Bryce L. Shriver
Senior Vice President and
Chief Nuclear Officer

PPL Susquehanna, LLC
769 Salem Boulevard
Berwick, PA 18603
Tel. 570.542.3120 Fax 570.542.1504
blshriver@pplweb.com

ppl™

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SUSQUEHANNA STEAM ELECTRIC STATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT
PLA-5748

Docket Nos. 50-387
and 50-388

The Susquehanna SES Annual Radiological Environmental Operating Report is hereby submitted for the calendar year 2003 in accordance with Technical Specification Section 5.6.2.

If you have any questions, please contact Mr. Rocco R. Sgarro at (610) 774-7552.

Sincerely,

B. L. Shriver

Attachments

copy: NRC Region I
Mr. R. V. Guzman, NRC Project Manager
Mr. S. Hansell, NRC Sr. Resident Inspector
Mr. R. Janati, DEP/BRP

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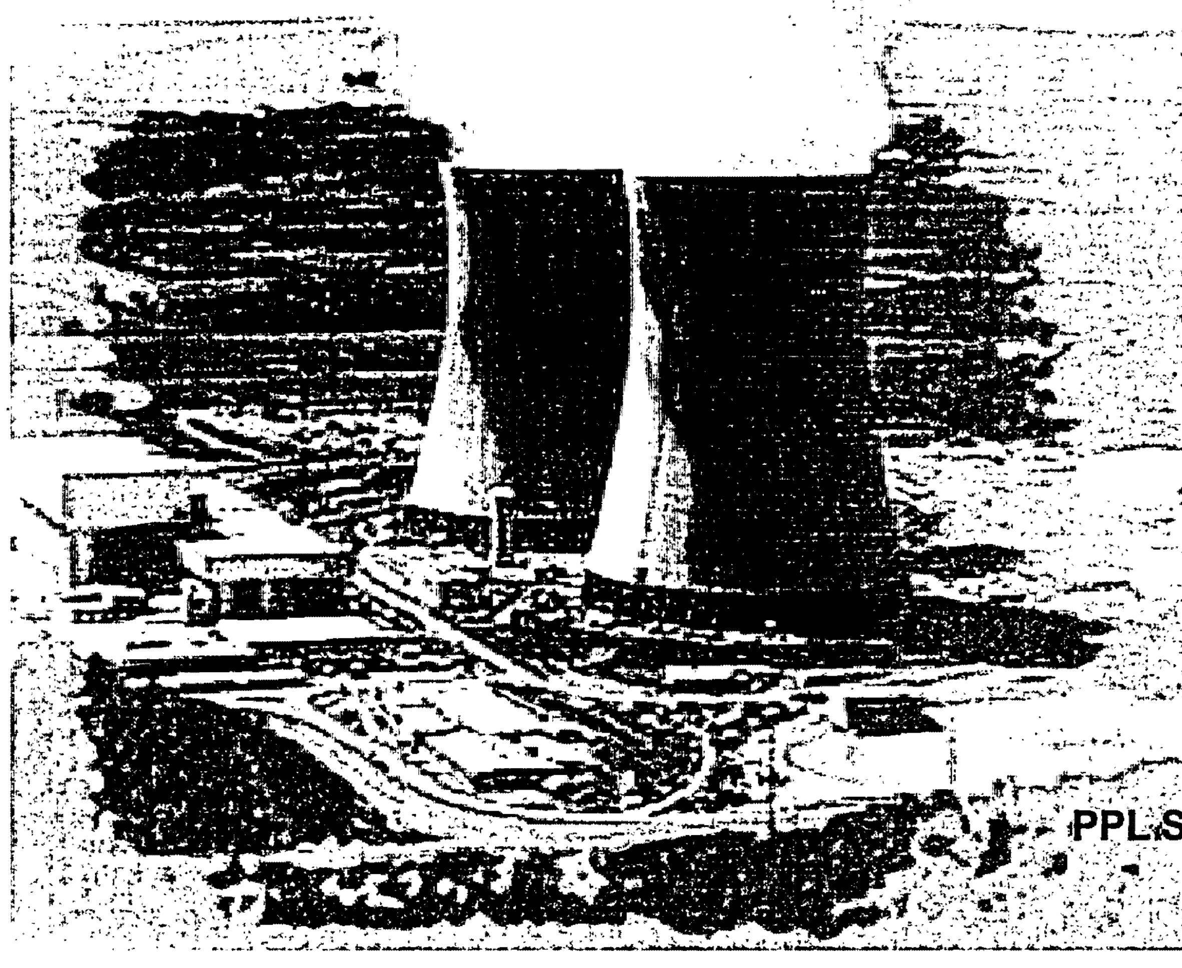
Susquehanna Steam Electric Station
Units 1 & 2

2003 ANNUAL REPORT

Annual
Radiological
Environmental
Operating
Report



PPL Susquehanna, LLC
Berwick, PA
April 2004

SUSQUEHANNA STEAM ELECTRIC STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

REPORT PERIOD: 12/30/02 – 1/30/04

Prepared by:

F. J. Hickey
Health Physicist

Reviewed by:

R.E. Doebler
Chemistry Support Supervisor – SSES

Approved by:

B.E. Rhoads
Manager – Plant Chemistry

PPL Susquehanna, LLC
769 Salem Boulevard
Berwick, Pennsylvania 18603

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SUMMARY AND CONCLUSIONS

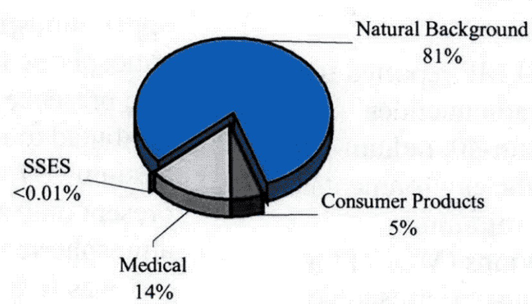
Radiological Dose Impact

The extent of the 2003 Radiological Environmental Monitoring Program (REMP) sampling met or exceeded the requirements of the Susquehanna Steam Electric Station (SSES) Technical Requirements. The types of analyses that were performed on these samples for the identification and quantification of radioactivity also met or exceeded the SSES Technical Requirements. The result of this effort was the verification of the SSES Effluent Monitoring Program data that indicate that the SSES operation has no deleterious effect on the health and safety of the public or the environment.

The amounts of the radionuclides detected in environmental samples during 2003 were very small, as in past years. Based on the radionuclide levels measured by the REMP, the maximum whole body dose or maximum organ dose to a member of the public from SSES operation is estimated to be less than one-tenth of one percent of the per unit dose guidelines established by the Nuclear Regulatory Commission (NRC) as stated in 10 CFR 50, Appendix I. The maximum hypothetical off-site whole body and organ doses from radionuclides detected by the REMP and attributable to the SSES operations were calculated to be approximately 0.0015 mrem/year.

By contrast, potassium-40, a very long-

COMPARISON OF PERCENT OF AVERAGE ANNUAL PUBLIC EFFECTIVE DOSE-EQUIVALENT FROM OTHER SOURCES WITH THAT FROM THE SSES



Sources for the values provided, with the exception of Susquehanna, are the following from NCRP Report #93 (1987): Tables 2.4 (Natural Background), 5.1 (Consumer Products), and 7.4 (Medical).

lived, naturally occurring radionuclide found in the human body, is estimated to deliver an average annual dose to the blood forming organs of individuals in the United States of about 27 millirem. While a small portion of the background dose from natural radiation sources, the potassium-40 dose is still 18,000 times the estimated maximum whole body and organ doses to a hypothetical member of the public from ingestion of radionuclides attributable to the SSES.

The maximum direct radiation dose from SSES operation to a member of the public was determined to be approximately 0.0314 millirem/year. The total whole body dose from both ingested radionuclides and direct radiation is negligible compared to the public's exposure from natural background radiation, medical irradiation, and radiation from consumer products of more than 300 millirem/year effective dose-equivalent.

Identified Radionuclides and Their Dose Contributions

Naturally Occurring Radionuclides

In 2003, the SSES REMP reported the naturally occurring radionuclides beryllium-7, potassium-40, radium-226, and thorium-228 in the environment at levels exceeding the minimum detectable concentrations (MDCs) for their respective gamma spectroscopic analyses. Beryllium-7 was identified in air and sediment. Potassium-40 was observed in fish, sediment, surface water, ground water, milk, soil, and fruit and vegetables. Thorium-228 and radium-226 were reported in sediment. These radionuclides are not related to the operation of the SSES. Doses from the presence of these radionuclides were not included in the estimate of the dose from SSES attributable radionuclides.

Man-made Radionuclides

Although not all due to SSES operation, the following man-made radionuclides were reported at levels in the environment in excess of the MDCs for their respective analyses: tritium, iodine-131 and cesium-137. These radionuclides, with the exception of cesium-137, were identified in surface, ground and drinking water. Tritium was measured above minimum detectable concentrations in some surface water, drinking water, and ground water samples. Iodine-131 was identified in surface water and drinking water. Cesium-137 was observed in sediment and soil.

Tritium is the only man-made radionuclide attributed to SSES operation. Tritium in media other than the Susquehanna River water downstream of the SSES was attributed to both natural production by the interaction of cosmic radiation with the upper atmosphere and previous atmospheric testing of nuclear weapons. The presence of cesium-137 was attributed to non-SSES sources. Cesium-137 was considered to be present only as residual fallout from atmospheric weapons testing. Iodine-131 was found in the aquatic pathway. Evidence indicates that it is there only as the result of the discharge of medical waste to the Susquehanna or Lackawanna Rivers through sewage treatment plants upstream of the SSES.

All of the man-made radionuclides mentioned above were not analyzed for in all media. For example, no analyses were performed in an effort to determine iodine-131 levels in ground water. When selecting the types of analyses that would be performed, consideration was given to the potential importance of different radionuclides in the pathways to man and the regulatory analysis requirements for various environmental media.

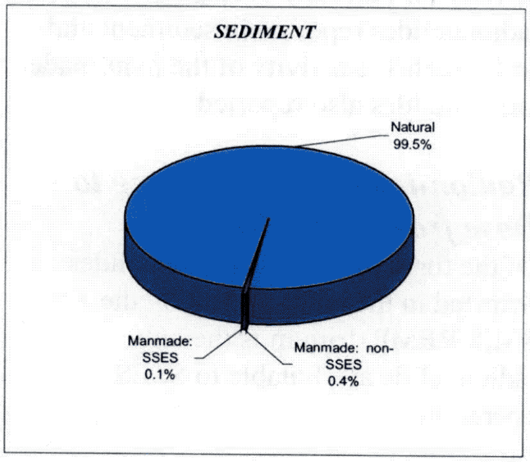
Relative Radionuclide Activity Levels in Selected Media

Some media monitored in the environment are significant for the numbers of gamma-emitting radionuclides routinely measured at levels exceeding analysis MDCs. Sediment in the aquatic pathway and soil in the terrestrial pathway are two such media.

The following pie graphs show the relative activity contributions for the types of gamma-emitting radionuclides reported at levels above the analysis MDCs in sediment and soil at indicator locations during 2003.

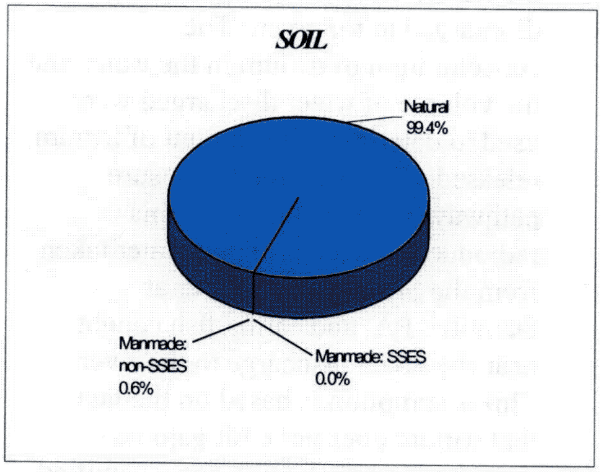
AQUATIC PATHWAY

PERCENT TOTAL GAMMA ACTIVITY



TERRESTRIAL PATHWAY

PERCENT TOTAL GAMMA ACTIVITY



Naturally occurring radionuclides accounted for 99.5 % and 99.4 % of the gamma-emitting activity in sediment and in soil, respectively, in 2003. Man-made radionuclides of SSES origin accounted for 0.1% of the gamma-emitting activity in sediment during

C02

2003. Man-made radionuclides of non-SSES origin account for the rest of the gamma-emitting activity in sediment and soil during 2003. Generally, the activity for naturally occurring radionuclides reported in sediment and soil dwarfs the activity of the man-made radionuclides also reported.

Radionuclides Contributing to Dose from SSES Operation

Of the three man-made radionuclides reported in the environment by the SSES REMP, tritium is the only radionuclide attributable to SSES operation.

The dose to members of the public attributable to the identified Tritium was 0.0015 mrem.

Tritium was included in the dose calculation because it was identified in the REMP samples of water being discharged to the river. The concentration of tritium in the water and the volume of water discharged were used to determine the amount of tritium released. The presumed exposure pathways to the public from this radionuclide were drinking water taken from the Susquehanna River at Danville, PA, and eating fish caught near the SSES discharge to the river. This assumption is based on the fact that tritium does not emit gamma radiation and the beta radiation emitted by tritium is not sufficiently penetrating to reach an individual on the shore.

INTRODUCTION

Radiological Environmental Monitoring

The enclosed information is consistent with the objectives outlined in the SSES ODCM and in 10CFR50 Appendix I, Section IV.B.2, IV.B.3 and IV.C.

In addition to the steps taken to control and to monitor radioactive effluents from the SSES, the SSES Technical Specifications also require a program for the radiological monitoring of the environment in the vicinity of the SSES. The objectives of the SSES REMP are as follows:

- Fulfillment of SSES Technical Requirements' radiological environmental surveillance obligations,
- Verification of no detrimental effects on public health and safety and the environment from SSES operations,
- Assessment of dose impacts to the public, if any,
- Verification of adequate SSES radiological effluent controls, and
- Identification, measurement, trending, and evaluation of radionuclides and their concentrations in critical environmental pathways near the SSES.

PPL has maintained a Radiological Environmental Monitoring Program (REMP) in the vicinity of the existing Susquehanna Steam Electric Station Units 1 and 2 since April, 1972, prior to construction of both units and ten years prior to the initial operation of Unit 1 in September, 1982. The SSES is located on an approximately 1500 acre tract along the Susquehanna River, five miles northeast of Berwick in Salem Township, Luzerne County, Pennsylvania. The area around the site is primarily rural, consisting predominately of forest and agricultural lands. (More specific information on the demography, hydrology, meteorology, and land use characteristics of the area in the vicinity of the SSES can be found in the Environmental Report (Reference 1), the Final Safety Analysis Report (Reference 2), and the Final Environmental Statement (Reference 3) for the SSES.) The purpose of the preoperational REMP (April, 1972 to September, 1982) was to establish a baseline for radioactivity in the local environment that could be compared with the radioactivity levels observed in various environmental media throughout the operational lifetime of the SSES. This comparison facilitates assessments of the radiological impact of the SSES operation.

The SSES REMP was designed on the basis of the NRC's Radiological Assessment Branch Technical Position on radiological environmental monitoring, as described in Revision 1, November 1979.(Reference 4)

However, the REMP conducted by PPL for the SSES exceeds the monitoring suggested by the NRC's branch technical position, as well as the SSES Technical Requirements in terms of the number of monitoring locations, the frequency of certain monitoring, the types of analyses required for the samples, and the achievable analysis sensitivities.

Potential Exposure Pathways

The three pathways through which radioactive material may reach the public from nuclear power plants are the atmospheric, terrestrial, and aquatic pathways. (Figure 1 depicts these pathways for the intake of radioactive materials.) Comprehensive radiological environmental monitoring must sample media from all of these pathways.

Mechanisms by which people may be exposed to radioactivity and radiation in the environment vary with the pathway. Three mechanisms by which a member of the public has the potential to be exposed to radioactivity or radiation from nuclear power plants such as the SSES are as follows:

- inhalation (breathing)
- ingestion (eating and drinking), and
- whole body irradiation directly from a plant or from immersion in the radioactive effluents.

REMP Scope

During the operational period of the SSES, it has been important to establish two different categories of monitoring locations, called control and indicator locations, to further assist in assessing the impact of the station operation. Control locations have been situated at sites where it is considered unlikely that radiation or radioactive material from normal station operation would be detected. Indicator locations are sited where it is expected that radiation and radioactive material that might originate from the station would be most readily detectable.

Control locations for the atmospheric and terrestrial pathways are more than 10 miles from the station. Preferably, the controls also are in directions from the station less likely to be exposed to wind blowing from the station than are the indicator locations. Control locations for the aquatic pathway, the Susquehanna River, are upstream of the station's discharge to the river.

Indicator locations are selected primarily on the basis of proximity to the station, although factors such as meteorology, topography, and sampling practicality also are considered. Indicator locations for the atmospheric and terrestrial pathways are typically less than 10 miles from the station. Most often, they are within 5 miles of the station. Indicator locations in the Susquehanna River are downstream of the station's discharge. Monitoring results from indicator locations are compared with results from control locations. These comparisons are made to discern any differences in the levels and/or types of radioactive material and/or radiation that might exist between indicators and controls and that could be attributable to the station.

In 2003, the SSES REMP collected more than 850 samples at more than 40 locations and performed more than 1,500 analyses. In addition, the REMP monitors ambient radiation levels using thermoluminescent dosimeters (TLDs) at 84 indicator and control locations, making as many as 336 radiation level measurements each year. The media monitored and analyses performed are summarized in the table below. Figures 2 through 7 display the REMP TLDs and sampling locations in the vicinity of the SSES. Appendix C provides directions, distances, and a brief description of each of the locations in Figures 2 through 7.

Regulatory agencies also participate in monitoring the SSES environment and also oversee PPL's monitoring efforts. The State of Pennsylvania's Department of Environmental Protection (PADEP) monitors air for radioactive particulates and radioactive iodine. It also monitors milk, fruits and vegetables, surface and drinking water, fish, river sediments, and ambient radiation levels. PADEP makes this data available to the NRC. Inspectors from the NRC regularly visit the SSES to review procedures and records, conduct personnel interviews, observe activities first-hand, and generally examine the programs supporting the effluent and environmental monitoring for the SSES.

REMP Monitoring Sensitivity

The sensitivity of the SSES REMP was demonstrated in 1986, following the problem with the Chernobyl reactor in the former Soviet Union. When the Chernobyl incident occurred, the SSES REMP was able to detect a relatively small increase in the level of gross beta activity in air samples at both control and indicator locations, as well as the presence of some specific radioactive materials that are not normally observed.

Detection of radiation and radioactive material from the SSES in the environment is complicated by the presence of naturally occurring radiation and radioactive materials from both terrestrial and cosmic sources. Man-made radiation and radioactive material from non-SSES sources, such as nuclear fallout from previous nuclear weapons tests and medical wastes, also can make identification of SSES radiation and radioactive material difficult. Together, this radiation and radioactive material present background levels from which an attempt is made to distinguish

SSES REMP	
Type of Monitoring	**Media Monitored**
Gross Alpha Activity	Drinking Water
Gross Beta Activity	All Waters, except Ground Water, and Air Particulates
Gamma-Emitting Radionuclide Activities	All Media
Tritium Activity	All Waters
Iodine-131 Activity	Surface Water, Drinking Water, Air & Milk
Exposure Rates (by TLD)	Ambient Radiation Levels

relatively small contributions from the SSES. This effort is further complicated by the natural variations that typically occur from both monitoring location to location and with time at the same locations.

The naturally occurring radionuclides potassium-40, beryllium-7, radium-226, and thorium-228 are routinely observed in certain environmental media. Potassium-40 has been observed in all monitored media and is routinely seen at readily detectable levels in such media as milk, fish, fruits and vegetables. Seasonal variations in beryllium-7 in air samples are regularly observed. Man-made radionuclides, such as cesium-137 left over from nuclear weapons testing are often observed as well. In addition, the radionuclide tritium, produced by both cosmic radiation interactions in the upper atmosphere as well as man-made (nuclear weapons), is another radionuclide typically observed.

Radioactivity levels in environmental media are usually so low that their measurements, even with state-of-the-art measurement methods, typically have significant degrees of uncertainty associated with them.(Reference 5) As a result, expressions are often used when referring to these measurements that convey information about the levels being measured relative to the measurement sensitivities. Terms such as "minimum detectable concentration" (MDC) are used for this purpose. The formulas used to calculate MDCs may be found in Appendix E.

The methods of measurement for sample radioactivity levels used by PPL's contracted REMP radioanalytical laboratories are capable of meeting the analysis sensitivity requirements found in the SSES Technical Requirements. Summary descriptions of the analytical procedures and the accompanying calculational methods used by the laboratories can be found in Appendix E.

Additional terrestrial and aquatic environmental monitoring is performed independent of the SSES REMP by the Academy of Natural Sciences of Philadelphia, Pennsylvania. The monitoring program is titled "Safety Net" and an annual report is provided to PPL Susquehanna , LLC. Although the Safety Net program is not part of the SSES REMP, the data has provided additional information relative to the environmental impact of the operation of the SSES.

