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

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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. 1 and 2
Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket Nos. 50-272 and 50-311

Subject: 2010 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 2010 Annual Radiological Environmental Operating Report. This report summarizes the results of the radiological environmental surveillance program for 2010 in the vicinity of the Salem and Hope Creek Generating Stations. The result of this program for 2010 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 Jeffrey Pantazes at (856) 339-7900.

Sincerely,

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Attachment - 2010 Annual Radiological Environmental Operating Report

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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

2010 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2010

Prepared by
PSEG POWER LLC
MAPLEWOOD TESTING SERVICES

April 2011

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SALEM & HOPE CREEK
GENERATING STATIONS

2010 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1 TO DECEMBER 31, 2010

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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, 2010, through December 31, 2010, and the results are discussed in this report. 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 2010 reporting period. The REMP objectives were also met during this period. The data that was collected in 2010 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], it can be concluded 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 1212 analyses on 868 environmental samples during 2010. Direct radiation dose measurements were made using 202 sets of thermoluminescent dosimeters (TLDs).

- In addition to the detection of naturally - occurring isotopes (i.e. Be-7, K-40, Ra-Nat and Th-232), trace levels of H-3 and Cs-137 were also detected. Tritium was detected in surface water samples at levels slightly above minimum detectable concentrations. For tritium analysis in water the PSEG REMP LLD is 200 pCi/L. Typical minimum delectable concentrations for tritium analysis in water range from 130pCi/L to 150 pCi/L. Cs-137 was detected in two river sediment samples at concentrations below the ODCM LLD value of 180 pCi/kg-dry.

- Dose measurements made with quarterly TLDs at offsite locations around the SGS/HCGS site averaged 49 milliroentgen for the year 2010. The average of the dose measurements at the control locations (background) was also 49 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 2010 results of the laboratory analysis indicated that tritium was detected in eight of the thirteen RGPP monitoring wells at levels ranging from 228 pCi/L to 1,479 pCi/L. The well with tritium results above the LLD (200 pCi/L) included AL, BB, BC, BD, BE, BG, U and Z.

Hope Creek

- The 2010 results of the laboratory analysis indicated that tritium was detected in six of the thirteen RGPP monitoring wells at levels ranging from 206 pCi/L to 1,408 pCi/L. The six wells with tritium detected above the 200 pCi/L LLD included BH, BI, BJ, BK, BM and BN.

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 1180.3 megawatt electric (MWe) and Salem Unit Two has a net rating of 1177 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. MTS reports for the operational phase from 1983 to 2009 are referenced in this report [10]. Teledyne Brown Engineering Environmental Services (TBE), assumed responsibility for third-party QA analyses and TLD processing from 1983 until June, 1995. 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. AREVA-NP, Inc. Environmental Laboratory (AREVA) served as the third party QA vendor from June, 1995 through June 2010, at which time they announced the closure of their environmental laboratory. PSEG once again, chose TBE to assume the function of the third party QA vendor, from June 2010 through December 2010.

AREVA provided the dosimetry services for PSEG throughout the reporting year 2010. However, AREVA announced that they would also be ceasing their dosimetry services after the 2010 reporting year. PSEG was tasked with procuring a new dosimetry vendor for the 2011 reporting year. Additional information regarding this task can be found in the Results and Discussion section of this report.

An overview of the 2010 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, 2010, 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 (TS) [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 2010 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, locations, 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 Eckert & Ziegler Analytics Environmental Cross Check (EZA - 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 EZA 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-four (84) passed the applicable criteria, this translates to a 94% acceptance rate.

The five medias and analysis which disagreed with the criteria were: water/gross alpha, two water/gross beta, and two water/I-131. The cause for these disagreements and the corrective actions are provided below.

The result disagreement for the Iodine in water analysis for the ERA PT Study (I745) was due to the wrong divisor being used in the report generation software. The ERA sample was 2 liters and the normal REMP samples are 4 liters which resulted in the wrong value being reported. When the result was adjusted using the correct volume, it would have been 29.6 pCi/L, within the agreement range.

The result disagreement for the gross beta in water analysis for the ERA PT Study (AB752) was attributed to the sample picking up moisture, which affected the sample weight and thickness and the accuracy of the self absorption counting efficiency factor. This occured during the summer when the counting room air conditioning system became inoperable and the humidity in the counting room went up. The ERA samples picked up moisture which caused them to gain weight and inaccurate counting data resulted. A plastic sleeve was made for the gas proportional counter with dessicant packets to keep the moisture in the room from affecting the water samples as they count.

The result disagreement for the Iodine in water analysis for the ERA PT Study (I758) was investigated and a reanalysis using the previous years calibration showed no change in our results. MTS then purchased a RadChem QC Standard with a known certified value, and prepared and analyzed this standard in the same manner as the PT study, using the same three gamma detectors. These three results were within the both the PT Performance Acceptance Limits and the QC Performance Acceptance Limits as certified by ERA. Source of disagreement could not be determined. However, disagreements outside of the +/- 25% range were high or overestimates, which is conservative. MTS reported the analytical values as greater than they actually were.

The result disagreement for the gross alpha and gross beta in water analysis for the 4th quarter Analytics ECC (AB762) was investigated. Verification of the Alpha – Beta control charts was completed along with the counting parameters in the procedure. Then the samples were recounted along with the samples from the 3rd quarter ECC. Both sets of counts showed no change in either quarters results as reported. Source of disagreement could not be determined. However, disagreements outside of the +/- 25% range were high or overestimates, which is conservative. MTS reported the analytical values as greater than they actually were.

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 2010. 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 2010 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2010 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 the 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 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 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 2010 was 99.7 percent.

- Gross beta activity was detected in all of the indicator station samples collected at concentrations ranging from 5.8×10^{-3} to 36×10^{-3} pCi/m^3 and in all of the control station samples from 6.5×10^{-3} to 38×10^{-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 1990 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, 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.

- 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 60 x 10^{-3} to 99 x 10^{-3} pCi/m^3, with an average of 79 x 10^{-3} pCi/m^3. It was detected in the 4 control station composites ranging from 69 x 10^{-3} to 96 x 10^{-3} pCi/m^3, with an average of 83 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 8.0 x 10^{-3} to 19 x 10^{-3} pCi/m^3 and it was also detected in all 4 control station samples, at concentrations of 11 X 10^{-3} to 19 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 2009 was 18 X10^{-3} pCi/m^3.

- Ra-Nat was only detected in 1 indicator station sample at a concentration of 0.6 X 10^{-3} pCi/L. It was not detected in any of the control station samples. No preoperational data is available for comparison. However, the average of all positive values for all stations for the years 1988 to 2009 was 1.2 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 for the year was analyzed for I-131. Total air sampler availability for the 6 sampling stations in 2010 was 99.7 percent.

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 <1.0 x 10^{-3} to <8.6 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 51 locations were monitored for direct radiation during 2010, including 14 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 elements. 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 14 quarterly on-site indicator TLDs was 4.1 milliroentgen per standard month. The average control TLD dose rate was the same at 4.1 milliroentgen per standard month. The preoperational average for the quarterly TLD readings was 4.4 milliroentgen per standard month. A summary of all recorded values can be found in Appendix C.

In Figure 2, the quarterly average radiation levels of the off-site indicator stations versus the control stations, are plotted for the period 1990 through 2010, with an inset graph depicting the period 1973 to 2010.

The results of the direct radiation measurements for 2010 confirmed that the radiation levels in the vicinity of the Salem and Hope Creek Generating Stations were similar to previous years.

As mentioned in the REMP preface (page 5) in June 2010, AREVA NP announced the decision to discontinue operations at the AREVA Environmental Laboratory (E-Lab) in Westborough, MA, including the Environmental Dosimetry Services. In response to AREVA's closure, PSEG evaluated potential dosimetry vendors and made the decision to procure dosimetry services from Landauer.

The decision to use Landauer's dosimetry services was based on the performance of Landauer's Optically Stimulated Luminescence (OSL) dosimetry in the field in comparison to the AREVA technology and other candidate vendors.

Landauer supplies OSL technology badges, which are based on a different technology than the Panasonic TLD badges supplied by Areva NP. Although the badges are similar in construction, the OSL dosimeter uses Aluminum oxide instead of calcium sulfate technology. The OSL badge is more responsive to very low gamma energy (the response to radon daughters is greater), resists environmental affects from heat, humidity, and chemical solvents and has the ability to be re-analyzed. In addition PSEG has had past working history with Landauer. Landauer currently supplies PSEG with personnel dosimetry badges.

PSEG conducted side by side monitoring for a full calendar quarter by co-locating the Landauer OSL with the Areva TLDs for all REMP locations. The Landauer results show a slightly higher reading at each station, which is attributed to differences in the dosimetry technology. The results were reviewed and reported in Appendix C. Landauer has recommended a background dose rate of 6 mrem per month for the PSEG environs based on results acquired in the fourth quarter of 2010 and their extensive database (Landauer provides approximately 1,000,000 badges throughout the nation), the average of the 4th quarter Landauer data is 6.02 mrem/month.

TERRESTRIAL

Terrestrial REMP sampling includes the collection of milk, well water and potable water, vegetation, fodder crop and soil samples.

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 new 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. 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 <0.5 pCi/L. The maximum preoperational level detected was 65 pCi/L which occurred following a period of atmospheric nuclear weapons tests. Results from 1990 to 2010 are plotted on Figure 3, with an inset graph depicting the period 1973 to 2010.

- 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 1230 to 1510 pCi/L, with an average of 1400 pCi/L. The 20 control station sample concentrations ranged from 1260 to 1500 pCi/L, with an average of 1350 pCi/L. The maximum preoperational level detected was 2000 pCi/L, with an average of 1437 pCi/L.

- Ra-Nat was detected in one of the indicator station samples at a concentration of 15 pCi/L. It was detected in one of the control station samples at 7.6 pCi/L. 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). 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 not detected above the minimum detectable concentration in any of the well water samples. LLD's ranged from <1.5 to 3.5 pCi/L. The maximum preoperational level detected was 9.6 pCi/L. There was no preoperational average determined for this analysis. However, PSEG compiled the average of all positive results for gross alpha for well samples for the operational years 1988 to 2009; the operational average was 2 pCi/L.

- Gross beta activity was detected in 5 well water samples. Concentrations for the samples ranged from 1.8 to 2.7 pCi/L, with an average of 2.1 pCi/L.
  As with the 2009 gross beta results, the 2010 results are 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 REMP participant 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 LLD's ranged from <131 to <147 pCi/L. The maximum preoperational level detected was 380 pCi/L. There was no preoperational average determined for this analysis. However, PSEG compiled the average of all the positive tritium results for the operational years 1988 to 2009; the operational average 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 8 of the samples at concentrations ranging from 39 to 71 pCi/L with an average of 52 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 2009 was 57 pCi/L.

- Ra-Nat was detected in all 12 of the well water samples at concentrations ranging from 12 to 189 pCi/L with an average of 98 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 2009 was 101 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 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 3 raw water samples at concentrations of 0.9 to 1.8 pCi/L. It was detected in one of the treated water samples at a concentration of 0.8 pCi/L. Minimum detectable concentrations for the remaining 22 samples (both treated and raw) ranged from <0.8 to <2.1 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 2009 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 2.6 to 5.6 pCi/L. Concentrations for the treated water ranged from 2.9 to 7.9 pCi/L. The average concentration for both raw and treated was 4.1 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 <130 to <147 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 <0.4 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 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 9 of the raw potable waters at concentrations ranging from 29 to 68 pCi/L. It was detected in 11 of the treated potable water samples at concentrations from 43 to 69 pCi/L. The average for both raw and treated results was 52 pCi/L. LLD's for the remaining 4 potable water samples were <15 to <22 pCi/L. There was no preoperational data available for comparison. The average of the positive K-40 results from 1988 to 2009 was 47 pCi/L.

- Ra-Nat was detected in 3 of the treated potable waters at concentrations ranging from 4 to 26 pCi/L. It was detected in 3 of the raw potable water samples at concentrations ranging from 4.3 to 6.5 pCi/L. The combined potable water average was 9.0 pCi/L. LLD's for the remaining 18 samples were <1.8 to <3.9 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 2009 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 vegetables from local farms are collected as management audit samples. In addition, cabbage and kale were grown from seed by MTS personnel and planted at three on site locations and one offsite location in Delaware, at 3.9 miles SSW. These broad leaf vegetable samples are collected since there are no 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). All samples (vegetable and broadleaf) were analyzed for gamma emitters and included asparagus, cabbage, kale, sweet corn, peppers, and tomatoes. These samples were from 8 indicator stations (19 samples) and 4 control stations (12 samples). The results for these samples are discussed below:

- Gamma spectroscopy performed on each of the 31 samples indicated the presence of the naturally-occurring radionuclides K-40, Ra-Nat, Th-232 and Be-7. All other gamma emitters searched for including radionuclides associated with nuclear plants (Co-60, Cs-137, etc) were below the minimum detectable concentration.

- Potassium-40 was detected in all 31 samples. Concentrations for the 19 indicator station samples ranged from 1680 to 5910 pCi/kg-wet and averaged 2790 pCi/kg-wet. Concentrations for the 12 control station samples ranged from 1290 to 2450 pCi/kg-wet, and averaged 1890 pCi/kg-wet. The average concentration detected for all samples, both indicator and control, was 2450 pCi/kg-wet. The maximum preoperational level detected was 4800 pCi/kg-wet, with an average of 2140 pCi/kg-wet.

- Ra-Nat was detected in two of the indicator station samples (Kale) at concentrations of 15 and 27 pCi/kg-wet. It was not detected in any of the control locations. LLD's for the remaining 29 samples were <5.9 to <13 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 2009 was 28 pCi/kg-wet.

- Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in four of the indicator station samples (all Kale) at concentrations of 192 to 351 pCi/kg-wet and an average of 269 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 2009 was 266 pCi/kg-wet.

- Thorium-232 was detected in only one of the indicator station samples (kale) at a concentration of 59 pCi/kg-wet. It was not detected in any of the control locations. No preoperational data is available for comparison. However, PSEG compiled the average for the positive Th-232 results from 1988 to 2009; the operational average was 58 pCi/kg-wet.

Fodder Crops (Table C-11)

Although not required by the SGS or HCGS Technical Specifications and ODCM, 4 samples of silage normally used as cattle feed were collected from three indicator stations and one control station. 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 are milk sampling stations.

- Gamma spectroscopy performed on each of the 4 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 2 of the indicator silage samples at concentrations of 280 and 440 pCi/kg-wet. It was detected in the control station silage sample at 825 pCi/kg-wet. The maximum preoperational level detected for silage was 4700 pCi/kg-wet, with an average of 2000 pCi/kg-wet.

- Potassium-40 was detected in all 4 of the silage samples. The average concentration of K-40 detected for these samples (3 indicator and 1 control) was 3790 pCi/kg-wet. Indicator station samples were at concentrations of 3370 to 4580 pCi/kg-wet while the control station had a concentration of 3600 pCi/kg-wet. Preoperational results averaged 7000 pCi/kg-wet.

SOIL (Table C-12)

Soil is sampled every three years at nine stations, and analyzed for gamma emitters. These management audit samples are collected at each station, in areas that have been relatively undisturbed since the last collection, in order to determine any change in the radionuclide inventory of the area.

- Gamma spectroscopy, performed on each of the 9 samples, indicated the presence of the naturally-occurring radionuclides Be-7, K-40, Ra-Nat and Th-232, in addition to low levels of the fission product Cs-137. All other gamma emitters searched for were below the LLD.

- Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in 3 of the indicator soil samples at concentrations from 213 to 238 pCi/kg-dry. It was detected in one control station soil sample at 186 pCi/kg-dry. The maximum preoperational level detected for Be-7 in soil was 21000 pCi/kg-dry. There was no preoperational average determined for this analysis. However PSEG compiled an average of the positive Be-7 results from 1983 to 2009; the operational average was 210 pCi/kg-dry.

- Potassium-40 was detected in all 7 of the indicator station samples at concentrations ranging from 4730 to 13100 pCi/kg-dry with an average of 8660 pCi/kg-dry. The 2 control station samples had an average of 7930 pCi/kg-dry. The maximum preoperational level detected was 24000 pCi/kg-dry with an average of 10000 pCi/kg-dry.

- Cesium-137 was detected in 6 of the indicator station samples ranging from 43 to 217 pCi/kg-dry, with an average of 115 pCi/kg-dry. The two control station samples had an average of 139 pCi/kg-dry. The maximum preoperational level detected was 2800 pCi/kg-dry, with an average of 800 pCi/kg-dry. Triennial results from 1974 to the current year are plotted on Figure 7.

- Ra-Nat was detected in all 7 indicator station samples in concentrations of 247 to 962 pCi/kg-dry, with an average of 528 pCi/kg-dry. The control station samples showed an average of 707 pCi/kg-dry. The maximum preoperational level detected was 1500 pCi/kg-dry with an average of 870 pCi/kg-dry.

- Thorium-232 was detected in all of the indicator station samples in ranges of 430 to 1160 pCi/kg-dry, and had an average of 750 pCi/kg-dry. The control station samples were 655 and 937 pCi/kg-dry with an average of 796 pCi/kg-dry. The maximum preoperational level detected was 1400 pCi/kg-dry with an average of 740 pCi/kg-dry.

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 and riverbed 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-13, C-14, C-15)

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 42 of the 48 indicator station samples ranging from 6.8 to 408 pCi/L, with an average of 123 pCi/L. Beta activity was detected in 11 of the control station samples with concentrations ranging from 16 to 239 pCi/L, with an average of 89 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 1990 to 2010, with an inset graph depicting the current period 1973 to 2010.

- Tritium activity was detected in 2 of the indicator station samples at concentrations of 167 and 194 pCi/L with an average of 181 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 <131 to <148 pCi/L. The maximum preoperational level detected was 600 pCi/L, with an average of 210 pCi/L. Positive results from 1990 to 2010 are plotted on Figure 5, with an inset graph depicting the period 1973 to 2010.

- Gamma spectroscopy performed on each of the 48 indicator station and 12 control station surface water samples indicated the presence of the naturally-occurring radionuclide K-40. 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 10 to 175 pCi/L and in all 12 of the control station samples ranging from 37 to 136 pCi/L. The average for the indicator station locations was 87 pCi/L, while the average for the control station locations was 79 pCi/L. The maximum preoperational level detected for K-40 was 200 pCi/L, with an average of 48 pCi/L.

Fish (Table C-16)

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 3380 to 3730 pCi/kg-wet for an average of 3543 pCi/kg-wet. K-40 was detected in both samples from the control location at 2990 and 3470 pCi/kg-wet. The average for the control samples was 3230 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 first semi-annual collection. It was not detected in any of the indicator station samples. The control station positive result was at a concentration of 23 pCi/kg-wet. MDC's for the remaining 5 samples both indicator and control ranged from <7.3 to <9.9 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 2009 were averaged for a concentration of 22 pCi/kg-wet.

Blue Crab (Table C-17)

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 1820 and 2550 pCi/kg-wet. It was detected in both control station samples at 1560 and 2120 pCi/kg-wet. The average for both the indicator and control station samples was 2010 pCi/kg-wet. The maximum preoperational level detected was 12000 pCi/kg-wet, with an average of 2835 pCi/kg-wet.

- Ra-Nat was not detected in any of the indicator station samples. It was detected in only 1 of the control location samples during the first semi-annual collection at 20 pCi/kg-wet. Minimum detectable concentrations for the remaining station samples, both indicator and control, ranged from <10 to <13 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 2009 were averaged for a concentration of 25 pCi/kg-wet.

Sediment (Table C-18)

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 was detected from one location (16F1) during both semi-annual collections. (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 (both 16F1) at concentrations of 32 and 68 pCi/kg-dry. It was not detected in either control location. MDC's for the remaining 12 samples, both indicator and control, ranged from <2.1 to <28 pCi/kg-dry.

The maximum preoperational level detected was 400 pCi/kg-dry, with an average of 150 pCi/kg-dry. Positive results from 1990 to 2010 are plotted on Figure 6, with an inset graph depicting the current year back to 1977.

- Beryllium-7 was detected in 3 of the indicator station samples at concentrations ranging from 97 to 439 pCi/kg-dry with an average of 257 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 2009 were averaged for a concentration of 513 pCi/kg-dry.

- Potassium-40 was detected in all 12 indicator station samples at concentrations ranging from 1840 to 14000 pCi/kg-dry, with an average of 7113 pCi/kg-dry. Concentrations detected in both of the control station samples were at 13300 and 16800 pCi/kg-dry. The average for the control station samples was 15050 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 80 to 801 pCi/kg-dry, with an average of 418 pCi/kg-dry. Concentrations detected in both of the control station samples were at 519 and 615 pCi/kg-dry, with an average of 570 pCi/kg-dry. The average for both the indicator and control station samples was 439 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 11 of the indicator station samples at concentrations ranging from 111 to 1160 pCi/kg-dry, with an average of 701 pCi/kg-dry. Concentrations detected in both of the control station samples were at 952 and 996 pCi/kg-dry, with an average of 974 pCi/kg-dry. The maximum pre-operational level detected was 1300 pCi/kg-dry, with an average of 840 pCi/kg-dry.

PROGRAM DEVIATIONS

There were no program deviations that occurred in 2010.

HOPE CREEK TECHNICAL SPECIFICATION LIMIT FOR PRIMARY WATER IODINE CONCENTRATIONS

The Hope Creek primary water chemistry results for 2010 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.

