-58	62	62	60	1.01	Acceptable
			Fe-59	92	82	60	1.12	Acceptable
			Co-60	205	210	60	0.97	Acceptable
			Zn-65	130	118	60	1.10	Acceptable
			Cs-134	89	111	60	0.8	Acceptable
			Cs-137	130	129	60	1.01	Acceptable
			Ce-141	185	191	60	0.97	Acceptable
09-2009	G727	SOIL	Cr-51	0.513	0.518	60	0.99	Acceptable
			Mn-54	0.502	0.483	60	1.04	Acceptable
			Co-58	0.236	0.233	60	1.01	Acceptable
			Fe-59	0.367	0.345	60	1.06	Acceptable
			Co-60	0.376	0.375	60	1.00	Acceptable
			Zn-65	0.511	0.477	60	1.07	Acceptable
			Cs-134	0.268	0.288	60	0.93	Acceptable
			Cs-137	0.540	0.526	60	1.03	Acceptable
			Ce-141	0.629	0.644	60	0.98	Acceptable

TABLE D-4

RESULTS FOR ENVIRONMENTAL RESOURCE ASSOCIATES (ERA) PROFICIENCY TESTING PROGRAM

Gamma Emitters in Water (pCi/L), Gross Alpha and Beta in Water (pCi/L), Iodine-131 Analysis in Water (pCi/L), and Tritium in Water (pCi/L),

Date MM-YY	MTS Sample Code	Sample Media	Nuclide	MTS Reported Value	ERA Assigned Value	Acceptance Limits	Evaluation
01-2009	AB710	WAT	Alpha	14.9	52.3	27.3 – 65.5	Disagree
			Beta	43.7	46.1	31.0 – 53.3	Acceptable
04-2009	H718	WAT	H-3	19510	20300	17800 – 22300	Acceptable
04-2009	I717	WAT	I-131	28.8	26.1	21.7 – 30.8	Acceptable
07-2009	G725	WAT	Ba-133	70.1	70.2	58.6 – 77.2	Acceptable
			Co-60	101.1	101	90.9 – 113.0	Acceptable
			Cs-134	86.4	88.7	72.8 – 97.6	Acceptable
			Cs-137	92.3	88.4	79.6 – 99.8	Acceptable
			Zn-65	101.6	77.7	69.8 – 93.6	Disagree
7-2009	AB724	WAT	Alpha	34.5	55.3	28.9 – 69.0	Acceptable
			Beta	62.6	64.7	44.8 – 71.3	Acceptable
10-2009	AB731	WAT	Alpha	12.8	23.2	11.6 – 31.1	Acceptable
			Beta	26.0	26.0	16.2 – 33.9	Acceptable
10-2009	I730	WAT	I-131	23.2	22.2	18.4 – 26.5	Acceptable
10-2009	H732	WAT	H-3	16369.0	16400	14300 – 18000	Acceptable

TABLE D-5

PERCENTAGE OF INDIVIDUAL TLD RESULTS THAT MET AREVA E-LAB TOLERANCE LIMITS

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental TLDs	84	100	100

(1) This table summarizes results of tests conducted by E-LAB and the Third-party tester.
(2) Environmental Dosimeter results are free in air.

TABLE D-6

THIRD PARTY TLD TESTING PERFORMANCE RESULTS

Dosimeter Type	Exposure Period	ANSI Category	% (Bias ± SD) *
Panasonic Environmental TLDs	FH 2009	II	8.1 +/- 2.0
Panasonic Environmental TLDs	SH 2008	II	-1.8 +/- 2.5

(1) Performance criteria are the same as the internal criteria.

(2) Results are expressed as the delivered exposure for environmental TLD. ANSI HPS N13.29-1995 (Draft) Category II, High Energy photons (Cs-137 or Co-60)

APPENDIX E

SYNOPSIS OF LAND USE CENSUS

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APPENDIX E

SYNOPSIS OF 2009 LAND USE CENSUS

A land use census was conducted in each of the 16 meteorological sectors to identify, within a distance of 8 km (5 miles), the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than $50m^2$ ($500ft^2$) producing broad leaf vegetation. In accordance with Salem and Hope Creek ODCMs the census was performed using a door to door survey, visual survey and by consulting with local agriculture authorities.

Meteorological Sector	Milk Animal Oct, 2009 Km (miles)	Nearest Residence Oct, 2009 Km (miles)	Vegetable Garden Oct, 2009 Km (miles)
N	None	None	None
NNE	None	None	None
NE	None	6.2 (3.9)	None
ENE	None	6.2(3.9)	None
E	None	None	None
ESE	None	None	None
SE	None	None	None
SSE	None	None	None
S	None	None	None
SSW	None	6.2 (3.9)	None
SW	None	6.9 (4.3)	7.3(4.6)
WSW	None	7.1 (4.4)	7.1 (4.4)
W	7.8 (4.9)	6.5 (4.0)	None
WNW	None	5.5 (3.4)	None
NW	None	5.9 (3.7)	None
NNW	None	6.8 (4.2)	None

The 2009 Land Use Census results are summarized in the above table. A comparison of the identified locations from the 2009 table with the 2008 table shows that no new nearest milk animal, nearest resident, or nearest vegetable garden (500 Ft^2) with broadleaf vegetation were identified. Therefore, no formal dose evaluation or changes to the ODCMs are required.

APPENDIX F

RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM (RGPP)

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2009 Radiological Groundwater Protection Program (RGPP)

Table of Contents

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I. Introduction

This is the annual report on the status of the Radiological Groundwater Protection Program (RGPP) conducted at Salem and Hope Creek Generating Stations. This report covers the RGPP groundwater samples collected from the PSEG site in 2009. This report also describes any changes to this program and provides the radiochemical analysis results for groundwater samples collected during the 2009 reporting year. The 2006 PSEG Annual Radiological Environmental Operating Report (AREOR) was the first report that provided a description of the RGPP (PSEG, 2007). Both the 2006, 2007 and 2008 AREORs contained information and detailed descriptions of the RGPP in Appendix F (PSEG 2007, 2008, 2009). This report contains the results of the 2009 long-term groundwater-sampling program.