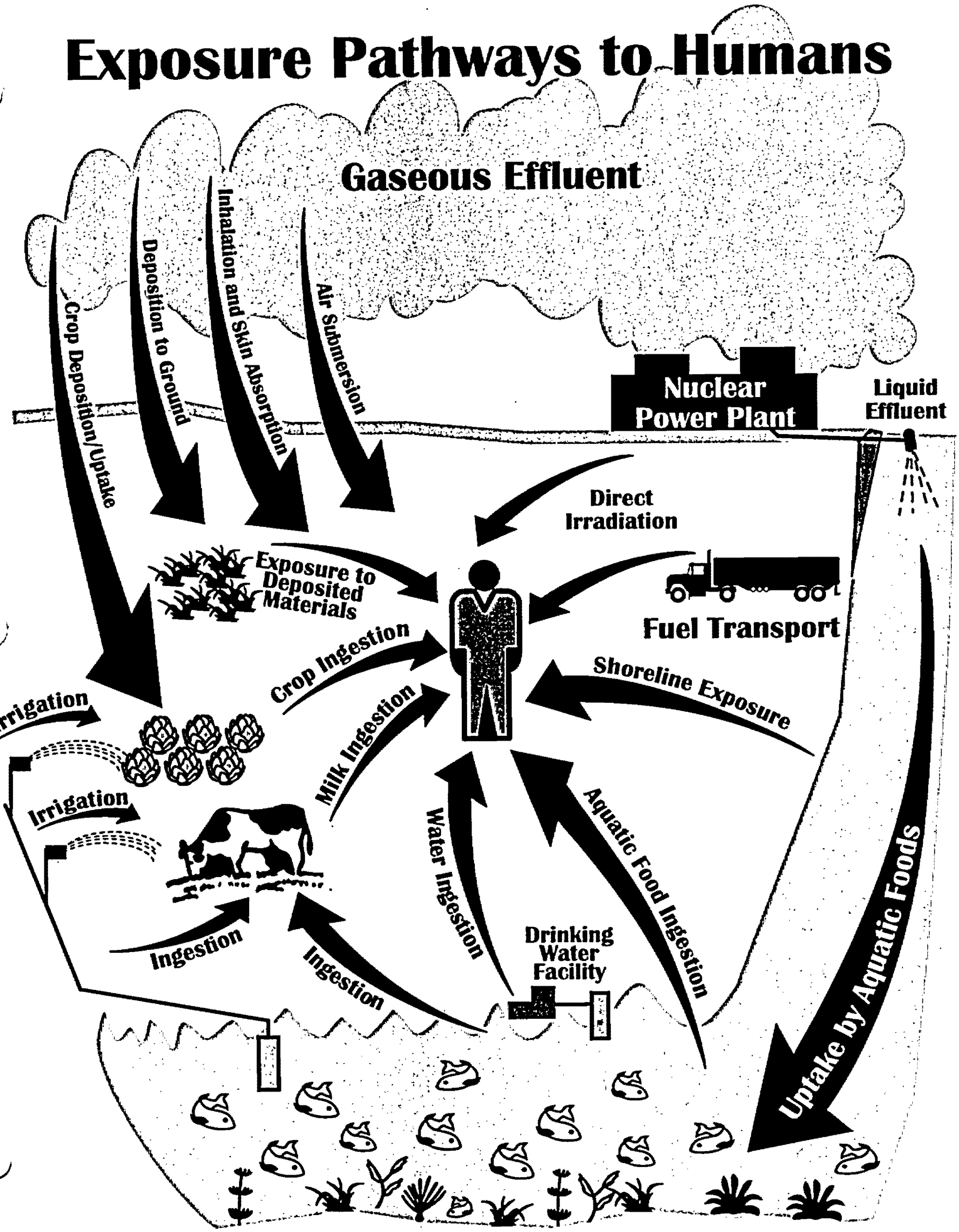

Exposure Pathways to Humans
Gaseous Effluent
Crop Deposition/Uptake
Deposition to Ground
Inhalation and Skin Absorption
Air Submersion
Nuclear Power Plant
Liquid Effluent
Direct Irradiation
Exposure to Deposited Materials
Fuel Transport
Crop Ingestion
Irrigation
Irrigation
Milk Ingestion
Shoreline Exposure
Water Ingestion
Aquatic Food Ingestion
Drinking Water Facility
Ingestion
Ingestion
Uptake by Aquatic Foods

Figure 1

FIGURE 2
2003 TLD MONITORING LOCATIONS
WITHIN ONE MILE OF THE SSES

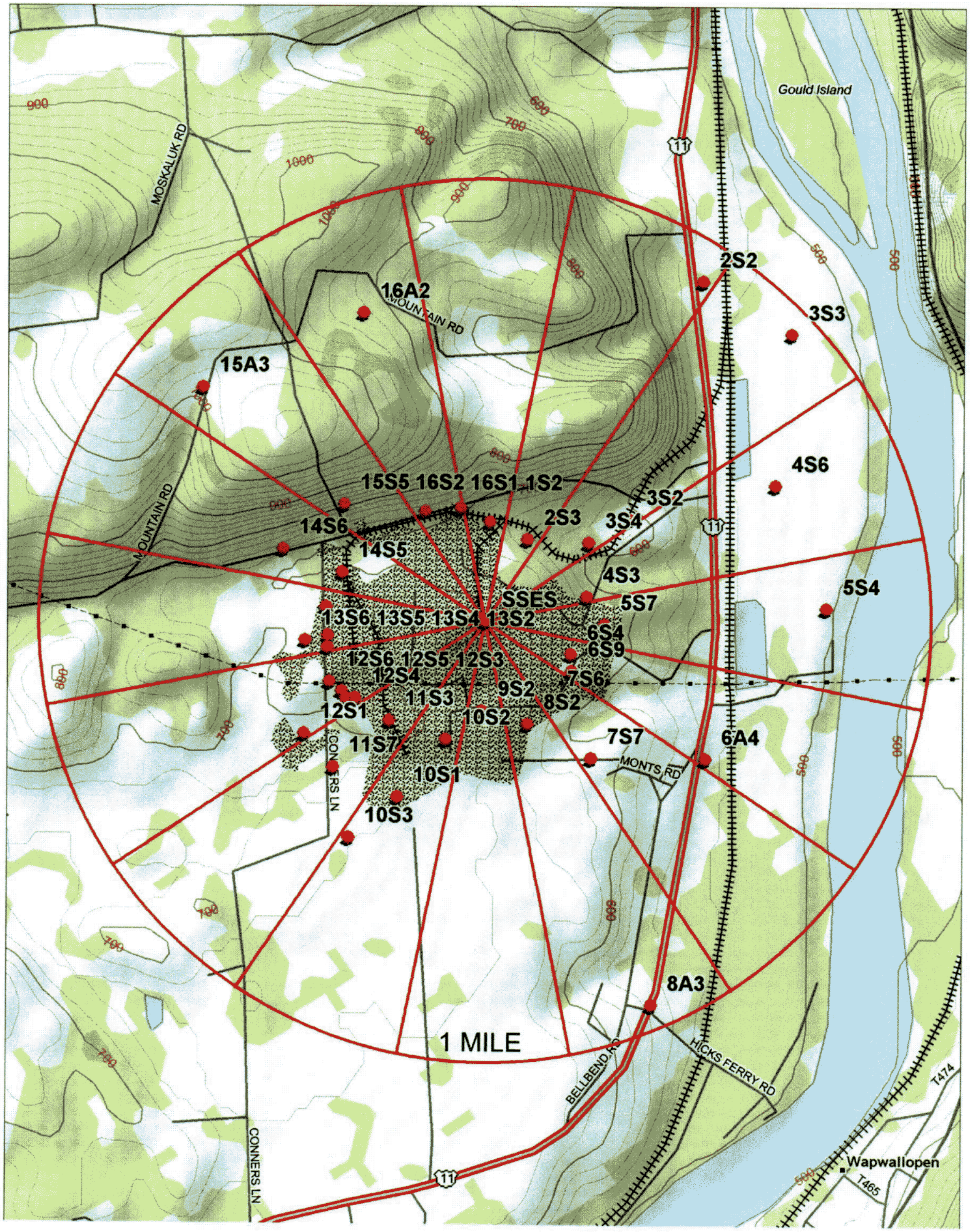


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FIGURE 3
2003 TLD MONITORING LOCATIONS
FROM ONE TO FIVE MILES FROM THE SSES

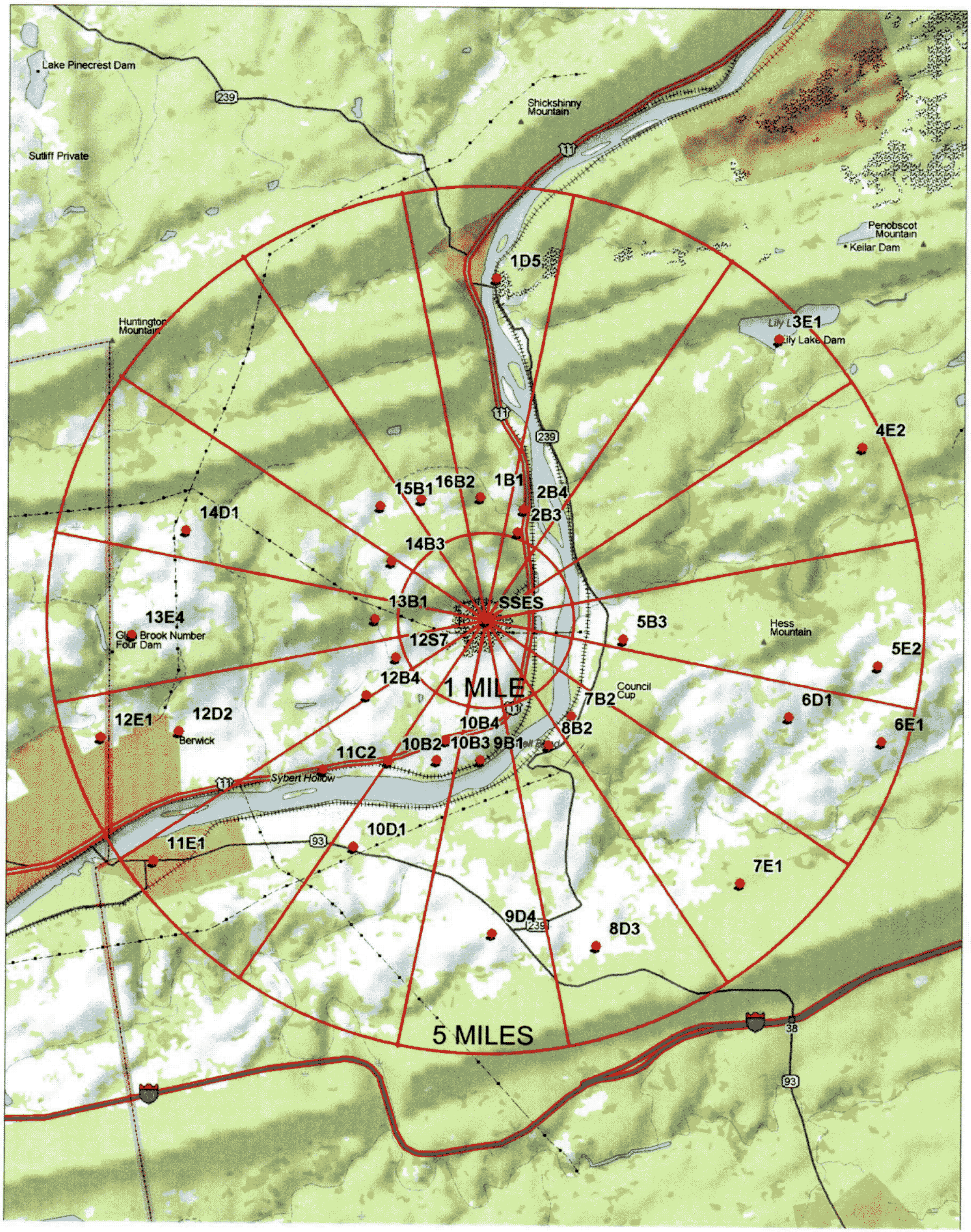

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FIGURE 4
2003 TLD MONITORING LOCATIONS
GREATER THAN FIVE MILES FROM THE SSES

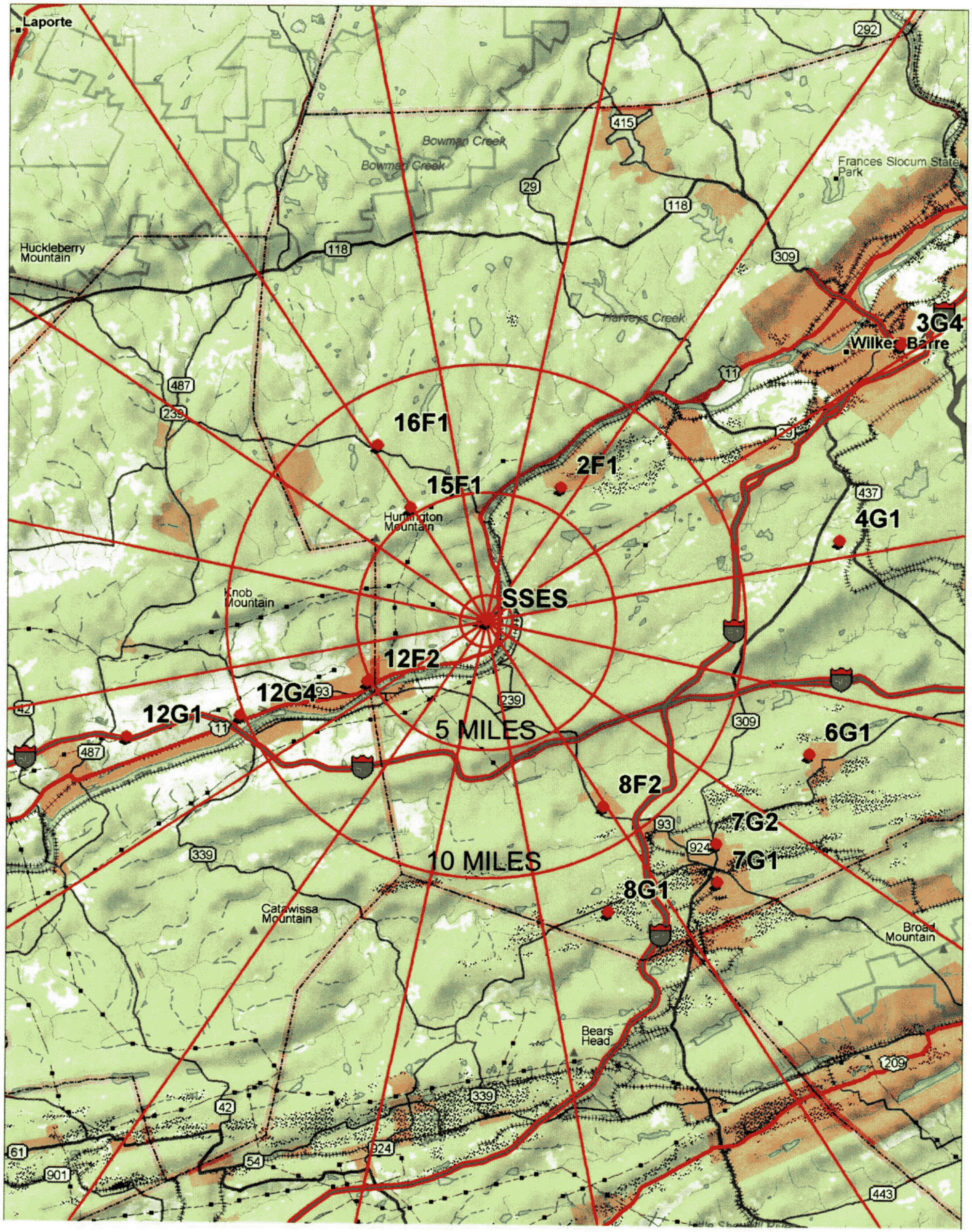

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FIGURE 5
2003 ENVIRONMENTAL SAMPLING LOCATIONS WITHIN ONE MILE OF THE SSES

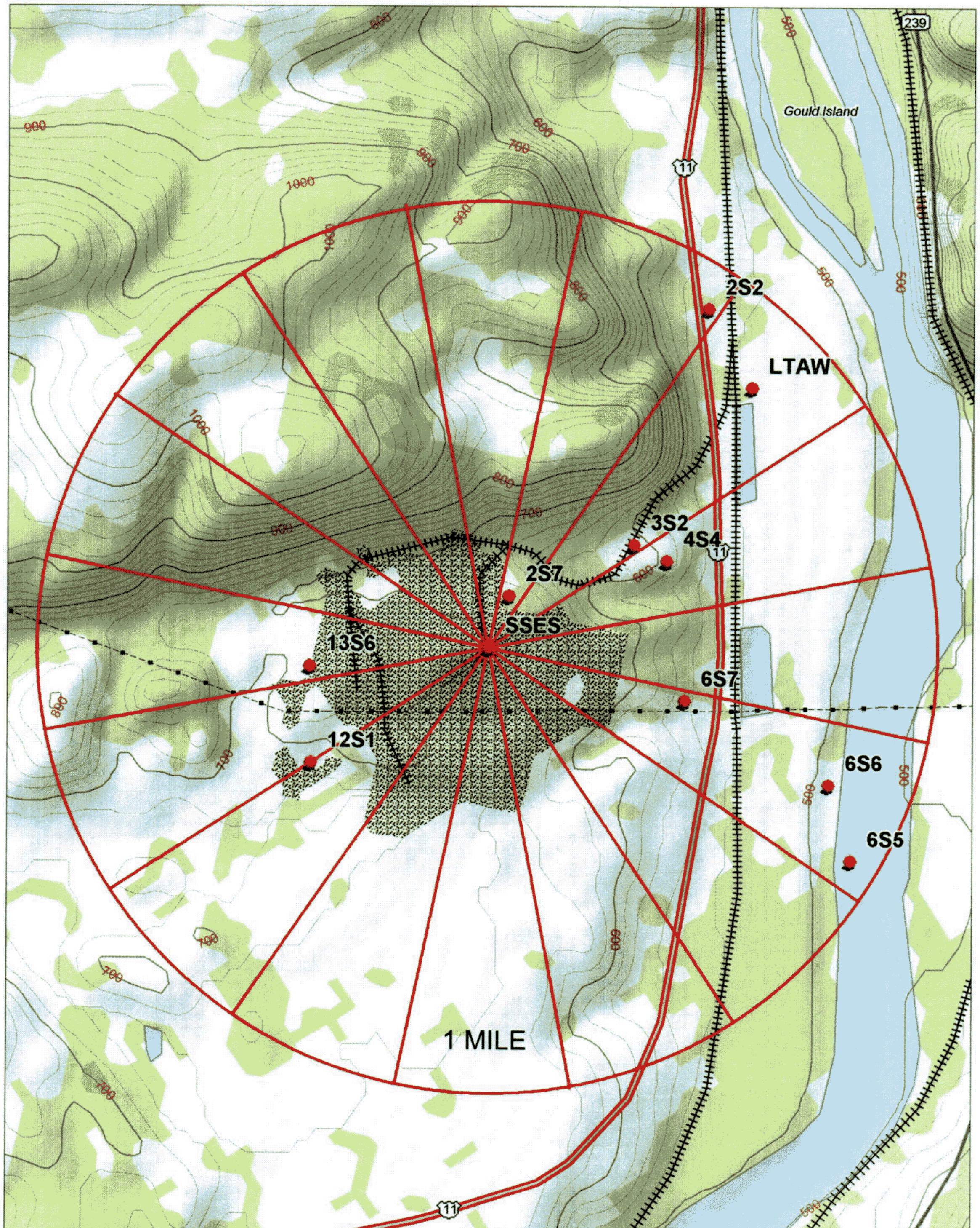

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FIGURE 6
2003 ENVIRONMENTAL SAMPLING LOCATIONS FROM ONE TO FIVE MILES FROM THE SSES

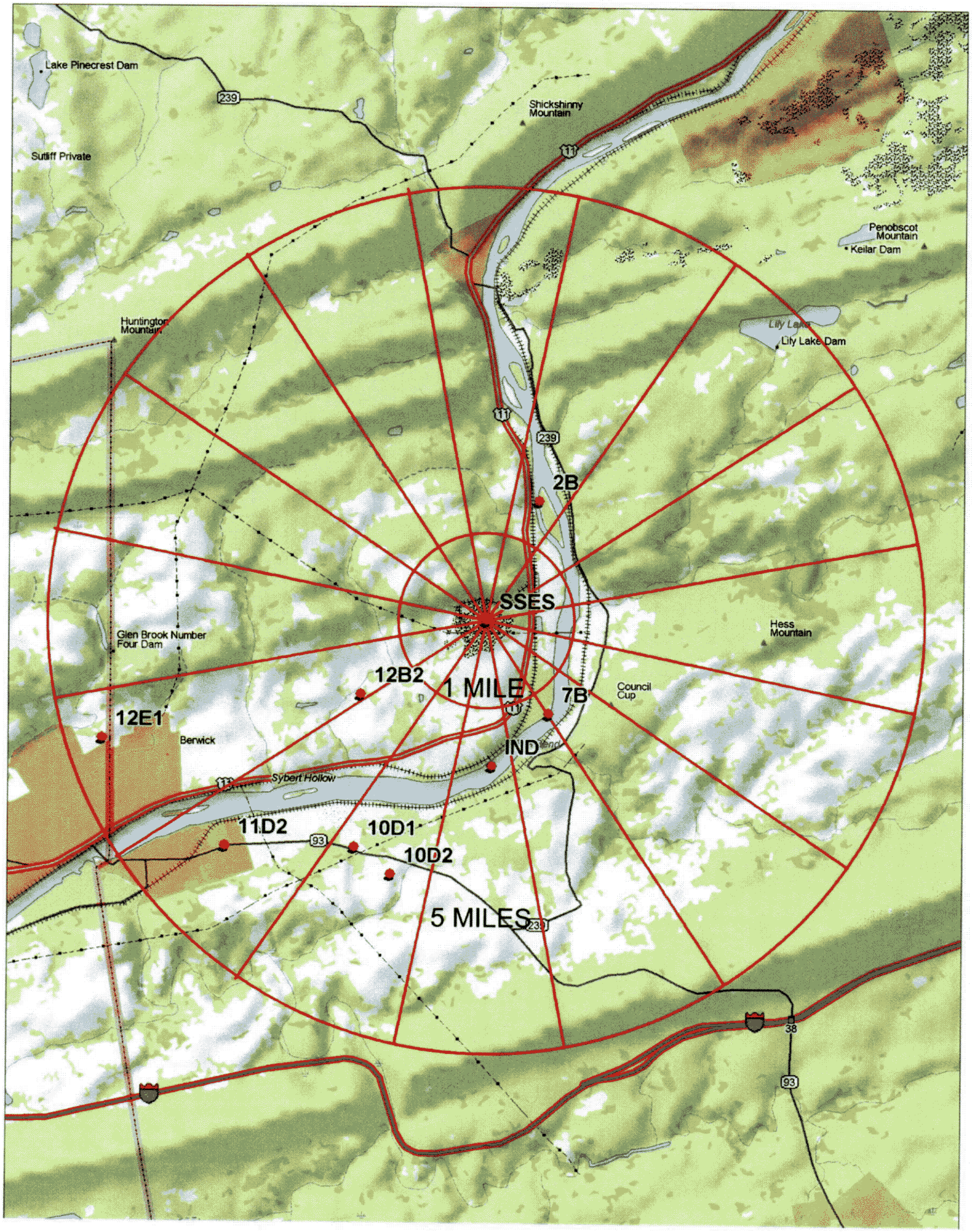

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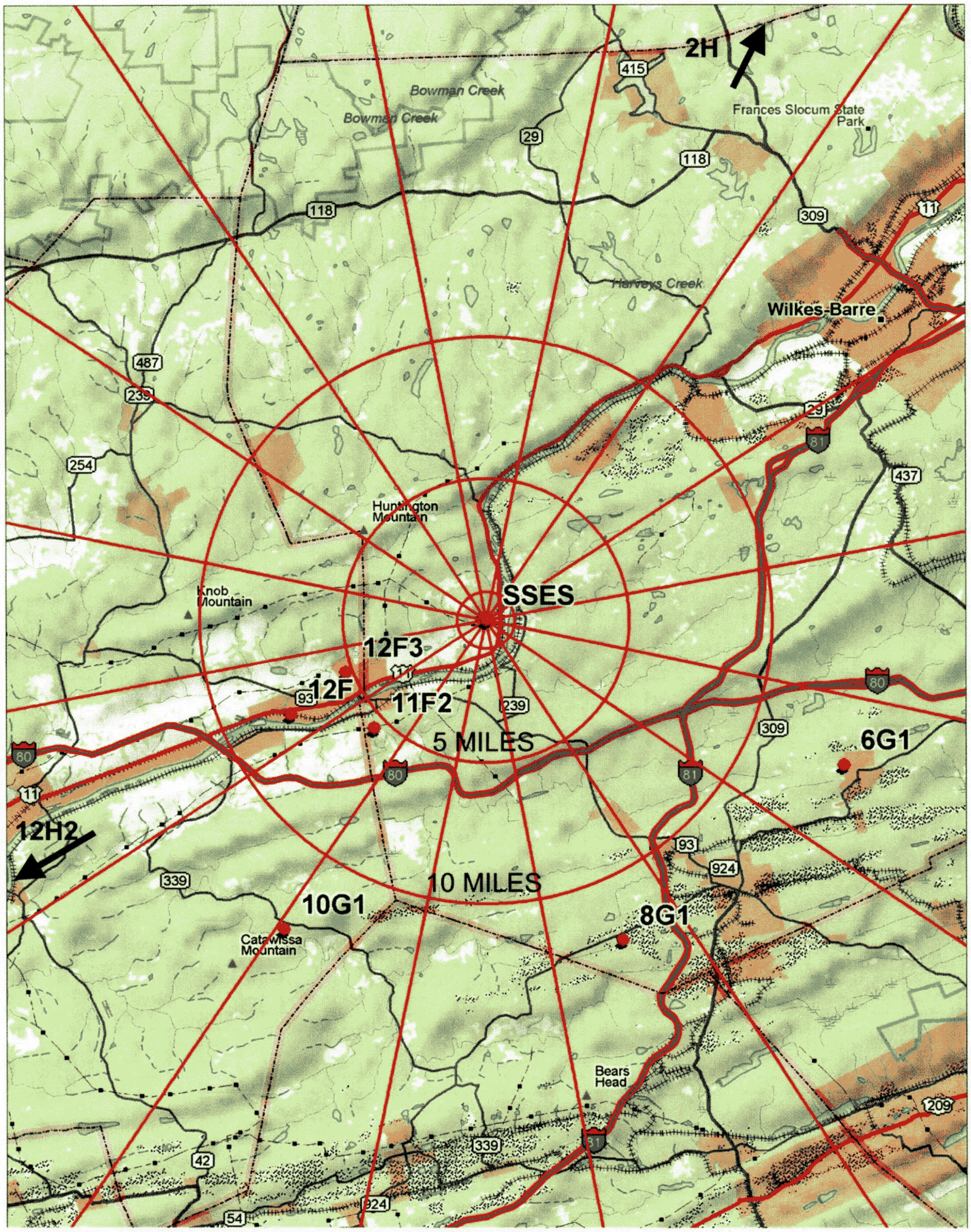
FIGURE 7
2003 ENVIRONMENTAL SAMPLING LOCATIONS GREATER THAN FIVE MILES FROM THE SSES