ERATTA DATA

Clarification on trending date ranges for Figures 1 – 6. To more effectively identify the trending date ranges in Figures 1 – 6 PSEG will now include indications for each reporting year.

Correction to the trending graphs in Appendix F. In the 2009 AREOR the trending graphs in Figures 3 and 4 were printed in gray scale, rendering the lighter trend lines illegible. The trending graphs have been updated to include 2010 data and the issue has been corrected by changing the trend lines to be identified by physical differences rather than color coding.

PSEG conducted a review of the 50.75g Decommissioning files and identified gaps in the format of the 50.75g data as presented in Appendix F during reporting years 2007 through 2009. These gaps were entered into the corrective action program. The table has been updated to clearly identify those events which have been documented in the 50.75g files. In addition, PSEG continues to track events which are not currently part of the 50.75g files, as this information is important to the Radiological Groundwater Protection Program and contribute to the comprehensive view of site operational history.

CONCLUSIONS

The Radiological Environmental Monitoring Program for Salem and Hope Creek Generating Stations was conducted during 2010 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	Fifty-one 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, 15S2, 16S1, 16S2. 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			
a. Milk	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
	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, 3E1 farm's well, is sampled as management audit sample)	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, 2G2, 9G1, 9G2, and 3H5. In addition, Broad leaf vegetation (cabbage and kale) was planted & collected onsite (1S1, 15S1, 16S1) and across the river, 10D1, in lieu of having a milk farm within 5 km of the Site [1].	Annually (at harvest)	Gamma scan/on collection
e. Fodder Crops	Although not required by SGS/HCGS ODCM, a sample of crops normally used as cattle feed (silage) were collected from our milk farms as management audit samples: 14F4, 3G1, 2G3, 13E3.	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 (Samples were collected in 2010)	Every 3 years (2010-2013-2016)	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 cabbage and kale at three locations on Site (1S1, 15S1, 16S1) and one across the river in Delaware (10D1).

(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
1990 THROUGH 2010

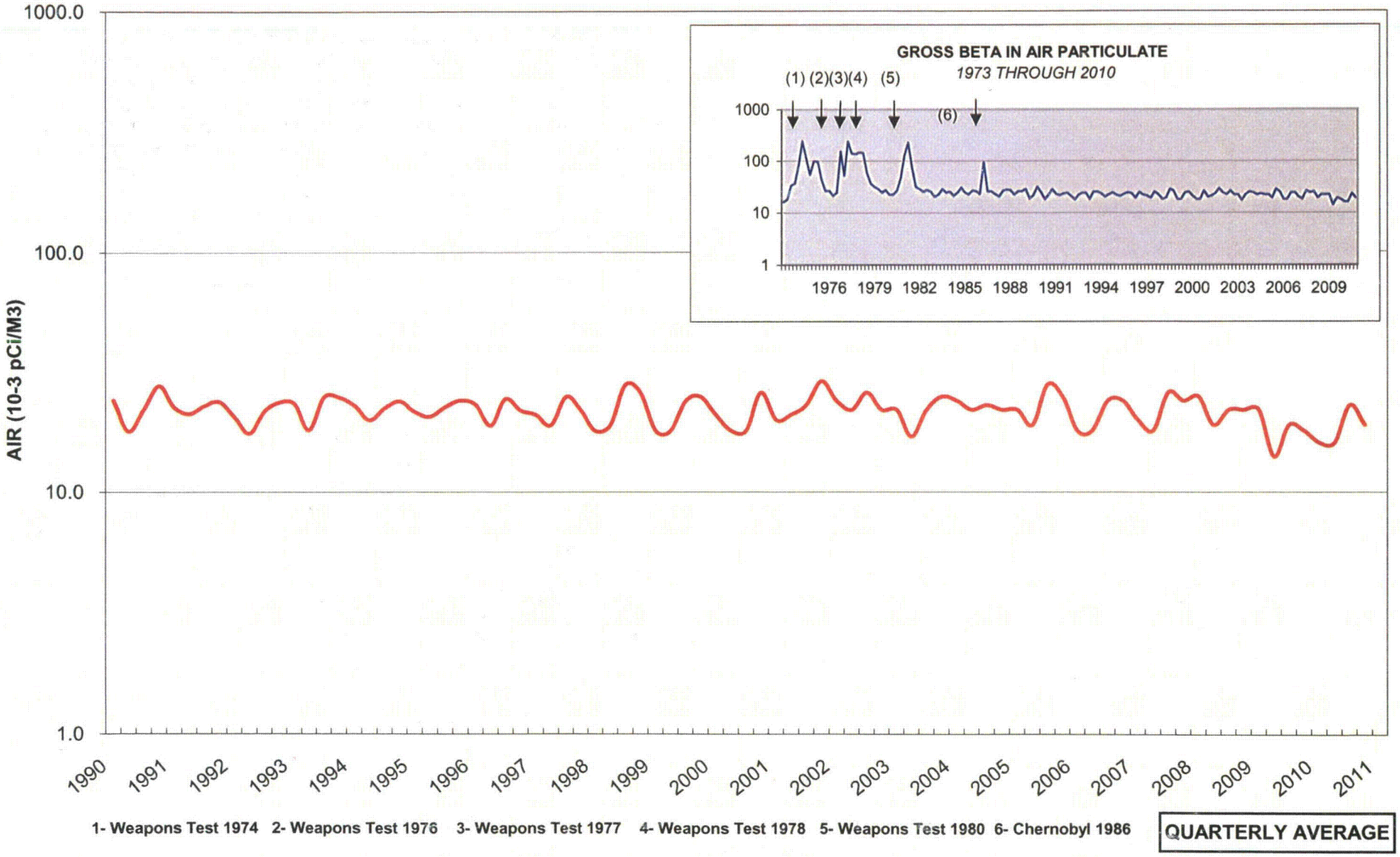
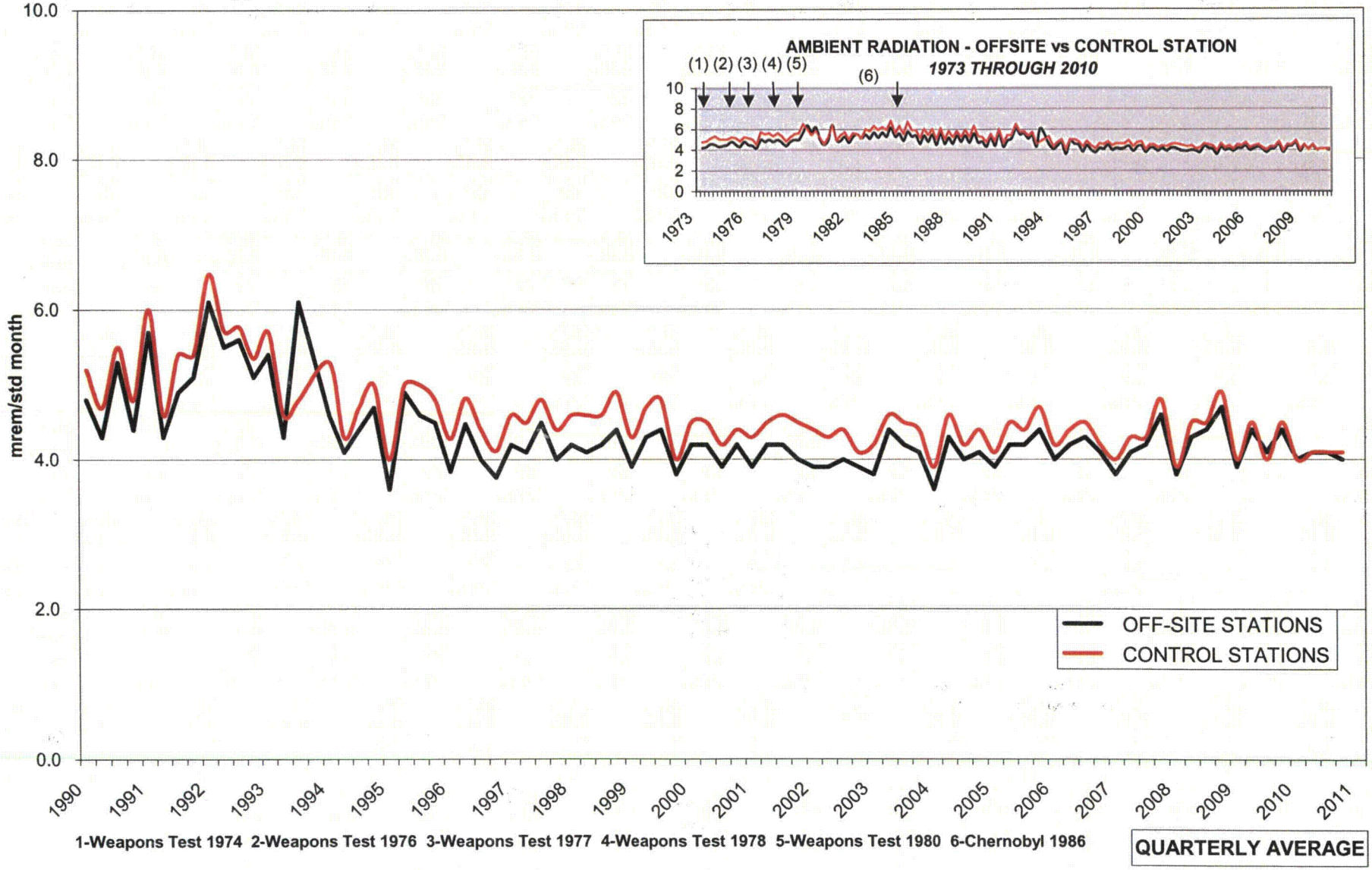


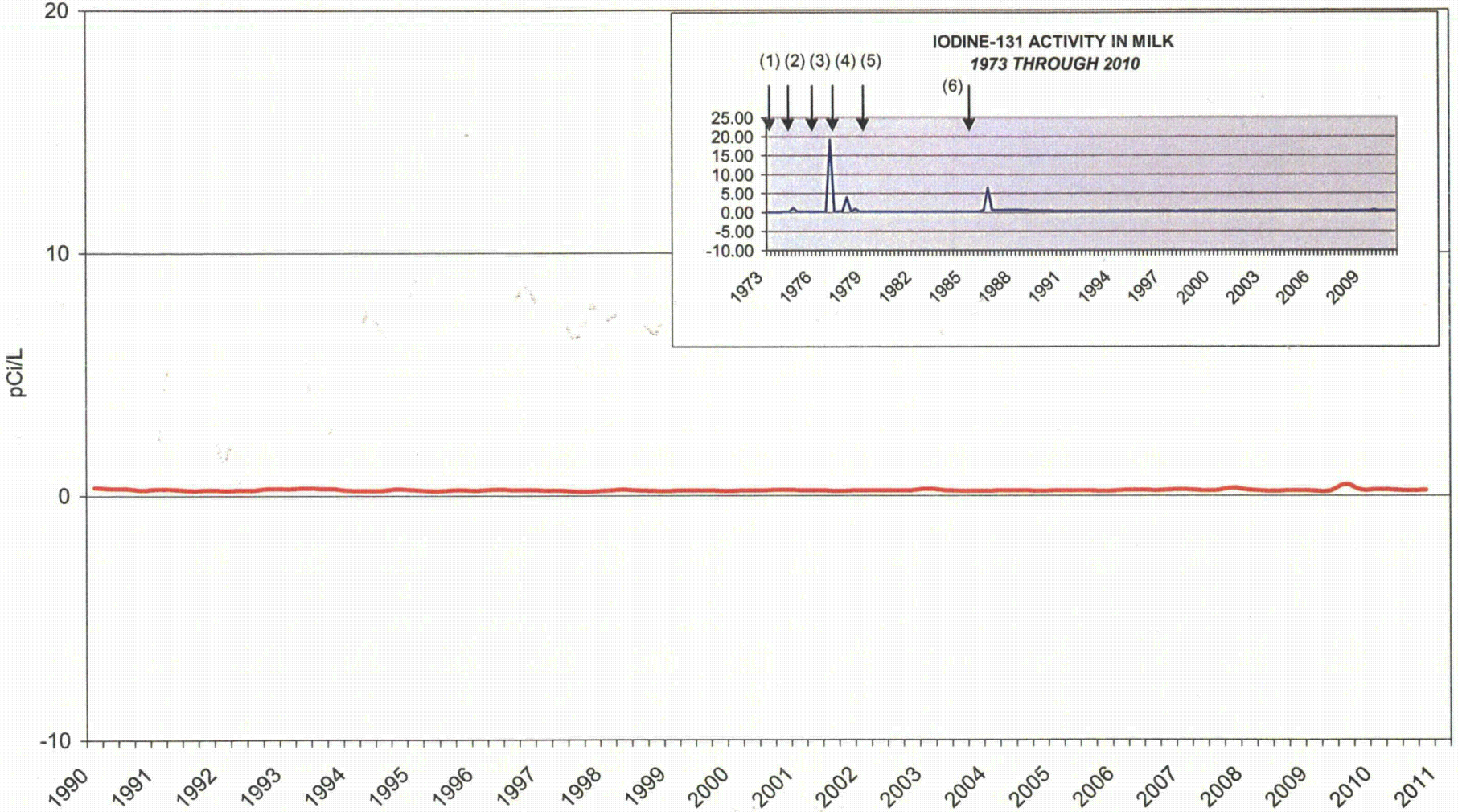
FIGURE 2
AMBIENT RADIATION - OFFSITE vs CONTROL STATION
1990 THROUGH 2010



1-Weapons Test 1974 2-Weapons Test 1976 3-Weapons Test 1977 4-Weapons Test 1978 5-Weapons Test 1980 6-Chernobyl 1986

QUARTERLY AVERAGE

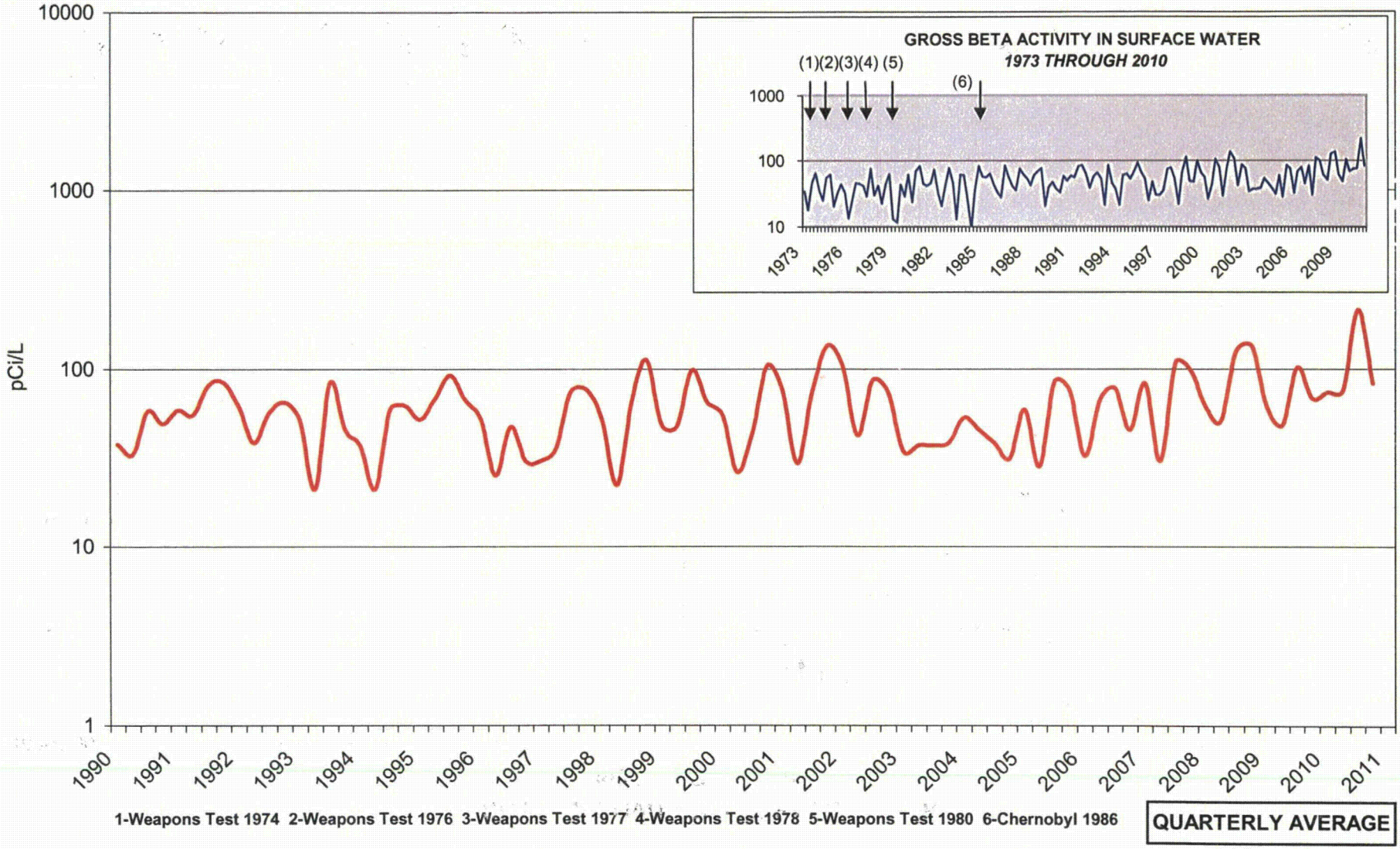
FIGURE 3
IODINE - 131 ACTIVITY IN MILK
1990 THROUGH 2010



1-Weapons Test 1974 2-Weapons Test 1976 3-Weapons Test 1977 4-Weapons Test 1978 5-Weapons Test 1980 6-Chernobyl 1986

QUARTERLY AVERAGE

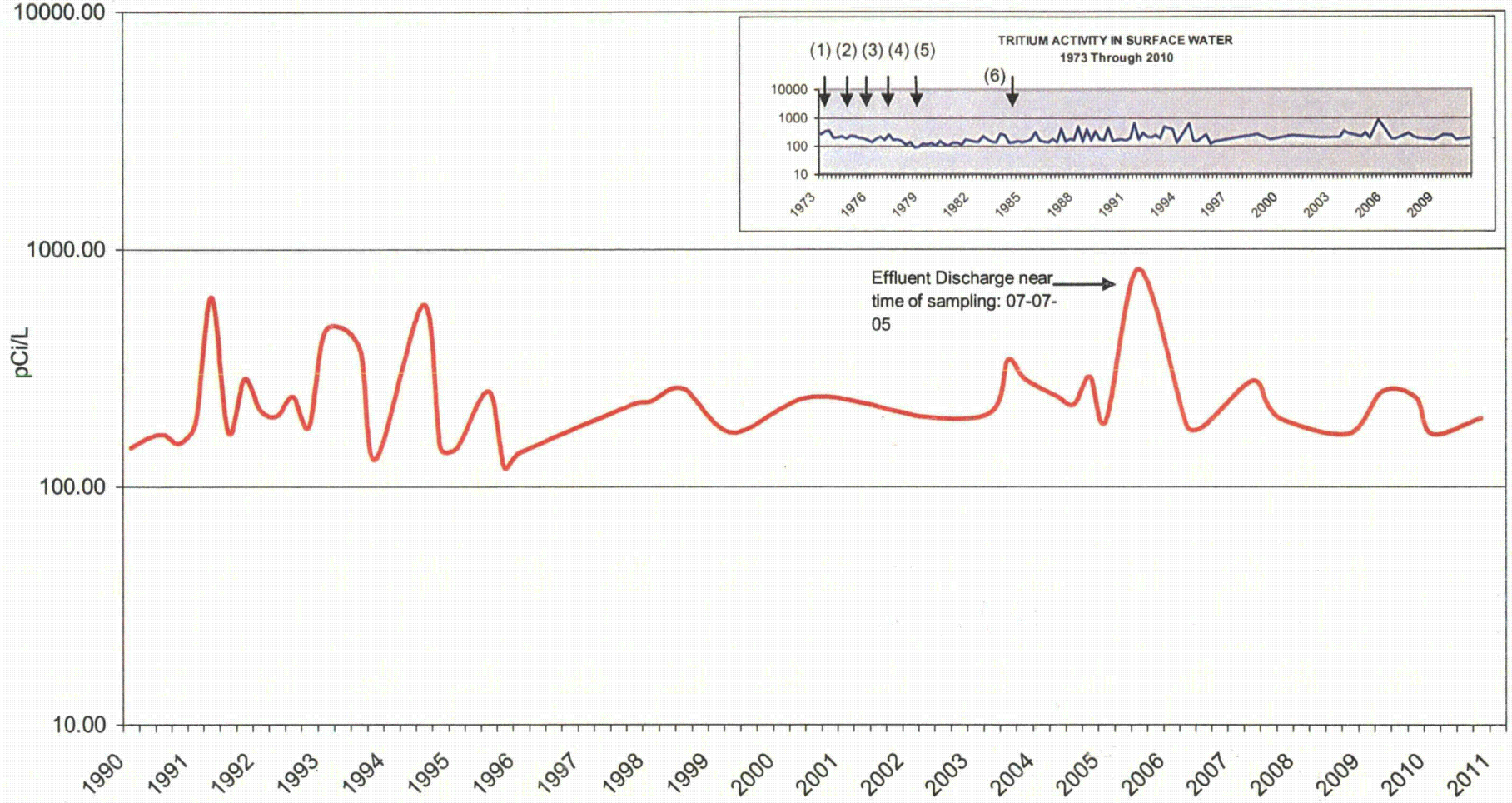
FIGURE 4
GROSS BETA ACTIVITY IN SURFACE WATER
1990 THROUGH 2010



1-Weapons Test 1974 2-Weapons Test 1976 3-Weapons Test 1977 4-Weapons Test 1978 5-Weapons Test 1980 6-Chernobyl 1986