The RGPP was initiated by PSEG in 2006 to determine whether groundwater at and in the vicinity of Salem and Hope Creek Stations had been adversely impacted by any releases of radionuclides related to nuclear station operations. The RGPP is a voluntary program implemented by PSEG in conjunction with the nuclear industry initiatives and associated guidance (NEI, 2007). Although it is designed to be a separate program, the RGPP complements the existing Radiological Environmental Monitoring Program and Radioactive Effluent Technical Specification Program. The long-term groundwater-sampling program is one of the key elements of the RGPP that provides for early leak detection. The other key elements that comprise the RGPP and contribute to public safety are spill/leak prevention, effective remediation of spills and leaks, and effective stakeholder communication.

In 2002, operations personnel at Salem Generating Station identified a release of radioactive liquids from the Unit 1 Spent Fuel Pool to the environment. PSEG developed a Remedial Action Work Plan (RAWP). This RAWP was reviewed by the United States Regulatory Commission (USNRC) and approved by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Nuclear Engineering (BNE). In

accordance with the RAWP, a Groundwater Recovery System (GRS) has been installed and is in operation to remove the groundwater containing tritium. This system was designed to reduce the migration of the tritium plume towards the plant boundary. The GRS is fully discussed in the quarterly Remedial Action Progress Reports (RAPR) provided to the state and the U.S. Nuclear Regulatory Commission by PSEG. The information and data associated with the GRS is not included in the annual RGPP reports. It should be noted that five shared monitoring wells (Well IDs AL, T, U, Y and Z) are included in both the GRS monitoring and RGPP long-term sampling programs to ensure that the two programs are comprehensive.

II. Groundwater Pathways

PSEG's Salem and Hope Creek Generating Stations are located in a flat, largely undeveloped region of southern New Jersey. The Sites are bordered on the west and south by the Delaware River Estuary and on the east and north by extensive marshlands. Both of the sites obtain cooling water from the Delaware River Estuary and discharge it back to this Estuary.

The two sites are underlain by over 1,000 feet of inter-layered sand, silt and clay. The Salem and Hope Creek sites derive potable and sanitary water from deep wells in the Potomac-Raritan-Magothy (PRM) formations, greater than 600 feet below the surface.

There are no potable wells off-site within at least one mile. The nearest potable supply well is located 3.65 miles away in the state of Delaware. In the vicinity of the site there are no public water supply wells or private wells that can be impacted by radionuclides associated with nuclear station operations.

A. Objectives for the RGPP

The long-term sampling program objectives are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment or potential drinking water sources can occur.

2. Understand the local hydro-geologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.

3. Perform routine water sampling from strategic locations and evaluate radiochemical analysis results.

4. Report new leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.

5. Regularly evaluate analytical results to identify adverse trends.

6. Take necessary corrective actions to protect groundwater resources.

III. Long-term Groundwater Sampling Program Description

A. Sample Collection

This section describes the general sampling methodologies used to collect water samples from monitoring wells for the Salem and Hope Creek Generating Stations RGPP. In 2006, the RGPP monitoring wells (Tables 1 and 2, Monitoring Well Construction Details) were installed and developed for both Salem and Hope Creek as part of the Site Investigation Report (ARCADIS, 2006A and 2006B). Groundwater samples are

collected from all new monitoring wells, as well as the five pre-existing wells located at Salem (AL, T, U, Y & Z). Test Engineers and Laboratory Technicians from PSEG Maplewood Testing Services (MTS) collect the groundwater samples. Sampling protocols are consistent with USEPA and NJDEP guidance; a modified low-flow sampling methodology is used. This methodology is consistent with protocols established for the Salem GRS investigation. In May 2006, after the Site Hydrological Investigation was completed the long-term groundwater-sampling program was initiated. The program includes sampling all 26 wells at least semi-annually.

The Hope Creek RGPP monitoring wells are currently sampled semi-annually (BL, BT, BO, BP, BR and BS) and quarterly (BH, BI, BJ, BK, BM, BN and BQ). The Salem RGPP monitoring wells are currently sampled semi-annually (BA, BB, BC, BD, BE, BF, BG and BU), quarterly (AL, T and U) and monthly (Y and Z). The sampling frequencies that are specified in the RGPP procedures may be modified by the PSEG RGPP Manager for purposes of adaptive management of the RGPP. However, sampling and analysis shall not occur less frequently than semi annually.

B. Sample Analysis

This section describes the general analytical methodologies used to analyze the water samples for radioactivity for the Salem and Hope Creek Generating Stations RGPP. Groundwater samples were analyzed for plant-related gamma emitting radionuclides (semi-annually), tritium (every sample) and total strontium (annually) by a radiochemical analytical laboratory. In order to achieve the stated RGPP objectives, the long-term groundwater-sampling program includes the following measurements and analyses:

- Concentrations of gamma emitting radionuclides in water by gamma spectroscopy.

- Concentrations of tritium in water by filtration/distillation and liquid scintillation.

- Concentrations of strontium in water by chemical separation and liquid scintillation.

The tritium analysis results reported in Tables 4A and 4B were obtained from PSEG MTS laboratory located in Maplewood, NJ. The gamma spectroscopy and total Sr analysis results are obtained from Teledyne Brown Engineering (TBE) Laboratory located in Knoxville, TN. Analytical laboratories are subject to internal quality assurance programs and inter-laboratory cross-check programs. The inter-laboratory cross-check program for the RGPP samples is conducted between the PSEG MTS laboratory and the TBE laboratory (tritium analysis only). Station personnel review and evaluate all analytical data deliverables obtained from these laboratories upon receipt (typically within 30 days after the water samples are received by the laboratory).

C. Data Evaluation

This section describes the method used to evaluate the analytical results for RGPP samples obtained at the Salem and Hope Creek Generating Stations site. Analytical data results are reviewed for adverse trends or anomalous data. Investigations and notification are made as required by RGPP program procedures. The radiological data for groundwater collected during the preoperational phase of the stations were used as a baseline with which current operational data were compared. Several factors are important in the interpretation and evaluation of the radiological data:

1. Lower Limit of Detection

The lower limit of detection (LLD) is specified by federal regulation as a minimum sensitivity value that must be achieved routinely by the analytical method. The Lower Limit of Detection (LLD) is defined as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank

observation represents a "real" signal.