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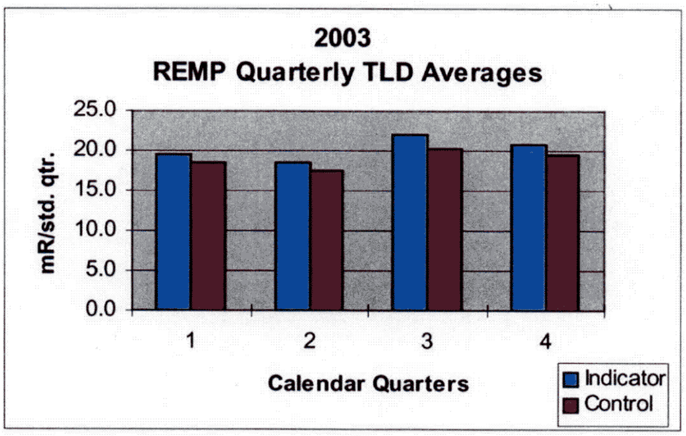
AMBIENT RADIATION MONITORING

INTRODUCTION

The principal or primary method for the SSES REMP's measurement of ambient radiation levels is the use of thermoluminescent dosimeters (TLDs). The TLDs are crystals (calcium sulfate) capable of detecting and measuring low levels of radiation by absorbing a portion of the radiation's energy that is incident upon them and storing the captured energy until the TLDs are processed (read). Processing involves heating the TLDs to release their stored energy in the form of light and measuring the intensity of the light that they emit. The intensity of the emitted light is proportional to the amount of radiation to which they were exposed. Calibration of the TLD processors permits a reliable relationship to be established between the light emitted and the amount of radiation dose received by the TLDs; the result permits accurate measurements of the ambient radiation in the environment.

Environmental TLDs are continually exposed to natural radiation from the ground (terrestrial radiation) and from the sky (cosmic) radiation. In addition, they also may be exposed to man-made radiation. Most of the environmental TLD's natural radiation exposure comes from sources in the ground. These terrestrial sources vary naturally with time due to changes in soil moisture, snow cover, etc. The natural-radiation picture is complicated because the factors affecting radiation reaching the TLDs from the ground vary differently with time from one location to another due to locational differences in such factors as soil characteristics (amounts of organic matter, particle size, etc.), drainage opportunities, and exposure to sunlight. Environmental TLDs can also be affected by direct radiation (shine) from the SSES turbine buildings during operation, radwaste transfer and storage, and radioactive gaseous effluents from the SSES.

Unfortunately, TLDs do not have any inherent ability to indicate the source of the radiation to which they are exposed. The placement of numerous TLDs in the environment can facilitate decision-making about the possible radiation sources to which TLDs are exposed. However, a method for evaluating TLD data is still required. The SSES REMP relies on a statistically based approach to simultaneously compare indicator TLD data with control TLD data and operational TLD data with preoperational TLD data. This approach permits the flagging of environmental TLD doses that might have been produced by both man-made sources of radiation, as well as natural radiation sources. It also provides a means for attributing a portion of the total TLD dose to SSES operation if appropriate. Appendix E, pages E-6 through E-10, provides a description of the process for evaluating the results of TLD measurements.



The estimated quarterly exposure contributions were summed by location for the entire year. The largest dose suggested was approximately 0.0314 mrem at an onsite monitoring location, 9S2, 0.2 mile south of the SSES. This dose was used for determining compliance with SSES Technical Requirement Limit 3.11.3 for annual effluent reporting purposes. This dose amounts to only 0.13% of the 25 mrem whole-body dose limit of SSES Technical Requirement 3.11.3.

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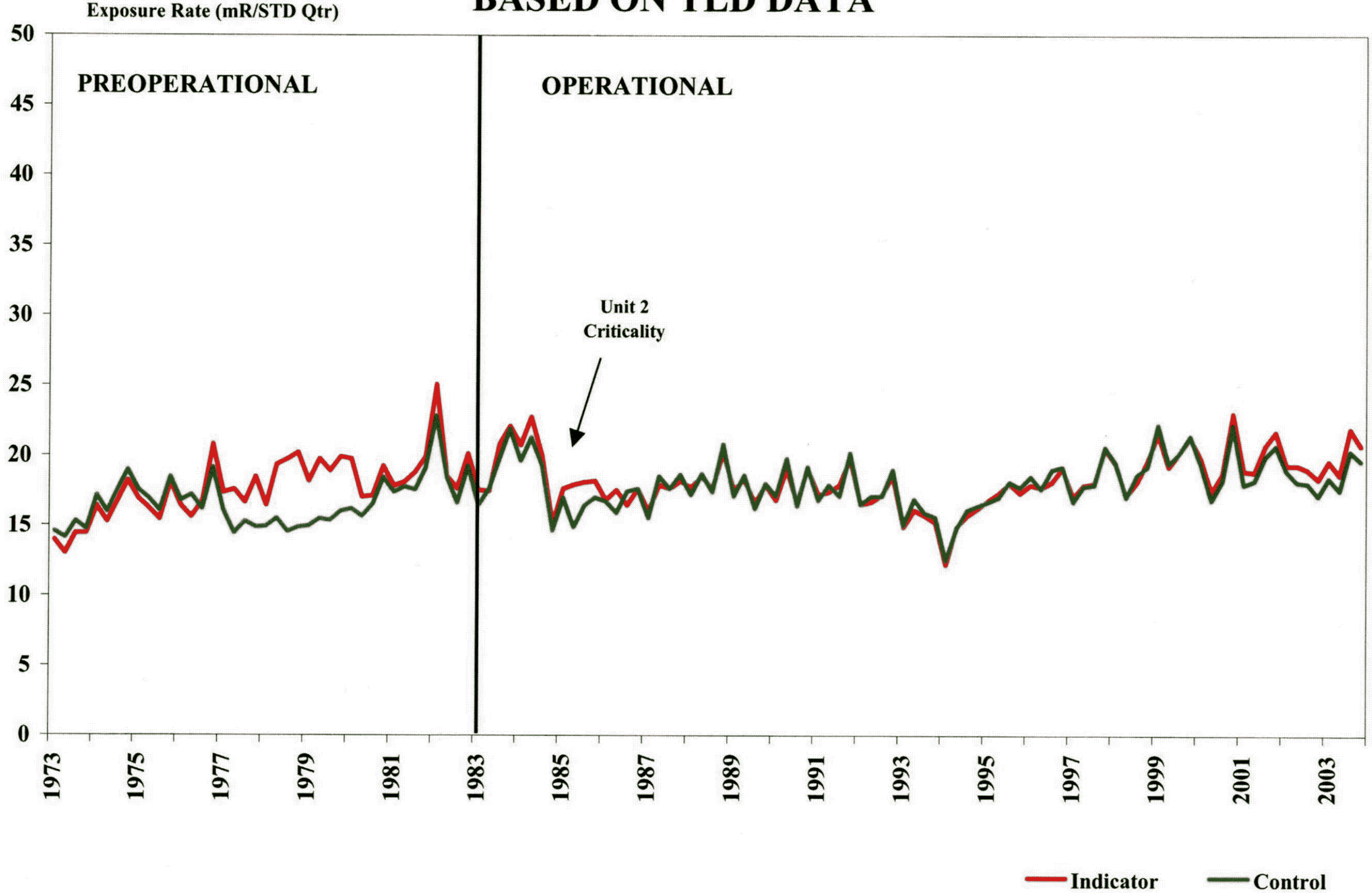
FIGURE 8 - AMBIENT RADIATION LEVELS BASED ON TLD DATA



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AQUATIC PATHWAY MONITORING

INTRODUCTION

The following media were monitored in 2003 by the SSES REMP in the aquatic pathway: surface water, drinking water, fish, and sediment. Some of the media (e.g., drinking water and fish) provide information that can be especially useful to the estimation of possible dose to the public from potentially ingested radioactivity, if detected. Other media, such as sediment, can be useful for trending radioactivity levels in the aquatic pathway, primarily because of their tendency to assimilate certain materials that might enter the surface water to which they are exposed. The results from monitoring all of these media provide a picture of the aquatic pathway that is clearer than that which could be obtained if one or more were not included in the REMP.

Fruits or vegetables that are grown in fields irrigated with surface water would also be in the aquatic pathway. The land use census (Reference 11) conducted in 2003 looked at farms within 10 miles downstream of the SSES. Two farm fields were found to have been irrigated during the 2003 growing season.

The aquatic pathway in the vicinity of the SSES is the Susquehanna River. Monitoring of all of the aquatic media, except drinking water, is conducted both downstream and upstream of the location from which occasional SSES low-level radioactive discharges enter the river. The upstream monitoring locations serve as controls to provide data for comparison with downstream monitoring results. The potential exists for radioactive material that might be present in SSES airborne releases to enter the Susquehanna River upstream of the plant through either direct deposition (e.g., settling or washout) or by way of runoff from deposition on land adjacent to the river. However, direct deposition and runoff are considered to be insignificant as means of entry for SSES radioactivity into the Susquehanna River when compared to liquid discharges under normal conditions.

Lake Took-a-While (LTAW), which is located in PPL's Riverlands Recreation Area adjacent to the Susquehanna River, is also considered to be part of the aquatic pathway for monitoring purposes. Although it is not in a position to receive water discharged to the river from the SSES, it can receive storm runoff from the SSES. Storm runoff from the SSES site should not normally contain any measurable radioactivity from the plant. However, the SSES REMP, consistent with other aspects of aquatic monitoring and the REMP, in general, goes beyond its requirements by monitoring LTAW.

Scope

Surface Water

Surface water was routinely sampled from the Susquehanna River at one indicator location (6S5) and one control location (6S6) at the SSES River Water Intake during 2003. Sampling also took place at the following additional indicator locations: the SSES discharge line to the river (2S7/6S7) and Lake Took-A-While (LTAW).

Drinking Water

Drinking water samples were collected at location 12H2, the Danville Municipal Water Authority's treatment facility on the Susquehanna River, in 2003. Treated water is collected from the end of the processing flowpath, representing finished water that is suitable for drinking. This is the nearest point downstream of the SSES discharge to the River at which drinking water is obtained. No drinking water control location is sampled. For all intents and purposes, control surface water sampling locations would be suitable for comparison.

Fish

Fish were sampled from the Susquehanna River in the spring and fall of 2003 at one indicator location, IND, downstream of the SSES liquid discharge to the River and one control location, 2H, sufficiently upstream to essentially preclude the likelihood that the fish caught there would spend any time below the SSES discharge. In addition, fish were also sampled in the fall from PPL's Lake Took-a-While, location LTAW. This location is not downstream of the SSES discharge. It is sampled because of its potential for receiving runoff from the SSES. LTAW is considered an indicator location.

Sediment

Sediment sampling was performed in the spring and fall at indicator locations 7B and 12F and control location 2B on the Susquehanna River. In addition, sediment was also obtained from location LTAW.

Sampling

Surface Water

Weekly grab sampling was performed at the indicator location 6S5. Weekly grab samples were composited both monthly and biweekly at this location. Location 6S5 was considered a backup for locations 2S7 and 6S7 in the event that water could not be obtained from the automatic samplers at these locations. Nevertheless, 6S5 was sampled routinely throughout 2003, since it is the closest downstream sampling point to the SSES discharge.

Indicator locations 2S7 and 6S7, the SSES Cooling Tower Blowdown Discharge (CTBD) line, and control location 6S6, the SSES River Water Intake structure, were sampled time proportionally using automatic continuous samplers. The samplers were typically set to obtain 30-60 ml aliquots every 20-25 minutes. Weekly, the water obtained by these samplers was retrieved for both biweekly and monthly compositing.

The other surface water monitoring location, LTAW, was grab sampled once each month.

Drinking Water

Treated water was sampled time proportionally by an automatic sampler. The sampler was typically set to obtain three 12-ml aliquots every twenty minutes. Weekly, the water obtained by this sampler was retrieved for both biweekly and monthly compositing.

Fish

Fish were obtained by electrofishing. Electrofishing stuns the fish and allows them to float to the surface so that those of the desired species and sufficient size can be sampled. Sampled fish include recreationally important species, such as smallmouth bass, and also channel catfish and shorthead redhorse. The fish are filleted and the edible portions are kept for analysis.

Sediment

Shoreline sediment was collected to depths of four feet of water.

Sample Preservation and Analysis

Surface and Drinking Water

Surface and drinking water samples were analyzed monthly for beta activities, the activities of gamma-emitting radionuclides, and tritium activities. Biweekly composite samples were analyzed for I-131. In addition, drinking water samples were analyzed for gross alpha activity.

The use of nitric acid and sodium bisulfite as preservatives in surface and drinking water samples was discontinued in 2003 (at the request of the vendor laboratory).

Sediment and Fish

Fish are frozen until shipment. All samples are analyzed by gamma spectroscopy for the activities of any gamma emitting radionuclides that may be present.

Monitoring Results

Surface Water

Results from specific sample analyses of surface water may be found in Tables I-2 and I-3 of Appendix I. A summary of the 2003 surface water data may be located in Table G of Appendix G. Comparisons of 2003 monitoring results with those of past years may be found in Tables H 2 through H 4 of Appendix H.

The Nuclear Regulatory Commission (NRC) requires that averages of the activity levels for indicator environmental monitoring locations and for control environmental monitoring locations of surface water, as well as other monitored media, be reported to the NRC annually. Data from the following three surface water monitoring locations were averaged together as indicators for reporting purposes: one location (6S5) on the Susquehanna River downstream of the SSES, Lake-Took-a While (LTAW) adjacent to the river, and the SSES cooling tower blowdown discharge (CTBD) line to the river (2S7).

Technically, the CTBD line is not part of the environment. The CTBD line is a below ground pipe to which the public has no access, contrary to the other environmental monitoring locations on the Susquehanna River to which the public does have access. However, currently there is no automatic composite sampling of an indicator location on the Susquehanna River, so the CTBD line from the SSES is included as an indicator monitoring location in the radiological environmental monitoring program.

Most of the water entering the Susquehanna River through the SSES CTBD line is simply water that was taken from the river upstream of the SSES, used for cooling purposes without being radioactively contaminated by SSES operation, and returned to the river. Nevertheless, batch discharges of relatively small volumes of slightly radioactively contaminated water are made to the river through the SSES CTBD at times throughout each year. The water is released from tanks of radioactively contaminated water on site to the CTBD and mixes with the noncontaminated water already present in the CTBD. Flow rates from the tanks containing radioactively contaminated water being discharged to the CTBD vary based on the radioactivity level of the batch release. In addition, the minimum flow rate for the returning water in the CTBD is maintained at a flow rate of 5,000 gpm or higher. These requirements are in place to ensure adequate dilution of radioactively contaminated water by the returning noncontaminated water in the CTBD prior to entering the river.

At the point that CTBD water enters the river, additional, rapid dilution of the discharged water by the river is promoted by releasing it through a diffuser. The diffuser is a large pipe with numerous holes in it that is positioned near the bottom of the river. CTBD discharges exit the diffuser through the many holes, enhancing the mixing of the discharge and river waters. The concentrations of contaminants are reduced significantly as the discharged water mixes with the much larger flow of river water. The mean flow rate of the Susquehanna River in 2003 was approximately 9,910,000 gpm. This is more than 1,900 times the required minimum flow rate through the CTBD for discharges to be permitted.

The amounts of radioactively contaminated water being discharged are small. Nevertheless, sensitive analyses of the water samples can often detect the low levels of certain types of radioactivity in the CTBD water following dilution. Though the levels of radioactivity measured in the CTBD water are generally quite low, they tend to be higher than those in the river downstream of the SSES. Most radionuclides discharged from the SSES CTBD are at such low levels in the downstream river water that, even with the sensitive analyses performed, they cannot be detected.

When the radioactivity levels from the CTBD samples throughout the year are averaged with those obtained from actual downstream monitoring locations, the result is an overall indicator location average that is too high to be representative of the actual average radioactivity levels of the downstream river water. As the following discussions are reviewed, consideration should be given to this inflation of average radioactivity levels from the inclusion of CTBD (location 2S7/6S7) results in the indicator data that is averaged.

The 2003 data for **gross beta activity** analyses of surface water indicator locations is higher than those of 2002.

The 2003 mean gross beta activity of 6.1 pCi/liter for indicator locations is greater than the 2002 indicator mean gross beta activity of 5.4 pCi/liter. The 2003 indicator mean activity is within the range of the annual means for the previous operational period of the SSES. The 2003 mean gross beta activity of 2.4 pCi/liter for control locations is less than the 2.9 pCi/liter for the 2002 control mean gross beta activity. The 2003 control mean activity is within the range of the annual means for previous operational periods. The 2003 control mean is below the range of annual means for preoperational periods. Refer to Figure 9 which trends gross beta activities separately for surface water indicator and control locations quarterly from 1975 through 2003.

Comparison of the 2003 indicator mean (6.1 pCi/l) to the 2003 control mean (2.4 pCi/l) suggests a contribution of beta activity from the SSES. The 2003 data is similar in this regard to the averages of annual means for indicator and control locations for the prior operational period. During the prior operational period, the average of annual indicator means exceeds the average of annual control means for gross beta activity.

The 2003 means for **iodine-131 activity** at indicator and control surface water monitoring locations were 0.36 pCi/liter and 0.26 pCi/liter, respectively. The 2003 indicator and control means are less than the corresponding 2002 means. The 2003 indicator mean activity is greater than the averages of the annual means for indicator locations for the prior operational and preoperational periods of the SSES. The 2003 control mean activity is less than the averages of the annual means for control locations for the prior operational and preoperational period of the SSES.

Throughout the course of a year, iodine-131 is typically measured at levels in excess of analysis MDCs in some samples obtained from control surface water monitoring locations on the Susquehanna River upstream of the SSES as well as indicator locations downstream of the SSES. As determined by measurements of samples obtained by the SSES REMP, the mean iodine-131 activity level from the CTBD for all of 2003 was approximately 0.78 pCi/liter. This may be compared to the activity level of 0.26 pCi/liter for control surface water monitoring locations in 2003.

Iodine-131 from the discharge of medical wastes into the Susquehanna River upstream of the SSES is drawn into the SSES cooling tower basins through the SSES River Water Intake Structure. It is reasonable to assume that concentration of the already existing iodine-131 in the cooling tower basins occurs as it does for other substances found in the river. For example, the SSES routinely assumes concentration factors in the basin for calcium of four to five times the concentrations in the river water entering the basins, based on past measurements. This concentrating effect occurs because of the evaporation of the water in the basins, leaving behind most dissolved and suspended materials in the unevaporated water remaining in the basins. If a concentration factor of four for iodine-

131 were to be applied to the 2003 mean iodine-131 activity level for the control samples from the Susquehanna River, a mean concentration of 1.04 pCi/liter for iodine-131 in the basin water and the water being discharged from the basins would be expected. The actual 2003 mean of 0.78 pCi/liter for the CTBD iodine-131 activity level was less than this.

Because iodine-131 is radioactive, unlike the calcium that has been measured, iodine-131 is removed from the water while it is in the basins through the radioactive decay process. Thus, it might be expected that the net concentration factor for iodine-131 would be somewhat less than that for calcium, considering this additional removal process. The extent to which the iodine-131 concentration factor is less than that for calcium would depend on the mean residence time for the water in the basins compared to iodine-131's radioactive half-life - the greater the ratio of the mean residence time to the half-life, the smaller the concentration factor. A mean residence time for water in the basins is expected to be about two days. This is only about one-fourth of the approximately eight-day half-life of iodine-131. Thus, radioactive decay would not be expected to reduce the concentration factor for iodine-131 by a large amount. Therefore, the difference between the 2003 mean iodine-131 activity of about 0.78 pCi/liter in the CTBD and the 2003 mean iodine-131 activity for the control location of 0.26 pCi/liter should be the result of concentration in the basins. Iodine-131 was not reported to have been discharged with water released from the SSES to the Susquehanna River during 2003.

The 2003 mean tritium activity for indicator locations is more than the corresponding 2002 mean. The 2003 means for tritium activity at indicator and control locations were 1,567 pCi/liter and 31.8 pCi/liter, respectively. The 2003 indicator mean is greater than the annual average mean for prior operational and preoperational periods of the SSES. Note that the 2003 mean tritium activity at indicator locations is higher than the range for both operational and preoperational periods. The control mean is within the range of the corresponding annual mean reported for the prior operational period of the SSES. Refer to Figure 10 which trends tritium activity levels separately for surface water indicator and control locations from 1972 through 2003.

The 2003 indicator mean tritium level for all surface water locations can be misleading for those interested in the mean tritium level in the Susquehanna River downstream of the SSES for 2003. The much higher levels of tritium observed in the CTBD line (location 2S7/6S7), when averaged with the low levels from the downstream location 6S5 sample analysis results distort the real environmental picture. The mean tritium activity level from indicator location 6S5 for 2003 was 140 pCi/liter, which is greater than the mean tritium activity, 31.8 pCi/liter, for the control location, but is within the range of prior operational and preoperational periods.

In spite of the fact that the tritium activity levels reported for 2S7/6S7 are from the discharge line prior to dilution in the river, the highest quarterly average tritium activity reported at 2S7/6S7 during 2003 was approximately 6,990 pCi/liter for the first quarter, well below the NRC non-routine reporting levels for quarterly average activity levels of 20,000 pCi/liter when a drinking water pathway exists or 30,000 pCi/liter when no drinking water pathway exists.