QUARTERLY AVERAGE

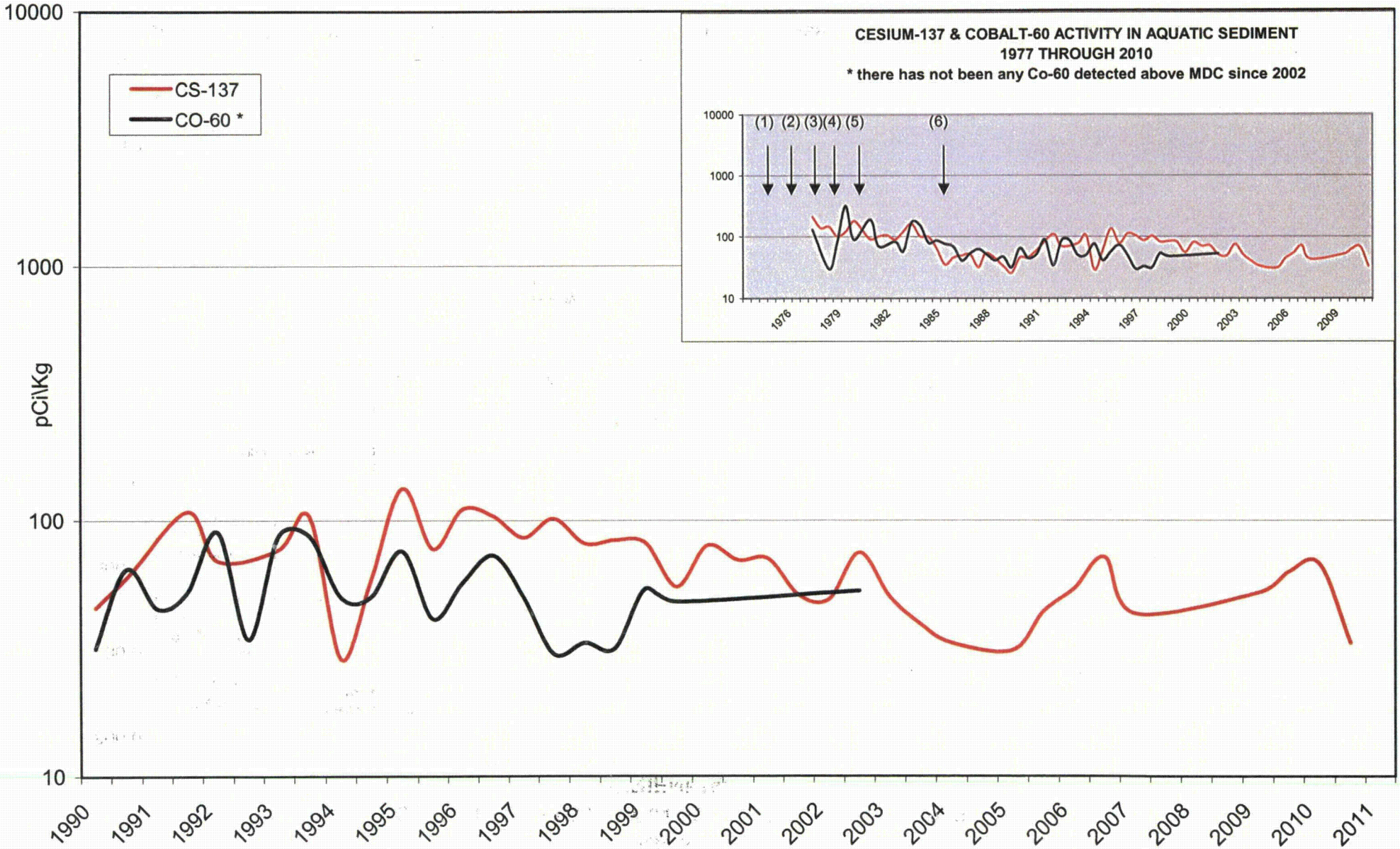
FIGURE 5
TRITIUM ACTIVITY IN SURFACE WATER
1990 THROUGH 2010



1-Weapons Test 1974 2-Weapons Test 1976 3-Weapons Test 1977 4-Weapons Test 1978 5-Weapons Test 1980 6-Chernobyl 1986

QUARTERLY AVERAGE

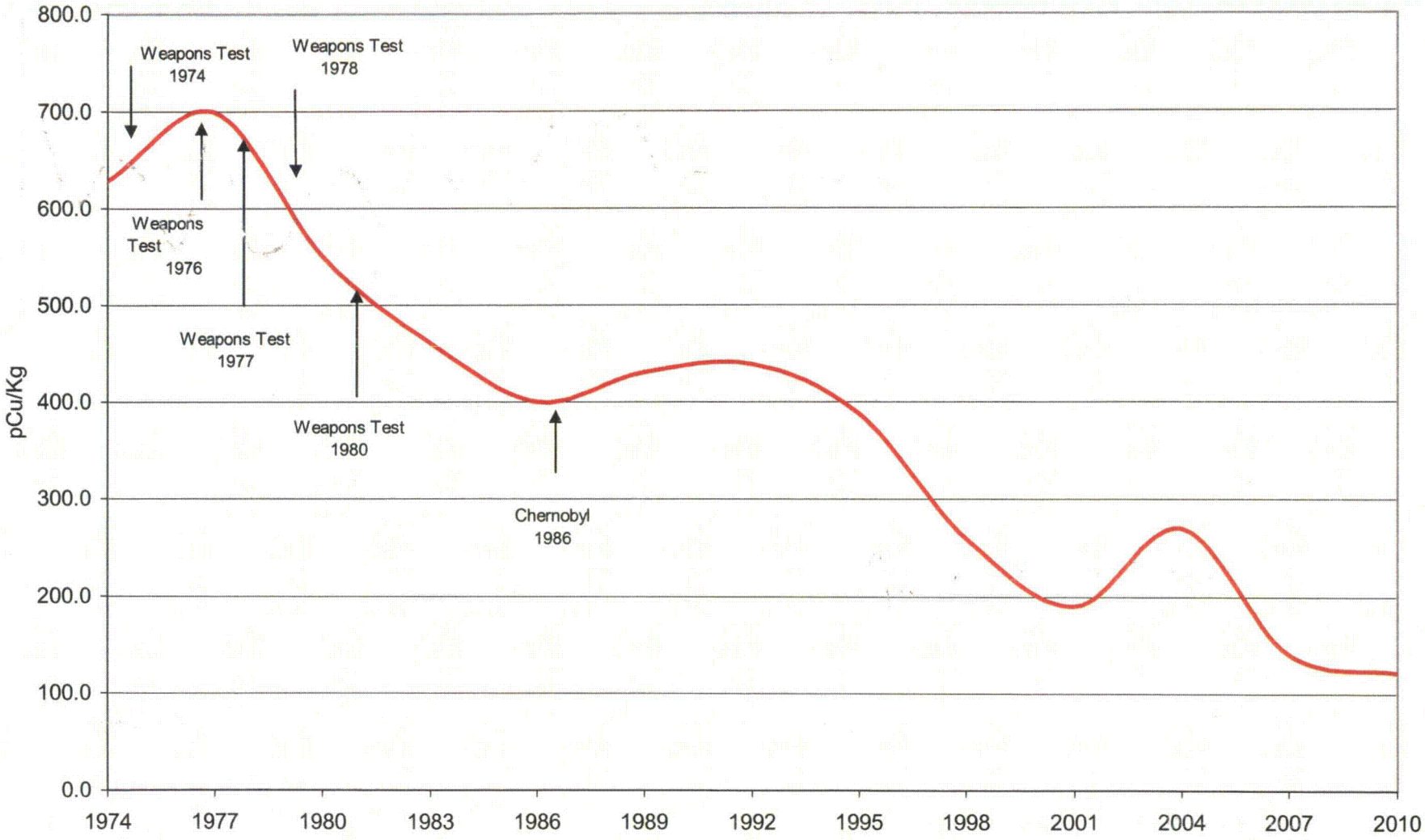
FIGURE 6
CESIUM-137 & COBALT-60 ACTIVITY IN AQUATIC SEDIMENT
1990 THROUGH 2010



1-Weapons Test 1974 2-Weapons Test 1976 3-Weapons Test 1977 4-Weapons Test 1978 5-Weapons Test 1980 6-Chernobyl 1986

SEMI-ANNUAL AVERAGE

FIGURE 7
CESIUM -137 ACTIVITY IN SOIL 1974 THROUGH 2010
(TRIENNIAL)



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

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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.

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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, 2010 to DECEMBER 31, 2010

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	312	6.0	18 (260 /260) (5.1-36)	1F1 5.8 mi N	19 (52 /52) (5.8-36)	19 (52 /52) (6.5-38)	0
					5S1 0.86 mi E	19 (52 /52) (5.2-33)		
	Gamma Be7	24	2.0	79 (20 /20) (60-99)	2F6 7.3 mi NNE	83 (4 /4) (69-96)	78 (4 /4) (65-95)	0
	K-40	24	9.0	12 (20 /20) (8-19)	5D1 3.5 mi E	14 (4 /4) (11-19)	10 (4 /4) (8-10)	0
	RANAT	24	0.6	0.6 (1 /20) (0.6)	1F1 5.8 mi N	0.6 (1 /4) (0.6)	<LLD	0
Air Iodine (10^{-3} pCi/m^3)	I-131	312	8.5	<LLD	-	<LLD	<LLD	0
II DIRECT								
Direct Radiation (mrad/std. month)	Quarterly Badges	202	-	4.1 (178 /178) (2.7-7.2)	16S2 0.60 mi N	6.3 (3 /3) (5.7-7.2)	4.1 (24 /24) (3.3-4.6)	0
III TERRESTRIAL								
Milk (pCi/L)	I-131	80	0.5	<LLD	-	<LLD	<LLD	0
	Gamma K-40	80	32	1400 (60 /60) (1230-1510)	14F4 7.6 mi WNW	1440 (20 /20) (1360-1510)	1350 (20 /20) (1260-1500)	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, 2010 to DECEMBER 31, 2010

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								
Milk (pCi/L)	Ra-Nat	80	5.4	15 (1 /60) (15)	2G3 12 mi NNE	15 (1 /20) (15)	7.6 (1 /20) (7.6)	0
Well Water (pCi/L)	Alpha	12	3.5	<LLD	-	<LLD	No Control Location	0
	Beta	12	2***	2.1 (5 /12) (1.8-2.7)	3E1 4.1 mi NE	2.1 (5 /12) (1.8-2.7)	No Control Location	0
	H-3	12	147	<LLD	-	<LLD	No Control Location	0
	Gamma							
	K-40	12	34	52 (8 /12) (39-71)	3E1 4.1mi NE	52 (8 /12) (39-71)	No Control Location	0
	Ra-Nat	12	2.9	98 (12 /12) (12-189)	3E1 4.1mi NE	98 (12 /12) (12-189)	No Control Location	0
Potable Water (pCi/L)	Alpha	24	2.1	1.2 (4 /24) (0.8-1.8)	2F3 8.0 mi NNE	1.2 (4 /24) (0.8-1.8)	No Control Location	0
	Beta	24	1.0***	4.1 (24 /24) (2.6-7.9)	2F3 8.0 mi NNE	4.1 (24 /24) (2.6-7.9)	No Control Location	0
	H-3	24	147	<LLD	-	<LLD	No Control Location	0
	Gamma							
	K-40	24	34	52 (20 /24) (29-69)	2F3 8.0 mi NNE	52 (20 /24) (29-69)	No Control Location	0
	I-131	24	0.4	<LLD	-	<LLD	No Control Location	0
	Ra-Nat	24	2.9	9 (6 /24) (4-26)	2F3 8.0 mi NNE	9 (6 /24) (4-26)	No Control Location	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SALEM GENERATING STATION DOCKET 50-272/-311
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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)	Gamma							
	K-40	31	70	2790 (19/19) (1680-5910)	1S1 0.57 mi N	5910 (1/1) (5910)	1890 (12/12) (1290-2450)	0
	Ra-Nat	31	13	<LLD	1S1 0.57 mi N	27 (1/1) (27)	<LLD	0
	Be-7	31	46	269 (4/19) (192-351)	10D1 3.9 mi SSW	351 (1/2) (351)	<LLD	0
	Th-232	31	23	59 (1/19) (59-59)	15S1 0.57 mi NW	59 (1/1) (59)	<LLD	0
Fodder Crops (pCi/Kg-wet)	Gamma							
	Be-7	4	83	360 (2/3) (280-440)	3G1 16.5 mi NE	825 (1/1) (825)	825 (1/1) (825-825)	0
	K-40	4	32	3850 (3/3) (3370-4580)	2G3 11.8 mi NNE	4580 (1/1) (4580)	3600 (1/1) (3600-3600)	0
Soil (pCi/Kg-dry)	Gamma							
	Be-7	9	232	228 (3/7) (213-238)	10D1 3.9 mi SSW	238 (1/1) (238)	186 (1/2) (186-186)	0
	K-40	9	70	8860 (7/7) (4730-13100)	14F4 7.6 mi WNW	13100 (1/1) (13100)	7930 (2/2) (6970-8890)	0
	Cs-137	9	22	115 (6/7) (43-217)	10D1 3.9 mi SSW	217 (1/1) (217)	139 (2/2) (122-156)	0
	RANAT	9	60	528 (7/7) (247-962)	14F4 7.6 mi WNW	962 (1/1) (962)	707 (2/2) (592-822)	0
	Th-232	9	8.5	750 (7/7) (430-1160)	14F4 7.6 mi WNW	1160 (1/1) (1160)	796 (2/2) (655-937)	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, 2010 to DECEMBER 31, 2010

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
IV AQUATIC								
Surface Water (pCi/L)	Beta	60	14	123 (42 /48) (6.8-408)	7E1 4.5 mi SE	205 (12 /12) (15-408)	89 (11 /12) (16-239)	0
	H-3	60	149	164 (3 /48) (132-194)	7E1 4.5 mi SE	167 (1 /12) (167)	<LLD	0
	Gamma K-40	60	34	87 (48 /48) (10-175)	7E1 4.5 mi SE	111 (12 /12) (52-175)	79 (12 /12) (37-136)	0
Blue Crabs (pCi/kg-wet)	Gamma K-40	4	59	2185 (2 /2) (1820-2550)	11A1 0.2 mi. SW	2185 (2 /2) (1820-2550)	1840 (2 /2) (1560-2120)	0
	Ra-Nat	4	23	<LLD	12C1 2.5 mi. WSW	20 (1 /2) (20)	20 (1 /2) (20)	0
Edible Fish (pCi/kg-wet)	Gamma K-40	6	59	3543 (4 /4) (3380-3730)	11A1 0.2 mi. SW	3590 (2 /2) (3450-3730)	3230 (2 /2) (2990-3470)	0
	Ra-Nat	6	23	<LLD	12C1 2.5 mi. WSW	23 (1 /2) (23)	23 (1 /2) (23)	0
Sediment (pCi/kg-dry)	Gamma							
	Be-7	14	88	257 (3 /12) (97-439)	16F1 6.9 mi. NNW	338 (2 /2) (236-439)	<LLD	0
	K-40	14	55	7113 (12 /12) (1840-14000)	12C1 2.5 mi. WSW	15050 (2 /2) (13300-16800)	15050 (2 /2) (13300-16800)	0
	Co-60	14	17	<LLD	-	<LLD	<LLD	0
	Cs-137	14	20	50 (2 /12) (32-68)	16F1 6.9 mi. NNW	50 (2 /2) (32)	<LLD	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

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SALEM COUNTY, NEW JERSEY JANUARY 1, 2010 to DECEMBER 31, 2010

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
IV AQUATIC Sediment (pCi/kg-dry)	Ra-Nat	14	5.0	418 (12 /12) (80-801)	7E1 4.5 mi. SE	793 (2 /2) (784-801)	570 (2 /2) (519-615)	0
	Th-232	14	8.1	701 (11 /12) (111-1160)	7E1 4.5 mi. SE	991 (2 /2) (942-1040)	974 (2 /2) (952-996)	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.

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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
15S2	0.61 mi. NNW	39 - 28 - 12	75 - 32 - 32	IDM
16S1	0.57 mi. NNW	39 - 28 - 215	75 - 32 - 432	IDM,VGT
16S2	0.60 mi. N	39 - 28 - 16	75 - 32 - 17	IDM
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)

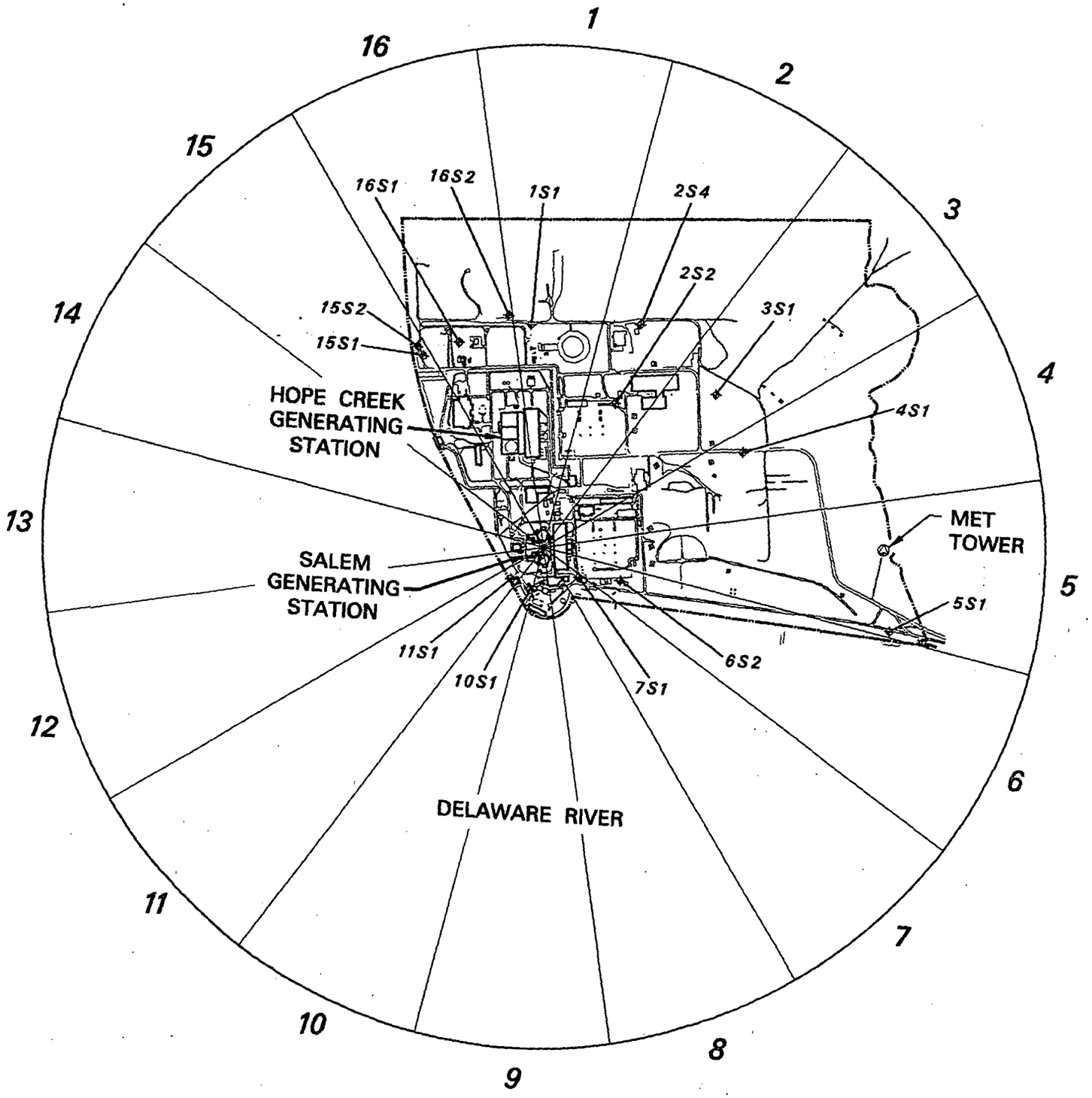
STATION CODE	STATION LOCATION	LATITUDINAL DEG. MIN. FT	LONGITUDINAL DEG. MIN. FT	SAMPLE TYPE
13F3	9.3 mi. W; Redding Middle School, Middletown, Delaware	39 - 27 - 215	75 - 42 - 543	IDM
13F4	9.8 mi. W; Middletown, Delaware	39 - 26 - 857	75 - 43 - 111	IDM
14F2	6.7 mi. WNW; Boyds Corner	39 - 29 - 979	75 - 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