The environmental LLD is specified for the detectibility of each isotope that may be produced by Salem or Hope Creek stations in the Offsite Dose Calculation Manual (ODCM). A fact of particular interest to the industry, state and public is the LLD of tritium of which the station ODCM LLD is 3000 pCi/L in water. The station procedure was modeled after the ODCMs for environmental LLDs, however, for the RGPP tritium analyses are performed with the lower LLD of 200 pCi/L.

For 2009, the RGPP analytical sensitivities for all analysis met or were below the LLDs specified by the station procedure for H-3, Mn-54, Co-60, Zn-65, Cs-134 and Cs-137 in water. During 2009 12 samples did not meet LLDs for Co-58 and Fe-59, nineteen samples did not meet the LLDs for La-140 and Ba-140 and three samples did not meet LLDs for Zr-95, Nb-95 and Fe-55. The reason for the missed LLDs is attributed to extended delay between sampling and analysis which resulted in inaccurate counting statistics. The stations have taken actions to address this issue to ensure the time between sampling and analysis is minimal.

The station reviewed the extent of condition and identified that in the reporting years 2006, 2007 and 2008 the LLDs were not met for BA-140 and LA-140. In addition, the LLD was not achieved for Nb-95 for one sample in 2006. And the LLD was not achieved for Zr-95 for seven samples in 2006. The missed LLDs were procedural non-conformances for the stations and corrective actions are being implemented to prevent reoccurrence. There is no regulatory impact, as the radiological ground water protection program is a voluntary industry initiative.

2. Laboratory Measurements Uncertainty

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from the counting system measurement, calibration standards, sample volume or weight measurements, sampling uncertainty and other factors.

Analytical uncertainties are reported at the 95% confidence level in this RGPP report to be consistent with the uncertainties reported in the AREOR for the REMP.

3. Groundwater Data Quality Analysis

Groundwater samples generally consist of at least four aliquots. One of the groundwater sample aliquots is submitted to the respective station's onsite chemistry laboratory for tritium and gamma spectroscopy analysis. If these screening analyses indicated that tritium concentrations are below 10,000 pCi/L and no plant-related gamma emitters were present, then the samples are released for shipment to the offsite environmental laboratories. The on-site Chemistry laboratory's screening analysis for all 2009 RGPP groundwater samples were below 10,000 pCi/L for tritium and no plant-related gamma emitters were present above the associated LLDs specified in the ODCM.

The second sample aliquot is sent to the MTS Laboratory for tritium analysis. The third sample aliquot is submitted to the TBE Laboratory for tritium, gamma spectroscopy and total Strontium (Sr) analysis. During 2009, the tritium concentration results for those wells that had results above the minimum detectable concentrations were compared. The PSEG, MTS and TBE tritium results on split samples were found to have a relative percent difference within $\pm$ 30%.

The fourth sample aliquot is held as a back-up sample until all the analytical results were received and determined to be valid. In the event that the results were believed to be questionable or sample results were lost, the back-up sample would be submitted for analysis. In addition, this back-up sample can be used to verify any elevated analytical result.

All radionuclide results are compared to the limitations within the RGPP:

- Internal Administrative Control Limits are defined within the RGPP procedures, they are develop based on the historical baseline concentrations of tritium in each specific well and are used to identify tritium concentrations that warrant further

investigation for that specific well. Exceeding Administrative Control Limits does not initiate any external reporting.

- Courtesy Communication Control Limit is a tritium concentration established below regulatory requirements based on agreements with NJDEP-BNE and/or USNRC and other stakeholders, to ensure the stakeholders are cognizant. PSEG has verbally agreed to provide a courtesy communication by telephone no later than the end of the next business day to NJDEP-BNE for any confirmed tritium result that exceeds 3,000 pCi/L. The NRC Site Resident is also informed. This is not a required communication.
- Voluntary Communication Limits are those concentrations of radionuclides that require voluntary communication and reporting to regulators and/or stakeholders based on NEI 07-07 and ODCM.
- Reporting Level is the concentration of plant produced radioactive material in an environmental sampling medium (averaged over any calendar quarter) from a specified location that requires a 30-day written report to the Nuclear Regulatory Commission and is identified in the ODCM.

IV. Results and Discussion

The locations of the RGPP monitoring wells are illustrated on the maps for Hope Creek and Salem in Figures 1 and 2, respectively. (Note: The 2008 AREOR, Appendix F contained an editorial error in the Figure 2 Salem RGPP well locations. The position of RGPP wells Y and Z were incorrect. These positions have been corrected in the 2009 AREOR, Appendix F.) The Monitoring Well Construction Details for Hope Creek and Salem including monitoring interval below ground surface are provided in Table 1 Hope Creek RGPP Monitoring Wells: Construction Details and Table 2 Salem RGPP Monitoring Wells: Construction Details. The relevant radiological groundwater parameters used to evaluate the groundwater data are provided in Table 3 Relevant Groundwater Evaluation Criteria: Salem and Hope Creek Generating Stations.

The 2009 Groundwater Tritium Analytical Results for Hope Creek Generating Station are

shown in Table 4A. The 2009 Groundwater Tritium Analytical Results for Salem Generating Station are shown in Table 4B.

A. Groundwater Results

Samples were collected from RGPP monitoring wells during 2009 in accordance with the station and MTS procedures for the radiological groundwater protection program with the exception of three RGPP monitoring wells BC, BL and BQ.

The Salem monitoring well BC, which is sampled semi-annually, could not be sampled during the October 2009 sampling campaign due to a security modification. This modification prevented safe access to the well. This safety concern has been address and the well will be sampled as scheduled in 2010.