The tritium activity reported in the CTBD line from location 2S7/6S7 is attributable to the SSES. Refer to the "Dose from the Aquatic Pathway" discussion at the end of this section for additional information on the projected dose to the population from tritium and other radionuclides in the aquatic pathway attributable to the SSES.

With the following exceptions, no gamma-emitting radionuclides were measured in surface water primary samples at an activity level exceeding an analysis MDC in 2003: potassium-40 and iodine-131.

Drinking Water

Drinking water was monitored during 2003 at the Danville Water Company's facility 26 miles WSW of the SSES on the Susquehanna River. From 1977 (when drinking water samples were first collected) through 1984, drinking water samples were also obtained from the Berwick Water Company at location 12F3, 5.2 miles WSW of the SSES. The drinking water supply for the Berwick Water Company is not, however, water from the Susquehanna River; it is actually well water.

There are no known drinking water supplies in Pennsylvania on the Susquehanna River upstream of the SSES and therefore no drinking water control monitoring locations. Danville drinking water analysis results may be compared to the results for surface water control monitoring locations.

Results from specific sample analyses of drinking water may be found in Table I-4 of Appendix I. A summary of the 2003 drinking water data may be located in Table G of Appendix G. Comparisons of 2003 monitoring results with those of past years may be found in Tables H 5 through H 7 of Appendix H.

Gross alpha activity has been monitored in drinking water since 1980. Gross alpha activity has been observed at levels above the analysis MDCs in a small minority of the samples during most years since 1980. The 2003 mean gross alpha activity level for drinking water was 0.18 pCi/liter. The 2003 mean alpha activity level is within the range of the corresponding annual means for the prior operational years. No gross alpha activity in drinking water during 2003 is attributed to liquid discharges from the SSES to the Susquehanna River.

Gross beta activity has been monitored in drinking water since 1977. Gross beta activity is typically measured at levels exceeding the MDCs in drinking water samples. The 2003 mean gross beta activity level for drinking water was 2.13 pCi/liter. The 2003 mean is below the 2002 mean gross beta activity level for drinking water but within the range of the corresponding annual means for prior operational periods. The 2003 mean is below the range of the corresponding annual means for preoperational periods. Refer to Figure 11 which trends gross beta activity levels separately for drinking water indicator and control locations from 1977 through 2003. No gross beta activity in drinking water during 2003 is attributed to liquid discharges from the SSES to the Susquehanna River.

Iodine-131 was measured in excess of analysis MDCs in 2 out of 26 drinking water samples in 2003. This compares with results from 6 samples for which analysis MDCs were exceeded in 2002. The 2003 mean iodine-131 activity level in drinking water samples was 0.18 pCi/liter. This is less than the 2002 mean drinking water activity level of 0.22 pCi/liter. Also, it is less than the 2003 mean of 0.26 pCi/liter for the surface water control location. No iodine-131 activity in drinking water during 2003 is attributed to liquid discharges from the SSES to the Susquehanna River.

Tritium was measured in excess of analysis MDCs twice in 2003 in drinking water. The 2003 mean tritium activity level for drinking water was 62 pCi/liter. The 2003 mean is equal to the averages of the corresponding annual means for both the prior operational and preoperational periods of the SSES. The 2003 mean tritium activity level for drinking water is higher than the 2003 mean tritium activity level for the surface water control location. Tritium activity in drinking water can be attributed to liquid discharges from the SSES to the Susquehanna River.

With the exception of I-131, no gamma-emitting radionuclides were measured above the analysis MDCs for gamma spectroscopic analyses of drinking water samples during 2003.

Fish

Results from specific sample analyses of fish may be found in Table I 5 of Appendix I. A summary of the 2003 fish data may be located in Table G of Appendix G. A comparison of 2003 monitoring results with those of past years may be found in Table H 8 of Appendix H.

Three species of fish were sampled at each of one indicator location and one control location on the Susquehanna River in May 2003 and again in October 2003. The species included the following: smallmouth bass, channel catfish, shorthead redhorse, and white sucker. In addition, one largemouth bass was sampled from PPL's LTAW. A total of 13 fish were collected and analyzed.

The only gamma-emitting radionuclide reported in excess of analysis MDCs in fish during 2003 was naturally occurring potassium-40. The 2003 indicator and control means for the activity levels of potassium-40 in fish were 3.57 pCi/gram and 3.16 pCi/gram, respectively. The 2003 indicator and control means were less than the 2002 means. Both the 2003 indicator and control means are within the ranges of their corresponding annual means for prior operational years. The 2003 indicator mean is greater than the range of corresponding annual means for preoperational periods. The 2003 control mean is within the range of corresponding annual means for preoperational periods. Naturally occurring potassium-40 in fish is not attributable to the liquid discharges from the SSES to the Susquehanna River.

Sediment

Shoreline sediment was sampled in May 2003 and again in October 2003. Results from specific sample analyses of sediment may be found in Table I-6 of Appendix I. A summary of the 2003 sediment data is located in Table G of Appendix G. Comparisons of 2003 monitoring results with those of past years may be found in Tables H 9 through H 12 of Appendix H.

Naturally occurring potassium-40, radium-226, and thorium-228 were measured at activity levels above analysis MDCs in all shoreline sediment samples in 2003.

The 2003 indicator and control means for potassium-40 activity levels in shoreline sediment were 12.3 pCi/gram and 12.9 pCi/gram, respectively. The 2003 indicator mean for potassium-40 activity is less than the corresponding 2002 mean. The 2003 control mean is greater than the corresponding 2002 mean. The 2003 indicator and control means were within the ranges of corresponding annual means for all prior operational years. The 2003 indicator and control means were greater than the ranges of corresponding means for preoperational periods.

The 2003 indicator and control means for radium-226 activity levels in shoreline sediment were 2.38 pCi/gram and 1.6 pCi/gram, respectively. The 2003 indicator mean radium-226 activity is higher than the corresponding 2002 mean. The 2003 control mean radium-226 activity is lower than the corresponding 2002 means. The 2003 radium-226 mean was above the range of corresponding annual means for all prior operational years. The 2003 control mean was within the range of corresponding annual means for all prior operational years.

The 2003 indicator and control means for thorium-228 activity levels in shoreline sediment were 3.2 and 3.0 pCi/gram, respectively. The 2003 indicator and control means are higher than the corresponding 2002 means. The 2003 indicator and control means are greater than the range of corresponding means for prior operational years. The naturally occurring radionuclides in sediment discussed above are not attributable to the liquid discharges from the SSES to the Susquehanna River.

Cesium-137 was measured at activity levels in shoreline sediment exceeding analysis MDCs in 5 of 6 analyses during 2003. The 2003 indicator and control means for cesium-137 activity levels in sediment were 0.07 pCi/gram and 0.08 pCi/gram, respectively. The 2003 indicator mean is greater than the corresponding 2002 mean. The 2003 control mean is less than the corresponding 2002 mean. The 2003 indicator and control means are less than the average of corresponding annual means for both prior operational as well as preoperational years. The cesium-137 in sediment is attributed to residual fallout from past atmospheric nuclear weapons tests.

Dose from the Aquatic Pathway

Tritium was the only radionuclide identified in 2003 by the SSES REMP in the aquatic pathway that was attributable to SSES operation and also included in the pathway to man.

The total tritium activity released from the SSES for the year was estimated based on REMP monitoring results for use in projecting maximum doses to the public. This estimate assumed that the tritium was present continuously in the CTBD line throughout 2003 at a level equivalent to the annual mean activity level of tritium. It was also assumed that the annual average activity level of tritium being contributed to the Susquehanna River water could be represented by the difference between the annual mean activity levels of tritium in the CTBD line (without correction for cooling tower basin reconcentration) and in the river upstream of the SSES.

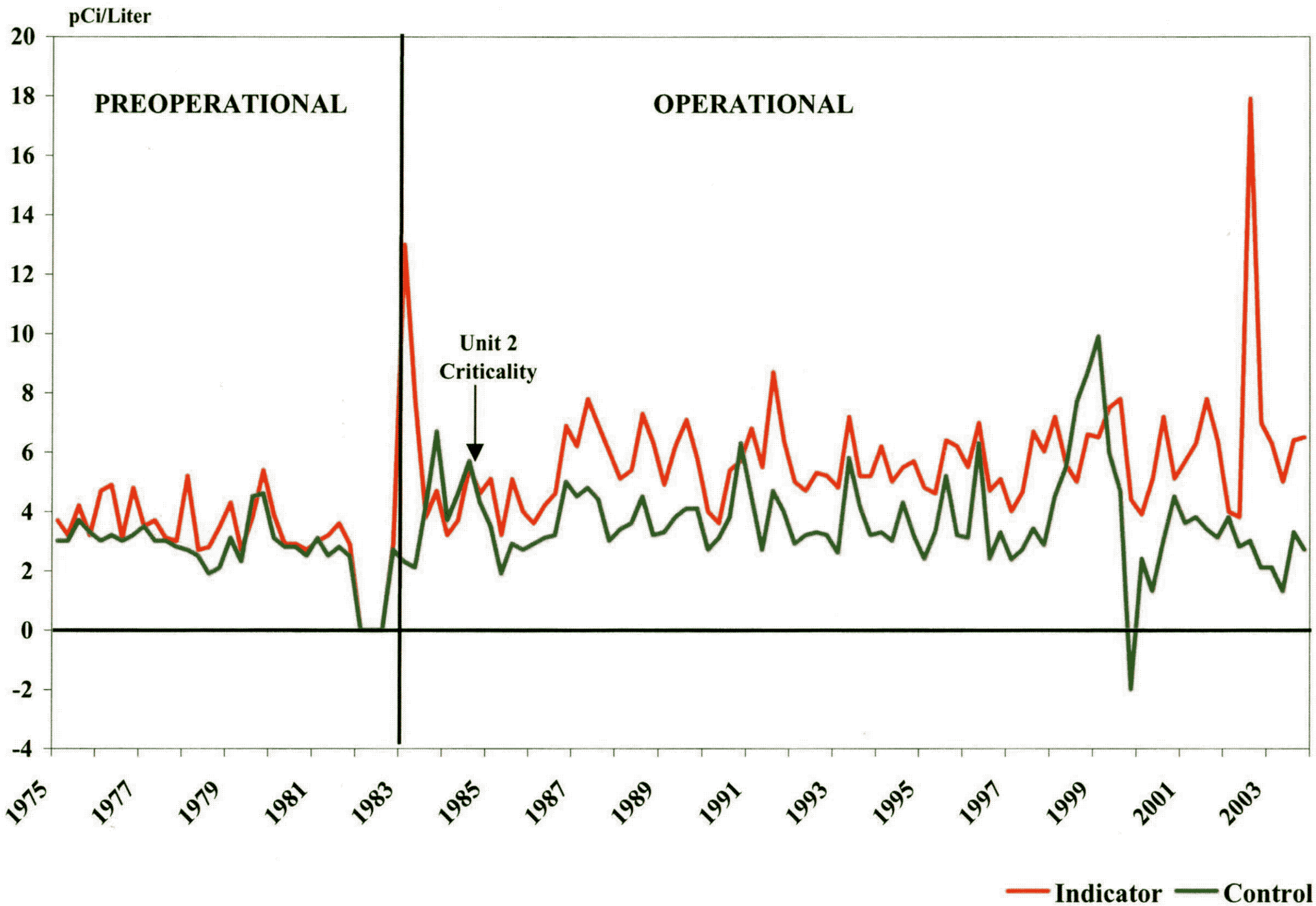
The annual mean activity level of tritium in the CTBD line (monitoring location 2S7\6S7) for 2003 was 4,416 pCi/l. The annual mean activity level for the river upstream of the SSES (monitoring location 6S6) was approximately 32 pCi/l. Thus, the difference in the mean activity levels for these two locations was about 4,384 pCi/l. The annual mean flow rate for the CTBD line was 7,703 gpm. Using the proper unit conversions and multiplying 7,703 gpm times 4,384 pCi/l yields a value of 67.2 curies for the estimate of tritium released during 2003 based on the results of radiological environmental monitoring.

This estimate is 3 curies less than the amount of tritium determined by effluent monitoring to have been released to the river by the SSES in 2003. This agreement between the estimate based on environmental monitoring and the amount reported by effluent monitoring is consistent with previous years comparisons.

Given the total tritium activity released, the maximum whole-body and organ doses to hypothetical exposed individuals in four age groups (adult, teenager, child, and infant) were determined according to the methodology of the Offsite Dose Calculation manual using the RETDAS computer program. This is in accordance with SSES Technical Requirement 3.11.4.1.3.

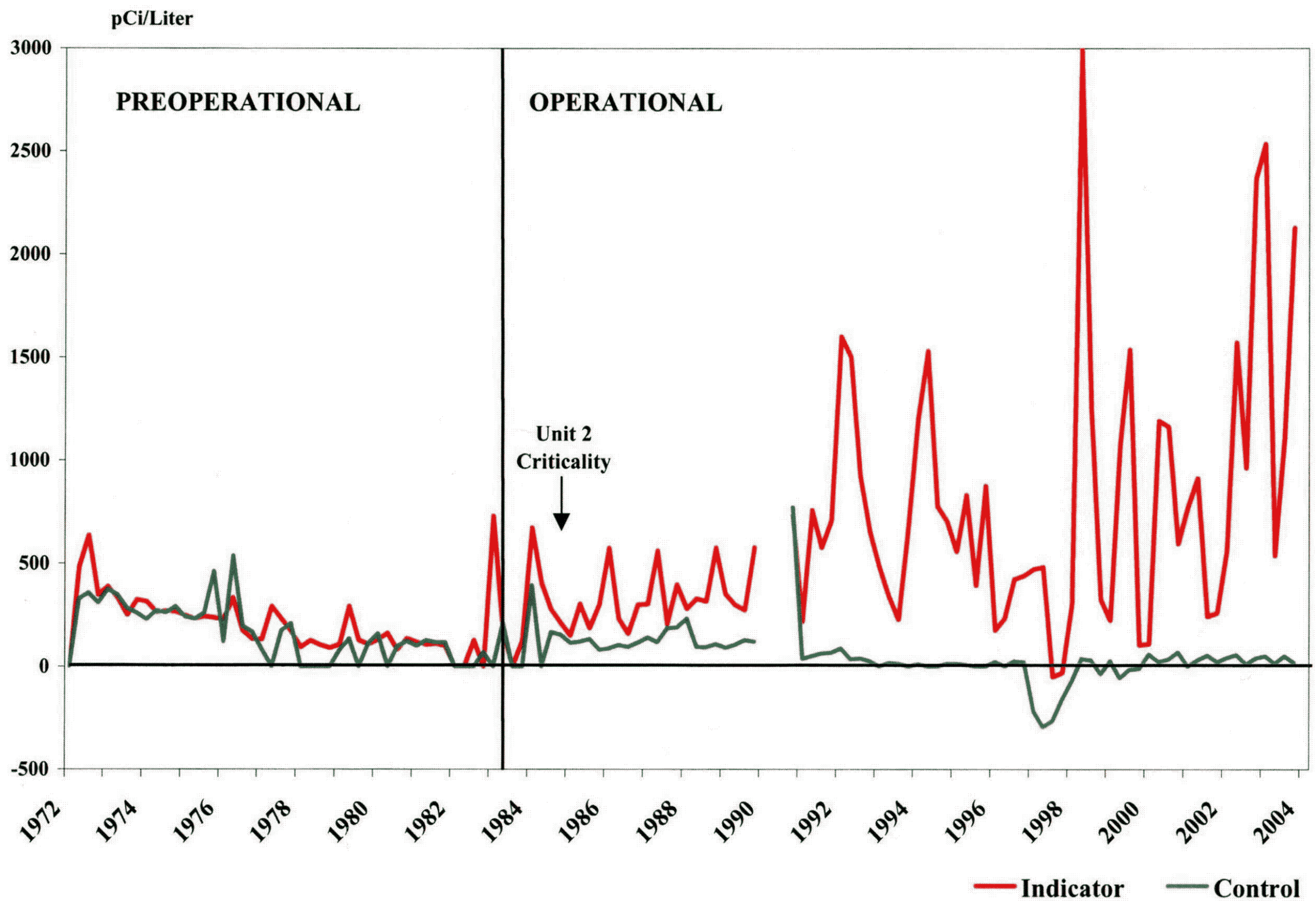
The maximum dose obtained from the ingestion of tritium was estimated at the nearest downriver municipal water supplier via the drinking water pathway and near the outfall of the SSES discharge to the Susquehanna River via the fish pathway. The maximum whole body and organ doses were each estimated to be approximately 0.0015 mrem.

FIGURE 9 - GROSS BETA ACTIVITY IN SURFACE WATER



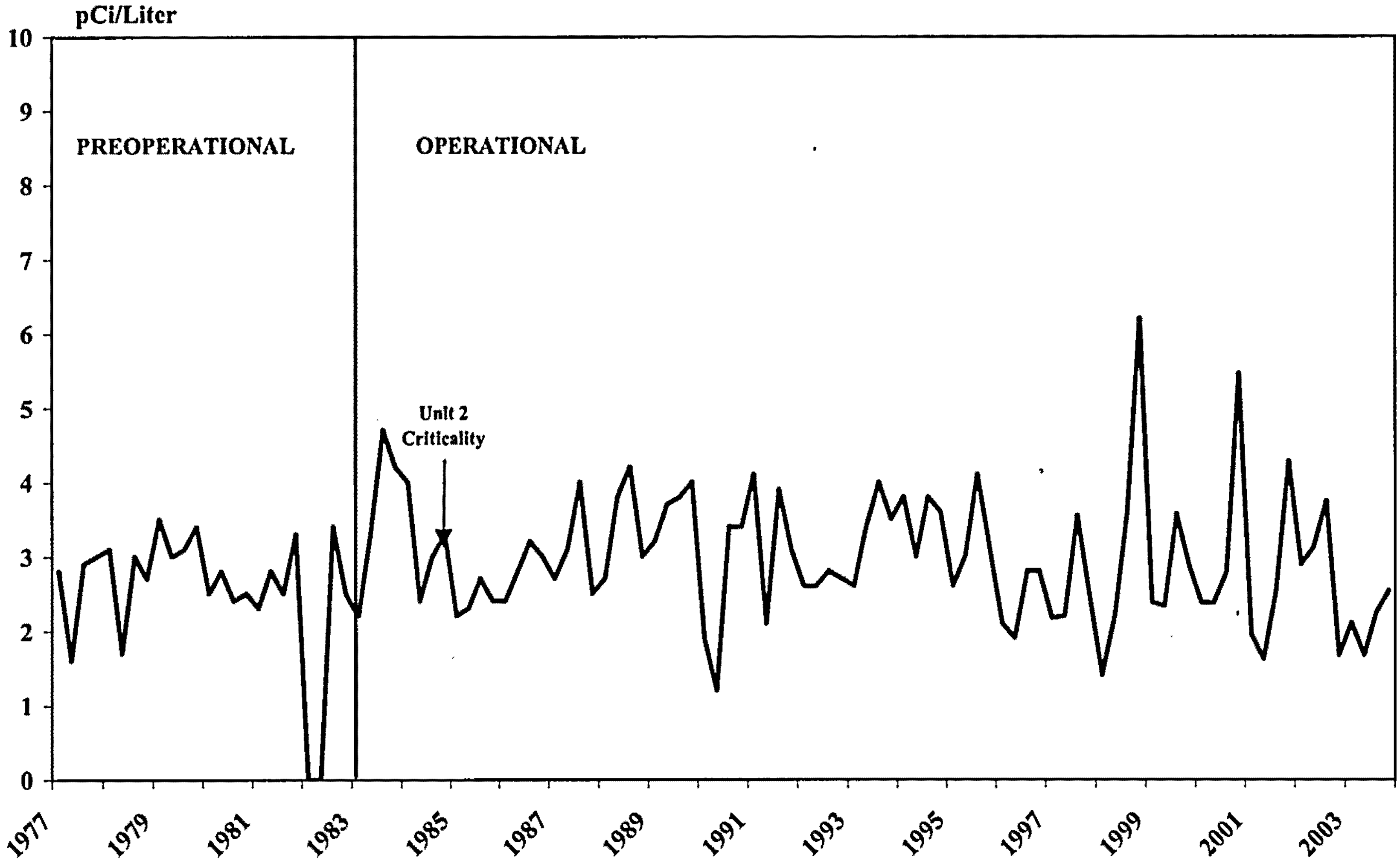
C11

FIGURE 10 - TRITIUM ACTIVITY IN SURFACE WATER



C12

FIGURE 11 - GROSS BETA ACTIVITY IN DRINKING WATER



ATMOSPHERIC PATHWAY MONITORING

INTRODUCTION

Atmospheric monitoring by the SSES REMP involves the sampling and analysis of air. Because the air is the first medium that SSES vent releases enter in the pathway to man, it is fundamental that it be monitored. Mechanisms do exist for the transport of airborne contaminants to other media and their concentration in them. For example, airborne contaminants may move to the terrestrial environment and concentrate in milk. Concentrations of radionuclides can make the sampling and analysis of media like milk more sensitive approaches for the detection of radionuclides, such as iodine-131, in the pathway to man than the monitoring of air directly. (PPL also samples milk; refer to the Terrestrial Pathway Monitoring section of this report.) Nevertheless, the sensitivity of air monitoring can be optimized by the proper selection of sampling techniques and the choice of the proper types of analyses for the collected samples.

Scope

Air samples were collected on particulate filters and charcoal cartridges at indicator locations 3S2, 12S1, 13S6 and 12E1, and control locations 6G1 and 8G1.

Sampling and Analysis

Air

The SSES REMP monitored the air at four indicator locations and two control locations during 2003. The SSES Technical Requirements require monitoring at only a total of five sites. Monitoring is required at three locations at the SSES site boundary in different sectors with the greatest predicted sensitivities for the detection of SSES releases. Monitoring must be performed at the community in the vicinity of the SSES with the greatest predicted sensitivity. A control location that is expected to be unaffected by any routine SSES releases must be monitored.

Airborne particulates were collected on glass fiber filters using low volume (typically 2.0 to 2.5 cfm sampling rates) air samplers that run continuously. Air iodine samples were collected on charcoal cartridges, placed downstream of the particulate filters.

Particulate filters and charcoal cartridges were exchanged weekly at the air monitoring sites. Sampling times were recorded on elapsed-time meters. Air sample volumes for particulate filters and charcoal cartridges were measured with dry-gas meters.

Air filters were analyzed weekly for gross beta activity, then composited quarterly and analyzed for the activities of gamma-emitting radionuclides. The charcoal cartridges were analyzed weekly for iodine-131.

Monitoring Results

Air Particulates

Gross beta activity is always measured at levels in excess of the analysis MDCs on the fiber filters. The highest gross beta activity levels that have been measured during the operational period of the SSES were obtained in 1986 following the Chernobyl accident in the former Soviet Union. Figure 12 trends the quarterly mean gross beta activities for the indicator and control locations separately from 1974 through 2003. Note that prior to SSES operation, before 1982, the unusually high gross beta activities were generally attributable to fallout from atmospheric nuclear weapons tests. Typical gross beta activities measured on air particulate filters are the result of naturally occurring radionuclides associated with dust particles suspended in the sampled air. They are thus terrestrial in origin.