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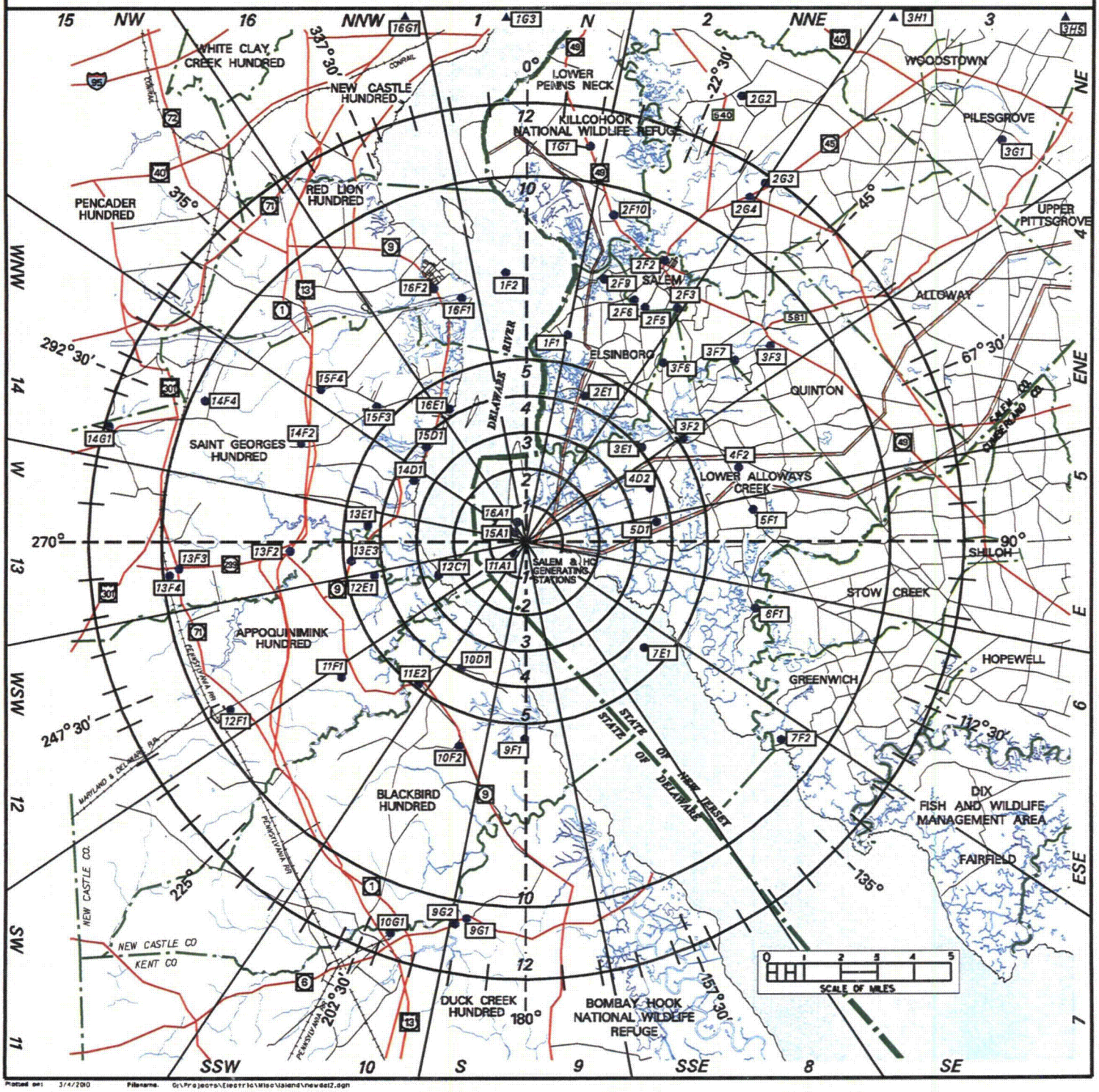
MAP B-2

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



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APPENDIX C

DATA TABLES

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APPENDIX C

DATA TABLES

Appendix C presents the analytical results of the 2010 Radiological Environmental Monitoring Program for the period of January 1 to December 31, 2010.

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Table C-1

2010 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 EMMITTERS-----> Be-7	K-40	Ra-Nat
SA-APT-5S1	12/29/2009	to	3/30/2010	65±7	10±3	<0.3
SA-APT-1F1	12/29/2009	to	3/30/2010	77±6	9±2	0.6±0.2
SA-APT-2F6	12/29/2009	to	3/30/2010	78±7	13±3	<0.3
SA-APT-5D1	12/29/2009	to	3/30/2010	71±7	11±2	<0.3
SA-APT-16E1	12/29/2009	to	3/30/2010	76±6	9±2	<0.2
SA-APT-14G1(C)	12/29/2009	to	3/30/2010	68±7	10±3	<0.4
SA-APT-5S1	3/30/2010	to	6/29/2010	78±4	18±4	<0.6
SA-APT-1F1	3/30/2010	to	6/29/2010	84±4	11±3	<0.4
SA-APT-2F6	3/30/2010	to	6/29/2010	89±4	13±3	<0.3
SA-APT-5D1	3/30/2010	to	6/29/2010	81±5	15±4	<0.3
SA-APT-16E1	3/30/2010	to	6/29/2010	77±4	14±3	<0.4
SA-APT-14G1(C)	3/30/2010	to	6/29/2010	85±4	8±2	<0.3
SA-APT-5S1	6/29/2010	to	9/27/2010	89±4	8±2	<0.2
SA-APT-1F1	6/29/2010	to	9/27/2010	99±5	11±3	<0.4
SA-APT-2F6	6/29/2010	to	9/27/2010	96±5	12±4	<0.4
SA-APT-5D1	6/29/2010	to	9/27/2010	99±6	19±4	<0.5
SA-APT-16E1	6/29/2010	to	9/27/2010	99±5	11±3	<0.3
SA-APT-14G1(C)	6/29/2010	to	9/27/2010	95±5	10±2	<0.2
SA-APT-5S1	9/27/2010	to	12/28/2010	60±4	9±3	<0.3
SA-APT-1F1	9/27/2010	to	12/28/2010	60±4	8±3	<0.3
SA-APT-2F6	9/27/2010	to	12/28/2010	69±5	15±3	<0.5
SA-APT-5D1	9/27/2010	to	12/28/2010	64±4	12±3	<0.2
SA-APT-16E1	9/27/2010	to	12/28/2010	71±4	11±2	<0.2
SA-APT-14G1(C)	9/27/2010	to	12/28/2010	65±4	10±3	<0.3
AVERAGE				79±26	12±6	-

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19.
(C) Control Station

TABLE C-2

2010 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	11±2	14±2	14±2	14±2	13±2	13±2	13±2
	14±2	11±2	13±2	12±2	11±2	13±2	12±3
	20±2	23±2	23±2	21±2	22±2	21±2	22±3
	15±2	12±2	14±2	14±2	13±2	11±2	13±3
	18±2	19±2	20±2	19±2	20±2	19±2	19±1
February	19±2	19±2	23±2	22±2	19±2	20±2	20±3
	13±2	13±2	14±2	14±2	14±2	14±2	14±1
	16±2	14±2	14±2	17±2	17±2	15±2	15±3
	7±2	5±1	6±1	6±2	5±1	5±1	6±1
March	18±2	17±2	17±2	16±2	16±2	17±2	17±1
	14±2	18±2	20±2	20±2	19±2	17±2	18±4
	25±2	19±2	21±2	20±2	22±2	16±2	21±6
	18±2	15±2	19±2	17±2	18±2	18±2	18±3
April	10±2	6±2	10±2	7±2	11±2	10±2	9±4
	23±2	21±2	24±2	21±2	25±2	24±2	23±4
	17±2	14±2	19±2	17±2	17±2	17±2	17±3
	16±2	18±2	18±2	20±2	19±2	24±2	19±5
	15±2	17±2	20±2	18±2	16±2	18±2	17±3
May	17±2	19±2	20±2	20±2	20±2	15±2	18±4
	14±2	13±2	15±2	14±2	13±2	13±2	14±2
	12±2	12±2	12±2	13±2	11±2	11±1	12±1
	15±2	15±2	17±2	18±2	13±2	15±2	15±3
June	15±2	15±2	19±2	16±2	13±2	16±2	16±4
	12±2	8±2	9±2	9±2	10±2	8±2	9±3
	17±2	15±2	14±2	17±2	14±2	12±2	15±4
	23±2	21±2	19±2	25±2	19±2	22±2	21±5

TABLE C-2

2010 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	17±2	17±2	16±2	16±2	14±2	13±2	15±3
	29±3	23±3	23±2	28±3	21±2	22±2	24±7
	23±2	22±2	22±2	24±2	22±2	19±2	22±4
	23±2	23±2	24±2	21±2	22±2	22±2	22±2
	17±2	18±2	20±2	20±2	17±2	17±2	18±3
August	23±2	21±2	23±2	22±2	22±2	19±2	21±3
	24±2	21±2	23±2	20±2	20±2	19±2	21±4
	28±2	29±3	28±2	29±3	25±2	25±2	27±4
	24±2	22±2	25±2	24±2	21±2	21±2	23±3
September	38±3	34±3	36±3	35±2	33±2	33±2	35±4
	17±2	17±2	16±2	17±2	16±2	16±2	16±1
	23±2	23±2	21±2	24±2	21±2	19±2	21±4
	29±2	28±2	31±3	32±3	28±3	27±2	29±4
October	11±2	10±2	11±2	10±2	9±2	11±2	10±1
	20±2	19±2	19±2	20±2	18±2	18±2	19±2
	27±2	26±2	29±2	28±2	28±2	26±2	27±2
	24±2	22±2	23±2	22±2	22±2	23±2	23±2
	16±2	14±2	15±2	15±2	16±2	15±2	15±1
November	10±1	11±2	13±2	13±2	13±2	13±2	12±3
	22±2	21±2	21±2	23±2	22±2	18±2	21±3
	30±2	30±2	32±2	30±2	28±2	27±2	29±3
	26±2	24±2	26±2	29±2	23±2	22±2	25±5
December	16±2	18±2	17±2	16±2	16±2	17±2	17±2
	18±2	16±2	17±2	18±2	15±2	13±2	16±3
	20±2	23±2	21±2	22±2	23±2	22±2	22±3
	17±2	17±2	15±2	15±2	16±2	14±2	15±2
AVERAGE	19±12	18±12	19±12	19±12	18±11	18±11	18±11
					GRAND AVERAGE		18±12

TABLE C-3

2010 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	<6.2	<4	<4.1	<4.4	<3.2	<2.5
	<5.6	<2	<3	<2.5	<1.8	<4
	<2.8	<2.5	<2.2	<1.8	<3.2	<3.5
	<5.6	<3	<2.5	<6	<7.4	<1.9
	<1.7	<2.5	<4.5	<4.8	<2.2	<2
February	<3.6	<2.7	<2.2	<2.3	<4.5	<1.9
	<5	<2.8	<3	<4.2	<2.6	<4.4
	<5.9	<4.7	<4.5	<5	<3.6	<3.8
	<1.9	<5.9	<1.7	<2.9	<3.2	<1.8
March	<3.9	<3	<2.9	<3.2	<4.5	<2
	<3.8	<4	<3.3	<5.4	<3.1	<2.5
	<2.7	<2.1	<3.8	<4.6	<5.5	<2.7
	<4.6	<3.6	<3.2	<4	<1.4	<4.9
April	<5.5	<1.3	<4.4	<4.2	<5.2	<6
	<6	<3.7	<7.1	<6.8	<3.2	<4.3
	<8.6	<4.4	<2.7	<2.6	<5.2	<2.8
	<2.8	<2.1	<2.6	<2.8	<6.5	<2.3
	<2	<2.3	<2.9	<2.4	<7.3	<2
May	<4.6	<7.1	<2.3	<2.5	<3.2	<3.2
	<2.5	<2.2	<6.1	<3	<6.7	<1.7
	<3.3	<2.3	<2.6	<2.6	<5.9	<1.4
	<1.9	<1.7	<2.7	<5.3	<4.1	<7.4
June	<2.2	<2.5	<5	<2.5	<4.7	<2.7
	<3.4	<2.6	<1.9	<3.5	<3.1	<2.4
	<4.7	<4	<2.3	<6.9	<1.9	<3.4
	<4	<3	<3.4	<4.3	<3.6	<3.1

TABLE C-3

2010 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	<3.1	<5.5	<3.7	<3.8	<4.9	<4.6
	<3.8	<6.2	<1.3	<6.1	<4	<3
	<2	<4.6	<8.5	<2.5	<4.7	<5
	<2.3	<3.4	<3.4	<3.2	<3.2	<1.8
	<5.3	<2.2	<3.5	<2.4	<5.7	<3.7
August	<3.7	<2.3	<2.9	<4.3	<1.8	<5.1
	<2.2	<2.2	<2.5	<3.3	<3.8	<1.7
	<3.2	<2	<3.2	<2.1	<5.1	<1.7
	<4.6	<1.4	<2	<2.9	<1.3	<2.8
September	<2	<2.5	<2.4	<1.8	<4.6	<4.3
	<2.6	<3.9	<1.5	<2	<2.2	<2.3
	<5.5	<7.5	<3.3	<2.2	<1.9	<2.9
	<2.2	<4.7	<2.3	<6.5	<4.5	<2.8
October	<3.8	<5.4	<2.4	<2.6	<4.7	<4.7
	<1.8	<3.3	<7.1	<2.8	<4.1	<2.5
	<1.8	<2.3	<2.6	<7.5	<6.1	<2.8
	<2.1	<2.7	<3.3	<6.4	<2.1	<2.6
	<5.9	<2.8	<5.6	<1	<3.3	<3.1
November	<2.3	<5.3	<2.9	<4.9	<4.7	<3.1
	<5.1	<2.4	<3.9	<3.4	<1.7	<1.4
	<4.1	<3	<2.8	<2.3	<3.2	<3.7
	<3.1	<2.8	<1.6	<4.3	<1.7	<3.2
December	<2.1	<5.5	<2.7	<1.2	<3.5	<5
	<2	<5.9	<2	<3.3	<3	<2.2
	<3.5	<2.3	<2.8	<4.1	<2.9	<4
	<3.2	<1.9	<1.9	<4.5	<1.9	<2.4

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

TABLE C-4

2010 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	*** 4th QTR Landauer Results
SA-IDM-1S1	4.7±0.3	4.7±0.6	5.0±0.5	4.7±0.5	4.8±0.3	6.2±1.6
SA-IDM-2S2	4.7±0.6	4.9±0.7	5.0±0.4	4.6±0.4	4.8±0.3	5.6±0.8
SA-IDM-2S4	3.6±0.4	3.8±0.5	3.7±0.4	3.7±0.2	3.7±0.2	5±1.4
SA-IDM-3S1	3.2±0.3	3.1±0.5	3.1±0.3	3.1±0.3	3.1±0.1	4±1.1
SA-IDM-4S1	3.9±0.3	3.7±0.6	3.9±0.4	4.0±0.3	3.9±0.2	4.4±0.7
SA-IDM-5S1	3.5±0.3	3.6±0.5	3.7±0.4	3.7±0.3	3.6±0.1	4.7±1.2
SA-IDM-6S2	5.0±0.4	4.9±0.8	4.7±0.4	4.9±0.4	4.9±0.2	5.6±0.9
SA-IDM-7S1	5.4±0.4	5.2±0.6	5.2±0.6	5.1±0.3	5.2±0.2	6.2±1.2
SA-IDM-10S1	4.7±0.4	3.3±0.5	3.9±0.5	3.6±0.3	3.9±1.2	5.6±2.4
SA-IDM-11S1	4.0±0.4	3.1±0.5	3.7±0.5	3.5±0.6	3.6±0.8	4.4±1.2
SA-IDM-15S1	5.2±0.6	3.3±0.6	3.3±0.3	3.6±0.5	3.8±1.8	4±0.8
SA-IDM-15S2	(1)	4.0±0.5	3.9±0.4	3.9±0.3	3.9±0.1	5.6±1.9
SA-IDM-16S1	4.1±0.4	4.0±0.5	4.1±0.3	4.2±0.3	4.1±0.2	4.7±0.8
SA-IDM-16S2	(1)	5.7±0.8	6.0±0.4	7.2±0.5	6.3±1.6	5.9±1.8
SA-IDM-4D2	4.1±0.4	4.3±0.5	4.4±0.3	4.2±0.3	4.2±0.3	4.7±1.1
SA-IDM-5D1	3.7±0.4	3.8±0.6	3.7±0.4	3.7±0.4	3.7±0.1	5.9±1.7
SA-IDM-10D1	4.2±0.4	4.4±0.6	4.5±0.5	4.4±0.4	4.4±0.2	5.6±2.1
SA-IDM-14D1	3.8±0.3	3.6±0.5	3.8±0.4	3.8±0.3	3.8±0.2	5.9±1.8
SA-IDM-15D1	4.3±0.4	4.3±0.5	4.5±0.4	3.7±1.5	4.2±0.6	5.3±1.4
SA-IDM-2E1	4.1±0.4	4.0±0.5	4.2±0.5	3.9±0.3	4.0±0.2	3.7±0.4
SA-IDM-3E1	3.3±0.3	3.3±0.5	3.6±0.9	3.4±0.4	3.4±0.3	6.5±1.6
SA-IDM-11E2	4.2±0.4	4.3±0.6	4.5±0.6	4.5±0.5	4.4±0.3	5.9±1.7
SA-IDM-12E1	4.5±0.7	4.6±0.6	4.4±0.3	4.4±0.3	4.5±0.2	5.6±1.3
SA-IDM-13E1	3.6±0.8	3.5±0.5	3.5±0.4	3.5±0.3	3.5±0.1	4.7±1.3
SA-IDM-16E1	4.1±0.6	3.7±0.5	4.2±0.5	4.2±0.3	4.0±0.4	5.6±1.9
SA-IDM-1F1	5.3±0.4	5.5±0.7	5.5±0.4	5.5±0.3	5.4±0.2	7.5±2.3
SA-IDM-2F2	3.6±0.4	3.5±0.6	3.4±0.3	3.5±0.3	3.5±0.2	4.7±1.4
SA-IDM-2F5	4.1±0.6	4.2±0.5	4.1±0.3	4.0±0.3	4.1±0.1	5.3±1.3
SA-IDM-2F6	3.9±0.3	4.1±0.7	3.7±0.3	3.8±0.2	3.9±0.3	6.2±2.7
SA-IDM-3F2	3.6±0.4	3.6±0.5	3.7±0.5	3.6±0.3	3.6±0.0	5±1.5
SA-IDM-3F3	3.6±0.4	3.6±0.6	3.6±0.5	3.7±0.3	3.6±0.1	5±1.6
SA-IDM-4F2	3.3±0.5	3.6±0.5	3.6±0.3	3.5±0.4	3.5±0.3	4.7±1.2
SA-IDM-5F1	3.7±0.4	3.7±0.6	3.8±0.3	3.7±0.4	3.7±0.1	5±1.4
SA-IDM-6F1	3.0±0.6	3.1±0.5	3.2±0.4	3.0±0.2	3.1±0.2	3.7±0.6
SA-IDM-7F2	3.2±0.3	2.6±0.4	2.7±0.3	2.8±0.2	2.8±0.5	3.1±0.5
SA-IDM-9F1	4.4±0.4	5.2±1.1	5.1±0.6	4.7±0.6	4.9±0.7	5.3±0.9
SA-IDM-10F2	4.2±0.4	4.5±0.6	4.5±0.4	4.1±0.3	4.3±0.4	5.6±1.1
SA-IDM-11F1	4.1±0.5	4.7±0.6	4.6±0.4	4.3±0.3	4.4±0.5	6.2±2.2
SA-IDM-12F1	4.1±0.4	4.4±0.5	4.3±0.4	4.4±0.4	4.3±0.3	4±0.2
SA-IDM-13F2	4.0±0.4	4.2±0.5	4.1±0.6	4.1±0.3	4.1±0.2	7.5±1.9
SA-IDM-13F3	4.2±0.5	4.3±0.5	4.3±0.4	4.3±0.4	4.3±0.0	5.9±1.9
SA-IDM-13F4	4.6±0.5	4.7±0.6	4.6±0.4	4.7±0.5	4.7±0.1	5±0.3
SA-IDM-14F2	5.1±0.7	4.9±0.8	4.5±0.4	4.6±0.4	4.8±0.5	5.9±1.4
SA-IDM-15F3	4.5±0.6	4.6±0.6	4.7±0.5	4.7±0.4	4.6±0.3	4.6±0.1
SA-IDM-16F2	3.8±0.3	3.9±0.6	3.9±0.5	3.9±0.3	3.9±0.1	5.3±1.6
SA-IDM-1G3 (C)	4.1±0.4	4.0±0.5	4.0±0.3	4.2±0.4	4.1±0.2	5±1.1
SA-IDM-3G1 (C)	4.2±0.5	4.5±0.6	4.4±0.4	4.4±0.3	4.4±0.3	5.3±1
SA-IDM-10G1(C)	4.3±0.4	4.5±0.5	4.3±0.5	4.5±0.3	4.4±0.3	5.9±1.8
SA-IDM-14G1(C)	4.0±0.9	4.4±0.7	4.6±0.6	4.4±0.4	4.3±0.5	5±0.5
SA-IDM-16G1(C)	3.3±0.3	4.1±0.5	3.9±0.6	3.8±0.6	3.7±0.7	5±1.2
SA-IDM-3H1 (C)	4.2±0.5	3.4±0.4	3.4±0.3	3.6±0.3	3.6±0.8	4.7±1.5
AVERAGE	4.1±1.1	4.1±1.3	4.1±1.3	4.1±1.4		
			GRAND AVG		4.1±1.3	

* Results are reported in millroentgen (mR) with the standard month = 30.4 days.
** Quarterly Element TLD results by AREVA - NP Environmental Laboratory.
*** Results by Landauer for informational purposes only. Not included in averages.
(C) Control Station
(1) New TLD locations installed in the 2nd quarter 2010.