The Hope Creek Well BL which is required to be sampled semi-annually was collected as required (March and October). These semi annual samples are to receive both tritium and gamma analysis. The tritium sample was sent to offsite laboratories (Maplewood Testing Services and TBE) in March 2009. However, due to communication error, the second sample collected in March for gamma analysis and the retained sample were discarded before being sent off site for analysis at Teledyne Brown Engineering. The October 2009 samples were collected and analyzed as required. In order to obtain a second gamma analysis for 2009, the station collected an additional sample from well BL in December 2009. The gamma analysis results for this second sample were less than Minimum Detectable Concentrations.

The third quarter sampling for Hope Creek Well BQ was missed. This was caused by an oversight made by sampling personnel. The well was sampled in the fourth quarter, analysis results were less than the Administrative Limit of 200 pCi/L for tritium.

The MTS Laboratory in Maplewood, NJ analyzed the groundwater samples for tritium. TBE Laboratory in Knoxville, TN analyzed the groundwater samples for plant-related

tritium (back-up and split samples), gamma emitters and total strontium. Analytical results and anomalies, if any, are discussed below.

Tritium Concentrations at Hope Creek Generating Station

The results of the laboratory analysis indicate that tritium was detected, i.e, reported at a concentration above the RGPP LLD of 200 pCi/L, in seven RGPP monitoring wells at the Hope Creek site. The tritium concentrations measured at wells BH, BI, BJ, BK, BM, BN and BQ ranged from <200 pCi/L to 7778 pCi/L during 2009 as shown on Table 4A.

There were two sample events for which a Courtesy Communication was performed to NJDEP-BNE and the NRC. In March 2009, Well BH indicated a tritium concentration of 4,517 pCi/L. Monthly sampling was initiated and no positive trend was observed. The subsequent two samples were below 300 pCi/L and the elevated tritium concentration of 4,517 pCi/L, was never reproduced in 2009. In November 2009, Well BJ indicated a tritium concentration of 7,778 pCi/L. Monthly sampling was initiated and no positive trend was observed. The December analysis was 628 pCi/L and the elevated tritium concentration has not been reproduced. Increased sample frequency has been maintained on these wells to ensure the elevated results were anomalous.

As a result of the elevated tritium results seen in March of 2009 the station put the following wells on a monthly sampling schedule: BH, BI, BJ, BK, BM and BN. These wells were sampled on a monthly frequency from March 2009 through December 2009. Analysis results for wells BH, BI, BJ, BK, BM, and BN were less than 526 pCi/L for tritium, during the April 2009 through October 2009 monthly sampling events. In November of 2009 wells BI, BJ and BK showed a spike in tritium concentrations which were 895, 7,778 and 1324 pCi/L respectively. The December sampling event showed a decreased tritium concentration in these wells; BI 472 pCi/L; BJ 628 pCi/L; BK 852 pCi/L. In addition, the December sampling for well BH showed a spike at 1,082 pCi/L. Trending of the well results can be seen in Figure 3 - Hope Creek Tritium Trends: Wells BH, BI, BJ, BK, BM, BN, and BQ. The concentrations of tritium are being tracked to

determine if any trend can be observed.

Tritium at Salem Generating Station

The results of the laboratory analysis indicate that tritium was detected, i.e., reported at a concentration above the RGPP LLD of 200 pCi/L, in nine RGPP monitoring wells at the Salem site. The tritium concentrations measured at wells AL, BB, BD BE, BG, T, U, Y and Z ranged from <200 pCi/L to 2,259 pCi/L during 2009.

These low concentrations of tritium were evaluated and determined not to be indicative of an adverse trend as shown in Figure 4 – Salem Tritium Trends: Wells AL, BD, BE, BG, T,U,Y, Z. There were no analytical results for which Courtesy Communication (greater than 3,000 pCi/L tritium) was required. The tritium concentrations in these wells are being monitored and trended.

Gamma Emitters

No plant-related gamma emitters were detected in any RGPP well sampled in 2009. Naturally occurring Potassium-40 was detected in several of the wells sampled during 2009.

Strontium

Total strontium, including Sr-89 and Sr-90, was not detected in any RGPP well sampled during 2009.

B. Investigations

Hope Creek Unit 2 Emergency Sump Investigation

As discussed in the 2008 AREOR, an elevated tritium concentration was measured in the water from the Unit 2 Turbine Building Emergency Sump at Hope Creek Station. This

resulted in a Tritium Investigation being conducted during the last quarter of 2008 and into 2009.

On November 7, 2008, as part of a station evaluation for an increase in plant water usage, water in the Unit 2 Emergency Sump was sampled. The results identified a tritium concentration of 40,990 pCi/L in the water from the Unit 2 Emergency Sump. One of the purposes for this sump is to collect the condensation from the Unit 2 Turbine Building HVAC. It was determined that this sump had been drained on or about November 3, 2008 and released through cooling tower blowdown to the Delaware River. Operations Department personnel were notified immediately. Equipment Operators tagged out the sump preventing any more inadvertent discharges.

A Prompt Investigation was initiated and a team was formed. The team's charter was to investigate and determine the source (s) of Tritium to the sump. The team evaluated eleven failure modes for the source of the Tritium in the Unit 2 Emergency Sump. Of the eleven failure modes identified, three were determined by the team to be the greatest potential sources of Tritium. In addition, the team performed a review of P&IDs drawings and visually inspected all potential sources to the sump. No anomalous inputs to the sump were identified.

The team determined that the elevated levels of Tritium found in the Unit 2 Emergency Sump were determined to be from the condensate line coming from the Admin Building HVAC System with contributing components from groundwater seepage and floor concrete leaching. (PSEG Hope Creek, 2008.) The Unit 2 Emergency Sump is being administratively controlled to ensure radiological monitoring prior to discharge.

Elevated Tritium Results in RGPP Wells Investigation

The station increased the sampling frequency of some of the Hope Creek and Salem RGPP wells during 2009. Several locations are under investigation for the fluctuating tritium concentrations.