Particulate gross beta activity levels for each monitoring location and monitoring period in 2003 are presented in Table I-8 of Appendix I. Comparisons of 2003 gross beta analysis results with those of previous years may be found in Table H 13 of Appendix H. For 2003, the annual means for the beta activities of the indicator and control locations are 1.47E-2 pCi/m^3 and 1.34E-2 pCi/m^3, respectively. These are near the low end of the corresponding ranges of previous operational yearly averages. They are significantly below the corresponding lower ends of their preoperational yearly averages. A contribution of radioactivity from the SSES may be suggested from the 2003 airborne gross beta data based on the higher mean activity reported for indicator location.

The SSES Technical Requirements Manual requires radionuclide analysis if any weekly gross beta result was greater than ten times the yearly mean of control sample results. This condition did not occur during 2003.

Quarterly gamma spectroscopic measurements of composited filters often show the naturally occurring radionuclide beryllium-7. Occasionally, other naturally occurring radionuclides, potassium-40 and radium-226, are also observed. Beryllium-7 is cosmogenic in origin, being produced by the interaction of cosmic radiation with the earth's atmosphere. The other two gamma-emitting radionuclides originate from soil and rock.

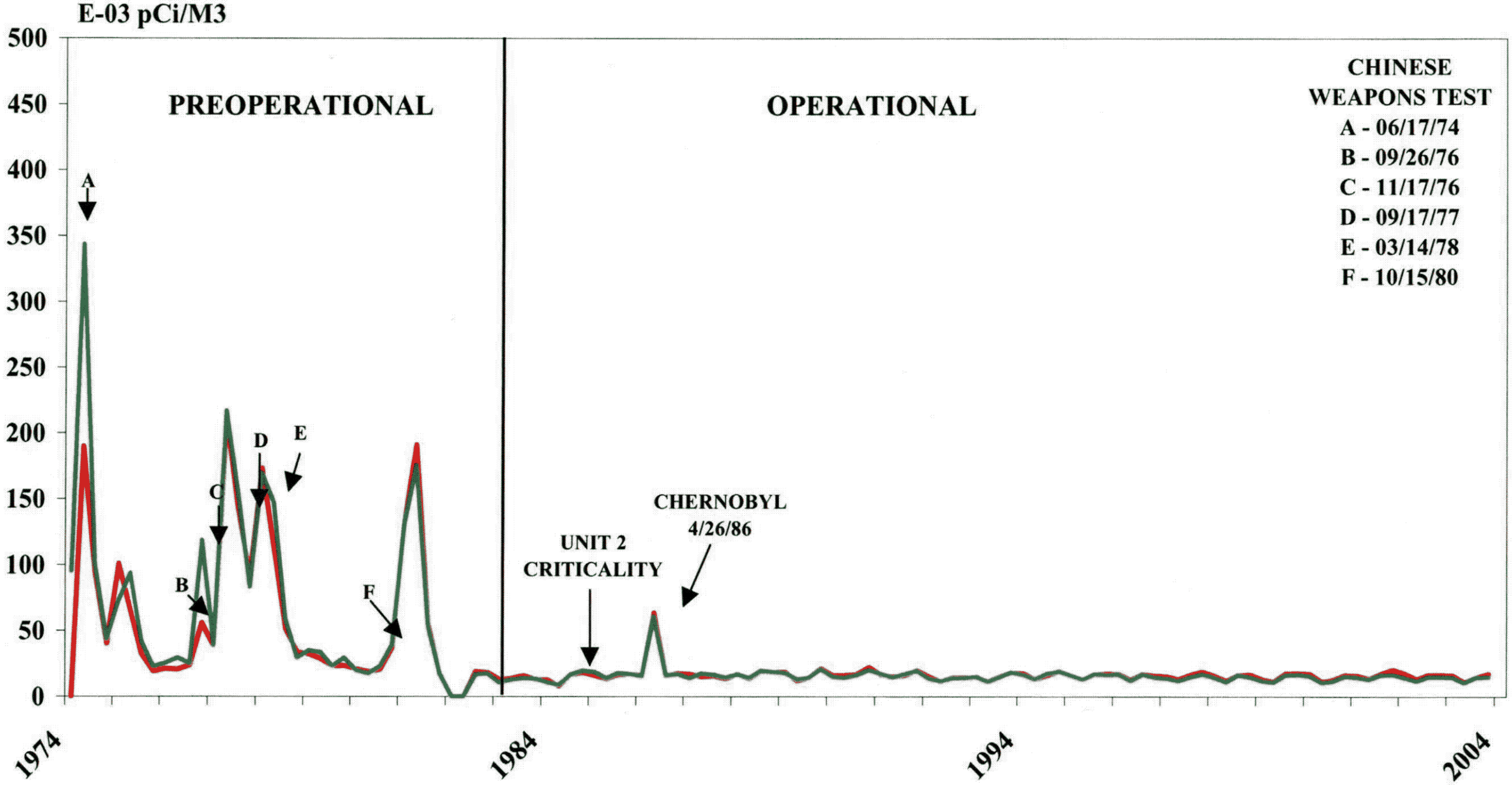
Beryllium-7 was measured above analysis MDCs for all quarterly composite samples in 2003. The 2003 indicator and control means for beryllium-7 activity were 9.10E-2 pCi/m^3, and 8.20E-2 pCi/m^3, respectively. The 2003 means are lower than the corresponding 2002 means. The 2003 indicator and control means were lower than the averages of the corresponding annual means for the prior operational and preoperational periods. Beryllium-7 activity levels for each 2003 calendar quarter at each monitoring location are presented in Table I-9 of Appendix I. Comparisons of 2003 beryllium-7 analysis results with previous years may be found in Table H 14 of Appendix H. Potassium-40 was measured above analysis MDCs for one quarterly composite sample during 2003 (control location 6G1).

No other gamma-emitting radionuclides were reported for air in 2003. Beryllium-7 and potassium-40 are not attributable to SSES operation.

Air Iodine

Iodine-131 has been detected infrequently from 1976, when it was first monitored, through 2003. Since operation of the SSES began in 1982, iodine-131 has only been positively detected in air samples in 1986 due to the Chernobyl accident. No iodine-131 was reported for the 2003 air monitoring results.

FIGURE 12 - GROSS BETA ACTIVITY IN AIR PARTICULATES



C13

TERRESTRIAL PATHWAY MONITORING

INTRODUCTION

The following media were monitored in the Terrestrial Pathway in 2003: soil, milk, fruits and vegetables.

Soil can be a great accumulator of man-made radionuclides that enter it. The extent of the accumulation in the soil depends of course on the amount of the radionuclides reaching it, but it also depends on the chemical nature of those radionuclides and the particular characteristics of the soil. For example, the element cesium, and, therefore, cesium-137 can be bound very tightly to clay in soils. The amount of clay in soil can vary greatly from one location to another. In clay soils, cesium-137 may move very slowly and also may be taken up very slowly in plants as they absorb soil moisture.

Any medium, such as soil, that tends to accumulate radioactive materials can also provide more sensitivity for radionuclide detection in the environment than those media that don't. Such a medium facilitates the early identification of radionuclides in the environment, as well as awareness of changes that subsequently may occur in the environmental levels of the identified radionuclides.

The SSES REMP samples soil near four of the six REMP air sampling stations. The purpose for soil sampling near the air sampling sites is to make it easier to correlate air sampling results with soil sampling results if any SSES related radioactive material were found in either medium. Sampling is performed at different depths near the surface to help provide information on how recently certain radioactive materials may have entered the soil. Sampling at more than one depth also may help ensure the detection of materials that move relatively quickly through the soil. Such quick-moving materials may have already passed through the topmost layer of soil at the time of sampling.

Milk was sampled at four locations and fruit and vegetable samples were obtained at 2 locations in 2003. SSES Technical Requirements require that the SSES REMP sample milk at the three most sensitive monitoring locations near the SSES and one control location distant from the SSES. SSES Technical Requirements only require that fruit and vegetables be sampled at locations irrigated by Susquehanna River water from points downstream of the SSES discharge to the River. There are only three locations within 10 miles downstream of the SSES that have been known to irrigate with water from the Susquehanna River during unusually dry periods. These locations do not irrigate every year. Irrigation was performed at the Chapin Farms "Drake Field" (11F2) and the Lupini Farm "Route 93 Nescopeck Field" (11D2) during 2003 as identified by the 2003 Land Use Census (Reference 11).

No requirement exists for the SSES REMP to monitor soil. All monitoring of the terrestrial pathway that is conducted by the SSES REMP in addition to milk and certain fruit and vegetables is voluntary and reflects PPL's willingness to exceed regulatory requirements to ensure that the public and the environment are protected.

Scope

Soil

Soil was sampled in September 2003 in accordance with its scheduled annual sampling frequency, at the following four REMP air sampling locations, 3S2, 12S1, 13S6, and 8G1. Location 8G1 was a control sampling location; the remaining sampling sites were indicator locations.

Twelve soil plugs were taken at selected spots at each monitoring location. The plugs were separated into "top" (0-2 inches) and "bottom" (2-6 inches) segments. Each set of top and bottom segments was composited to yield 2 soil samples from each location for analysis. Since there are four monitoring locations, a total of 8 soil samples were analyzed in 2003.

Milk

Milk was sampled at least monthly at the following four locations in 2003: 10D1, 10D2, 12B2 and 10G1.

Milk was sampled semi-monthly from April through October when cows were more likely to be on pasture. Locations 10D1, 10D2, and 12B2 are believed to be the most sensitive indicator sites available for the detection of radionuclides released from the SSES. Location 10G1 is the control location. A total of 76 milk samples from both indicator and control locations were analyzed in 2003.

Fruits and Vegetables

Potatoes were sampled during the harvest season at 2 locations surrounding the SSES. A total of 2 samples were collected from locations 11D2, and 11F2.

Both locations were identified as having irrigated with Susquehanna River water from downstream of the SSES during 2003. There are often years with adequate rainfall when no irrigation is performed.

Sample Preservation and Analysis

All media in the terrestrial pathway are analyzed for the activities of gamma-emitting radionuclides using gamma spectroscopy. The other analysis that is routinely performed is the radiochemical analysis for iodine-131 in milk. The use of sodium bisulfite as a preservative in milk samples was discontinued in 2003 (at the request of the vendor laboratory).

Monitoring Results

The only man-made radionuclides normally expected at levels in excess of analysis MDCs in the terrestrial pathway are strontium-90 and cesium-137. Both of these radionuclides are present in the environment as a residual from previous atmospheric nuclear weapons testing.

Strontium-90 analyses are not now routinely performed for any media samples in the terrestrial pathway. Strontium-90 activity would be expected to be found in milk. SSES Technical Requirements do not require that milk be analyzed for strontium-90. Strontium-90 analyses may be performed at any time if the results of other milk analyses would show detectable levels of fission product activity which might suggest the SSES as the source.

Cesium-137 normally has been measured in excess of analysis MDCs in most soil samples. Although game is not currently being monitored, cesium-137 has also been seen often at levels above the MDCs in game in the past.

Certain naturally occurring radionuclides are also routinely found above analysis MDCs in terrestrial pathway media. Potassium-40, a primordial and very long-lived radionuclide, which is terrestrial in origin, is observed in all terrestrial pathway media. Other naturally occurring radionuclides often observed are thorium-228 and radium-226 in soil, and beryllium-7 in fruits and vegetables.

The results of the 2003 terrestrial pathway monitoring resemble those of the past. Results for specific sample analyses of terrestrial pathway media may be found in Tables I-10 through I-12 of Appendix I. A summary of the 2003 terrestrial monitoring data may be located in Appendix G. Comparisons of 2003 monitoring results with those of past years may be found in Tables H 15 through H 19 of Appendix H.

Soil

The following gamma-emitting radionuclides are routinely measured in soil at levels exceeding analysis MDCs: naturally occurring potassium-40, radium-226, and thorium-228 and man-made cesium-137. The 2003 analysis results were similar to those for previous years. No other gamma-emitting radionuclides were reported at levels above analysis MDCs.

The 2003 means for indicator and control location sample potassium-40 activity were 14.4 pCi/gram and 10.6 pCi/gram, respectively. The indicator and control means are within the range of corresponding means for both prior operational and preoperational years. This is not the result of SSES operation because the potassium-40 is naturally occurring. The 2003 indicator and control means for potassium-40 were greater than the corresponding 2002 means.

Ra-226 analysis of soil samples was deleted from the SSES REMP in 2002. Ra-226 was not performed on any soil samples in 2003 and has been discontinued from the SSES REMP soil sample analysis library.

The 2003 means for indicator and control location sample thorium-228 activity were both 0.8 pCi/gram. The 2003 indicator mean is equal to the corresponding 2002 mean. The 2003 control mean for thorium-228 is greater than the corresponding 2002 mean. The indicator and control means are within the ranges of the corresponding means for both the previous operational and preoperational periods, as applicable, of the SSES. Thorium-228 in soil is not the result of SSES operation because it is naturally occurring.

The 2003 means for indicator and control location sample cesium-137 activity were 0.04 pCi/g and 0.07 pCi/g, respectively. The 2003 indicator mean is within the range of the corresponding annual means for prior operational years. The 2003 indicator mean is below the ranges of the corresponding means for preoperational years. The 2003 control mean is below the ranges of the corresponding annual means for both prior operational and preoperational years. Cesium-137 levels in soil samples typically vary widely from sample to sample. Levels of cesium-137 activity in 2003 samples varied by a factor of four over the entire range. Cesium-137 in soil, although man-made, is not from the operation of the SSES. It is residual fallout from previous atmospheric nuclear weapons testing.

Milk

Iodine-131 has been chemically separated in milk samples and counted routinely since 1977. Refer to Figure 13 which trends iodine-131 activity in milk for indicator and control locations separately from 1977 through 2003. Typically, iodine-131 is not reported at levels exceeding the MDCs for the analyses in any milk samples during a monitored year. The 2003 monitoring year was no exception; no iodine-131 above the analysis MDCs was observed in either indicator or control samples.

The preoperational years 1976, 1978, and 1980 were exceptional years in the sense that iodine-131 activity was observed in excess of MDCs due to fallout from atmospheric nuclear weapons testing. Iodine-131 activity was also measured at levels exceeding MDCs in milk samples in 1986 in the vicinity of the SSES as a result of the Chernobyl incident.

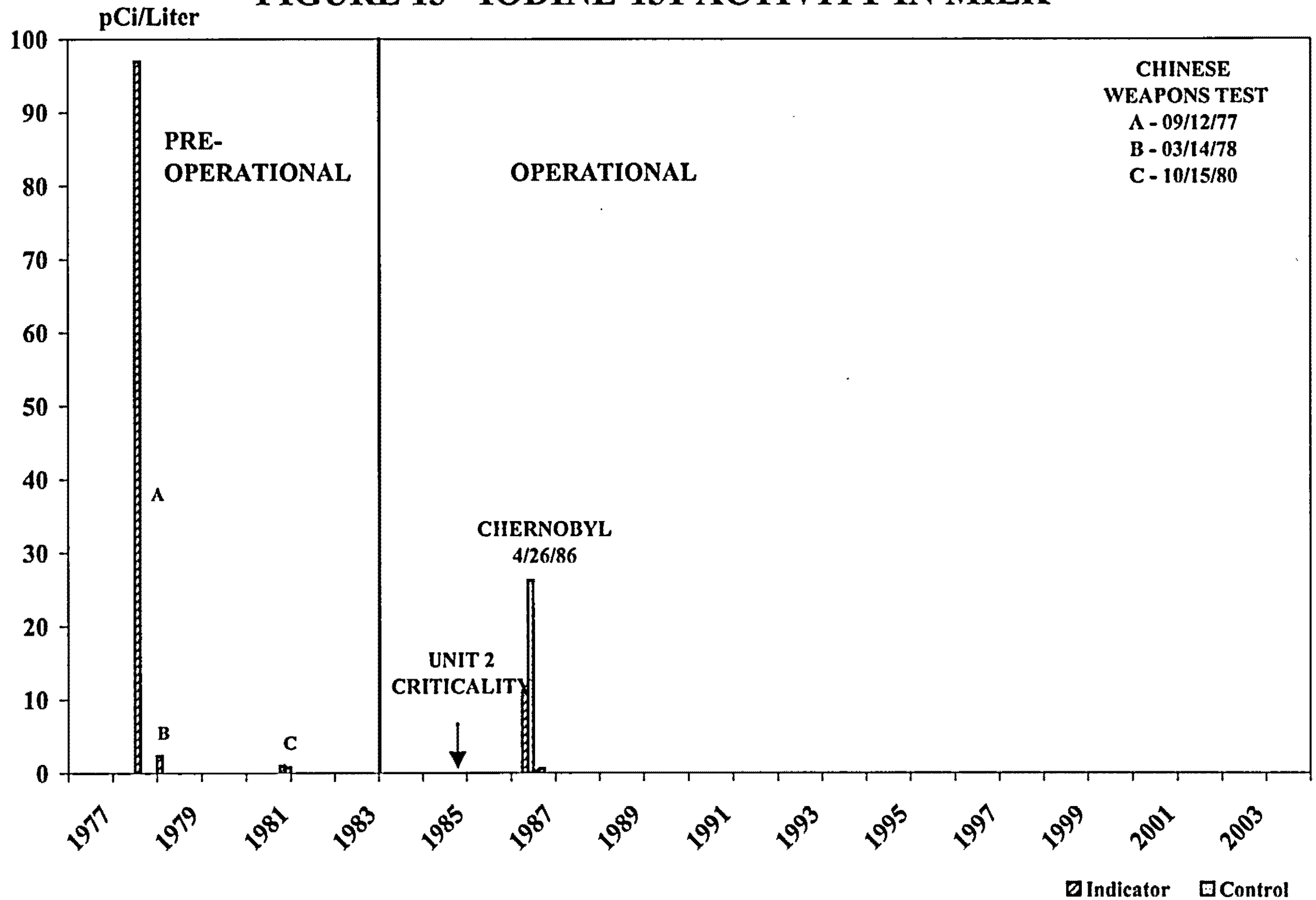
With the exception of the naturally occurring potassium-40, no gamma-emitting radionuclides were measured in excess of analysis MDCs in 2003. The 2003 means for indicator and control location sample potassium-40 activity were 1383 pCi/liter and 1406 pCi/liter, respectively. The 2003 indicator mean is less than the 2002 mean. The 2003 control mean is greater than the corresponding 2002 mean. The 2003 indicator and control means for potassium-40 activity are within the corresponding ranges of annual means for previous operational and preoperational years. The potassium-40 activity in milk is not attributable to the SSES operation because it is naturally occurring.

Fruits and Vegetables

Naturally occurring potassium-40 was the only gamma-emitting radionuclide measured in fruits and vegetables at an activity level in excess of analysis MDC during 2003.

Due to excessive rainfall during the 2003 growing season, fruits and/or vegetables were only sampled twice, both from indicator locations. The 2003 indicator location sample potassium-40 activity mean was 4.6 pCi/gram. The 2003 indicator mean is higher than its corresponding 2002 mean. The 2003 indicator mean is above the range of the corresponding annual means for pre-operational and prior operational years. Potassium-40 in fruits and vegetables is not attributable to SSES operation because it is a naturally occurring radionuclide.

FIGURE 13 - IODINE-131 ACTIVITY IN MILK



GROUND WATER MONITORING

INTRODUCTION

Normal operation of the SSES does not involve the release of radioactive material to ground water directly or indirectly through the ground. As a result, there are no effluent monitoring data to compare with REMP ground water monitoring results. Ground water could conceivably become contaminated by leakage or spills from the plant or by the washout or deposition of radioactive material that might be airborne. If deposited on the ground, precipitation/soil moisture could aid in the movement of radioactive materials through the ground to water that could conceivably be pumped for drinking purposes. No use of ground water for irrigation near the SSES has been identified.

Because routine SSES operation releases primarily tritium and, to a lesser extent, isotopes of xenon and krypton to the air, no radionuclides attributable to SSES operation are expected to be observed in ground water. Iodine and particulate releases to the air are negligible. Gaseous xenon and krypton tend to remain airborne; deposition or washout of these would be expected to be very minimal. Tritium would be the most likely radionuclide to reach the ground with precipitation and, if not lost to streams (surface water) by runoff, move readily through the soil to the ground water.

Scope

Ground water in the SSES vicinity was sampled monthly at 2 indicator locations (2S2 and 4S4) and one control location (12F3) during 2003.

With the exception of location 4S4, untreated ground water was sampled. Untreated means that the water has not undergone any processing such as filtration, chlorination, or softening. At location 4S4, the SSES Training Center, well water actually is obtained from on-site and piped to the Training Center after treatment. This sampling is performed as a check to ensure that water has not been radioactively contaminated. Sampling is performed at the Training Center to facilitate the sample collection process.

Sample Preservation & Analysis

Ground water samples were analyzed for the activities of gamma-emitting radionuclides and tritium activity. Gamma spectrometric analyses of ground water were begun in 1979 and tritium analyses in 1972, both prior to SSES operation. The use of nitric acid as a preservative in ground water samples was discontinued in 2003 (at the request of the vendor laboratory).

Monitoring Results

Tritium activity levels in ground water have typically been observed to be lower than in surface water. A noticeable decline occurred between 1992 and 1993. Fewer measurements were above the analysis sensitivities in 1993 than in 1992.

Gamma-emitting radionuclides in excess of MDCs have been found in only a few samples in all the years that these analyses have been performed. The naturally occurring radionuclides potassium-40 and thorium-228 have been measured above their MDCs occasionally in ground water. Potassium-40 was reported in 1979, 1981, 1985, 1991, 1992, 1993, and 1997. Thorium-228 was found in 1985 and 1986. The man-made radionuclide cesium-137 has been detected only occasionally since 1979. Its presence has always been attributed to residual fallout from previous atmospheric nuclear weapons tests.

The results of the 2003 REMP ground water surveillance resemble those of the past. Results for specific ground water sample analyses may be found in Table I-7 of Appendix I. A summary of the 2003 ground water monitoring data may be located in Appendix G. Comparisons of 2003 monitoring results for tritium with those of past years may be found in Table H 20 of Appendix H.

During 2003, tritium was measured in excess of analysis MDCs on 4 occasions. The 2003 mean tritium activity levels for indicator and control monitoring locations were 54 pCi/liter and 17 pCi/liter, respectively. The indicator and control means are lower than those for 2002. Both the 2003 indicator and control mean tritium activity levels are within the range of corresponding averages of annual means for prior operational years. The 2003 indicator mean tritium activity is lower than the corresponding means for preoperational years. The 2003 control mean is within the range of corresponding means for preoperational years.

Naturally occurring potassium-40 was measured in excess of analysis MDCs in 2 ground water samples during 2003. No man-made gamma-emitting radionuclides were determined to be at levels in excess of analysis MDCs. No radioactivity contributions to ground water from the SSES were identifiable in 2003.

APPENDIX A

2003 REMP CHANGES

REMP Sample Analyses

The following table summarizes the REMP sample analyses for which different laboratories were responsible during 2003. Note that TBE represents Teledyne Brown Engineering and E-LAB represents Framatome ANP.