TABLE C-5

2010 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	1/17/2010	1/18/2010	<0.3	1330 ±69	<3.8
SA-MLK-13E3	1/17/2010	1/18/2010	<0.2	1330 ±72	<3.8
SA-MLK-14F4	1/17/2010	1/18/2010	<0.3	1420 ±75	<3.3
SA-MLK-3G1 (C)	1/17/2010	1/18/2010	<0.2	1310 ±70	<3.8
SA-MLK-2G3	2/8/2010	2/9/2010	<0.4	1310 ±70	<3
SA-MLK-13E3	2/8/2010	2/9/2010	<0.3	1380 ±73	<3.6
SA-MLK-14F4	2/8/2010	2/9/2010	<0.2	1390 ±74	<3.5
SA-MLK-3G1 (C)	2/8/2010	2/9/2010	<0.5	1420 ±74	<3.9
SA-MLK-2G3	3/14/2010	3/15/2010	<0.3	1290 ±70	<2.8
SA-MLK-13E3	3/14/2010	3/15/2010	<0.2	1290 ±74	<2.9
SA-MLK-14F4	3/14/2010	3/15/2010	<0.3	1470 ±75	<3.8
SA-MLK-3G1 (C)	3/14/2010	3/15/2010	<0.1	1290 ±69	<3.6
SA-MLK-2G3	4/4/2010	4/5/2010	<0.2	1380 ±73	<4
SA-MLK-13E3	4/4/2010	4/5/2010	<0.2	1350 ±73	<3
SA-MLK-14F4	4/4/2010	4/5/2010	<0.3	1360 ±76	<3.1
SA-MLK-3G1 (C)	4/4/2010	4/5/2010	<0.2	1270 ±66	<3
SA-MLK-2G3	4/18/2010	4/19/2010	<0.2	1390 ±74	<3.2
SA-MLK-13E3	4/18/2010	4/19/2010	<0.3	1360 ±71	<3.5
SA-MLK-14F4	4/18/2010	4/19/2010	<0.2	1460 ±75	<4.9
SA-MLK-3G1 (C)	4/18/2010	4/19/2010	<0.3	1330 ±66	<3.6
SA-MLK-2G3	5/2/2010	5/3/2010	<0.2	1420 ±71	<3.8
SA-MLK-13E3	5/2/2010	5/3/2010	<0.3	1390 ±73	<3.5
SA-MLK-14F4	5/2/2010	5/3/2010	<0.1	1450 ±79	<2.9
SA-MLK-3G1 (C)	5/2/2010	5/3/2010	<0.2	1350 ±74	<3.2
SA-MLK-2G3	5/16/2010	5/17/2010	<0.3	1230 ±73	<3.2
SA-MLK-13E3	5/16/2010	5/17/2010	<0.3	1280 ±76	<3.3
SA-MLK-14F4	5/16/2010	5/17/2010	<0.2	1420 ±72	<3.6
SA-MLK-3G1 (C)	5/16/2010	5/17/2010	<0.4	1350 ±68	<4.2
SA-MLK-2G3	6/6/2010	6/7/2010	<0.3	1430 ±72	<4.8
SA-MLK-13E3	6/6/2010	6/7/2010	<0.2	1400 ±74	<3.7
SA-MLK-14F4	6/6/2010	6/7/2010	<0.3	1360 ±76	<2.6
SA-MLK-3G1 (C)	6/6/2010	6/7/2010	<0.2	1500 ±79	<3.2
SA-MLK-2G3	6/20/2010	6/21/2010	<0.3	1380 ±75	<2.9
SA-MLK-13E3	6/20/2010	6/21/2010	<0.2	1340 ±75	<3.2
SA-MLK-14F4	6/20/2010	6/21/2010	<0.2	1490 ±74	<5.2
SA-MLK-3G1 (C)	6/20/2010	6/21/2010	<0.3	1480 ±74	<3.6
SA-MLK-2G3	7/5/2010	7/6/2010	<0.2	1420 ±72	<3.9
SA-MLK-13E3	7/5/2010	7/6/2010	<0.4	1450 ±74	<3.2
SA-MLK-14F4	7/5/2010	7/6/2010	<0.2	1510 ±77	<3.2
SA-MLK-3G1 (C)	7/5/2010	7/6/2010	<0.2	1410 ±76	<3.4
SA-MLK-2G3	7/18/2010	7/19/2010	<0.2	1280 ±75	<3.7
SA-MLK-13E3	7/18/2010	7/19/2010	<0.2	1430 ±72	<3.1
SA-MLK-14F4	7/18/2010	7/19/2010	<0.3	1430 ±74	<5.4
SA-MLK-3G1 (C)	7/18/2010	7/19/2010	<0.2	1260 ±69	<5.2

TABLE C-5

2010 CONCENTRATIONS OF IODINE-131* AND GAMMA EMITTERS** IN MILK

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

STATION ID	SAMPLING PERIOD START	SAMPLING PERIOD STOP ***	I-131	<— GAMMA EMITTERS —> K-40	RA-NAT
SA-MLK-2G3	8/1/2010	8/2/2010	<0.2	1390 ±72	<3.1
SA-MLK-13E3	8/1/2010	8/2/2010	<0.2	1360 ±76	<2.9
SA-MLK-14F4	8/1/2010	8/2/2010	<0.2	1470 ±73	<3.8
SA-MLK-3G1 (C)	8/1/2010	8/2/2010	<0.3	1360 ±72	<5.3
SA-MLK-2G3 (1)	8/15/2010	8/16/2010	<0.3	1410 ±77	<3.3
SA-MLK-13E3	8/15/2010	8/16/2010	<0.3	1470 ±78	<3.2
SA-MLK-14F4	8/15/2010	8/16/2010	<0.2	1390 ±72	<4.8
SA-MLK-3G1 (C)	8/15/2010	8/16/2010	<0.4	1280 ±71	<3.5
SA-MLK-2G3 (1)	9/6/2010	9/7/2010	<0.2	1470 ±73	<3.9
SA-MLK-13E3	9/6/2010	9/7/2010	<0.3	1380 ±72	<3.2
SA-MLK-14F4	9/6/2010	9/7/2010	<0.2	1440 ±77	<2.9
SA-MLK-3G1 (C)	9/6/2010	9/7/2010	<0.2	1380 ±74	<3.1
SA-MLK-2G3	9/19/2010	9/20/2010	<0.2	1330 ±69	<3
SA-MLK-13E3	9/19/2010	9/20/2010	<0.2	1380 ±75	<3.1
SA-MLK-14F4	9/19/2010	9/20/2010	<0.2	1490 ±74	<3.3
SA-MLK-3G1 (C)	9/19/2010	9/20/2010	<0.2	1360 ±72	<3.2
SA-MLK-2G3	10/3/2010	10/4/2010	<0.2	1420 ±79	<2.5
SA-MLK-13E3	10/3/2010	10/4/2010	<0.2	1450 ±74	<3.2
SA-MLK-14F4	10/3/2010	10/4/2010	<0.3	1470 ±73	<3.6
SA-MLK-3G1 (C)	10/3/2010	10/4/2010	<0.2	1380 ±71	7.7 ±3
SA-MLK-2G3	10/17/2010	10/18/2010	<0.2	1340 ±71	<5.2
SA-MLK-13E3	10/17/2010	10/18/2010	<0.3	1350 ±71	<3.8
SA-MLK-14F4	10/17/2010	10/18/2010	<0.2	1470 ±75	<3.2
SA-MLK-3G1 (C)	10/17/2010	10/18/2010	<0.2	1310 ±76	<5.1
SA-MLK-2G3	11/7/2010	11/8/2010	<0.3	1410 ±76	<3.2
SA-MLK-13E3	11/7/2010	11/8/2010	<0.1	1460 ±75	<3.6
SA-MLK-14F4	11/7/2010	11/8/2010	<0.3	1480 ±75	<3.5
SA-MLK-3G1 (C)	11/7/2010	11/8/2010	<0.3	1320 ±71	<3.4
SA-MLK-2G3	11/21/2010	11/22/2010	<0.2	1420 ±73	15 ±3
SA-MLK-13E3	11/21/2010	11/22/2010	<0.3	1330 ±73	<4.2
SA-MLK-14F4	11/21/2010	11/22/2010	<0.2	1380 ±71	<8.8
SA-MLK-3G1 (C)	11/21/2010	11/22/2010	<0.2	1350 ±68	<3.6
SA-MLK-2G3	12/5/2010	12/6/2010	<0.3	1350 ±74	<3.2
SA-MLK-13E3	12/5/2010	12/6/2010	<0.2	1380 ±72	<4.5
SA-MLK-14F4	12/5/2010	12/6/2010	<0.2	1400 ±73	<3.5
SA-MLK-3G1 (C)	12/5/2010	12/6/2010	<0.3	1350 ±71	<3.4
AVERAGE			-	1380 ±130	-

* 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-19

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

(C) Control Station

TABLE C-6

2010 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	1/25/2010	<1.8	<1.4	<131
SA-WWA-3E1	2/22/2010	<1.5	<1.5	<143
SA-WWA-3E1	3/31/2010	<2.4	<1.9	<145
SA-WWA-3E1	4/26/2010	<2.1	<2	<136
SA-WWA-3E1	5/25/2010	<2.1	<2	<139
SA-WWA-3E1	6/30/2010	<3	1.8±1.2	<141
SA-WWA-3E1	7/26/2010	<3.5	2.7±1.4	<141
SA-WWA-3E1	8/31/2010	<2	<1.6	<147
SA-WWA-3E1	9/29/2010	<1.8	1.9±0.9	<133
SA-WWA-3E1	10/25/2010	<1.5	1.8±1	<134
SA-WWA-3E1	11/30/2010	<1.5	<1.3	<132
SA-WWA-3E1	12/28/2010	<2.4	2.3±1.1	<139
AVERAGE		-	-	-

* Management Audit Sample : not required by ODCM.

TABLE C-7

2010 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	1/25/2010	<19	151±6
SA-WWA-3E1	2/22/2010	<14	124±4
SA-WWA-3E1	3/31/2010	54±20	28±2
SA-WWA-3E1	4/26/2010	<20	189±5
SA-WWA-3E1	5/25/2010	39±14	94±4
SA-WWA-3E1	6/30/2010	44±14	12±2
SA-WWA-3E1	7/26/2010	41±12	93±5
SA-WWA-3E1	8/31/2010	53±19	57±4
SA-WWA-3E1	9/29/2010	71±17	96±4
SA-WWA-3E1	10/25/2010	<16	99±5
SA-WWA-3E1	11/30/2010	65±22	145±6
SA-WWA-3E1	12/28/2010	50±19	85±5
AVERAGE		41±19	98±51

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19.
** Management Audit Samples: not required by ODCM.

TABLE C-8

2010 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	1/1-31/2010	<0.9	2.6±0.6	<141
TREATED	1/1-31/2010	<1.3	4.5±0.9	<140
RAW	2/1-28/2010	1.4±0.8	3.4±0.7	<141
TREATED	2/1-28/2010	<0.8	3.3±0.7	<140
RAW	3/1-31/2010	<1.1	2.8±0.7	<144
TREATED	3/1-31/2010	<1.1	3.3±0.8	<145
RAW	4/1-30/2010	<1.1	4.3±0.9	<137
TREATED	4/1-30/2010	<1.5	5.8±1.2	<138
RAW	5/1-31/2010	1.8±1.1	4.4±0.9	<136
TREATED	5/1-31/2010	<1.2	4.3±1	<136
RAW	6/1-30/2010	<1.8	5.6±1	<141
TREATED	6/1-30/2010	<1.7	5±1	<140
RAW	7/1-31/2010	<1.7	3.9±0.9	<140
TREATED	7/1-31/2010	<2.1	7.9±1.2	<141
RAW	8/1-31/2010	<1.1	5±0.8	<146
TREATED	8/1-31/2010	<1	2.9±0.7	<147
RAW	9/1-30/2010	<0.9	4.3±0.7	<134
TREATED	9/1-30/2010	<0.9	4.1±0.7	<134
RAW	10/1-31/2010	0.9±0.6	3.6±0.7	<130
TREATED	10/1-31/2010	0.8±0.6	2.9±0.6	<132
RAW	11/1-30/2010	<0.8	2.6±0.5	<132
TREATED	11/1-30/2010	<0.8	3.3±0.6	<131
RAW	12/1-31/2010	<1.1	4.9±0.7	<141
TREATED	12/1-31/2010	<1.3	4±0.8	<141
AVERAGE				
RAW		-	4±2	-
TREATED		-	4.3±2.9	-
GRAND AVERAGE		-	4.1±2.4	-

* Managemnent Audit Sample: not required by ODCM.

TABLE C-9

2010 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
RAW	1/1-31/2010	<0.3	48±16	<1.8
TREATED	1/1-31/2010	<0.3	60±20	<2.2
RAW	2/1-28/2010	<0.2	52±16	<3
TREATED	2/1-28/2010	<0.3	69±15	<2.3
RAW	3/1-31/2010	<0.2	<16	4.3±1
TREATED	3/1-31/2010	<0.2	<22	<1.5
RAW	4/1-30/2010	<0.3	49±15	<2.4
TREATED	4/1-30/2010	<0.4	58±18	26±3
RAW	5/1-31/2010	<0.3	29±13	<3.2
TREATED	5/1-31/2010	<0.2	58±14	<2
RAW	6/1-30/2010	<0.3	54±18	<1.8
TREATED	6/1-30/2010	<0.1	49±13	<2
RAW	7/1-31/2010	<0.3	54±14	<1.7
TREATED	7/1-31/2010	<0.3	48±15	6.8±1
RAW	8/1-31/2010	<0.2	<19	<1.7
TREATED	8/1-31/2010	<0.2	58±14	<2
RAW	9/1-30/2010	<0.3	<15	6.5±2
TREATED	9/1-30/2010	<0.3	50±12	4±2
RAW	10/1-31/2010	<0.2	68±15	<3.9
TREATED	10/1-31/2010	<0.2	54±15	<3.9
RAW	11/1-30/2010	<0.2	39±14	4.7±2
TREATED	11/1-30/2010	<0.1	43±12	<2.1
RAW	12/1-31/2010	<0.2	35±14	<2.3
TREATED	12/1-31/2010	<0.4	61±15	<2
AVERAGES				
RAW		-	40±34	-
TREATED		-	52±24	-
GRAND AVERAGE		-	46±32	-

* 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-19
*** Management Audit Sample: not required by ODCM.

TABLE C-10

2010 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	Th-232
SA-FPV-2F9	4/26/2010	Asparagus	1840±158	<13	<32	<20
SA-FPV-2G2 (C)	5/10/2010	Asparagus	2200±173	<9.4	<91	<22
SA-FPV-3H5 (C)	5/10/2010	Asparagus	2010±164	<8.6	<34	<19
AVERAGE			2020±360	-	-	-
SA-FPL-3H5 (C)	6/29/2010	Cabbage	2080±186	<9	<42	<29
SA-FPL-2F10	7/22/2010	Cabbage	1910±17	<9.2	<27	<23
SA-FPL-3F7	6/28/2010	Cabbage	2150±182	<13	<27	<21
SA-FPL-10D1 (1)	9/29/2010	Cabbage	2120±174	<7.8	<46	<20
SA-FPL-16S1 (1)	9/30/2010	Cabbage	3370±205	<7.7	<47	<20
AVERAGE			2330±1180	-	-	-
SA-FPL-15S1 (1)	12/28/2010	Kale	5390±274	<11	192±62	59±21
SA-FPL-10D1 (1)	12/28/2010	Kale	5500±273	15±7	351±60	<25
SA-FPL-1S1 (1)	12/28/2010	Kale	5910±283	27±12	315±69	<48
SA-FPL-16S1 (1)	12/28/2010	Kale	5540±272	<11	219±57	<7.9
AVERAGE			5590±450	-	269±152	-
SA-FPV-3H5 (C)	8/9/2010	Corn	2120±160	<8.4	<16	<15
SA-FPV-2F9	7/12/2010	Corn	2140±153	<10	<25	<19
SA-FPV-2G2 (C)	7/26/2010	Corn	2090±153	<11	<19	<18
SA-FPV-9G2 (C)	8/16/2010	Corn	2450±158	<6.5	<22	<14
AVERAGE			2200±340	-	-	-
SA-FPV-2F9	7/13/2010	Peppers	1790±172	<11	<32	<27
SA-FPV-3F7	6/28/2010	Peppers	1680±144	<8.4	<26	<25
SA-FPV-2G2 (C)	7/26/2010	Peppers	1370±131	<8.9	<26	<22
SA-FPV-3F7	7/19/2010	Peppers	1790±128	<9.6	<25	<15
SA-FPV-3H5 (C)	8/9/2010	Peppers	1290±128	<8.4	<24	<20
SA-FPV-2F10	7/22/2010	Peppers	1970±159	<12	<37	<20
SA-FPV-3F6	7/13/2010	Peppers	1700±167	<8.6	<34	<23
SA-FPV-9G1 (C)	8/16/2010	Peppers	1720±140	<6.7	<34	<21
AVERAGE			1660±450	-	-	-
SA-FPV-3H5 (C)	6/29/2010	Tomatoes	1620±129	<6.7	<26	<22
SA-FPV-3F6	8/2/2010	Tomatoes	2160±150	<6	<54	<16
SA-FPV-2F9	7/12/2010	Tomatoes	1810±131	<7	<20	<18
SA-FPV-2F10	7/22/2010	Tomatoes	2180±151	<6	<29	<14
SA-FPV-3F7	7/19/2010	Tomatoes	2010±151	<5	<37	<17
SA-FPV-2G2 (C)	7/26/2010	Tomatoes	1870±152	<5.9	<21	<22
SA-FPV-9G1 (C)	8/16/2010	Tomatoes	1860±143	<6.6	<26	<15
AVERAGE			1930±400	-	-	-
GRAND AVERAGE			2440±2560	-	-	-

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19.
** Management Audit Sample: not required by ODCM.
(C) Control Station
(1) On site and 10D1 cabbage and kale grown from seeds and planted by MTS Personnel.

TABLE C-11

2010 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-2G3	10/25/2010	Silage	440±75	4580±230
SA-VGT-3G1 (C)	10/25/2010	Silage	825±68	3600±175
SA-VGT-13E3	10/25/2010	Silage	280±52	3610±199
SA-VGT-14F4	10/25/2010	Silage	<21	3370±176
AVERAGE			390±670	3790±1080

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19.
** Management Audit Sample: not required by ODCM.
(C) Control Station

TABLE C-12

2010 CONCENTRATIONS OF GAMMA EMITTERS* IN SOIL

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

STATION ID	SAMPLING DATE	Be-7	<----------GAMMA EMITTERS ----------> K-40	Cs-137	Ra-Nat	Th-232
SA-SOL-6S2	9/2/2010	<92	8640±261	48±9	247±18	564±47
SA-SOL-2F9	9/2/2010	<130	6730±208	117±11	572±16	632±33
SA-SOL-5F1	9/2/2010	213±76	4730±196	177±10	501±15	571±39
SA-SOL-10D1	9/2/2010	238±89	9830±290	217±16	448±25	935±46
SA-SOL-16E1	9/2/2010	232±67	10200±263	43±8	656±24	959±42
SA-SOL-13E3	9/2/2010	<80	7420±221	<17	313±14	430±36
SA-SOL-14F4	9/2/2010	<148	13100±329	88±16	962±20	1160±63
SA-SOL-2G3 (C)	9/2/2010	<134	6970±216	122±12	592±16	655±34
SA-SOL-3G1 (C)	9/2/2010	186±82	8890±278	156±13	822±18	937±44
GRAND AVERAGE		-	8500±4840	109±134	568±456	760±486

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19

(C) Control Station

TABLE C-13

2010 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	135±11	92±9	55±8	48±7	164±13	99±101
February	24±8	16±7	11±7	<10	75±12	31±55
March	162±22	37±11	37±10	34±10	144±22	83±129
April	<12	<12	<12	<12	15±8	-
May	53±13	25±10	<14	<14	141±23	73±108
June	94±16	59±12	52±11	24±9	211±27	88±147
July	290±36	186±25	152±23	51±15	313±36	199±213
August	285±38	163±27	108±23	94±20	351±45	200±226
September	307±39	239±35	148±25	113±22	408±44	243±239
October	154±21	69±14	44±10	22±8	302±31	118±229
November	105±16	68±13	41±10	30±9	224±26	94±157
December	33±6	21±5	7±4	10±4	110±13	36±85
AVERAGE	138±213	82±149	57±103	39±67	205±238	
				GRAND AVERAGE		104±202