Specifically, the station placed six of the Hope Creek RGPP wells on an increased sampling frequency from March 2009 through December 2009. (Station wells BH, BI, BJ, BK, BM and BN were placed on a monthly sampling campaign.)
As a result of the fluctuating sample analysis results, the station set forth to investigate the potential causes for the elevated analysis results via the use of a Failure Mode Causal Table (FMCT) and team of Subject Matter Experts (SMEs). Evaluation of the Site Conceptual Model and the hydrological transport mechanism confirm that the transport of water containing tritium is retarded by the subsurface configuration. Therefore, the observed rate of change in tritium concentrations would not be expected to originate from a spill or a leak.
The station identified seven failure modes that could have potentially contributed to the elevated tritium levels. Some of these failure modes examine systems structures and components which have the potential to leak radiological isotopes to the environment, sample contamination, tritium recapture and run off, etc. The FMCT is still underway. Actions taken to date include a visual inspection of the RGPP wells by Maplewood Testing services technicians (completed October 2009), replacing the well caps with new sealing well caps (completed February 2010), well pump inspections performed by well contractors (Arcadis) which includes a full internal inspection of the wells (pumps, seals, casing) (completed March 2010) and a precipitation study is which planned for spring of 2010.

Salem RGPP wells also experienced elevated tritium levels during the 2009 sampling campaign. Well Y had sample analysis results of 2,259 pCi/L during the March 2009 sampling campaign. Other wells with analysis results over 1000 pCi/L included wells BG and Z. Salem has increased the sampling frequency and continues to monitor these wells. Actions taken to date include a visual inspection of the RGPP wells by Maplewood Testing services technicians (completed October 2009), replacing the well caps with new sealing well caps (completed February 2010), and a precipitation study is which planned for spring of 2010.

C. RGPP 2009 Status

The RGPP long-term sampling program will be modified as required in 2010 to effect changes as a result of the recent tritium concentrations and to adaptively manage the program to meet the RGPP objectives. Baseline sampling and analysis of groundwater will continue on the following schedule:

- Tritium will be analyzed at least semi-annually each calendar year to an LLD of 200 pCi/L;
- Plant-related gamma emitters will be analyzed semi-annually to the Environmental LLDs specified in the ODCM;
- Strontium will be analyzed annually as total strontium; if the total strontium is greater than 2.0 pCi/L separate analysis for strontium-89 and strontium-90 will be performed; and,
- RGPP monitoring well sample frequency will be adjusted based on analytical results, but in no event less than twice per year.

2009 USNRC Inspection of the RGPP

On March 9 –13, 2009 the NRC's Division of Reactor Projects performed an inspection of the PSEG Radiological Groundwater Protection Program (NRC 2009). The purpose of this inspection was to verify that PSEG implemented the voluntary industry Groundwater Protection Initiative (GPI). The GPI was unanimously approved by the senior members of Nuclear Energy Institute (NEI) namely, the Chief Nuclear Officers from the participating Nuclear Utilities in the US. This inspection was performed using the NRC Inspection Manual Temporary Instruction 2515/173 Review of the Implementation of the Industry Ground Water Protection Voluntary Initiative by a Senior Health Physicist from Region I (http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=083080274). The NRC Inspector verified that the NEI-07-07 Objectives for the GPI were documented in the PSEG RGPP plans and procedures.

2009 NEI Peer Assessment of the RGPP

In accordance with the NEI 07-07 Industry Groundwater Protection Initiative, the stations underwent a peer assessment by NEI from January 2009 through December 2009 (NEI .2010). The purpose of this peer assessment was to evaluate Salem/Hope Creek's implementation of NEI 07-07 Industry Groundwater Protection Initiative – Final Guidance Document. The NEI team which was composed of SMEs from other nuclear utilities determined that Salem/Hope Creek site has satisfactorily met the majority of the NEI 07-07 Objective/Acceptance Criteria. Identified improvements and enhancements are being addressed.

D. Impacts to Groundwater: Past Spills and Leaks

Historical unplanned and unmonitored releases on site are listed in Table 5, Salem and Hope Creek 10CFR50.75 (g) Data. There are currently no known active releases into the groundwater at Salem or Hope Creek Stations.

In conclusion, the operation of Salem and Hope Creek Stations has had minimal adverse radiological impact on the environment from unmonitored or unplanned releases of radionuclides.

V. References

1. ARCADIS, 2006A. Site Investigation Report July 2006. PSEG Nuclear LLC. Hope Creek Generating Station, Hancock's Bridge, New Jersey.
2. ARCADIS, 2006B. Site Investigation Report July 2006. PSEG Nuclear LLC. Salem Generating Station, Hancock's Bridge, New Jersey.
3. NEI, 2007. NEI 07-07, Industry Groundwater Protection Initiative – Final Guidance Document, Nuclear Energy Institute, Washington, DC, June 2007.

4. PSEG, 2007. 2006 Annual Radiological Environmental Operating Report, January 1 to December 31, 2006, Salem Generating Station Unit 1 and 2 and Hope Creek Generating Station, April 2007.
5. PSEG, 2008. 2007 Annual Radiological Environmental Operating Report, January 1 to December 31, 2007, Salem Generating Station Unit 1 and 2 and Hope Creek Generating Station, April 2008.
6. PSEG, 2009. 2008 Annual Radiological Environmental Operating Report, January 1 to December 31, 2008, Salem Generating Station Unit 1 and 2 and Hope Creek Generating Station, April 2009.
7. PSEG Hope Creek, 2008. Tritium Investigation Unit 2 Turbine Bldg Sump, Apparent Cause Evaluation, 70091569.
8. PSEG Hope Creek, 2009. BH Well High Tritium Results, Failure Mode Causal Table, 70099170.
9. NRC, 2009. NRC Inspection Report 05000354/2009002: Hope Creek Generating Station – NRC Integrated Inspection Report, April 27, 2009.
10. NEI, 2010. NEI 07-07 NEI Groundwater Protection Initiative Pier Assessment Report, January 21, 2010.