SOURCE OF REMP DATA FOR MONITORING YEAR 2003				
Sample Medium	**Analysis Type**	**Sample/Analysis Frequency**	**Data Period**	**Lab**
Air	Gross Beta	Weekly	All Year	TBE
Air	I-131	Weekly	All Year	TBE
Air	Gamma	Quarterly	All year	TBE
Surface Water	Gross Beta	Monthly	All Year	TBE
Drinking Water	Gross Beta & Gross Alpha	Monthly	All Year	TBE
All Water	Tritium	Monthly	All Year	TBE
Surface & Drinking Water	Gamma	Monthly	All Year	E-LAB
Surface Water (LTAW)	I-131	Monthly	All Year	E-LAB
Ground Water	Gamma	Monthly	All Year	E-LAB
Surface & Drinking Water	I-131	Bi/weekly	All Year	E-LAB
Milk	Gamma	Monthly/ Semi-Monthly	All Year	E-LAB
Milk	I-131	Monthly/ Semi-Monthly	All Year	E-LAB
Fish	Gamma	Semi-Annually	Spring/Fall	TBE
Sediment	Gamma	Semi-Annually	Spring/Fall	TBE

SOURCE OF REMP DATA FOR MONITORING YEAR 2003 (continued)				
Sample Medium	**Analysis Type**	**Sample/Analysis Frequency**	**Data Period**	**Lab**
Fruits & Vegetables	Gamma	In Season (when irritgated)	All Year	TBE
Soil	Gamma	Annually	All Year	E-LAB

Direct Radiation Monitoring

There were no changes to direct radiation monitoring in 2003.

Air Monitoring

There were no changes to the air monitoring program during 2003

Milk Monitoring

There were no changes to the milk monitoring program in 2003.

Ground Water Monitoring

There were no changes to the ground water monitoring program during 2003.

Fruits & Vegetables

Because of the milk monitoring that is performed, there is no requirement to sample from gardens that have a potential for the deposition of activity by way of the airborne pathway. Fruits and vegetables are sampled from locations that irrigate with water taken from the Susquehanna River downstream from the SSES diffuser. The only change to the fruit and vegetable monitoring program in 2003 was the addition of Control Location 5S10. Location 5S10 is a farm irrigated with Susquehanna River water upstream of the SSES diffuser. Due to excessive rainfall, no irrigation was performed at Location 5S10 during 2003.

APPENDIX B

2003 REMP MONITORING SCHEDULE (SAMPLING AND ANALYSIS)

TABLE 1
(Page 1 of 2)

Annual Analytical Schedule for the PPL Susquehanna Steam Electric Station Radiological Environmental Monitoring Program - 2003

Media & Code	No. of Locations	Sample Freq.(a)	Analyses Required	Analysis Freq. (b)
Airborne Particulates	6	W	Gross Beta (c)	W
			Gamma Spectrometry	QC
Airborne Iodine	6	W	I-131	W
Sediment	4	SA	Gamma Spectrometry	SA
Fish	2	SA	Gamma Spectrometry	SA
	1	A	(on edible portion)	
Surface Water (d)	4	MC, M, or BWC	Gross Beta	M
			I-131	BW
			Gamma Spectroscopy	M
			Tritium	M
Well (ground) Water	3	M	Gamma Spectroscopy	M
			Tritium	M
Drinking Water (e)	1	MC, BWC	Gross Alpha	M
			Gross Beta	M
			I-131	BW
			Gamma Spectrometry	M
			Tritium	M
Cow Milk	4(f)	M, SM(f)	I-131	SM, M
			Gamma Spectrometry	SM, M
Food Products (Potatoes)	2	A	Gamma Spectrometry	A
Soil	4	A	Gamma Spectrometry	A
Direct Radiation	84	Q	TLD	Q

Note: See footnotes at end of table.

(a) W = weekly, BW = biweekly, BWC = biweekly composite, M = monthly, SM = semi-monthly, Q = quarterly, QC = quarterly composite, SA = semi-annually, A = annually, MC = monthly composite.

(b) Codes are the same as for sample frequency.

(c) If the gross beta activity were greater than 10 times the yearly mean of the control sample, gamma analysis would be performed on the individual filter. Gross beta analysis was performed 24 hours or more following filter change to allow for radon and thoron daughter decay.

(d) Locations 6S6, 6S7, and 2S7 were checked at least weekly to ensure that the automatic composite samplers were operational. Time proportional sampling was performed at locations 6S6, 6S7 and 2S7 the entire year. Station 6S5 was grab sampled weekly. Individual composites of the weekly samples were made both monthly (MC) and biweekly (BWC) for analysis.

(e) Water from location 12H2 was retrieved weekly. Composite samples of the weekly collections at this location were made both monthly (MC) and biweekly (BWC) for analysis. Sampling at 12H2 was performed using an automatic continuous sampler (ACS) that was operated in the time proportional mode.

(f) Locations 10D1, 10D2, 10G1, and 12B2 were sampled semi-monthly from April through October.

APPENDIX C

2003
REMP MONITORING LOCATION DESCRIPTIONS

TABLE C 1
(Page 1 of 5)

TLD Locations for the SSES Radiological Environmental Monitoring Program – 2003

Less Than One Mile from the SSES[a] - See Figure 2

Location Code(b)	Distance (miles)	Direction	Description
1S2	0.2	N	Perimeter Fence
2S2	0.9	NNE	Energy Information Center
2S3	0.2	NNE	Perimeter Fence
3S2	0.5	NE	SSES Backup Met Tower
3S3	0.9	NE	ANSP Riverlands Garden
3S4	0.3	NE	Perimeter Fence
4S3	0.2	ENE	Post, West of SSES APF
4S6	0.7	ENE	Riverlands
5S4	0.8	E	West of Environmental Laboratory
5S7	0.3	E	Perimeter Fence
6S4	0.2	ESE	Perimeter Fence (north)
6S9	0.2	ESE	Perimeter Fence (south)
7S6	0.2	SE	Perimeter Fence
7S7	0.4	SE	End of Kline's Road
8S2	0.2	SSE	Perimeter Fence
9S2	0.2	S	Security Fence
10S1	0.4	SSW	Post - south of switching station
10S2	0.2	SSW	Security Fence
10S3	0.6	SSW	Confer's Lane – east of Confer's Lane, south of Towers Club
11S3	0.3	SW	Security Fence
11S7	0.4	SW	SSES Access Road Gate #50
12S1	0.4	WSW	SSES West Building

TABLE C 1
(Page 2 of 5)

TLD Locations for the SSES Radiological Environmental Monitoring Program – 2003

Location Code (b)	Distance (miles)	Direction	Description
Less Than One Mile from the SSES[a] - See Figure 2			
12S3	0.4	WSW	Perimeter Fence
12S4	0.4	WSW	Perimeter Fence
12S5	0.4	WSW	Perimeter Fence
12S6	0.4	WSW	Perimeter Fence
13S2	0.4	W	Perimeter Fence
13S4	0.4	W	Perimeter Fence
13S5	0.4	W	Perimeter Fence
13S6	0.4	W	Former Laydown Area - west of Confer's Lane
14S5	0.5	WNW	Beach Grove Road/Confer's Lane
14S6	0.7	WNW	Beach Grove Road (pole)
15S5	0.4	NW	Perimeter Fence
16S1	0.3	NNW	Perimeter Fence (east)
16S2	0.3	NNW	Perimeter Fence (west)
6A4	0.6	ESE	Restaurant (U.S. Route 11)
8A3	0.9	SSE	PPL Wetlands Sign (U. S. Route 11)
15A3	0.9	NW	Hosler Residence
16A2	0.8	NNW	Benkinney Residence
From One to Five Miles from the SSES[a] - See Figure 3			
12S7	1.1	WSW	Kisner Residence
1B1	1.4	N	Mingle Inn Road
2B3	1.3	NNE	Leggett & Platt
2B4	1.4	NNE	U.S. Route 11/Mingle Inn Road Intersection
5B3	1.6	E	PPL Switchyard
7B2	1.5	SE	Heller's Orchard Store
8B2	1.4	SSE	Lawall Residence

TABLE C 1
(Page 3 of 5)

TLD Locations for the SSES Radiological Environmental Monitoring Program – 2003

From One to Five Miles from the SSES[a] - See Figure 3

Location Code (b)	Distance (miles)	Direction	Description
9B1	1.3	S	Transmission Line - east of Route 11
10B2	2.0	SSW	Algatt Residence
10B3	1.7	SSW	Castek Inc.
10B4	1.4	SSW	U. S. Route 11/River Road Intersection
12B4	1.7	WSW	Berger Farm
13B1	1.3	W	Walker Run Creek (Tele. Pole #36)
14B3	1.3	WNW	Moskaluk Residence
15B1	1.7	NW	Country Estates Trailer Park
16B2	1.7	NNW	Walton Power Line
11C2	2.0	SW	MP Metals (U.S. Route 11)
1D5	4.0	N	Shickshinny/Mocanaqua Sewage Treatment Plt.
6D1	3.5	ESE	St. Peters Church – Hobbie
8D3	4.0	SSE	Mowry Residence
9D4	3.6	S	Country Folk Store
10D1	3.0	SSW	R. & C. Ryman Farm
12D2	3.7	WSW	Dagostin Residence
14D1	3.6	WNW	Moore's Hill/Mingle Inn Roads Intersection
3E1	4.7	NE	Webb Residence - Lilly Lake
4E2	4.7	ENE	Ruckles Hill/Pond Hill Roads Intersection
5E2	4.5	E	Bloss Farm
6E1	4.7	ESE	St. James Church

TABLE C 1
(Page 4 of 5)

TLD Locations for the SSES Radiological Environmental Monitoring Program – 2003

Location Code (b)	Distance (miles)	Direction	Description
From One to Five Miles from the SSES[a] - See Figure 3			
7E1	4.2	SE	Harwood Transmission Line Pole #2
11E1	4.7	SW	Thomas Residence
12E1	4.7	WSW	Berwick Hospital
13E4	4.1	W	Kessler Farm
Greater than Five Miles from the SSES[a] - See Figure 4			
2F1	5.9	NNE	St. Adalberts Cemetery
8F2	8.5	SSE	Huff Residence
12F2	5.2	WSW	Berwick Substation
15F1	5.4	NW	Zawatski Farm
16F1	7.8	NNW	Hidlay Residence
3G4	17	NE	Wilkes Barre Service Center
4G1	14	ENE	Mountaintop - Crestwood Industrial Park
6G1	13.5	ESE	Freeland Substation
7G1	14	SE	Hazleton PP&L Complex
7G2	12	SE	Hazleton Cemetery - 14th Street
8G1	12	SSE	PPL SFC - Humbolt Industrial Park
12G1	15	WSW	PPL Service Center, Bloomsburg
12G4	10	WSW	Naus Residence

TABLE C 1
(Page 5 of 5)

TLD Locations for the SSES Radiological Environmental Monitoring Program – 2003

a) All distances from the SSES to monitoring locations are measured from the standby gas treatment vent at 44200/N34117 (Pa. Grid System). The location codes are based on both distance and direction from the SSES. The letters in the location codes indicate if the monitoring locations are on site (within the site boundary) or, if they are not on site, the approximate distances of the locations from the SSES as described below:

S - on site
A - <1 mile
B - 1-2 miles
C - 2-3 miles
D - 3-4 miles
E - 4-5 miles
F - 5-10 miles
G - 10-20 miles
H - >20 miles

The numbers preceding the letters in the location codes provide the directions of the monitoring locations from the SSES by indicating the sectors in which they are located. A total of 16 sectors (numbered 1 through 16) equally divide an imaginary circle on a map of the SSES and its vicinity, with the SSES at the center of the circle. The middle of sector 1 is directed due north (N). Moving clockwise from sector 1, the sector immediately adjacent to sector 1 is sector 2, the middle of which is directed due north, northeast (NNE). Continuing to move clockwise, the sector numbers increase to 16, which is the north, northwest sector.

The numbers following the letters in the location codes are used to differentiate sampling locations found in the same sectors at approximately the same distances from the SSES.

TABLE C 2 (Page 2 of 4) Sampling Locations for the SSES Radiological Environmental Monitoring Program – 2003			
Less Than One Mile from the SSES[a] - See Figure 5			
Location Code	**Distance (miles)**	**Direction**	**Description**
GROUND WATER			
2S2	0.9	NNE	SSES Energy Information Center
4S4	0.5	ENE	SSES Learning Center
From One to Five Miles From the SSES - See Figure 6			
FISH[b]			
IND	0.9 - 1.4	ESE	At or Below the SSES Discharge Diffuser
SEDIMENT[c]			
2B	1.6	NNE	Gould Island
7B	1.2	SE	Bell Bend
AIR			
12E1	4.7	WSW	Berwick Hospital
MILK			
10D1	3.0	SSW	R. & C. Ryman Farm
10D2	3.1	SSW	Raymond Ryman Farm
12B2	1.7	WSW	Berger Farm
FRUITS/VEGETABLES			
11D2	3.5	SW	Lupini Field – U.S. Route 93

TABLE C 2
(Page 3 of 4)

Sampling Locations for the SSES Radiological Environmental Monitoring Program – 2003

Greater than Five Miles from the SSES[a] - See Figure 7

Location Code	Distance (miles)	Direction	Description
			DRINKING WATER
12H2	26	WSW	Danville Water Co. (treated)
			FISH[b]
2H	30	NNE	Near Falls, Pa.
			SEDIMENT[c]
12F	6.9	WSW	Old Berwick Test Track
			AIR
6G1	13.5	ESE	Freeland Substation
8G1	12	SSE	PPL SFC - Humbolt Industrial Park
			SOIL
8G1	12	SSE	PPL SFC - Humbolt Industrial Park
			MILK
10G1	14	SSW	Davis Farm
			FRUITS/VEGETABLES
11F2	5.5	SW	Chapin (Drake) Field
			GROUND WATER
12F3	5.2	WSW	Berwick Water Company

TABLE C 2
(Page 4 of 4)

Sampling Locations for the SSES Radiological Environmental Monitoring Program – 2003

a) All distances from the SSES to monitoring locations are measured from the standby gas treatment vent at 44200/N34117 (Pa. Grid System. The location codes are based on both distance and direction from the SSES. The letters in the location codes indicate if the monitoring locations are on site (within the site boundary) or, if they are not on site, the approximate distances of the locations from the SSES as described below:

S - on site	E - 4-5 miles
A - <1 mile	F - 5-10 miles
B - 1-2 miles	G - 10-20 miles
C - 2-3 miles	H - >20 miles
D - 3-4 miles	

The numbers preceding the letters in the location codes provide the directions of the monitoring locations from the SSES by indicating the sectors in which they are located. A total of 16 sectors (numbered 1 through 16) equally divide an imaginary circle on a map of the SSES and its vicinity, with the SSES at the center of the circle. The middle of sector 1 is directed due north (N). Moving clockwise from sector 1, the sector immediately adjacent to sector 1 is sector 2, the middle of which is directed due north, northeast (NNE). Continuing to move clockwise, the sector numbers increase to 16, which is the north, northwest sector.

The numbers following the letters in the location codes are used to differentiate sampling locations found in the same sectors at approximately the same distances from the SSES.

b) No actual location is indicated since fish are sampled over an area which extends through 3 sectors (5, 6, 7) near the outfall area.

c) No permanent locations exist; samples are taken based on availability. Consequently, it is not necessary to assign a number following the letter in the location code.

APPENDIX D

2003
LAND USE CENSUS RESULTS

2003 LAND USE CENSUS RESULTS

The SSES Technical Requirements require that a census be conducted annually during the growing season to determine the location of the nearest milk animal, residence and garden greater than 50 m^2 (approx. 500 ft^2) producing broad leaf vegetation within a distance of 8 km (approx. 5 miles) in each of the 16 meteorological sectors surrounding the SSES. To comply with this requirement, a land-use census was conducted for the SSES during 2003.

A comparison of the 2002 and 2003 Land Use Census results for the SSES indicates the changes listed in the tables below. Tables 1 display the changes in the nearest gardens and Table 2 displays the changes in sampling of irrigated foods from 2002 to 2003.

Overall, the changes since the 2002 Land Use Census were minimal. In 2003, the nearest garden in sector 5 was revised from 1.4 miles to 1.8 miles from the SSES. There was no garden identified in sector 14 which met the requirements for sampling in 2003. The farm identified in 2002 (P. Moskaluk, Jr.) in sector 14, did not plant a garden in 2003.

TABLE 1
CHANGE FROM 2002 TO 2003 IN NEAREST GARDENS AS DETERMINED BY THE 2003 LAND USE CENSUS

Sector/ Direction	2002		2003	
	Owner's Name	Distance from SSES (mi.)	Owner's Name	Distance from SSES (mi.)
5/E	Kozlowski/Witts	1.4	W. Daily	1.8
14/WNW	P. Moskaluk, Jr.	1.3	N/A	N/A

These changes in gardens had no impact on the intended sampling of fruits and vegetables during 2003. Because of the milk monitoring that is performed, there is no requirement to sample from gardens that have a potential for the deposition of activity by way of the airborne pathway.

Irrigated fruits and vegetables were monitored at 2 indicator locations during 2003. The only crop irrigated in 2003 was potatoes. No other fields within 10 miles downriver of the SSES were irrigated in 2003, because wet weather prevailed much of the spring and summer.

TABLE 2
CHANGE FROM 2002 TO 2003 IN VEGETABLES IRRIGATED WITH SUSQUEHANNA RIVER WATER FROM DOWNSTREAM OF THE SSES DISCHARGE DURING 2003

Sector/Direction	Owner	Distance from SSES (mi.)	2002	2003
11F2/SW	Chapin (Drake) Farm	5.5	N/A	Potatoes
11D2/SW	Lupini Farm (Rt. 93)	3.5	N/A	Potatoes

TABLE 3

Nearest residence, garden, and dairy animal in each of the 16 meteorological sectors within a 5-mile radius of the Susquehanna Steam Electric Station, 2003.

SECTOR	DIRECTION	NEAREST RESIDENCE	NEAREST GARDEN	NEAREST DAIRY ANIMAL
1	N	1.3 mi	3.2 mi	>5.0 mi
2	NNE	1.0 mi	2.3 mi [i]	>5.0 mi
3	NE	0.9 mi	2.7 mi	>5.0 mi
4	ENE	2.1 mi	2.4 mi [a,c,d,f,l]	>5.0 mi
5	E	1.4 mi [a,c]	1.8 mi	4.5 mi [g]
6	ESE	0.5 mi	2.5 mi	2.7 mi
7	SE	0.5 mi	0.6 mi	>5.0 mi
8	SSE	0.6 mi	1.5 mi	>5.0 mi
9	S	1.0 mi	1.1 mi	>5.0 mi
10	SSW	0.9 mi	1.2 mi	3.0 mi [a,b,c,d,e,g]
11	SW	1.5 mi	1.9 mi	>5.0 mi
12	WSW	1.1 mi	1.1 mi	1.7 mi [g,i]
13	W	1.2 mi	1.2 mi	5.0 mi [g]
14	WNW	0.8 mi	>5.0 mi	>5.0 mi
15	NW	0.8 mi	1.8 mi [l]	>5.0 mi
16	NNW	0.6 mi	4.0 mi	4.2 mi

[a] Chickens raised for consumption at this location.
[b] Ducks raised for consumption at this location.
[c] Eggs consumed from chickens at this location.
[d] Geese raised for consumption at this location.
[e] Pigs raised for consumption at this location.
[f] Turkeys raised for consumption at this location.
[g] Fruits/vegetables raised for consumption at this location.
[h] Rabbits raised for consumption at this location.*
[i] Beef cattle raised for consumption at this location.
[j] Goats raised for consumption at this location.*
[k] Pheasants raised for consumption at this location.*
[l] Sheep raised for consumption at this location.

*No locations were identified as raising rabbits, goats, and pheasants during 2003.

APPENDIX E

SUMMARY DESCRIPTION OF SSES REMP ANALYTICAL METHODS

TLD MEASUREMENTS

The PPL dosimetry system used for monitoring ambient radiation levels in the environment consists of Panasonic 710A readers and Panasonic UD-814 TLDs. The UD-814 TLD badges each contain four elements. Elements 2, 3, and 4 in each badge are made of calcium sulfate with 800 mg/cm^2 of filtering and element 1 is composed of lithium tetraborate with filtering of 25 mg/cm^2. Only the calcium sulfate elements are normally used for environmental measurements because of their higher light output per unit of radiation exposure relative to the lithium tetraborate and, consequently, greater sensitivity for the detection and measurement of radiation.

> Note: Element 1 would be of value in the event of an unusually large release of noble gases, especially xenon, that would produce relatively low-energy X-ray or gamma emissions. This is because the lithium tetraborate does not over-respond to such low-energy emissions as does the calcium sulfate.

The TLD element manufacturers' attempt to make each element as similar as possible to each of the other elements in each batch that is produced. Nevertheless, each element ends up somewhat different in its response to radiation. In order to minimize the effect of these inherent differences when comparing actual monitoring results for different elements, Element Correction Factors (ECFs) are determined for each element. The ECFs are used to effectively normalize the readings of the field elements placed at particular monitoring locations for given monitoring periods to the average of the readings that would be expected if so-called reference elements were to be placed simultaneously at those individual locations. Reference elements are elements that have been demonstrated to display superior measurement performance.

The selection process for reference elements involves repeatedly irradiating a large set of elements, processing them, calculating the mean response for each set of elements, and evaluating the deviation of each individual element response from the mean response. After this process has been repeated at least several times, the elements with the least variability in their responses and with mean responses nearest to the mean response of the entire population of elements are chosen as reference elements.

To determine ECFs for individual field elements, the elements are first exposed to known amounts of radiation (100 mR) and processed, a minimum of three times each. Each element reading is then divided by the mean of the readings obtained from reference elements (typically 30 to 35) that were exposed to the same amounts of radiation as the elements for which the ECFs are being determined and that were processed at the same time as these elements. The mean quotient (ratio) is then calculated for each element by summing the quotients obtained for each processing and then dividing by the total number of the processings performed.

The following equation shows how ECFs are calculated:

$$ECF = \left[\frac{\sum_{i=1}^{n} \frac{E_i}{\overline{E}_{ref}}}{n} \right]$$

where

E_i an uncorrected exposure reading for the element.

n = the total number of individual element exposures averaged.

$\overline{E}_{ref}$ = the mean of the ECF-corrected exposure readings of the reference elements.

Irradiated control TLDs are processed (read) with the batches of TLDs from the field to provide both processing calibration information and quality control. Field control TLDs, which accompany the field TLDs when they are being taken to their monitoring locations and subsequently retrieved from these locations, and cave control TLDs, which are stored with the field TLDs for the periods between annealing and field distribution and between retrieval from the field and processing, are also read with the field TLDs to provide checks on the exposures that the field TLDs might receive on their way to and from their monitoring locations and while in storage, respectively.

The raw data from the field TLD processings is Run Calibration Factor (RCF) corrected using the irradiated control TLD data. The irradiated control TLDs are exposed to 100 mR from a cesium-137 source at the Battelle Lab in Richland WA. The irradiated TLDs are accompanied enroute to and from the Battelle Lab by transit control TLDs. An estimate of the exposures received by the irradiated TLDs in-transit is obtained by processing the transit controls and determining the transit control mean by the following equation:

$$\overline{E}_{tc} = \frac{\sum_{i=1}^{n} \left[\frac{E_i}{ECF_i} \right]_{tc}}{n}$$

where

$\overline{E}_{tc}$ = the mean of the elementally corrected exposure readings of all the transit control elements.

E_i = the uncorrected exposure reading of each individual transit control element.

$ECF_i =$ the elemental correction factor of each individual transit control element.

$n =$ the total number of individual element exposures averaged.

The mean of the transit control exposures is then subtracted from each of the elementally corrected exposures of the irradiated elements to obtain the net exposures for each element resulting from the irradiation. The mean of these net exposures is then divided by the known exposure (100 mR) from the irradiation to determine the RCF. The following equation describes the calculations performed:

$$RCF = \frac{\left[\dfrac{\sum_{i=1}^{n}\left(\dfrac{E_i}{ECF_i} - \overline{E}_{tc}\right)_{ic}}{n}\right]}{KE_{ic}}$$

where

$RCF =$ the run correction factor for an individual field monitoring element.