TABLE C-14

2010 CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER

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

STATION ID	SAMPLING DATE	<--GAMMA EMITTERS--> K-40
SA-SWA-1F2	1/14/2010	84±20
SA-SWA-7E1	1/14/2010	139±20
SA-SWA-11A1	1/14/2010	144±20
SA-SWA-12C1(C)	1/14/2010	80±18
SA-SWA-16F1	1/14/2010	89±15
SA-SWA-1F2	2/4/2010	35±16
SA-SWA-7E1	2/4/2010	99±18
SA-SWA-11A1	2/4/2010	46±12
SA-SWA-12C1 (C)	2/4/2010	68±14
SA-SWA-16F1	2/4/2010	54±17
SA-SWA-1F2	3/2/2010	81±20
SA-SWA-7E1	3/2/2010	134±20
SA-SWA-11A1	3/2/2010	82±22
SA-SWA-12C1(C)	3/2/2010	67±16
SA-SWA-16F1	3/2/2010	75±15
SA-SWA-1F2	4/6/2010	64±16
SA-SWA-7E1	4/6/2010	52±12
SA-SWA-11A1	4/6/2010	51±13
SA-SWA-12C1(C)	4/6/2010	37±15
SA-SWA-16F1	4/6/2010	49±17
SA-SWA-1F2	5/4/2010	61±17
SA-SWA-7E1	5/4/2010	92±21
SA-SWA-11A1	5/4/2010	78±20
SA-SWA-12C1(C)	5/4/2010	65±18
SA-SWA-16F1	5/4/2010	53±16
SA-SWA-1F2	6/2/2010	62±14
SA-SWA-7E1	6/2/2010	82±16
SA-SWA-11A1	6/2/2010	101±20
SA-SWA-12C1(C)	6/2/2010	87±14
SA-SWA-16F1	6/2/2010	96±20
SA-SWA-1F2	7/6/2010	74±14
SA-SWA-7E1	7/6/2010	175±22
SA-SWA-11A1	7/6/2010	142±21
SA-SWA-12C1(C)	7/6/2010	105±19
SA-SWA-16F1	7/6/2010	115±18

TABLE C-14

2010 CONCENTRATIONS OF GAMMA EMITTERS* IN SURFACE WATER

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

STATION ID	SAMPLING DATE	<----------GAMMA EMITTERS----------> K-40
SA-SWA-1F2	8/2/2010	10±17
SA-SWA-7E1	8/2/2010	104±23
SA-SWA-11A1	8/2/2010	127±17
SA-SWA-12C1(C)	8/2/2010	95±16
SA-SWA-16F1	8/2/2010	91±17
SA-SWA-1F2	9/7/2010	85±21
SA-SWA-7E1	9/7/2010	164±20
SA-SWA-11A1	9/7/2010	168±24
SA-SWA-12C1(C)	9/7/2010	136±22
SA-SWA-16F1	9/7/2010	127±22
SA-SWA-1F2	10/6/2010	55±16
SA-SWA-7E1	10/6/2010	78±19
SA-SWA-11A1	10/6/2010	76±20
SA-SWA-12C1(C)	10/6/2010	61±22
SA-SWA-16F1	10/6/2010	79±14
SA-SWA-1F2	11/1/2010	65±16
SA-SWA-7E1	11/1/2010	113±21
SA-SWA-11A1	11/1/2010	103±19
SA-SWA-12C1 (C)	11/1/2010	90±18
SA-SWA-16F1	11/1/2010	57±15
SA-SWA-1F2	12/9/2010	44±18
SA-SWA-7E1	12/9/2010	97±19
SA-SWA-11A1	12/9/2010	46±18
SA-SWA-12C1(C)	12/9/2010	53±16
SA-SWA-16F1	12/9/2010	65±16
AVERAGE		85±69

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19
(C) Control Station

TABLE C-15

2010 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	<131	<132	<127	<133	<133	-
February	<132	<131	<131	<132	<131	-
March	<139	<138	<138	<138	167±86	-
April	<146	<145	<144	<145	<150	-
May	<136	<139	<139	<137	<137	-
June	<132	<132	<132	<132	<132	-
July	<140	<141	<141	<140	<141	-
August	<148	<146	<147	<147	<148	-
September	<146	<147	<149	<146	<146	-
October	194±83	<133	<134	<135	<132	-
November	132±81	<130	<131	<132	<132	-
December	<131	<130	<131	<131	<133	-

TABLE C-16

2010 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	6/18-7/21/10	3380±190	<9.9
SA-ESF-11A1	6/18-7/21/10	3450±190	<9.7
SA-ESF-12C1 (C)	6/18-7/22/10	2990±170	23±9
AVERAGE		3270±500	-
SA-ESF-7E1	9/29-10/18/10	3610±190	<7.7
SA-ESF-11A1	9/29-10/18/10	3730±190	<7.9
SA-ESF-12C1 (C)	9/29-10/19/10	3470±190	<7.3
AVERAGE		3600±260	-
GRAND AVERAGE		3440±510	-

** All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19
(C) Control Station

TABLE C-17

2010 CONCENTRATIONS OF GAMMA EMITTERS* IN CRABS

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

STATION ID	SAMPLING PERIOD	<---- GAMMA EMITTERS ----> (FLESH) K-40	Ra-Nat
SA-ECH-11A1	7/12-15/2010	2550±160	<10
SA-ECH-12C1 (C)	7/12-15/2010	2120±140	20±7
AVERAGE		2340±610	-
SA-ECH-11A1 (1)	8/19-26/2010	1820±140	<10
SA-ECH-12C1 (C) (1)	8/19-26/2010	1560±130	<13
AVERAGE		1690±370	-
GRAND AVERAGE		2010±850	-

* All other gamma emitters searched for were <LLD; Typical LLDs are given in Table C-19.
(C) Control Station

TABLE C-18

2010 CONCENTRATIONS OF GAMMA EMITTERS* IN SEDIMENT

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

STATION ID	SAMPLING DATE	Be-7	<----------GAMMA EMITTERS----------> K-40	Co-60	Cs-137	Ra-Nat	Th-232
SA-ESS-6S2	5/21/2010	97±37	1840±114	<7.6	<6.3	114±8	111±19
SA-ESS-7E1	5/20/2010	<173	13900±385	<7.2	<28	784±21	1040±61
SA-ESS-11A1	5/20/2010	<86	4590±185	<7.4	<4.2	328±13	428±39
SA-ESS-15A1	5/20/2010	<102	4000±170	<4.7	<8.6	246±10	353±28
SA-ESS-16A1	5/20/2010	<94	5830±224	<6.6	<5.8	579±18	789±38
SA-ESS-12C1 (C)	5/20/2010	<89	16800±471	<5.1	<11	519±22	996±58
SA-ESS-16F1	5/20/2010	439±124	14000±385	<11	68±15	643±21	1150±57
AVERAGE			8710±11970	-	-	459±475	695±798
SA-ESS-6S2	12/28/2010	<47	1850±108	<3.7	<2.1	80±10	<18
SA-ESS-7E1	11/22/2010	<73	11200±313	<8.6	<20	801±18	942±48
SA-ESS-11A1	11/22/2010	<65	3990±169	<4.4	<5.5	533±14	729±46
SA-ESS-15A1	11/22/2010	<59	2910±140	<4.7	<6.2	147±8	227±20
SA-ESS-16A1	11/22/2010	<87	7340±272	<16	<6.3	236±30	1160±68
SA-ESS-12C1 (C)	11/22/2010	<75	13300±354	<10	<6.6	615±22	952±47
SA-ESS-16F1	11/22/2010	236±98	13900±372	<12	32±12	520±26	783±50
AVERAGE		-	7780±10100	-	-	419±535	687±828
GRAND AVERAGE		-	8250±10690	-	-	439±488	691±780

* All other gamma emitters searched for were <LLD; typical LLDs are given in Table C-19
(C) Control Station

TABLE C-19

2010 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	-	2.0	15	-	16	-
NA-22	-	0.3	1.2	-	6.2	-
K-40	-	9.0	34	-	32	-
CR-51	-	7.0	14	-	27	-
MN-54	-	0.16	1.4	-	1.9	-
CO-58	-	0.5	1.6	-	2.2	-
FE-59	-	0.76	3.6	-	6.5	-
CO-60	-	0.30	1.6	-	6.2	-
ZN-65	-	0.67	2.8	-	4.9	-
ZRNB-95	-	0.6	3.8	-	5.2	-
MO-99	-	19	300	-	22	-
RU-103	-	0.46	1.2	-	1.9	-
RU-106	-	2.9	9.1	-	16	-
AG-110M	-	0.22	1.7	-	2.8	-
SB-125	-	0.45	3.9	-	5.2	-
TE-129M	-	15	61	-	92	-
I-131	8.5	0.64	3.2	0.43	2.9	0.45
TE-132	-	1.3	2.3	-	6.3	-
BA-133	-	0.22	4.3	-	4.1	-
CS-134	-	0.19	0.8	-	1.5	-
CS-136	-	0.43	3.6	-	2.2	-
CS-137	-	0.28	2.5	-	2.0	-
BALA-140	-	1.1	9.2	-	8.7	-
CE-141	-	0.29	2.0	-	2.7	-
CE-144	-	0.72	8.8	-	15	-
Ra-Nat	-	0.55	2.9	-	5.4	-
TH-232	-	1.1	6.8	-	14	-

TABLE C-19 (Cont'd)

2010 MAPLEWOOD TESTING SERVICES
LLDs FOR GAMMA SPECTROSCOPY

SAMPLE TYPE:	FOOD PRODUCTS GAMMA SCAN	VEGETATION GAMMA SCAN	SOIL GAMMA SCAN	FISH & CRAB GAMMA SCAN	SEDIMENT GAMMA SCAN
ACTIVITY:	pCi/kg WET	pCi/kg WET	pCi/kg DRY	pCi/kg WET	pCi/kg DRY
GEOMETRY:	500 ml	3.5 LITER	500ml	500 ml	500 ml
COUNT TIME:	500 MINS	500 MINS	500 MINS	500 MINS	500 MINS
DELAY TO COUNT:	3 DAYS	7 DAYS	30 DAYS	5 DAYS	30 DAYS
NUCLIDES					
BE-7	46	83	232	58	88
NA-22	12	11	17	6.1	29
K-40	70	32	70	59	55
CR-51	36	31	57	59	91
MN-54	6.5	5.3	20	5.2	24
CO-58	6.5	5.3	9.9	5.2	15
FE-59	13	21	21	14	26
CO-60	13	11	14	7.6	17
ZN-65	15	11	17	10	27
ZRNB-95	10	5.0	32	10	39
MO-99	269	60	5610000 *	442	108000 *
RU-103	4.9	3.4	10	5.8	12
RU-106	58	31	66	46	88
AG-110M	95	43	13	7.1	20
SB-125	18	11	33	8.8	85
TE-129M	260	135	546 *	270	2880 *
I-131	8.7	3.9	43	8.6	70
TE-132	8.9	6.1	1410 *	29	2780 *
BA-133	6.2	4.8	7.0	4.6	10
CS-134	4.7	6.2	6.7	2.9	7.9
CS-136	10	4.9	32	27	41
CS-137	14	11	22	8.6	20
BALA-140	36	12	194	86	165
CE-141	6.4	27	48	7.4	19
CE-144	18	27	48	18	48
Ra-Nat	13	15	60	23	5.0
TH-232	23	38	8.5	23	8.1

* These high non ODCM LLDs for nuclides Molybdenum 99, Tellurium 129M and 132 are the result delays between sample collection and analysis in soil and sediment. The delay between collection and analysis are in place to minimize the impact of Radon and its decay procucts in analysis sensitivity. These nuclides with high LLDs have short half lives, the period utilized for Radon decay increases the LLDs of Molybdenum 99, Tellurium 129M and 132.

TABLE C-20

2010 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	-	3.5	-
Gross Beta	(1)	2.0	14
Tritium	-	147	149

(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 2010 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
03-2010	B739	APT	Beta	119	122	61	0.97	Acceptable
03-2010	H740	WAT	H-3	11646	12000	60	0.97	Acceptable
03-2010	I743	AIO	I-131	84.1	85	61	0.99	Acceptable
06-2010	B747	APT	Beta	78.8	75	60	1.05	Acceptable
06-2010	AB748	WAT	Alpha	105	102	60	1.03	Acceptable
			Beta	258	266	60	0.97	Acceptable
06-2010	I749	AIO	I-131	83.4	80	60	1.05	Acceptable
06-2010	H751	WAT	H-3	9411	9630	60	0.98	Acceptable
09-2010	I754	AIO	I-131	59.2	60	60	1.00	Acceptable
09-2010	H756	WAT	H-3	4014	4020	60	1.00	Acceptable
09-2010	AB757	WAT	Alpha	196	159	60	1.23	Acceptable
			Beta	253	207	60	1.22	Acceptable
12-2010	AB762	WAT	Alpha	359	249	60	1.44	Disagree
			Beta	157	122	60	1.29	Disagree
12-2010	I763	AIO	I-131	80.3	84.2	60	0.95	Acceptable
12-2010	H761	WAT	H-3	8992	9960	60	0.90	Acceptable
12-2010	B765	APT	Beta	76.8	69.9	60	1.10	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
03-2010	G741	WAT	Cr-51	366	364	60	1.01	Acceptable
			Mn-54	205	209	60	0.98	Acceptable
			Co-58	143	144	60	1.00	Acceptable
			Fe-59	124	138	60	0.90	Acceptable
			Co-60	178	185	60	0.96	Acceptable
			Zn-65	260	256	60	1.02	Acceptable
			I-131	71	72	60	0.99	Acceptable
			Cs-134	165	179	60	0.92	Acceptable
			Cs-137	159	159	60	1.00	Acceptable
			Ce-141	254	263	60	0.97	Acceptable
03-2010	G744	MILK	Cr-51	357	361	60	0.99	Acceptable
			Mn-54	207	207	60	1.00	Acceptable
			Co-58	143	143	60	1.00	Acceptable
			Fe-59	143	137	60	1.04	Acceptable
			Co-60	180	183	60	0.98	Acceptable
			Zn-65	255	254	60	1.01	Acceptable
			I-131	74	74	60	1.00	Acceptable
			Cs-134	166	178	60	0.93	Acceptable
			Cs-137	160	158	60	1.01	Acceptable
			Ce-141	255	261	60	0.98	Acceptable
12-2010	G764	WAT	Cr-51	479	455	60	1.05	Acceptable
			Mn-54	129	119	60	1.09	Acceptable
			Co-58	94	90	60	1.04	Acceptable
			Fe-59	145	131	60	1.11	Acceptable
			Co-60	301	300	60	1.00	Acceptable
			Zn-65	186	174	60	1.07	Acceptable
			I-131	103	100	60	1.03	Acceptable
			Cs-134	154	157	60	0.98	Acceptable
			Cs-137	197	186	60	1.06	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
03-2010	G742	Soil	Cr-51	0.638	0.624	60	1.02	Acceptable
			Mn-54	0.384	0.358	60	1.07	Acceptable
			Co-58	0.249	0.247	60	1.01	Acceptable
			Fe-59	0.272	0.237	60	1.15	Acceptable
			Co-60	0.325	0.317	60	1.03	Acceptable
			Zn-65	0.465	0.439	60	1.06	Acceptable
			Cs-134	0.299	0.307	60	0.97	Acceptable
			Cs-137	0.392	0.364	60	1.08	Acceptable
			Ce-141	0.456	0.452	60	1.01	Acceptable
06-2010	G750	APT	Cr-51	641	622	60	1.03	Acceptable
			Mn-54	326	310	60	1.05	Acceptable
			Co-58	186	186	60	1.00	Acceptable
			Fe-59	253	218	60	1.16	Acceptable
			Co-60	350	360	60	0.97	Acceptable
			Zn-65	416	377	60	1.10	Acceptable
			Cs-134	185	231	60	0.80	Acceptable
			Cs-137	288	275	60	1.05	Acceptable
			Ce-141	200	202	60	0.99	Acceptable
09-2010	G755	SOIL	Cr-51	0.870	0.872	60	1.00	Acceptable
			Mn-54	0.466	0.446	60	1.04	Acceptable
			Co-58	0.277	0.275	60	1.01	Acceptable
			Fe-59	0.381	0.340	60	1.12	Acceptable
			Co-60	0.644	0.638	60	1.01	Acceptable
			Zn-65	0.773	0.761	60	1.02	Acceptable
			Cs-134	0.327	0.347	60	0.94	Acceptable
			Cs-137	0.486	0.443	60	1.10	Acceptable
			Ce-141	0.477	0.486	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
04-2010	AB738	WAT	Alpha	25	32.9	16.9 – 42.6	Acceptable
			Beta	36.8	37.5	24.7 – 45.0	Acceptable
04-2010	H7746	WAT	H-3	12187	12400	10800 – 13600	Acceptable
04-2010	I745	WAT	I-131	14.8	26.4	21.9 – 31.1	Disagree
07-2010	G753	WAT	Ba-133	84.8	89.1	75 – 98	Acceptable
			Co-60	79.9	72.8	65.5 – 82.5	Acceptable
			Cs-134	76.6	88.3	72.4 – 97.1	Acceptable
			Cs-137	208.3	210	189 – 232	Acceptable
			Zn-65	121.3	110	99 – 131	Acceptable
7-2010	I766	WAT	I-131	30.2	28.4	23.6 – 33.3	Acceptable
7-2010	AB752	WAT	Alpha	74.8	61.1	32 – 75.9	Acceptable
			Beta	69.5	56.4	38.6 – 63.3	Disagree
10-2010	AB759	WAT	Alpha	48.1	42.3	21.9 – 53.7	Acceptable
			Beta	39.6	36.6	24 – 44.2	Acceptable
10-2010	I758	WAT	I-131	34.3	27.5	22.9 – 32.3	Disagree
10-2010	H760	WAT	H-3	12012	12900	11200 – 14200	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 2010	II	-2.2 +/- 1.1
Panasonic Environmental TLDs	SH 2010	II	-1.5 +/- 1.4

(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 2010 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, 2010 Km (miles)	Nearest Residence Oct, 2010 Km (miles)	Vegetable Garden Oct, 2010 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 2010 Land Use Census results are summarized in the above table. A comparison of the identified locations from the 2010 table with the 2009 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.

In 2009 the stations identified two meat animal farms within 5 miles of the site. These locations are located 4.2 mi NNE and located at 4.6 mi SW. The stations have documented these farms in the corrective action program for tracking and initial dose calculations have been performed. Initial dose calculations indicate that this is not a limiting dose pathway. However, requests for samples from the meat farms were initiated in 2010. Sample collections from the meat animal farms are scheduled for the 2011 reporting year.

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APPENDIX F

RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM (RGPP)

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2010 Radiological Groundwater Protection Program (RGPP)

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2 Salem RGPP Monitoring Wells: Construction Details

2A Salem Unit 2 Tritium Investigation Well Construction Details

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

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2 Salem RGPP Monitoring Well Locations

3- Salem Unit 2 Tritium Investigation Well Locations

4 Hope Creek Tritium Trends: Wells BH, BI, BJ, BK, BM, BN, BQ

5 Salem Tritium Trends: Wells AL, BB, BD, BE, BG, T, U, Y, Z

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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 2010. This report also describes any changes to this program and provides the radiochemical analysis results for groundwater samples collected during the 2010 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, 2008 and 2009 AREORs contained information and detailed descriptions of the RGPP in Appendix F (PSEG 2007, 2008, 2009, 2010). This report contains the results of the 2010 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) was 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 and 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 (BM, BN and BQ) and monthly BH, BI, BJ, BK. 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.

Program Deviations

One deviation from the RGPP sampling program occurred in during 2010. The deviation was for Salem Well BG. The Salem monitoring well BG, which is scheduled to be sampled semi-annually, was collected as required. The semi annual sample (fall collection date) should have received the following analyses tritium, gamma and total strontium and iron-55. The tritium, gamma and strontium sample was sent to offsite laboratories (Maplewood Testing Services and Teledyne Brown Engineering). However, due to an oversight error, the request for iron-55 analysis was not completed. The issue has been documented in the site corrective action program and the well has been scheduled for iron-55 analysis in the spring of 2011.

Deviations for sample analysis were as follows,12 gamma emitter LLD's were not met for Barium-Lanthium 140 (BA-LA-140). The LLDs missed for BA-LA 140 occurred for the following wells BA, BB, BC, BD, BE, BF, BU, AL, T, U, Y and Z. The cause for the missed LLDs was an extended hold time between sample collection and analysis. This was attributed to assessment of potential ground water impact during the Salem Unit 2 Vent condensation release. The missed LLDs have been entered in to the corrective action program, the wells are scheduled for semi-annual gamma analysis in Spring 2011.

Installation of New Wells at Salem and Hope Creek Stations

In 2010, 12 new wells were installed at Salem and Hope Creek Stations. These wells were installed as part of two site investigations.

At Hope Creek Station, two wells were installed in November 2010. These wells BY and BZ were installed as part of the 2009 Tritium Investigation. The first well is located at the North East corner of the Hope Creek Administration Building

(BY). The second well is located to the east of the Condensate Storage Tank dike (BZ). Well specifications can be found in Table 1. Details of investigation can be found in the Investigation section. Sample collection is scheduled to begin in the first quarter of 2011.

In response to the Salem Unit 2 tritium release from the Vent to the storm drain system, and in an effort to understand the potential impact to groundwater, ten new investigation wells were installed at Salem Generating Station; DA, DB, DC, DD, DE, DF, DG, DH, DI, and DJ. These wells are located around Salem Unit 2 in areas surrounding the Fuel Handling Building, containment, and mainsteam mixing bottle. These wells were installed in November 2010 as part of the continued investigation for Salem Unit 2 event, see Table 2a. Salem Unit 2 Tritium Investigation Well Construction Details. A map showing the locations of the wells can be found in Figure 3 Salem Unit 2 Tritium Investigation Well Locations. Details of investigation can be found in the Investigation section. Sample collection is scheduled to begin in the first quarter of 2011.

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) and iron-55 (bi-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 Strontium (Sr) and Iron-55 (Fe-55) 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 detectablity 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 2010, the RGPP analytical sensitivities for 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 2010 all LLDs for Co-58 and Fe-59, gamma emitters, strontium 89/90 and iron-55 LLDs were met.