Table 1 Hope Creek RGPP Monitoring Wells: Construction Details

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	MP Elevation (feet RPD)	MP Elevation (feet msl)	Monitoring Purpose	Source Targets
Well BH	May-06	Sch-40 PVC	4	37.0	27 - 37	97.92	8	Perimeter	NA
Well BI	May-06	Sch-40 PVC	4	38.5	28.5 - 38.5	99.6	9.68	Source	Facilities; Piping
Well BJ	May-06	Sch-40 PVC	4	38.0	28 - 38	100.23	10.31	Source	Condensate Storage & Transfer; Facilities; Piping
Well BK	May-06	Sch-40 PVC	4	38.5	28.5 - 38.5	98.19	8.27	Perimeter	NA
Well BL	May-06	Sch-40 PVC	4	35.0	25 - 35	99.71	9.79	Perimeter	NA
Well BM	May-06	Sch-40 PVC	4	38.0	28 - 38	99.76	9.84	Source	Facilities; Piping
Well BN	May-06	Sch-40 PVC	4	12.5	7.5 - 12.5	102.64	12.72	Source	Auxiliary Boiler Building; Piping
Well BO	May-06	Sch-40 PVC	4	36.0	26 - 36	97.98	8.06	Perimeter/Source	Building Sewage
Well BP	May-06	Sch-40 PVC	4	38.0	28 - 38	99.06	9.14	Perimeter/Source	Building Sewage
Well BQ	May-06	Sch-40 PVC	4	42.0	32 - 42	102.16	12.24	Source	Auxiliary Boiler Building; Dry Cask Storage Building; Piping
Well BR	May-06	Sch-40 PVC	4	40.5	30.5 - 40.5	104.28	14.36	Perimeter/Source	Piping; Dry Cask Storage Building
Well BS	May-06	Sch-40 PVC	4	35.0	25 - 35	100.55	10.63	Upgradient	NA
Well BT	May-06	Sch-40 PVC	4	38.5	28.5 - 38.5	99.60	9.68	Upgradient	NA

Notes:

MP	Measuring Point
bgs	Below ground surface
RPD	Relative to plant datum
msl	Relative to mean sea level (NAVD 1988)
NA	Not applicable
NAD 83	North American Datum 1983

Table 2. Salem RGPP Monitoring Wells: Construction Details

Well ID	Installation Date	Construction Details	Diameter (inches)	Total Depth (feet bgs)	Monitoring Interval (feet bgs)	MP Elevation (feet RPD)	MP Elevation (feet msl)	Monitoring Purpose	Source Targets
Well T	Jun-03	Sch-40 PVC	2	31.2	21.2 - 31.2	104.13	14.21	Source	Facilities; House Heating Blr
Well U	May-03	Sch-40 PVC	2	32.2	27.2 - 32.2	98.57	8.65	Source	Facilities; House Heating Blr
Well Y	Sep-03	Sch-40 PVC	2	37.0	27.0 - 35.0	101.81	11.89	Perimeter	NA
Well Z	Sep-03	Sch-40 PVC	2	37.5	27.5 - 37.5	101.86	11.94	Perimeter	NA
Well AL	Jan-04	Sch-40 PVC	2	25.3	15.3 - 25.3	99.13	9.21	Perimeter	NA
Well BA	May-06	Sch-40 PVC	4	39.5	29.5 - 39.5	101.07	11.15	Perimeter	NA
Well BB	May-06	Sch-40 PVC	4	47.0	37 - 47	99.38	9.46	Perimeter	NA
Well BC	May-06	Sch-40 PVC	4	38.0	28 - 38	98.78	8.86	Source / Perimeter	Facilities; RAP Tanks; Piping
Well BD	May-06	Sch-40 PVC	4	40.5	30.5 - 40.5	98.78	8.86	Source	Facilities; RAP Tanks; Piping
Well BE	May-06	Sch-40 PVC	4	37.0	27 - 37	98.31	8.39	Perimeter	NA
Well BF	May-06	Sch-40 PVC	4	42.5	32.5 - 42.5	99.11	9.19	Perimeter	NA
Well BG	May-06	Sch-40 PVC	4	37.0	27 - 37	100	10.08	Perimeter	NA
Well BU	May-06	Sch-40 PVC	4	36.0	26 - 36	100.16	10.24	Upgradient	NA

Notes:

MP	Measuring Point
bgs	Below ground surface
RPD	Relative to plant datum
msl	Relative to mean sea level (NAVD 1988)
NA	Not applicable
NAD 83	North American Datum 1983

Table 3. Relevant Groundwater Evaluation Criteria: Salem and Hope Creek Generating Stations

Isotope	RGPP LLD (pCi/L)	PSEG ODCM Reporting Level (pCi/L)
Tritium	200	30,000
Total Strontium	2.0	8
Mn-54	15	1000
Fe-59	30	400
Co-60	15	300
Zn-65	30	300
Nb-95	15	400
Zr-95	15	200
Cs-134	15	30
Cs-137	18	50
Ba-140	60	200
La-140	15	200

Table 4A. Analytical Results for Tritium in Groundwater:
Hope Creek Generating Station

Well ID	Sample Date	Tritium Conc. (pCi/L)	Well ID	Sample Date	Tritium Conc. (pCi/L)
				03/10/2009	**918.46**
	03/10/2009	**4,517.62**		04/27/2009	<200
	04/23/2009	**272.56**		05/19/2009	<200
	05/19/2009	**292.23**		06/15/2009	**309.83**
	06/15/2009	**317.50**		07/27/2009	<200
BH	07/27/2009	**526.36**	BM	08/20/2009	**255.50**
	08/19/2009	<200		09/23/2009	<200
	09/14/2009	<200		10/27/2009	<200
	10/14/2009	<200		11/19/2009	<200
	11/20/2009	**337.62**		12/29/2009	<200
	12/29/2009	**1,082**			
	03/10/2009	**1,469**		03/19/2009	**760**
	04/27/2009	**217**		06/18/2009	**240**
	05/19/2009	**485**		07/29/2009	**322**
	06/15/2009	**366**		08/25/2009	**274**
	7/27/2009	**817**	BN	09/17/2009	**270**
BI	08/20/2009	**235**		10/30/2009	<200
	09/14/2009	<200		11/20/2009	<200
	09/14/2009	<200		12/30/2009	**393**
	10/27/2009	**485**			
	11/19/2009	**895**		04/16/2009	<200
	12/10/2009	**472**	BO	10/13/2009	<200
	03/10/2009	**917**		04/16/2009	<200
	04/27/2009	<200	BP	10/13/2009	<200
	05/19/2009	<200			
	06/15/2009	**214**		03/19/2009	**720**
	07/27/2009	<200	BQ	06/18/2009	<200
BJ	08/20/2009	**241**		10/30/2009	<200
	09/14/2009	**436**			
	10/27/2009	**411**		04/16/2009	<200
	11/19/2009	**7,778**	BR	10/13/2009	<200
	12/04/2009	**628**			
				04/16/2009	<200
	03/10/2009	**576**	BS	10/13/2009	<200
	05/19/2009	**230**			
	06/15/2009	**233**		04/16/2009	<200
	07/27/2009	**274**	BT	10/13/2009	<200
BK	08/19/2009	**309**			
	09/14/2009	<200		03/10/2009	<200
	10/14/2009	<200	BL	10/14/2009	<200
	11/20/2009	**1,324**		12/23/2009	<200
	12/10/2009	**852**			