$E_i =$ the exposure reading of each individual irradiated control element.

$ECF_i =$ the elemental correction factor of each individual irradiated control element.

$n =$ the total number of individual element exposures averaged.

$KE_{ic} =$ the known exposure for each of the irradiated control elements.

Exposure readings for individual field monitoring elements are corrected using the appropriate mean transit exposure and the elemental and run correction factors as follows:

$$CE_x = \frac{UE_x - \overline{E}_{TC}}{ECF_x \times RCF_x}$$

where

$CE_x =$ the corrected exposure reading for field monitoring element x.

$UE_x =$ the uncorrected exposure reading for field monitoring element x.

$ECF_x =$ the elemental correction factor for field monitoring element x.

$\overline{E}_{TC}$ = mean transit exposure

$RCF_x =$ the run correction factor for field monitoring element x.

NOTE: The mean transit exposure is determined from the elements of the TLDs that accompany the field TLDs during transportation to and from the field locations.

The exposure representing each environmental monitoring location and monitoring period is normally the mean of the corrected exposure readings for a total of six calcium sulfate elements, three from each of two different TLDs at each location. The following equation shows the calculation of this exposure:

$$\overline{E}_c = \frac{\sum_{i=1}^{n} CE_i}{n},$$

where

$\overline{E}_c =$ the mean of the corrected exposure readings for a given monitoring location and period.

$CE_i =$ the corrected exposure reading of an individual element for a given monitoring location and period.

n = the total number of individual element exposures averaged.

The mean of the corrected exposure readings for a given location and period may be calculated using less than the six calcium sulfate elements if the reading from one of the elements is more than two standard deviations from the mean. In this situation, the mean would be recalculated with only five element readings, excluding the element reading that was more than two standard deviations from the originally calculated mean. The mean may be automatically calculated by the dosimetry software with as few as four element readings before the data is flagged. The following calculation is used to determine the standard deviation of the corrected elemental exposure readings:

$$S_{ce} = \sqrt{\frac{\sum_{i=1}^{n}\left(CE_i - \overline{E}_c\right)^2}{n-1}}$$

where

S_{ce} = the standard deviation of the corrected exposure readings from a given monitoring location and period for (n-1) degrees of freedom.

$\overline{E}_c$ = the mean of the corrected exposure readings for a given monitoring location and period.

CE_i = the corrected exposure reading of an individual element for a given monitoring location and period.

n = the total number of individual element exposures averaged.

The standard monitoring period for the reporting of TLD exposures is the calendar quarter. The calendar quarter is defined as a period of 91.25 days. The actual monitoring periods for TLDs in the field are often for times other than 91.25 days. The means of the corrected exposures for these nonstandard periods must be normalized to the standard calendar quarter. The following equation shows how the normalization is performed:

$$NE = \frac{\overline{E}_c \times 91.25}{MP}$$

where

NE = mean corrected exposure normalized to a standard calendar quarter of 91.25 days.

$\overline{E}_c$ = the mean of the corrected exposure readings for a given monitoring location and period.

MP = the actual TLD monitoring period (time in the field) in days.

TLD DATA INTERPRETATION

Pre-operational and operational data are compared for the purpose of determining whether or not TLD data may indicate a dose contribution from SSES operation. Between 1979 and 1994, both TLD types and TLD processing systems changed more than once. In order to avoid possible confusion in data interpretation as a result of these changes, ratios of TLD doses for specific indicator locations to the average of the TLD doses for control locations from operational periods compared to their counterparts from the preoperational period. Comparison of these ratios is performed in lieu of comparing the actual operational and preoperational doses. The following equation shows how these ratios are calculated:

$$r_i = d_i \div \bar{d}_c$$

where

r_i = the indicator-to-control-average dose ratio for a particular location and calendar quarter,

d_i = the quarterly dose for a particular indicator location, and

$\bar{d}_c$ = the average quarterly dose for certain control locations.

Note:

The r_i are the quotients of the indicator doses to the average doses of the following control locations: 3G4, 4G1, 7G1, 12G1, and 12G4. Only these control locations are used because they were the only ones existing during the preoperational period.

Operational r_i for indicator locations that do not have preoperational histories are compared with the range of preoperational control-to-control-average dose ratios (r_c) experienced at control locations. It can be safely assumed that the preoperational range of these r_c at control locations are the result of variations in the levels of background radiation at those locations. Any operational indicator r_i for an indicator location without a preoperational history that is above the uppermost range expected at control locations based on preoperational data is assumed to suggest a possible contribution from the SSES operation. The following equation shows how r_c is calculated:

$$r_c = d_c \div \bar{d}_c$$

where

r_c - is the control-to-control-average dose ratio for a particular location and calendar quarter,

d_c - is the quarterly dose for a particular control location, and

$\bar{d}_c$ - is the average quarterly dose for certain control locations.

$$D_{SSES} = (r_i - 1.22) \times D_{CA} \times OF$$

where

D_{SSES} = the dose attributable to SSES fuel cycle operations,

r_i = the indicator-to-control average ratio for a particular location and calendar quarter,

1.22 = the highest expected r_c for control locations due to variations in natural radiation levels based on preoperational data. Refer to location 12G4 in Attachment 1.

D_{CA} = the average quarterly dose for control locations.

OF = the occupancy factor.

Each year, the SSES attributable doses calculated for each calendar quarter are summed for all calendar quarters at each location to obtain annual doses by location.

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA ACTIVITY

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Aliquots of water samples are evaporated to near dryness in beakers. The remaining volumes (approximately five milliliters or less) are transferred to stainless steel planchets and evaporated to dryness.

All planchets are counted in low background gas-flow proportional counters. Calculations of both gross alpha and beta activities include the use of empirical self-absorption correction curves to account for changes in effective counting efficiency occurring as a result of changes in the masses of residue being counted.

Weekly air particulate filters are placed into planchets as received and counted in low background gas-flow proportional counters. No corrections are made for beta self-absorption when calculating the gross beta activities of the air particulate filters because of the impracticality of weighing the deposit and because the penetration depth of the deposit into the filter is unknown.

CALCULATION OF THE SAMPLE ACTIVITY

$$\frac{pCi}{\text{unit volume or mass}} = \frac{\left[\frac{C}{t} - R_b\right]}{2.22\,(V)(E)} \pm \frac{2\sqrt{\frac{\frac{C}{t} + R_b}{t}}}{2.22\,(V)\,(E)}$$

net activity **random uncertainty**

where: C = total counts for sample

t = count time for sample/background (minutes)

R_b = background count rate of counter (cpm)

2.22 = $\frac{dpm}{pCi}$

V(M) = volume or mass of sample analyzed

E = efficiency of the counter (cpm/dpm)

4.66 = sigma level

Calculation of the Minimum Detectable Concentration (MDC) Value

$$MDC = \frac{4.66\sqrt{\frac{R_b}{t}}}{2.22\,(V)\,(E)}$$

RADIOCHEMICAL DETERMINATION OF I-131 IN CHARCOAL AND VEGETATION SAMPLES

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Radioiodine is separated from the sample matrix to periodate solution.

Charcoal filters are opened and the exposed charcoal is emptied into a refluxing flask, iodide carrier is added, and the mixture is refluxed in sodium hydroxide to remove the iodine absorbed on the charcoal and bringing it into solution. The resulting iodide solution is oxidized with hypochlorite to periodate.
Vegetation samples are chopped, iodide carrier added, the mixture evaporated to dryness, leached with sodium hydroxide, and fused in a muffle furnace. The resulting melt is dissolved in distilled water and filtered. The resulting iodide solution is oxidized with hypochlorite to periodate.

The periodate solution is reduced to iodine with hydroxylamine hydrochloride, and extracted into toluene as free iodine. The iodine is back extracted into distilled water through reduction to iodide with aqueous sodium bisulfite and is ultimately precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting.

The dried precipitate is beta counted on a low-level counter.

CALCULATION OF THE SAMPLE ACTIVITY

$$A = \frac{\left[\frac{C}{t} - R_b\right]}{2.22(V)(y)(DF)(E)} \pm \frac{2\sqrt{\frac{\frac{C}{t}+R_b}{t}}}{2.22(V)(y)(DF)(E)}$$

net activity random uncertainty

where: A = activity concentration (pCi/l)

C = total counts from sample

t = counting time for sample (min)

R_b = background count rate of counter (cpm)

2.22 = $\frac{dpm}{pCi}$

V	=	volume of sample analyzed (liters)
y	=	chemical yield of the mount or sample counted
DF	=	decay factor from the collection (milk/vegetables) or midpoint of compositing period (water/charcoal cartridges) to the mid-count time
E	=	efficiency of the counter for the I-131 betas.
4.66	=	sigma level

Note: Efficiency is determined by counting an I-131 standard.

Calculation of the MDC

$$MDC = \frac{4.66\sqrt{\frac{R_b}{T}}}{2.22(V)(y)(DF)(E)}$$

RADIOCHEMICAL DETERMINATION OF I-131 IN MILK AND WATER SAMPLES

FRAMATOME ANP ENVIRONMENTAL LABORATORY

First, iodide carrier is added to either a two-kilogram sample aliquot of milk or water. For water, the next step is to add sodium hypochlorite, followed by hydroxylamine hydrochoride, and finally sodium bisulfite to convert all of the iodine in the sample to iodide. After sufficient time for equilibration of the stable iodide carrier, anion exchange resin is added to the sample to extract the iodide from the sample aliquot. The iodide ion is subsequently removed from the resin using sodium hypochlorite. It is then reduced to elemental iodine and transferred from the aqueous phase to the toluene. The iodine is then reduced to iodide using sodium bisulfite and back extracted into the aqueous phase. Once in the aqueous phase, the iodide is precipitated as cuprous iodide following the addition of cuprous chloride.

Another aliquot of sample may be used, if activity is detected in the sample, to determine the original stable iodide content of the sample using a specific-ion electrode. This information would then be used to correct the chemical yield determined from the mass of the dried precipitate.

The dried precipitate is then counted using a beta/gamma coincidence counter.

CALCULATION OF SAMPLE ACTIVITY

$$A = \frac{\left(\frac{G}{t} - B\right) * \lambda * t}{\left(1 - e^{-\lambda t}\right) * 2.22 * V * y * D * E} \pm \frac{2 * \lambda * t * \sqrt{\frac{\left(\frac{G}{t} + B\right)}{t}}}{\left(1 - e^{-\lambda t}\right) * 2.22 * V * y * D * E}$$

Where:

A = activity concentration (pCi/l)
G = gross count at the end of the sample counting interval (t)
t = sample counting interval
B = background count rate (cpm)
λ = decay constant for I-131 (5.987E-5 min^{-1})
2.22 = dpm/pCi
V = volume of sample (l)
y = chemical yield (recovery) of the iodide

D = decay factor ($e^{-\lambda T}$) where λ is the decay constant for I-131 and T is the decay period from sample collection (milk) or the mid-point of the sample compositing period (water) to the mid-point of the counting interval

E = is the I-131 beta/gamma counting efficiency (cpm/dpm)

CALCULATION OF MDC

$$MDC = \frac{4.66 * \lambda * t * \sqrt{\frac{B}{t}}}{\left(1 - e^{-\lambda t}\right) * 2.22 * V * y * D * E}$$

Where:

MDC = minimum detectable activity concentration (pCi/l)

DETERMINATION OF TRITIUM IN WATER BY LIQUID SCINTILLATION COUNTING

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Ten milliliters of water is mixed with liquid scintillation material and counted for typically 200 minutes to determine its activity.

CALCULATION OF THE SAMPLE ACTIVITY FOR TRITIUM

$$\frac{pCi}{\ell} = \frac{\left[\frac{C}{t} - R_b\right]}{2.22(V)(E)} \pm \frac{2\sqrt{\frac{\frac{C}{t} + R_b}{t}}}{2.22(V)(E)}$$

net activity random uncertainty

where:

	C	=	total counts from sample
	t	=	count time for sample (minutes)
	R_b	=	background count rate of counter (cpm)
	2.22	=	$\frac{dpm}{pCi}$
	V	=	initial volume before enrichment (liters)
	E	=	efficiency of the counter for tritium (cpm/dpm)

Calculation of the MDC

$$MDC = \frac{4.66\sqrt{\frac{R_b}{t}}}{(2.22)(V)(E)}$$

Calculation of SSES Attributable Direct Radiation Dose based on Onsite Indicator TLD Measurements

For TLD locations where direct radiation dose contributions from the SSES are indicated, these calendar quarter doses are estimated based on the amounts referred to as the excess ratios. Excess ratio for each location's r_i for a particular calendar quarter is the amount by which that r_i exceeds the high end of its range of preoperational r_i. The excess ratio at a specific location is multiplied times both the average dose for control locations measured during that calendar quarter and an occupancy factor based on a reasonable estimate of the portion of the calendar quarter that a MEMBER OF THE PUBLIC might spend near an onsite TLD location. The following is a table of occupancy factors that are used:

Environmental TLD Monitoring Locations	Occupancy Factors
Onsite	4.56E-4
Offsite (other than Private Residences)	3.65E-3
Private Residences	1

The following equation is used for obtaining direct radiation doses attributable to the SSES at indicator TLD locations when preoperational data exists for those locations:

$$D_{SSES} = (r_i - r_u) \times D_{CA} \times OF$$

where

D_{SSES} = the dose attributable to SSES fuel cycle operations,

r_i = the indicator-to-control average ratio for a particular location and calendar quarter,

r_u = the indicator-to-control average ratio corresponding to the upper end of the 95% confidence range for a particular location for the preoperational period, and

D_{CA} = the average quarterly dose for control locations.

OF = the occupancy factor.

The equation below is used for obtaining direct radiation doses attributable to the SSES at indicator locations when preoperational data **does not** exist for those locations:

Flagging Environmental TLD Measurements for Possible Non-Natural Dose Contributions

Confidence ranges, within which 95% of environmental TLD doses resulting from natural, background radiation are expected to be, have been derived for each location with a preoperational history by multiplying the standard deviation (S) of the r_i for the location by the appropriate t score (t) based on the applicable degrees of freedom for each location. (Degrees of freedom (df) are equal to the number of ratios that were averaged less one.) The product of the t score and the standard deviation (tS) was then subtracted from the mean ($\bar{x}$) to determine the lower end of the 95% confidence range (R) and added to the mean to obtain the upper end of the range (R) as indicated by the following equation:

$$R = \left(\bar{x} - t*S\right) to \left(\bar{x} + t*S\right)$$

The following t scores were used in the range calculations:

t SCORES	
df	$t_{0.05}$
1	12.706
2	4.303
3	3.182
4	2.776
5	2.571
6	2.447
7	2.365

For indicator locations with no preoperational history, TLD results are flagged for potential non-natural dose contributions to TLD measurements based on comparisons to the maximum expected variation in control-to-control-average dose ratios (r_c) for control locations. The expected ranges of r_c for each control location for each calendar quarter during the 1980-81 preoperational period have been calculated. The highest expected r_c for all the preoperational control locations is 1.22.

Ratios for indicator locations greater than 1.22 are flagged for possible SSES direct radiation dose contributions.

DETERMINATION OF GAMMA EMITTING RADIOISOTOPES

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES & FRAMATOME ANP ENVIRONMENTAL LABORATORY

Gamma emitting radionuclides are determined with the use of a lithium-drifted germanium (Ge(Li)) and high purity germanium detectors with high resolution spectrometry in specific media, such as, air particulate filters, charcoal filters, milk, water, vegetation, soil/sediments, biological media, etc. Each sample is prepared and counted in standard geometries such as one liter or four liter wrap-around Marinelli containers, 300 ml or 150 ml bottles, two-inch filter paper source geometries, etc.

The analysis of each sample consists of calculating the specific activities of all detected radionuclides as well as the minimum detectable concentration for a standard list of nuclides. The germanium detection systems are calibrated for each standard geometry using certified radionuclide standards traceable to the National Institute of Standards and Technology.

CALCULATION OF THE SAMPLE ACTIVITY

$$Net\ pCi / vol\ or\ mass = \frac{[C-B]}{2.22(V)(E)(GA)DF)(t)} \pm \frac{2\sqrt{C+B}}{2.22(V)(E)(GA)(DF)(t)}$$

net activity random uncertainty

where: C = area, in counts, of a spectral region containing a gamma emission of the nuclide of interest

Note (1): If the detector exhibits a peak in this region when counting a blank, the counts from that peak are subtracted from C before using the above equation.

Note (2): If no peaks are exhibited, the counts in the channels where the predominant peaks for gammas from selected radionuclides would be expected are summed for C and used in the calculation of "net" activity.

B = background counts in the region of interest, calculated by fitting a straight line across the region connecting the two adjacent regions.

Note: If no peak exists in a region from which a "net" activity is being calculated, background is represented by the average of the counts in one channel from each side of that region.

t = counting interval of sample (minutes)

2.22 = dpm/pCi

V = volume or mass of sample analyzed

E = efficiency of counter at the energy region of interest

GA = gamma abundance of the nuclide at the gamma emission energy under consideration

DF = decay factor from sample collection time or midpoint of sample collection (air I-131) to midpoint of the counting interval

Calculation of the MDC

$$MDC(\ pCi\,/\,vol\ or\ mass\ ) = \frac{4.66\sqrt{B}}{2.22(V)(E)(GA)(DF)(t)}$$

The width of the region around the energy where an emission is expected is calculated differently for MDCs than it is for the width of a peak that is actually identified. Consequently, the value of B used in the two equations may differ.

APPENDIX F

2003 EXCEPTIONS TO THE SSES TECHNICAL REQUIREMENTS SAMPLE SCHEDULE, METHODS AND ANALYSIS SENSITIVITIES

Exceptions to the SSES Technical Requirements occurred in the monitoring of the following media: drinking water, surface water, air, and ambient radiation monitoring. These exceptions involved sample collections that did not take place for the required periods due to sampling equipment problems and various environmental conditions (rain) that impacted sample collection or analysis.

These exceptions are discussed in this appendix and specifically documented in the tables of Appendix I.

Drinking Water

Sampling at the Danville Municipal Water Facility, monitoring location 12H2, proceeded flawlessly during most of 2003, with only one exception. The only exception during 2003 occurred when the sample collectors incorrectly mixed the drinking water sample for week 1 of the April monthly composite period with the week 1 sample of the April monthly composite period from Surface Water monitoring location 6S5. The April monthly composite for monitoring location 12H2 sent for analysis contained only weeks 2-4 for April 2003.

There were no malfunctions of the ACS at monitoring location 12H2 during 2003. Sampling at this location was routine (as expected) for 100% of the year.

Surface Water

Monitoring at control location 6S6, the SSES River Water Intake Structure, and indicator location 2S7 or its alternate location 6S7, the SSES Cooling Tower Blowdown Discharge (CTBD) to the Susquehanna River, are the only environmental surveillance's of surface water required by SSES Technical Specifications. The other SSES REMP routine indicator surface water monitoring location on the Susquehanna River, which is downstream from the SSES discharge to the river, and the monitoring location at LTAW are not required. They have been monitored to provide added assurance that the environment is not being compromised by radiological releases resulting from the SSES operation.

Sampling at locations 6S6 and 2S7 or 6S7 is required to be performed by the collection of aliquots at time intervals that are small compared to the compositing period. Composite samples from these locations are required to be analyzed monthly and are expected to be representative of the streams from which they are collected.

Problems occurred in 2003 with the automatic composite sampler (ACS) at sampling location 6S6 during portions of the following collection periods: March 17, through March 24, 2003 and June 23, through June 26, 2003. Sample collectors discovered low flow through the ACS due to rising river level causing debris and silt build-up on intake screens. Initially, the ACS sample flow rate was adjusted to insure sufficient volume was collected. Preventive maintenance was performed on the ACS (cleaned lines) and the sample flow rates were reset to 1.5 gpm.

The ACS at monitoring location 6S6 operated routinely (as expected) for approximately 97% of 2003. No malfunctions of the ACS at monitoring location 6S6 required the collection of grab samples during 2003.

Surface water samples could not be taken at ACS location 2S7 from October 3 at 1011 through October 4 at 0541 due to power failure. Power was restored to the sampler on October 4, 2003 at 0541. There was adequate volume for sample requirements. The ACS at monitoring location 2S7 operated routinely (as expected) for approximately 99% of 2003.

Air

Reasons for exceptions to REMP air sampling during 2003 included the following: loss of electrical power to air sampling stations and air sample equipment problems (pump malfunctions).

Electrical power to the air sampling stations at monitoring locations 3S2, 13S6, 13S6Q, 12S1, and 12E1 was interrupted for about 3-4 hours on September 19, 2003, during the monitoring period from September 17 through September 24, 2003. There was a wide area power outage during the referenced time period due to Tropical Storm Isabel. Power was restored to the air sampling equipment and adequate sample volume was achieved for the monitoring period.

The sample pump at monitoring station 12E1 experienced a pump motor failure during the monitoring period from October 1 through October 8, 2003. Low sample volume was obtained during the sample period due to the pump motor failure. The Air Sample Pump was replaced.

The sample pump failed at monitoring station 6G1 during the monitoring period from June 4 through June 11, 2003. Low sample volume was obtained during the sample period due to the pump motor failure. The Air Sample Pump was replaced.

Collectively, the air sampling equipment at the six air monitoring locations operated routinely (as expected) for more than 99% of 2003 in spite of the exceptions noted above.

Ambient Radiation Monitoring

Exceptions occurred to the monitoring of ambient radiation during the second and fourth quarterly monitoring periods of 2003. The second quarterly monitoring period was April 29 through July 24, 2003. The TLD's at location 3S4 were wet and unable to process for the referenced monitoring period. The fourth quarterly monitoring period was October 21, 2003 through January 30, 2004. The TLD's at location 14B3 were wet and unable to process.

APPENDIX G

2003 SSES REMP SUMMARY OF DATA

The averages for indicator and control locations reported in the Summary of Data Table, which summarizes the entire year's results for the SSES REMP, were calculated using all measured values, when available, whether or not they were reported in Appendix I tables. Values below the MDCs, even zeroes and negatives, were part of the averaging process for these analysis results. When no measured results are available in these cases, "LLD" is reported.

Preferably, the averages reported in the Summary of Data table for sample media that are normally collected continuously are determined using only results from continuously collected samples. Occasionally, grab samples are taken for these media when equipment malfunctions or other anomalies preclude or otherwise perturb routine continuous sampling. These grab samples are taken to minimize the time periods when no sampling is being performed, or, in some instances, when continuous sampling is considered to be nonrepresentative.

Because grab samples are snapshots of the media over brief periods, it is preferable not to average the analysis results of these samples with those for continuously collected composite samples. However, when equipment malfunctions are protracted, relatively large periods of time could be entirely unrepresented by averages if the results from grab sample analyses are not considered.

Allowing analysis results for grab samples to be weighted equally with those representing relatively large periods of time would tend to bias the resulting averages unjustifiably towards the conditions at the times that the grabs are obtained. Averages obtained in this way might less accurately reflect the conditions for the combined period of continuous sampling and grab sampling than if only the results from continuous sampling were used. On the other hand, using weighting factors for the analysis results of grab samples derived from the actual time it takes to collect those samples would lead to the grab sample analysis results having a negligible effect on the overall average and not justifying the effort involved.