During 2010, 20 tritium LLD's were not met. Of these, six were missed, but by less than 10 percent of the LLD (201 to 216 pCi/L) due to slightly higher background levels. The remaining 14 missed RGPP tritium LLDs were the result of a conscious decision to use 30 minute count times, compared to the typical 150 minute count time, to permit quick turnaround of results while assessing potential ground water impact during the Salem Unit 2 Vent condensation release (see Investigation section below).

During 2010, 12 gamma emitter LLD's were not met for Barium-Lanthium 140

(BA-LA-140). The LLDs missed for BA-LA 140 occurred for the following wells BA, BB, BC, BD, BE, BF, BU, AL, T, U, Y and Z. The cause for the missed LLDs was an extended hold time between sample collection and analysis. This was attributed to assessment of potential ground water impact during the Salem Unit 2 Vent condensation release (see Salem Investigation section below).

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 2010 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, total Strontium (Sr) and Iron-55 analysis.

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 developed 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. 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. Table 2A for Salem Unit 2 Tritium Investigation Wells has been created to reflect the 10 new monitoring wells installed in November 2010. 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 2010 Groundwater Tritium Analytical Results for Hope Creek Generating

Station are shown in Table 4A. The 2010 Groundwater Tritium Analytical Results for Salem Generating Station are shown in Table 4B.

A. Groundwater Results

Samples were collected from RGPP monitoring wells during 2010 in accordance with the station and MTS procedures for the radiological groundwater protection program.

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 total strontium and iron-55. 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 six RGPP monitoring wells at the Hope Creek site. The tritium concentrations measured at wells BH, BI, BJ, BK, BM, and BN ranged from <200 pCi/L to 1408 pCi/L during 2010 as shown on Table 4A.

Tritium was detected at well BH in the range of <200pCi/L to 1408 pCi/L. Well BH is located down gradient of the Condensate Storage Tank (CST) near the southwest protected area boundary and is a perimeter well. Tritium was detected at Well BI in the range of 234 pCi/L 662 pCi/L. Well BI is located due west of the reactor containment and is a sentinel (source) well for facilities and buried piping. Tritium was detected at Well BJ in the range of 333 pCi/L to 1,014 pCi/L. Well BJ is also located down gradient of the CST and is a sentinel (source) well for the CST. Tritium was detected at Well BK in the range of 206 pCi/L to 1,137 pCi/L. Well BK is also located due west of the reactor containment and is a perimeter

well. Tritium was detected in well BM in the range of <200 pCi/L to 254 pCi/L. Well BM is located west of the abandoned Unit 2 reactor building and is a sentinel (source) well for facilities and buried piping. Tritium was detected at Well BN in the range of <200 pCi/L to 338 pCi/L. Well BN is located northeast of the Materials Control Center and is a sentinel (source) well for the Auxiliary Boiler building and buried piping.

In accordance with station procedures, a sample analysis result that is above the administrative limit is re-sampled for a confirmatory analysis. The administrative limits for all station wells were based on limited data, gathered jut after the wells were installed in 2006. The station is evaluating the potential cause(s) for the elevated levels and is considering revising the administrative limits to better reflect baseline tritium levels at each location.

These low concentrations of tritium were evaluated and determined to not be indicative of an adverse trend as Shown in Figure 4- Hope Creek Tritium Trends: Wells BH, BI, BJ, BK, BM, BN, and BQ. There were no analytical results for which a Courtesy Communication (greater than 3,000 pCi/L tritium) was required as part of the RGPP. The tritium concentrations in these wells are being monitored and trended. Details of the Hope Creek Tritium Investigation can be found in the Investigation Section.

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 eight RGPP monitoring wells at the Salem site. The tritium concentrations measured at wells AL, BB, BC, BD BE, BG, U, and Z ranged from <200 pCi/L to 1,479 pCi/L during 2010.

Tritium was detected at Well AL in the range of 583 pCi/L to 1048 pCi/L. Well AL is located south of the Salem Unit 1 reactor building and is a sentinel (source) well. Tritium was detected at Well BB in the range of <200 pCi/L to 307 pCi/L. Well BB is located along the shoreline just north of the Circulating Water Intake Structure and is a perimeter wells. Tritium was detected in Well BC in the range of <200pCi/L to 737 pCi/L. Well BC is a sentinel (source)/perimeter well located southwest of Facilities, Refueling Water Storage Tank, Auxiliary Feedwater Storage Tank and Primary Water Storage Tank (RAP) tanks and Piping. Tritium was detected in Well BD in the range of <200 pCi/L to 929 pCi/L Well BD is located to the west of Salem Unit 2 reactor building and is a sentinel (source) well for Facilities, RAP tanks, piping. Tritium was detected at Well BE in the range of 521 pCi/L to 1261 pCi/L. Well BE is located to the west of Salem Unit 2 reactor building and is a perimeter well. Tritium was detected at Well BG in the range of 446 pCi/L to 1479 pCi/L. Well BG is located northwest of Salem Unit 2 reactor building and is a perimeter well. Tritium was detected at Well U in the range of <200pCi/L to 420 pCi/L. Well U is located north of Salem Unit 2 reactor building and is a sentinel (source) well for the House Heating Boilers. Tritium was detected at Well Z in the range of 201 pCi/L to 812 pCi/L. Well Z is located west of Salem Units 1&2 reactor buildings and is a perimeter well.

These low concentrations of tritium were evaluated and determined not to be indicative of an adverse trend as shown in Figure 5 – Salem Tritium Trends: Wells AL, BB, BC, BD, BE, BG, U and Z. There were no analytical results for which Courtesy Communication (greater than 3,000 pCi/L tritium) was required as part of the RGPP. The tritium concentrations in these wells are being monitored and trended.

There was one event for which a Courtesy Communication was performed to NJDEP-BNE, NRC for an event which occurred on March 25, 2010 at Salem. During this event the station identified a leak from the Steam Generator Blow Down Line where it enters the Non-Radioactive Waste Basin. A discussion of the event and subsequent investigation can be found in the Investigations section.

There was one event for which a Voluntary Communication was performed to NJDEP-BNE, NRC, American Nuclear Insurers and Nuclear Energy Institute for an event which occurred on April 6 2010 at Salem Unit 2. During this event the station identified tritium in storm drain catch basin at 1,200,000 pCi/L. A discussion of the event and subsequent investigation can be found in the Investigations section.

Gamma Emitters

No plant-related gamma emitters were detected in any RGPP well sampled in 2010. Naturally occurring Potassium-40 was detected in several of the wells sampled during 2010.

Strontium

Total strontium, including Sr-89 and Sr-90, was not detected in any RGPP well sampled during 2010.

Iron

Iron 55 (Fe-55) was not detected in any RGPP well sampled during 2010. Salem RGPP well BG was not sampled for Fe-55 due to equipment problems at the end of 2010. The site has scheduled this well for iron-55 analysis in the spring of 2011.

B. Investigations

Hope Creek Unit 2 Emergency Sump Investigation

As discussed in the 2008 and 2009 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 Hope Creek RGPP Wells Investigation

The station increased the sampling frequency of some of the Hope Creek and Salem RGPP wells during 2010. Several locations are under investigation for the fluctuating tritium concentrations.

Specifically, the station placed four of the Hope Creek RGGP wells on an increased sampling frequency from March 2010 through December 2010 (Station wells BH, BI, BJ, and BK were placed on a monthly sampling campaign). (Note: In February 2010 Well BK could not be sampled as planned due to the well being covered by snow. The inability to sample was documented in the corrective action program and monthly sampling was resumed in March 2010) 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 is on going since the summer of 2010.

In addition the station has completed a geoprobe study. A geoprobe is a direct push machine that uses both static force and percussion to advance sampling and logging tools into the subsurface. Direct Push refers to tools and sensors that are "pushed" into the ground without the use of drilling to remove soil or to make a path for the tool. Using a geoprobe direct push machine, the station's intention was to obtain soil cores and groundwater samples to depths of the existing RGPP wells, up to 45 feet below ground surface (ft bgs). The study was established to determine if the elevated tritium concentrations could be seen in groundwater near the RGPP wells of interest and SSCs with a reasonable probability of carrying radioactive liquids.

The station successfully installed 6 geoprobes. The geoprobe samples did not confirm the presence of tritium in groundwater at the same levels as seen by the RGPP wells. Five of the geoprobes were installed in the vicinity of the four RGPP wells which have demonstrated elevated tritium levels (Wells BH, BI, BJ, and BK). The geoprobes were placed up gradient of the wells of interest, some as close to the well as 10 feet. In each case the geoprobes were unable to confirm the presence of tritium at the levels being seen in the RGPP wells. One location, near the Condensate Storage Tank (CST) valve pit, identified tritium, at 401 pCi/L at 10 ft bgs. This level was nearly half the value of the BJ well (closest to the geoprobe site). The station decided to convert this location to a permanent well, identified as RGPP well BZ, installed in November 2010.

One geoprobe was installed in vicinity of the Unit 2 Emergency Sump which had seen groundwater seeping into the room in which the sump is located. During the Unit 2 Emergency Sump FMCT investigation (described above), the tritium

concentration of the water seeping into the walls was approximately 6,006 pCi/L. The geoprobe, located approximately 5-10 feet from the north east corner of the Hope Creek administration building, identified tritium at 919 pCi/L. The station decided to convert this location to a permanent well, identified as RGPP well BY, installed in November 2010.

In addition, the station has evaluated the potential for tritium recapture, Specifically in those RGPP wells which are designed as vault (flush mounted wells). These wells are installed below ground surface. The vault which protects the well shaft can become flooded when significant rain events occur, this creates the potential for the run-off to collect in the vault. After review with geohydrologist, Arcadis, the (flush) mounted wells BH, BI, BJ, BK, BL, BM and BQ were converted to stick mount (above ground level) in December 2010. The rational behind this is that the vault mounted wells are in low lying areas which collect rainwater runoff. Some tritium, which is release as a permitted discharge via the Salem and Hope Creek plant vents, may be re-captured during rain events, and then washed into the vaults of the RGPP wells. Conversion of these wells has removed the vaults and places the height of the well opening at approximately 3-4 feet above ground surface, thus removing the pooling of rainwater in the vault and around the well shaft.

The FMCT is on going, with next steps focusing on a re-evaluation of the PSEG Site Investigation Report. This report was developed by PSEG in 2006 and details the hydro-geological model and water flow paths at the PSEG site. It takes into consideration groundwater movement in relation to systems, structures and components which contain or have the potential to contain radioactive material and uses this information to determine the placement of RGPP wells. The SIR is periodically evaluated to ensure the site is monitored effectively for impacts to ground water.

Elevated Tritium Results in Salem RGPP Wells

Salem RGPP wells experienced elevated tritium levels during the 2010 sampling campaign. Well BG had sample analysis results of 1,479 pCi/L during the November 2010 sampling campaign. Other wells with analysis results over 1000 pCi/L included wells AL and BE. 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 in October 2009, replacing the well caps with new sealing well caps in February 2010, and a precipitation study initiated in the spring of 2010 and is ongoing. The station is also scheduled for a re-evaluation of the PSEG Site Investigation Report. This report was developed by PSEG in 2006 and details the hydro-geological model and water flow paths at the PSEG site. It takes into consideration groundwater movement in relation to systems, structures and components which contain or have the potential to contain radioactive material and uses this information to determine the placement of RGPP wells. The SIR is periodically evaluated to ensure the site is monitored effectively for impacts to ground water.

Salem Steam Generator Blow Down Leak

On March 8th 2010 a condition report was generated identifying water leaking from an underground pipe at the east end of the Salem Non-Radioactive Waste Basin (NRWB). Samples were collected an analysis results did not show evidence of being Steam Generator Blow Down Water. The leak was investigated to identify the cause.

On March 22, 2010 samples were again collected. This time the analysis results showed evidence of the water being from the Steam Generator Blow Down Line (SGBD), with tritium concentrations of 4,500 pCi/L. A confirmatory sample was collected on March 23 and found to contain 10,500 pCi/L of Tritium. All water was seen above ground, on the asphalt surface, this was considered a non-reportable

spill. Water was collected and pumped into the Non-Radioactive Waste Basin (a permitted discharge point under the Station NRC license) and repairs began to correct the leak in the pipe.

On March 26th at 2030, after initial repairs were complete, the shift manager notified the station and site Environmental that the leak was still active. This was evidenced by traces of water, containing chemicals and tritium, which was detected in the environment, around the pipe leak. After a determination by Environmental the leak was called into the NJ-DEP-BNE and the USNRC as a spill. Support organizations were called to the site to expedite the clean up within 24 hours. A second round of repairs were initiated and completed. During excavations for this leak, the station performed an extent of condition on the exposed piping, supporting the NEI 09-14 Buried Piping Initiative. The extent of condition identified through guided wave, ultrasonic testing that the pipe showed signs of degradation. These findings were captured and being addressed in the station's corrective action program.

Salem Unit 2 Tritium Event

On April 6, 2010, a steam relief valve on the auxiliary steam system activated releasing auxiliary steam in the vicinity of storm drain catch basin (CB) 18. In accordance with our practice, at 0830, a sample was collected from storm drain CB 18 to test for ammonia, hydrazine, pH and tritium due to their potential presence in steam. Tritium may be present in steam up to 30,000 pCi/L. No ammonia or hydrazine was detected and pH was neutral. Tritium, was analyzed at 1,200,000 pCi/L. A confirmatory sample was collected and upstream and downstream storm drain catch basins and manholes were sampled and analyzed for tritium. The storm drain catch basins and manholes all accumulate in down stream manholes. Water from upstream catch basins enters Manhole 7 and then proceeds to Manhole 8 which is the last discharge point before the Delaware River. The concentration of tritium on April 6 at manhole 7 was 3,450 pCi/L and at

manhole 8 was less than 3,000 pCi/L. At 2230 on April 6 inflatable plugs were installed in the storm drain system to isolate the affected catch basins (CB 17,18 and 19) from the storm drain system to terminate any potential discharge. Collection of water in these catch basins was directed to temporary tanks for retention and proper disposal via a licensed outfall after testing in accordance with the USNRC license and station procedures. The tritium was contained to the storm drain system and there was no indication of any discharge to the ground.

Investigation into the source of the elevated tritium in the catch basins was immediately initiated and the failure mode causal table method was used to identify all possible sources of tritium and evaluate their potential as a contributing source. Analysis of the water sources identified that the tritium was entering the storm drain system through auxiliary building roof drain line into CB 17. The roof drain line was plugged to further isolate the source. On April 23, 2010, leakage was observed on the auxiliary building roof at the expansion joint of the plant vent exhaust line. A sample was collected and determined by analysis to contain 9,700,000 pCi/L of tritium.

The plant ventilation exhaust line is designed to carry ventilation exhausted from the fuel handling building, auxiliary building and containment building to the top of the containment for discharge under the NRC license conditions. This exhaust is routinely monitored for monitored for radionuclides. The system is designed with a drain in the plant ventilation exhaust line to collect any humidity that condenses as the plant vent exhaust line exterior is exposed to ambient conditions, and transport that condensation to the radioactive liquid waste system. The investigation identified that the designed drain line was plugged with corrosion products, allowing the condensation to collect in the plant ventilation exhaust line. The expansion joint then provided a point for the condensate to leak out on to the roof, from which it flowed through the roof drain line to the catch basin system. The drain line in the plant ventilation exhaust has been cleaned and there is no further leakage. The extent of condition identified partial blockage in the Unit 1 plant

ventilation exhaust line designed drain line and preventative cleaning of the Unit 1 drain line is completed.

Although this event is terminated and its cause is resolved, PSEG Nuclear has initiated certain activities at the facility based on findings from investigation of the event. During the extent of condition investigation, anomalous tritium concentrations were identified in excavations and in unaffected roof runoff. PSEG believes these anomalous concentrations are due to recapture of licensed air emissions by precipitation, a common industry effect that is recognized by the USNRC.

PSEG Nuclear is continuing the local ground water investigation with expanded monitoring of existing wells and installation of an additional 10 groundwater monitoring well locations within the cofferdam, to more comprehensively understand the hydrogeology and tritium distribution within this area. PSEG installed temporary wells within the cofferdam area, surrounding the Fuel Handling Building, Containment and Mainsteam Mixing Bottle. Multiple sampling evolutions were conducted on the temporary wells with tritium concentrations ranging from less than detectable levels to 132,000 pCi/L (this high level was never repeated after initial sampling), the average tritium concentration was approximately 12,000 pCi/L. Ten of the temporary wells were converted to permanent wells in November 2010, with sampling to commence in 2011. Tritium concentration within the wells will be tracked and trended, with appropriate actions taken to address the levels identified. Additional actions include a near field precipitation study and re-evaluation of the PSEG Site Investigation Report. This report was developed by PSEG Nuclear in 2006 and details the hydro-geological model and water flow paths at the PSEG Nuclear site. It takes into consideration groundwater movement in relation to systems, structures and components which contain or have the potential to contain radioactive material and uses this information to determine the placement of RGPP wells. The SIR is periodically evaluated to ensure the site is monitored effectively for impacts to groundwater.

C. RGPP 2010 Status

The RGPP long-term sampling program will be modified as required in 2011 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.

2010 USNRC Inspection of the RGPP

On January 4 and 25th of 2010 the NRC's Division of Reactor Projects performed an inspection of the PSEG Radiological Groundwater Protection Program during the biennial Radiological Effluent Technical Specification Inspection (NRC 2010). One portion 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 71124.06 Radioactive Gaseous and Liquid Effluent Treatment by a Senior Health Physicist from Region I The NRC Inspector verified that the NEI-07-07 Objectives for the GPI were documented in the PSEG RGPP plans and procedures. The Inspector also reviewed reported groundwater monitoring results, and changes to the licensee's written program for identifying and controlling contaminated spills/leaks to groundwater. No findings were issued as a result of this inspection.

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. All action items, except one have been completed. The remaining action item is a site wide precipitation study which is currently underway since June of 2010.

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. In addition, the Investigation section of this appendix summarizes the tritium investigations on going in 2010. 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

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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
Well BY	Nov-10	Sch-40 PVC	4	40.3	30 - 40	103.36	101.12	Upgradient	NA
Well BZ	Nov-10	Sch-40 PVC	4	36.0	26 - 36	104.29	101.97	Source	Condensate Storage & Transfer; Facilities; Piping

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 2.a Salem Unit 2 Tritium Investigation 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 DA	November-10	Sch-40-PVC	4	16.0	17.0 - 22.0	98.93	9.01	Monitoring	NA
Well DB	November-10	Sch-40-PVC	4	24.9	1.55 - 24.5	101.69	11.77	Monitoring	NA
Well DC	November-10	Sch-40-PVC	4	25.4	20.0 - 25.0	100.90	10.98	Monitoring	NA
Well DD	November-10	Sch-40-PVC	4	21.9	16.0 - 21.0	101.23	11.31	Monitoring	NA
Well DE	November-10	Sch-40-PVC	4	20.9	15.0 - 20.0	101.43	11.51	Monitoring	NA
Well DF	November-10	Sch-40-PVC	4	21.3	16.0 - 21.0	101.32	11.40	Monitoring	NA
Well DG	November-10	Sch-40-PVC	4	13.3	11.0 - 13.0	98.98	9.06	Monitoring	NA
Well DH	November-10	Sch-40-PVC	4	24.6	19.5 - 24.5	101.54	11.62	Monitoring	NA
Well DI	November-10	Sch-40-PVC	4	20.5	15.0 - 20.0	101.64	11.72	Monitoring	NA
Well DJ	November-10	Sch-40-PVC	2	10.7	5.5 - 10.5	99.03	9.11	Monitoring	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)
BH	03/24/2010	<200
	04/28/2010	**728**
	05/13/2010	**1,215**
	06/28/2010	**613**
	07/16/2010	**375**
	08/18/2010	<200
	09/16/2010	**316**
	10/28/2010	<200
	11/23/2010	**488**
	12/08/2010	**1408**
BI	01/26/2010	**454**
	02/19/2010	**426**
	03/18/2010	**612**
	04/29/2010	**589**
	05/14/2010	**662**
	06/30/2010	**447**
	07/16/2010	**420**
	08/19/2010	**234**
	09/16/2010	**494**
	11/23/2010	**297**
	12/08/2010	**279**
BJ	01/26/2010	**487**
	02/19/2010	**485**
	03/18/2010	**912**
	04/29/2010	**379**
	05/14/2010	**420**
	06/30/2010	**719**
	07/16/2010	**412**
	08/19/2010	**333**
	09/24/2010	**1,014**
	10/28/2010	**584**
	11/23/2010	**498**
	12/08/2010	**409**
BK	01/26/2010	**1,137**
	03/24/2010	**512**
	04/28/2010	**604**
	05/13/2010	**661**
	06/28/2010	**371**
	06/29/2010	**411**
	07/16/2010	**372**
	08/19/2010	**206**
	09/16/2010	**378**
	11/23/2010	**314**
	12/08/2010	**357**

Well ID	Sample Date	Tritium Conc. (pCi/L)
BM	03/18/2010	<200
	04/29/2010	<200
	07/23/2010	<200
	09/16/2011	<200
	12/08/2010	**254**
BN	03/22/2010	<200
	04/26/2010	**214**
	07/27/2010	<200
	09/21/2010	**338**
	12/21/2010	**293**
BO	04/23/2010	<200
	10/12/2010	<200
BP	04/23/2010	<200
	10/12/2010	<200
BQ	03/22/2010	<200
	04/26/2010	<200
	07/27/2010	<200
	09/21/2010	<200
	12/22/2010	<200
BR	04/23/2010	<200
	10/12/2010	<200
BS	04/23/2010	<200
	10/12/2010	<200
BT	04/23/2010	<200
	10/28/2010	<200
BL	04/29/2010	<200
	07/16/2010	<200
	9/16/2010	<200