Bold concentration value indicates tritium level above200 pCi/L. NS- Not Sampled

Table 4B Analytical Results for Tritium in Groundwater: Salem Generating Station

Well ID	Sample Date	Tritium Conc. (pCi/L)
AL	01/19/2009	**568**
	04/08/2009	**441**
	06/10/2009	**452**
	07/21/2009	**598**
	10/20/2009	**686**
BA	04/13/2009	<200
	10/21/2009	<200
BB	04/13/2009	<200
	10/21/2009	**206**
BC	04/29/2009	<200
BD	04/13/2009	**380**
	10/27/2009	<200
BE	04/13/2009	**448**
	06/29/2009	<200
	10/27/2009	**636**
BF	04/13/2009	<200
	10/27/2009	<200
BG	04/29/2009	**354**
	06/15/2009	<200
	11/19/2009	**1,590**
BU	04/16/2009	<200
	10/13/2009	<200
T	01/19/2009	**266**
	06/10/2009	<200
	07/16/2009	<200
	10/20/2009	<200
U	01/19/2009	<200
	06/29/2009	**282**
	07/16/2009	<200
	10/20/2009	<200
Y	01/20/2009	<200
	02/25/2009	<200
	03/30/2009	**2,259**
	04/27/2009	<200
	05/20/2009	<200
	06/10/2009	<200
	07/22/2009	<200
	08/18/2009	<200
	09/24/2009	<200
	10/27/2009	<200
	11/19/2009	<200
	12/30/2009	<200
Z	01/20/2009	**276**
	02/25/2009	**244**
	03/30/2009	**1,042**
	04/27/2009	**225**
	05/20/2009	**288**
	06/10/2009	**249**
	07/22/2009	**398**
	08/18/2009	**299**
	09/24/2009	**314**
	10/27/2009	**369**
	11/19/2009	**368**
	12/30/2009	**210**

Bold concentration value above 200 pCi/L. NS -Not Sampled

Table 5. Salem and Hope Creek 10CFR 50.75(g) Data

Spill/Discharge	QuantitySpilled / Discharged	Location of Spill/Discharge	Description
Apr-95	~ 88 mCi	Hope Creek and Salem	Steam from the Decon Solution Evaporator released from Hope Creek's South Plant Vent
Jun-01	~5Ci	Unit 1 RWST	Salem Unit 1 RWST Nozzle Leak
Sep-02	~5 Ci	Ground west of Unit 1 Spent Fuel Building	Blockage of the Spent Fuel Pool liner's "tell-tales" caused backup of contaminated water through building seams
Jan-05	No discharge to the environment	Hope Creek rooms 3133, 3135, 3129 and 5102	Water from inside the Waste Sludge Phase Separator Tank Room appeared to be leaking through the crack in the wall
May-07	2.8 milli Curies of Cs 137	In front of Salem Unit 2 condensate polisher	Burst site glass during operation. Resin blown through wall into switchyard

Figure 1 Hope Creek RGPP Monitoring Well Locations

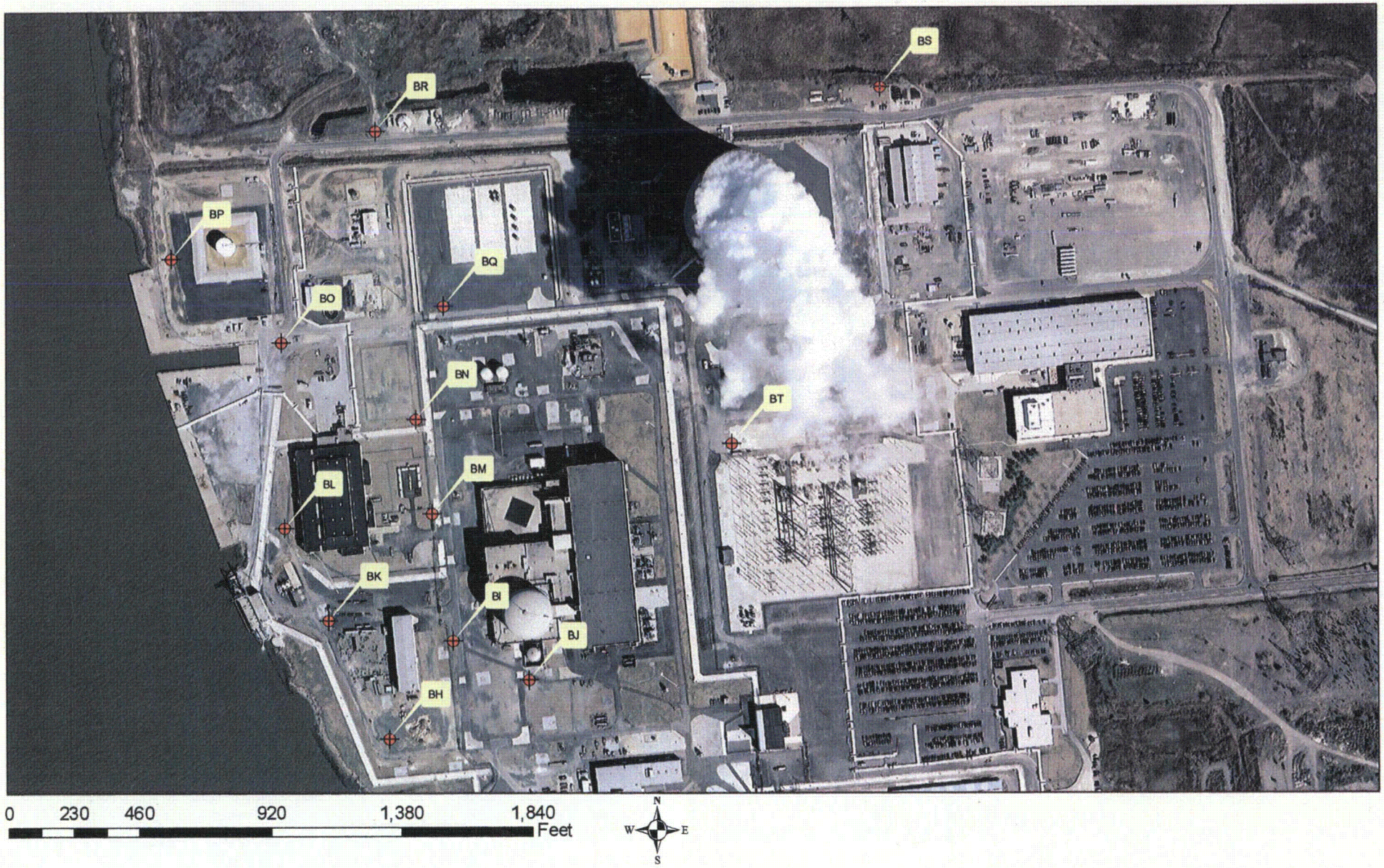

Figure 2 Salem RGPP Monitoring Well Locations

Figure 3 Hope Creek Tritium Trends: Wells BH, BI, BJ, BK, BM, BN and BQ

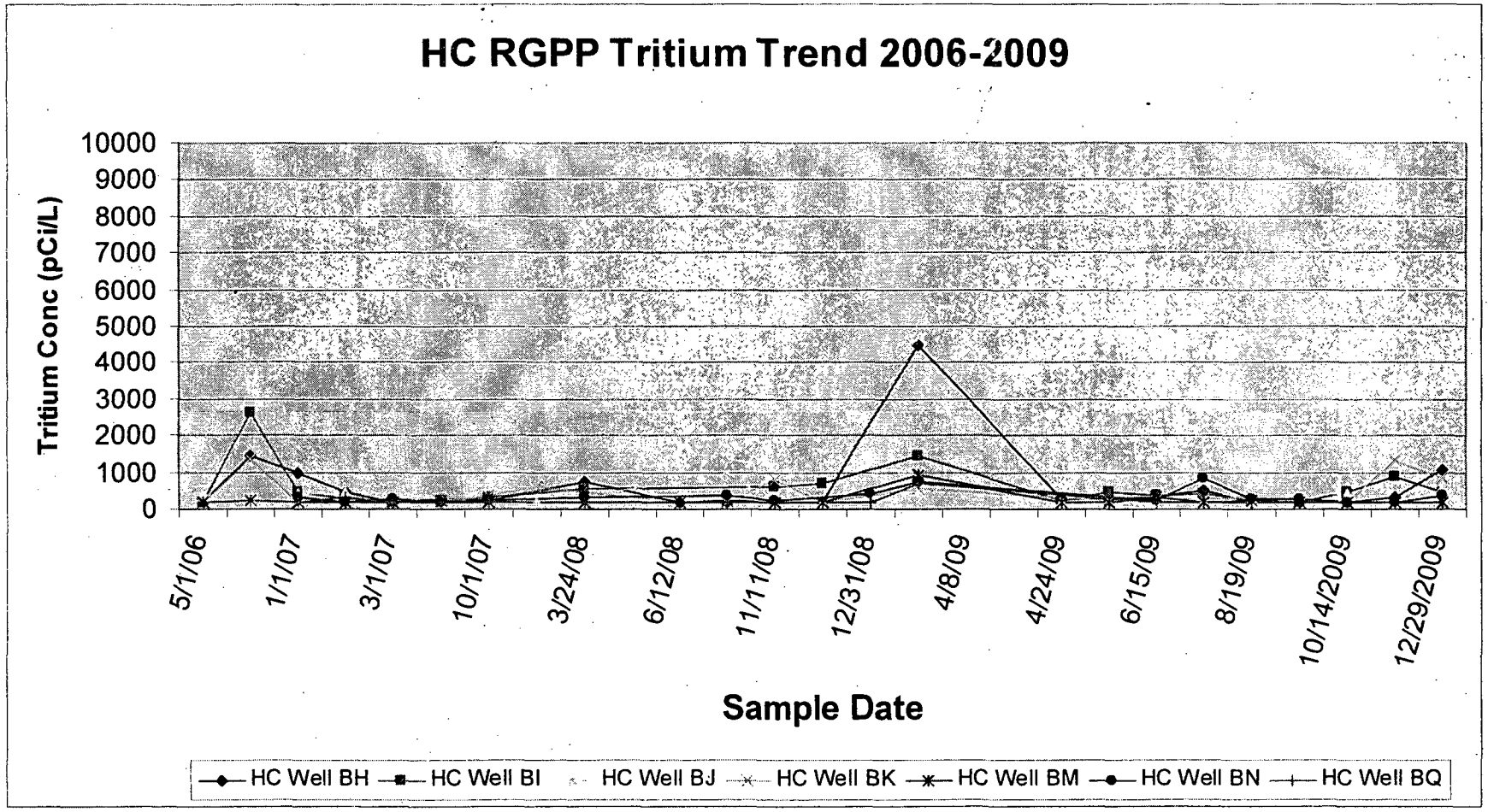

Figure 4 Salem Tritium Trends: Wells AL, BD, BE, BG, T, U, Y, Z