Bold concentration value indicates tritium level above 200 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	01/13/2010	**828**
	03/10/2010	**1048**
	04/11/2010	**789**
	04/11/2010	**758**
	04/11/2010	**855**
	06/17/2010	**703**
	06/28/2010	**853**
	07/09/2010	**815**
	08/09/2010	**748**
	09/17/2010	**583**
	10/18/2010	**624**
BA	04/14/2010	<200
	10/26/2010	<200
BB	06/15/2010	**239**
	08/25/2010	**307**
	11/24/2010	<200
BC	04/07/2010	**598**
	04/07/2010	**551**
	04/08/2010	**558**
	04/09/2010	<200
	04/13/2010	**373**
	04/16/2010	**245**
	04/19/2010	**623**
	04/22/2010	**280**
	04/28/2010	<200
	05/19/2010	<200
	06/02/2010	**355**
	06/17/2010	<200
	06/22/2010	<200
	07/07/2010	<200
	07/14/2010	**279**
	07/20/2010	**737**
	07/28/2010	**447**
	08/26/2010	**382**
	09/24/2010	**283**
	10/18/2010	**266**

Well ID	Sample Date	Tritium Conc. (pCi/L)
T	01/25/2010	<200
	04/11/2010	<200
	04/11/2010	<200
	04/11/2010	<200
	07/09/2010	<200
	10/20/2010	<200
BU	04/11/2010	<200
	04/11/2010	<200
	10/28/2010	<200
U	01/25/2010	**420**
	04/07/2010	<200
	04/07/2010	**372**
	04/08/2010	<200
	04/09/2010	<200
	04/13/2019	**230**
	04/16/2010	**288**
	04/19/2010	<200
	04/22/2010	<200
	04/28/2010	**232**
	05/19/2010	<200
	06/02/2010	**288**
	06/17/2010	<200
	06/22/2010	**241**
	06/28/2010	**276**
	07/07/201	**228**
	07/20/2010	**387**
	07/28/2010	**320**
	08/26/2010	**364**
	09/24/2010	**242**
	10/20/2010	<200
BG	03/10/2010	**446**
	04/29/2010	**1207**
	06/30/2010	**706**
	08/25/2010	**528**
	09/16/2010	**907**
	11/23/2010	**1466**
	11/23/2010	**1479**

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

Well ID	Sample Date	Tritium Conc. (pCi/L)
BE	02/22/2010	**762**
	04/07/2010	**1072**
	04/07/2010	**1261**
	04/08/2010	**1023**
	04/09/2010	**994**
	04/13/2010	**1213**
	04/16/2010	**1155**
	04/19/2010	**1160**
	04/22/2010	**1118**
	05/19/2010	**655**
	06/02/2010	**841**
	06/17/2010	**698**
	06/22/2010	**712**
	06/28/2010	**694**
	07/07/2010	**625**
	07/14/2010	**639**
	07/20/2010	**619**
	07/28/2010	**625**
	08/04/2010	**756**
	10/18/2010	**521**
BD	04/07/2010	<200
	04/07/2010	**312**
	04/08/2010	<200
	04/09/2010	<200
	04/13/2010	**334**
	04/16/2010	**221**
	04/19/2010	**299**
	04/22/2010	**207**
	04/28/2010	**205**
	05/19/2010	**929**
	06/02/2010	**598**
	06/17/2010	**506**
	06/22/2010	**457**
	06/28/2010	**401**
	07/07/2010	**381**
	07/14/2010	**249**
	07/20/2010	**455**
	07/28/2010	**353**
	08/04/2010	**442**
	10/18/2010	**395**

Well ID	Sample Date	Tritium Conc. (pCi/L)
Y	01/19/2010	<200
	02/18/2010	<200
	03/18/2010	<200
	04/08/2010	<200
	04/09/2010	<200
	04/09/2010	<200
	05/21/2010	<200
	06/17/2010	<200
	07/22/201	<200
	08/26/2010	<200
	09/26/2010	<200
	10/26/2010	<200
	11/29/2010	<200
	12/21/2010	<200
Z	01/19/2010	**434**
	02/18/2010	**399**
	03/18/20010	**321**
	04/08/2010	**402**
	04/09/2010	**201**
	04/09/2010	**812**
	06/17/2010	**471**
	07/22/2010	**489**
	08/26/2010	**478**
	09/09/2010	**472**
	10/26/2010	**325**
	11/29/2010	**252**
	12/21/2010	**283**
BF	04/07/2010	<200
	04/07/2010	<200
	04/08/2010	<200
	04/09/2010	<200
	04/13/2010	<200
	04/16/2010	<200
	0419/2010	<200
	04/22/2010	<200
	04/28/2010	<200
	05/19/2010	<200
	06/02/2010	<200
	06/17/2010	<200
	06/22/2010	<200
	06/28/2010	<200
	07/07/2010	<200
	08/04/2010	<200
	10/20/2010	<200

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

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

Spill/Discharge	Quantity Spilled / Discharged	Location of Spill/Discharge	Description
Apr-95	~ 88 millicuries	Hope Creek and Salem	Steam from the Decon Solution Evaporator released from Hope Creek's South Plant Vent
Jan-02		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
Mar-04	Co-60	North Side of Salem Circulating Water House	Corroded Pipe Cracked
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
July-05	5.2 microcuries	Hope Creek 54' Diesel Building	Overflow of plant system contained within the building.
Aug-06		Southside of Salem House Heating Boiler	Leaking Valve
May-07	2.8 microcuries of Cs 137	In front of Salem Unit 2 condensate polisher	Burst site glass during operation. Resin blown through wall into switchyard
Nov-10	0.3 microcuries of Cs 137	At the pedestal steps Salem Unit 2 containment	Attributed to Fallout

Figure 1 Hope Creek RGPP Monitoring Well Locations

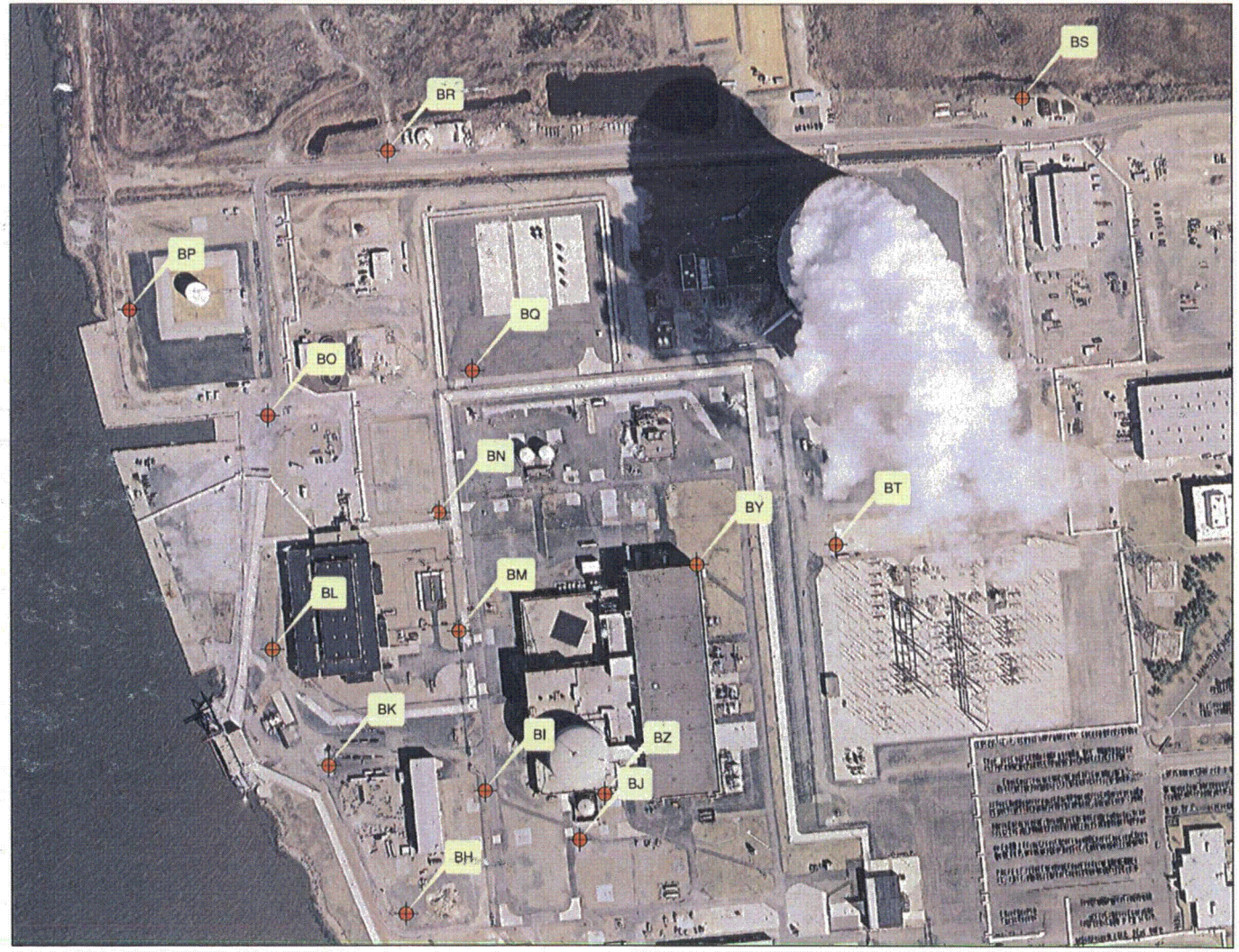
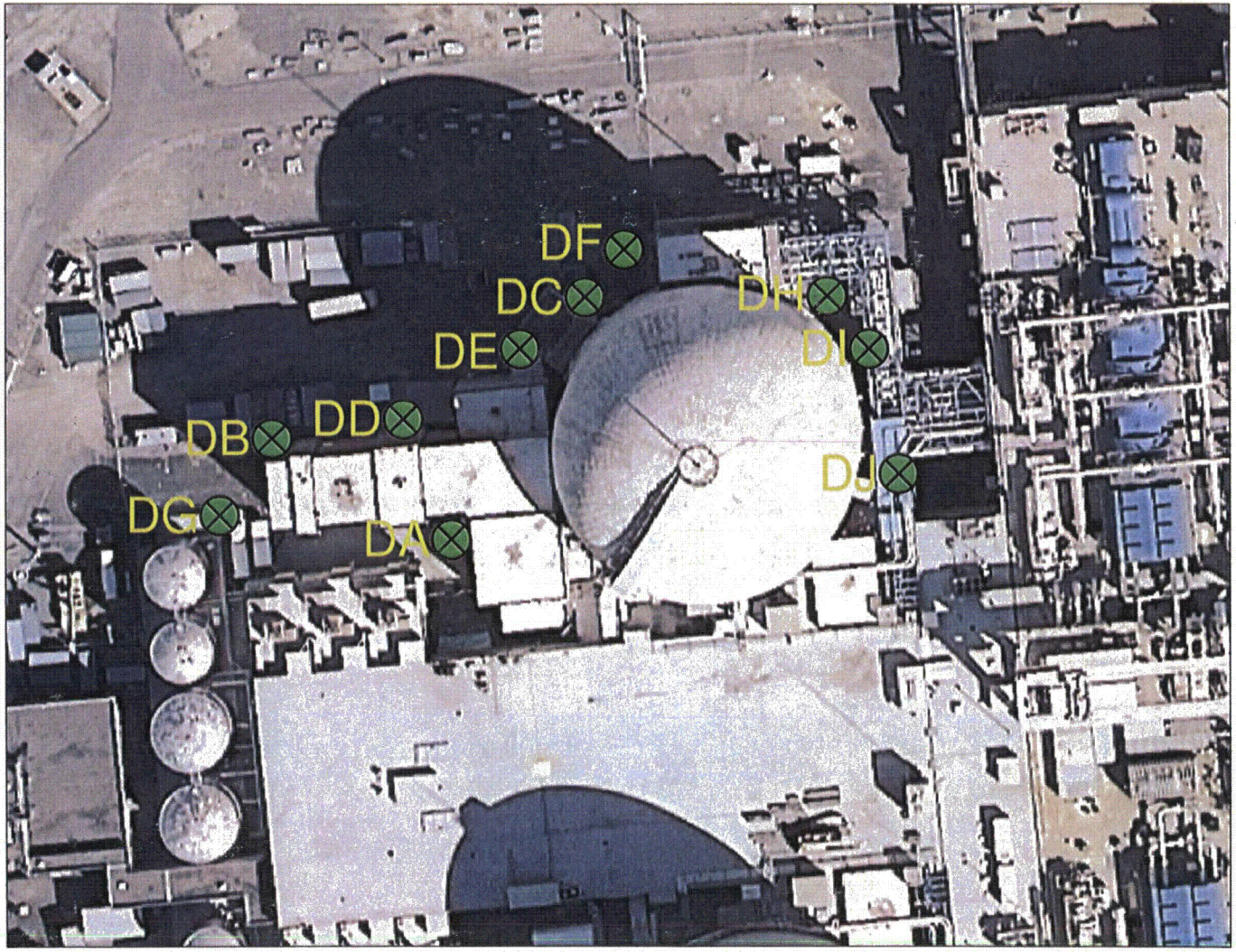


Figure 2 Salem RGPP Monitoring Well Locations

Figure 3 Salem Unit 2 Tritium Investigation Wells



N

0 37.5 75 150 225 300 Feet

Legend

- Investigation Wells

Figure 4 Hope Creek Tritium Trends: Wells BH, BI, BJ, BK, BM, BN and BQ

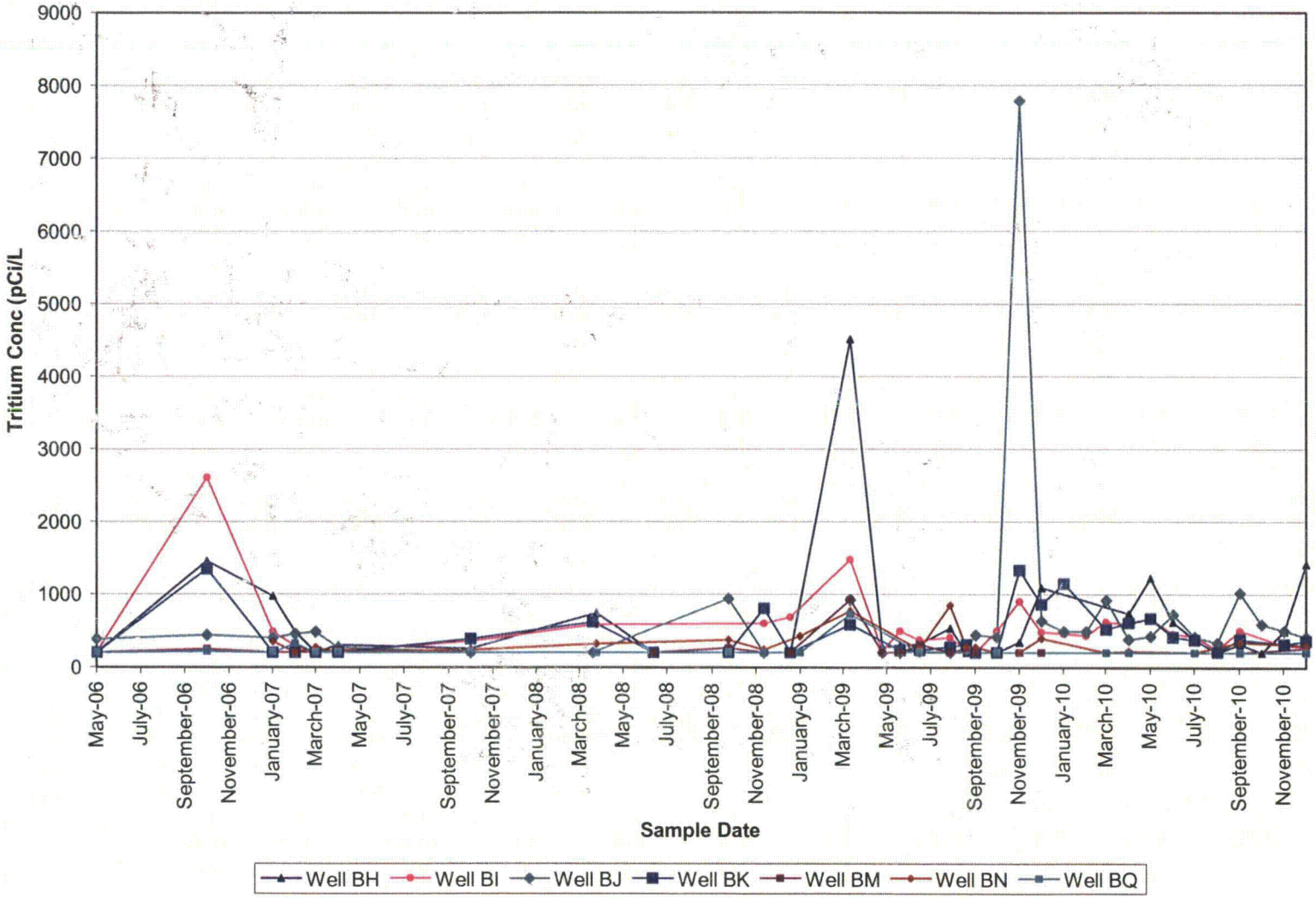
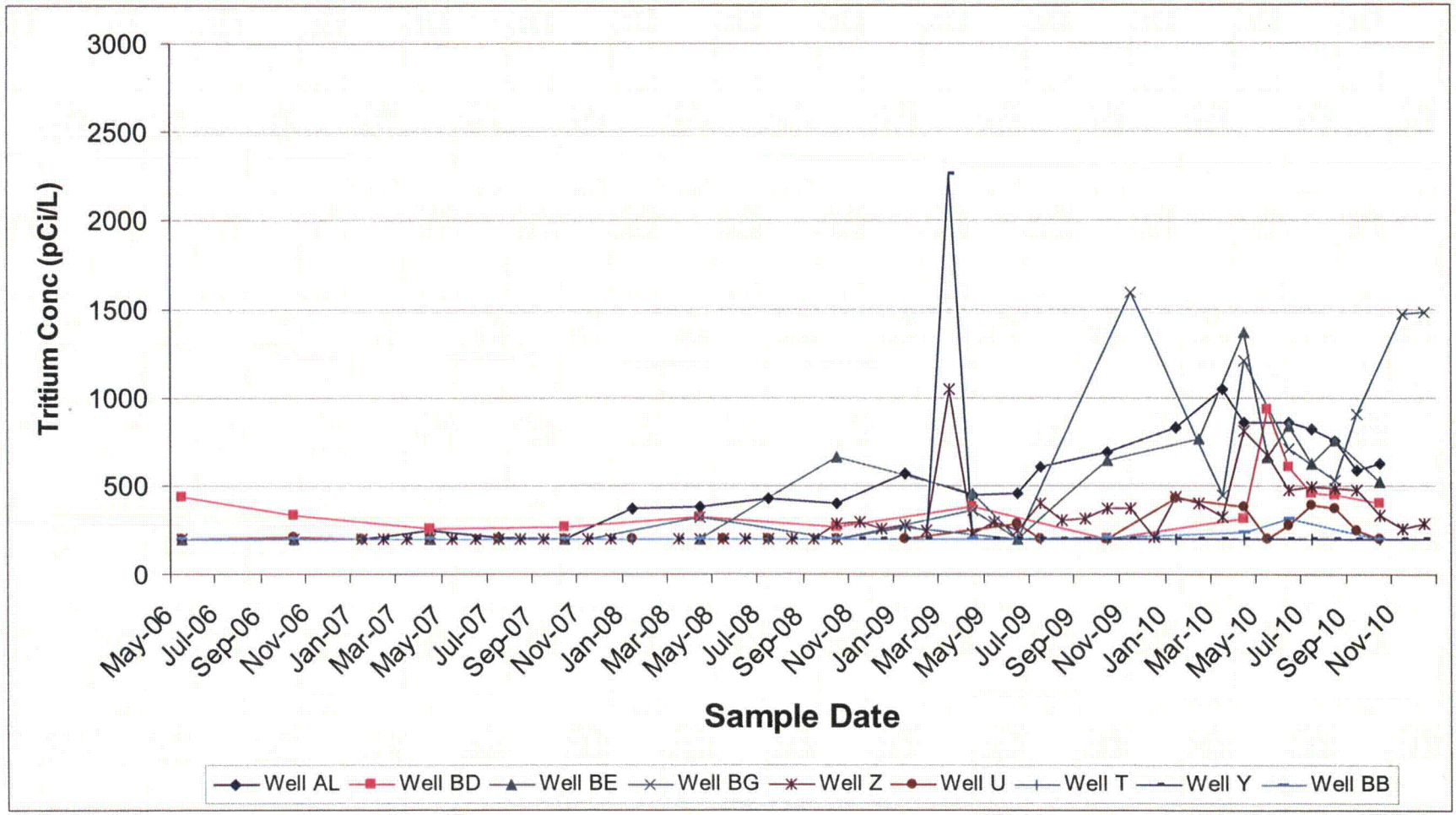



Figure 5 Salem Tritium Trends: Wells AL, BD, BE, BG, T, U, Y, Z