Grab samples collected in lieu of normal continuous sampling are typically obtained at regular intervals corresponding to the intervals (weekly) at which the continuously collected samples would usually be retrieved for eventual compositing. For example, grab samples are collected once a week but may be composited monthly in place of continuously collected samples that would normally be retrieved weekly and composited monthly. Since each grab sample is used to represent an entire week, albeit imperfect, it is reasonable to weight the analysis results the same. Thus, the results of one weekly grab are given approximately one-fourth the weight of the results for a monthly composite sample collected continuously for each of the four weeks in a month. Similarly, the analysis results of a composite of four weekly grab samples would carry the same weight as the analysis results for a composite of four weeks of continuously collected sample.

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS (4)
Ambient Radiation (mR/std. qtr.)	TLD	333		2.02E+01 (301 / 301) (1.27E+01 - 4.47E+01)	9S2 0.2 mi S	4.06E+01 (4 / 4) (3.17E+01 - 4.47E+01)	1.90E+01 (32 / 32) (1.41E+01 - 2.36E+01)	0
Surface Water (pCi/l)	Gross Beta	48	4	6.06E+00 (36 / 36) (2.42E+00 - 1.59E+01)	2S7 0.1 mi NNE	1.10E+01 (12 / 12) (7.08E+00 - 1.59E+01)	2.37E+00 (12 / 12) (6.08E-01 - 4.32E+00)	0
	Tritium	48	2000	1.57E+03 (36 / 36) (-3.54E+01 - 1.66E+04)	2S7 0.1 mi NNE	4.42E+03 (12 / 12) (1.13E+02 - 1.66E+04)	3.18E+01 (12 / 12) (-4.98E+01 - 1.37E+02)	0
	Iodine-131	90	1	3.65E-01 (64 / 64) (-1.10E-01 - 1.91E+00)	2S7 0.1 mi NNE	7.77E-01 (26 / 26) (-1.10E-01 - 1.91E+00)	2.58E-01 (26 / 26) (-1.00E-02 - 7.20E-01)	0
	Gamma Spec K-40	48		3.58E+00 (36 / 36) (-3.00E+01 - 5.00E+01)	6S5 0.9 mi ESE	4.75E+00 (12 / 12) (-2.40E+01 - 4.10E+01)	2.30E-01 (12 / 12) (-1.70E+01 - 2.40E+01)	0
	Mn-54	48	15	-8.37E-02 (36 / 36) (-1.90E+00 - 1.50E+00)	6S6 0.8 mi ESE	2.55E-02 (12 / 12) (-1.00E+00 - 2.10E+00)	2.55E-02 (12 / 12) (-1.00E+00 - 2.10E+00)	0
	Co-58	48	15	-2.05E-01 (36 / 36) (-3.30E+00 - 3.60E+00)	6S5 0.9 mi ESE	1.83E-01 (12 / 12) (-2.40E+00 - 2.50E+00)	-8.09E-01 (12 / 12) (-2.10E+00 - 2.00E-01)	0
	Fe-59	48	30	1.49E-01 (36 / 36) (-6.00E+00 - 4.70E+00)	6S5 0.9 mi ESE	1.23E+00 (12 / 12) (-2.10E+00 - 4.70E+00)	4.85E-01 (12 / 12) (-1.40E+00 - 5.80E+00)	0
	Co-60	48	15	2.96E-01 (36 / 36) (-1.10E+00 - 1.90E+00)	2S7 0.1 mi NNE	3.90E-01 (12 / 12) (-8.00E-01 - 1.90E+00)	2.63E-01 (12 / 12) (-8.00E-01 - 3.00E+00)	0
	Zn-65	48	30	-4.81E-01 (36 / 36) (-1.07E+01 - 7.70E+00)	6S5 0.9 mi ESE	7.92E-01 (12 / 12) (-5.50E+00 - 6.00E+00)	-2.91E-01 (12 / 12) (-4.40E+00 - 7.00E+00)	0

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Surface Water (cont.) (pCi/l)	Zr-95	48	30	-6.20E-01 (36 / 36) (-5.80E+00 - 3.70E+00)	6S5 (9.00E-01 mi ESE	-2.92E-01 (12 / 12) (-2.90E+00 - 1.70E+00)	-4.02E-01 (12 / 12) -(3.00E+00 - 1.50E+00)	0
	Nb-95	48	15	-8.60E-02 (36 / 36) (-3.80E+00 - 3.40E+00)	6S6 (8.00E-01 mi ESE	2.96E-01 (12 / 12) (-2.20E+00 - 4.40E+00)	2.96E-01 (12 / 12) -(2.20E+00 - 4.40E+00)	0
	Cs-134	48	15	3.83E-01 (36 / 36) (-1.70E+00 - 2.80E+00)	2S7 (1.00E-01 mi NNE	4.73E-01 (12 / 12) (-9.00E-01 - 1.40E+00)	3.73E-01 (12 / 12) -(2.70E-01 - 1.50E+00)	0
	Cs-137	48	18	5.97E-02 (36 / 36) (-1.40E+00 - 3.70E+00)	LTAW on site NE-ESE	6.08E-01 (12 / 12) (-1.20E+00 - 3.70E+00)	-4.50E-01 (12 / 12) -(1.60E+00 - 4.70E-01)	0
	Ba-140	48	60	8.97E-01 (36 / 36) (-3.40E+00 - 5.70E+00)	LTAW on site NE-ESE	1.36E+00 (12 / 12) (-1.50E+00 - 5.70E+00)	-2.54E-01 (12 / 12) -(5.00E+00 - 2.70E+00)	0
	La-140	48	15	1.03E+00 (36 / 36) (-3.90E+00 - 6.50E+00)	LTAW on site NE-ESE	1.57E+00 (12 / 12) (-1.80E+00 - 6.50E+00)	-2.87E-01 (12 / 12) -(5.80E+00 - 3.10E+00)	0

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Potable Water (pCi/l)	Gross Alpha	12		1.69E-01 (12 / 12) (-6.54E-01 - 1.37E+00)	12H2 26 mi WSW	1.69E-01 (12 / 12) (-6.54E-01 - 1.37E+00)	Only indicator stations sampled for this medium.	0
	Gross Beta	12	4	2.26E+00 (12 / 12) (8.98E-01 - 4.26E+00)	12H2 26 mi WSW	2.26E+00 (12 / 12) (8.98E-01 - 4.26E+00)		0
	Iodine-131	26	1	1.78E-01 (26 / 26) (-1.60E-01 - 5.80E-01)	12H2 26 mi WSW	1.78E-01 (26 / 26) (-1.60E-01 - 5.80E-01)		0
	Tritium	12	2000	6.43E+01 (12 / 12) (-7.67E+00 - 1.93E+02)	12H2 26 mi WSW	6.43E+01 (12 / 12) (-7.67E+00 - 1.93E+02)		0
	Gamma Spec K-40	12		4.04E+00 (12 / 12) (-2.00E+01 - 4.10E+01)	12H2 26 mi WSW	4.04E+00 (12 / 12) (-2.00E+01 - 4.10E+01)		0
	Mn-54	12	15	-5.36E-02 (12 / 12) (-1.40E+00 - 9.00E-01)	12H2 26 mi WSW	-5.36E-02 (12 / 12) (-1.40E+00 - 9.00E-01)		0
	Co-58	12	15	-4.26E-01 (12 / 12) (-1.20E+00 - 6.00E-01)	12H2 26 mi WSW	-4.26E-01 (12 / 12) (-1.20E+00 - 6.00E-01)		0
	Fe-59	12	30	-3.69E-01 (12 / 12) (-3.60E+00 - 3.00E+00)	12H2 26 mi WSW	-3.69E-01 (12 / 12) (-3.60E+00 - 3.00E+00)		0
	Co-60	12	15	1.55E-01 (12 / 12) (-7.00E-01 - 8.00E-01)	12H2 26 mi WSW	1.55E-01 (12 / 12) (-7.00E-01 - 8.00E-01)		0
	Zn-65	12	30	-1.21E+00 (12 / 12) (-9.80E+00 - 6.10E+00)	12H2 26 mi WSW	-1.21E+00 (12 / 12) (-9.80E+00 - 6.10E+00)		0
	Zr-95	12	30	-5.11E-01 (12 / 12) (-2.60E+00 - 4.00E-01)	12H2 26 mi WSW	-5.11E-01 (12 / 12) (-2.60E+00 - 4.00E-01)		0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Potable Water (cont) (pCi/l)	Nb-95	12	15	1.85E-01 (12 / 12) (-1.10E+00 - 1.10E+00)	12H2 26 mi WSW	1.85E-01 (12 / 12) (-1.10E+00 - 1.10E+00)	Only indicator stations sampled for this medium.	0
	Cs-134	12	15	9.23E-02 (12 / 12) (-5.70E-01 - 1.20E+00)	12H2 26 mi WSW	9.23E-02 (12 / 12) (-5.70E-01 - 1.20E+00)		0
	Cs-137	12	18	-1.41E-01 (12 / 12) (-2.40E+00 - 1.60E+00)	12H2 26 mi WSW	-1.41E-01 (12 / 12) (-2.40E+00 - 1.60E+00)		0
	Ba-140	12	60	3.05E-01 (12 / 12) (-2.80E+00 - 7.20E+00)	12H2 26 mi WSW	3.05E-01 (12 / 12) (-2.80E+00 - 7.20E+00)		0
	La-140	12	15	3.72E-01 (12 / 12) (-3.20E+00 - 8.30E+00)	12H2 26 mi WSW	3.72E-01 (12 / 12) (-3.20E+00 - 8.30E+00)		0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Fish (pCi/kg wet)	Gamma Spec K-40	13		3.58E+03 (7 / 7) (1.30E+03 - 4.39E+03)	LTAW on site NE-ESE	3.67E+03 (1 / 1) (3.67E+03 - 3.67E+03)	3.16E+03 (6 / 6) (1.30E+03 - 3.92E+03)	0
	Mn-54	13	130	1.95E+00 (7 / 7) (-9.19E+00 - 9.69E+00)	LTAW on site NE-ESE	5.74E+00 (1 / 1) (5.74E+00 - 5.74E+00)	3.15E+00 (6 / 6) (-6.18E+00 - 1.34E+01)	0
	Co-58	13	130	-1.67E+00 (7 / 7) (-9.09E+00 - 6.35E+00)	LTAW on site NE-ESE	-9.80E-01 (1 / 1) (-9.80E-01 - -9.80E-01)	-2.53E+00 (6 / 6) (-6.14E+00 - 1.21E+00)	0
	Fe-59	13	260	-9.51E+00 (7 / 7) (-4.40E+01 - 1.57E+01)	LTAW on site NE-ESE	1.06E+01 (1 / 1) (1.06E+01 - 1.06E+01)	-1.69E+00 (6 / 6) (-2.84E+01 - 1.88E+01)	0
	Co-60	13	130	-1.59E+00 (7 / 7) (-7.97E+00 - 4.40E+00)	2H 30 mi NNE	1.31E-01 (6 / 6) (-8.69E+00 - 9.99E+00)	1.31E-01 (6 / 6) (-8.69E+00 - 9.99E+00)	0
	Zn-65	13	260	-3.99E+01 (7 / 7) (-8.64E+01 - 2.85E+00)	2H 30 mi NNE	-3.26E+00 (6 / 6) (-2.95E+01 - 9.28E+00)	-3.26E+00 (6 / 6) (-2.95E+01 - 9.28E+00)	0
	Zr-95	13		1.68E-01 (7 / 7) (-1.50E+01 - 1.36E+01)	2H 30 mi NNE	3.84E+00 (6 / 6) (-3.25E+00 - 1.38E+01)	3.84E+00 (6 / 6) (-3.25E+00 - 1.38E+01)	0
	Nb-95	13		0.00E+00 (7 / 7) (0.00E+00 - 0.00E+00)	2H 30 mi NNE	0.00E+00 (6 / 6) (0.00E+00 - 0.00E+00)	0.00E+00 (6 / 6) (0.00E+00 - 0.00E+00)	0
	Cs-134	13	130	-1.86E+01 (7 / 7) (-4.35E+01 - 3.39E+00)	LTAW on site NE-ESE	3.39E+00 (1 / 1) (3.39E+00 - 3.39E+00)	-1.47E+01 (6 / 6) (-6.66E+01 - 1.19E+00)	0
	Cs-137	13	150	4.53E+00 (7 / 7) (-7.78E-01 - 1.22E+01)	IND 0.9-1.4 mi ESE	5.19E+00 (6 / 6) (-7.78E-01 - 1.22E+01)	-1.78E+00 (6 / 6) (-8.29E+00 - 3.14E+00)	0
	Ba-140	13		4.85E+01 (7 / 7) (-8.44E+01 - 1.85E+02)	LTAW on site NE-ESE	1.50E+02 (1 / 1) (1.50E+02 - 1.50E+02)	-3.49E+01 (6 / 6) (-2.26E+02 - 4.39E+01)	0
	La-140	13		-6.57E+00 (7 / 7) (-5.25E+01 - 3.31E+01)	IND 0.9-1.4 mi ESE	-6.25E+00 (6 / 6) (-5.25E+01 - 3.31E+01)	-7.25E+00 (6 / 6) (-1.94E+01 - 7.42E-01)	0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Sediment (pCi/kg dry)	Gamma Spec							
	Be-7	8		3.30E+02 (6 / 6) (-2.53E+01 - 7.26E+02)	12F 6.9 mi WSW	6.99E+02 (2 / 2) (6.71E+02 - 7.26E+02)	2.91E+02 (2 / 2) (2.58E+02 - 3.25E+02)	0
	K-40	8		1.37E+04 (6 / 6) (1.04E+04 - 1.58E+04)	LTAW on site NE-ESE	1.52E+04 (2 / 2) (1.47E+04 - 1.58E+04)	1.23E+04 (2 / 2) (7.23E+03 - 1.73E+04)	0
	Mn-54	8		9.58E+00 (6 / 6) (1.78E+00 - 2.55E+01)	LTAW on site NE-ESE	1.36E+01 (2 / 2) (1.78E+00 - 2.55E+01)	3.11E+00 (2 / 2) (-3.54E+00 - 9.75E+00)	0
	Co-58	8		-1.07E+01 (6 / 6) (-2.57E+01 - 2.41E+00)	12F 6.9 mi WSW	-7.79E-01 (2 / 2) (1.78E+00 - 2.41E+00)	-1.94E+01 (2 / 2) (-2.82E+01 - -1.05E+01)	0
	Fe-59	8		-6.29E+00 (6 / 6) (-2.98E+01 - 4.92E+01)	2B 1.6 mi NNE	2.58E+01 (2 / 2) (2.31E+00 - 4.92E+01)	2.58E+01 (2 / 2) (2.31E+00 - 4.92E+01)	0
	Co-60	8		4.57E+00 (6 / 6) (-9.06E+00 - 1.12E+01)	7B 1.2 mi SE	7.79E+00 (2 / 2) (4.42E+00 - 1.12E+01)	-2.50E+00 (2 / 2) (-1.20E+01 - 7.04E+00)	0
	Zn-65	8		7.53E+00 (6 / 6) (-2.05E+01 - 4.05E+01)	LTAW on site NE-ESE	2.57E+01 (2 / 2) (1.08E+01 - 4.05E+01)	-3.32E+01 (2 / 2) (-6.23E+01 - -4.07E+00)	0
	Zr-95	8		1.95E+01 (6 / 6) (1.20E+00 - 4.37E+01)	7B 1.2 mi SE	3.60E+01 (2 / 2) (2.83E+01 - 4.37E+01)	1.38E+01 (2 / 2) (5.34E+00 - 2.22E+01)	0
	Nb-95	8		0.00E+00 (6 / 6) (0.00E+00 - 0.00E+00)	2B 1.6 mi NNE	0.00E+00 (2 / 2) (0.00E+00 - 0.00E+00)	0.00E+00 (2 / 2) (0.00E+00 - 0.00E+00)	0
	Cs-134	8	150	-2.28E+00 (6 / 6) (-8.52E+00 - 7.96E+00)	LTAW on site NE-ESE	4.96E+00 (2 / 2) (1.97E+00 - 7.96E+00)	-6.59E+00 (2 / 2) (-1.07E+01 - -2.53E+00)	0
	Cs-137	8	180	5.20E+01 (6 / 6) (6.91E+00 - 1.00E+02)	7B 1.2 mi SE	8.92E+01 (2 / 2) (7.81E+01 - 1.00E+02)	7.56E+01 (2 / 2) (4.14E+01 - 1.10E+02)	0
	Ba-140	8		-2.30E+01 (6 / 6) (-9.92E+01 - 7.40E+01)	12F 6.9 mi WSW	-4.68E+00 (2 / 2) (-7.11E+00 - -2.25E+00)	-4.79E+01 (2 / 2) (-1.10E+02 - 1.42E+01)	0

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Sediment (cont) (pCi/kg dry)	La-140	8		-9.83E+00 (6 / 6) (-9.79E+01 - 4.89E+01)	7B 1.2 mi SE	2.81E+01 (2 / 2) (7.35E+00 - 4.89E+01)	1.91E+01 (2 / 2) (1.78E+01 - 2.05E+01)	0
	Ra-226	8		2.27E+03 (6 / 6) (1.96E+03 - 2.86E+03)	7B 1.2 mi SE	2.61E+03 (2 / 2) (2.36E+03 - 2.86E+03)	1.60E+03 (2 / 2) (7.50E+02 - 2.45E+03)	0
	Th-228	8		3.21E+03 (6 / 6) (2.46E+03 - 3.56E+03)	7B 1.2 mi SE	3.51E+03 (2 / 2) (3.47E+03 - 3.56E+03)	3.01E+03 (2 / 2) (1.28E+03 - 4.74E+03)	0
Ground Water (pCi/l)	Gamma Spec							
	K-40	36		-1.55E+00 (24 / 24) (-5.10E+01 - 2.70E+01)	2S2 0.9 mi NNE	2.49E+00 (12 / 12) (-1.90E+01 - 2.70E+01)	2.33E+00 (12 / 12) (-3.30E+01 - 5.30E+01)	0
	Mn-54	36	15	-1.18E-01 (24 / 24) (-2.90E+00 - 2.10E+00)	12F3 5.2 mi WSW	1.92E-01 (12 / 12) (-1.40E+00 - 2.00E+00)	1.92E-01 (12 / 12) (-1.40E+00 - 2.00E+00)	0
	Co-58	36	15	-7.57E-01 (24 / 24) (-2.70E+00 - 1.70E+00)	12F3 5.2 mi WSW	-5.00E-02 (12 / 12) (-1.70E+00 - 1.20E+00)	-5.00E-02 (12 / 12) (-1.70E+00 - 1.20E+00)	0
	Fe-59	36	30	5.83E-01 (24 / 24) (-5.30E+00 - 6.10E+00)	2S2 0.9 mi NNE	6.42E-01 (12 / 12) (-5.30E+00 - 6.10E+00)	3.75E-01 (12 / 12) (-4.20E+00 - 8.50E+00)	0
	Co-60	36	15	-1.28E-01 (24 / 24) (-2.40E+00 - 2.00E+00)	4S4 0.5 mi ENE	3.33E-02 (12 / 12) (-1.50E+00 - 2.00E+00)	-1.08E-01 (12 / 12) (-2.80E+00 - 1.90E+00)	0
	Zn-65	36	30	-1.32E+00 (24 / 24) (-9.40E+00 - 8.50E+00)	4S4 0.5 mi ENE	-1.20E+00 (12 / 12) (-9.40E+00 - 8.50E+00)	-4.43E+00 (12 / 12) (-2.80E+00 - 2.80E+00)	0
	Zr-95	36	30	-6.54E-01 (24 / 24) (-5.70E+00 - 3.30E+00)	12F3 5.2 mi WSW	1.15E+00 (12 / 12) (-2.70E+00 - 5.40E+00)	1.15E+00 (12 / 12) (-2.70E+00 - 5.40E+00)	0
	Nb-95	36	15	-2.46E-02 (24 / 24) (-2.90E+00 - 3.00E+00)	4S4 0.5 mi ENE	3.83E-01 (12 / 12) (-2.70E+00 - 3.00E+00)	-2.42E-01 (12 / 12) (-2.40E+00 - 2.10E+00)	0
	Cs-134	36	15	1.74E-01 (24 / 24) (-2.40E+00 - 2.80E+00)	4S4 0.5 mi ENE	4.42E-01 (12 / 12) (-9.00E-01 - 2.80E+00)	-3.67E-01 (12 / 12) (-1.70E+00 - 1.20E+00)	0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Ground Water (cont) (pCi/l)	Cs-137	36	18	-1.28E-01 (24 / 24) (-1.70E+00 - 1.40E+00)	2S2 0.9 mi NNE	-1.14E-01 (12 / 12) (-1.70E+00 - 1.40E+00)	-3.75E-01 (12 / 12) (-2.20E+00 - 1.20E+00)	0
	Ba-140	36	60	-2.67E-01 (24 / 24) (-5.20E+00 - 3.00E+00)	4S4 0.5 mi ENE	6.08E-01 (12 / 12) (-1.80E+00 - 2.60E+00)	1.08E-01 (12 / 12) (-4.80E+00 - 5.10E+00)	0
	La-140	36	15	-2.96E-01 (24 / 24) (-6.00E+00 - 3.40E+00)	4S4 0.5 mi ENE	7.00E-01 (12 / 12) (-2.10E+00 - 3.00E+00)	1.25E-01 (12 / 12) (-5.50E+00 - 5.80E+00)	0
	H-3	36	2000	5.44E+01 (24 / 24) (-6.74E+01 - 1.93E+02)	4S4 0.5 mi ENE	8.43E+01 (12 / 12) (-2.46E+00 - 1.93E+02)	1.74E+01 (12 / 12) (-8.84E+01 - 8.86E+01)	0
Air Particulates (E-03 pCi/m3)	Gross Beta	312	10	1.46E+01 (208 / 208) (3.59E+00 - 3.17E+01)	3S2 0.5 mi NE	1.51E+01 (52 / 53) (5.30E+01 - 4.91E+00)	1.34E+01 (104 / 104) (3.16E+00 - 3.10E+01)	0
Air Iodine (E-03 pCi/m3)	I-131	312	70	6.01E-04 (208 / 208) (-5.27E-03 - 5.97E-03)	3S2 0.5 mi NE	8.29E-04 (52 / 52) (5.20E+01 - -2.79E-03)	-6.44E-05 (104 / 104) (-3.74E-03 - 6.30E-03)	0
Air Particulates Quarterly Composite (E-03 pCi/m3)	Gamma Spec Be-7	24		9.06E+01 (16 / 16) (6.70E+01 - 1.11E+02)	12S1 0.4 mi WSW	9.10E+01 (4 / 4) (7.65E+01 - 1.06E+02)	8.21E+01 (8 / 8) (6.63E+01 - 9.34E+01)	0
	K-40	24		1.29E+00 (16 / 16) (-4.94E+00 - 4.04E+00)	3S2 0.5 mi NE	2.21E+00 (4 / 4) (2.27E-01 - 4.04E+00)	9.20E-01 (8 / 8) (-5.79E+00 - 4.66E+00)	0
	Mn-54	24		3.63E-02 (16 / 16) (-6.98E-02 - 2.23E-01)	6G1 13.5 mi ESE	1.10E-01 (4 / 4) (-5.75E-02 - 3.29E-01)	9.23E-02 (8 / 8) (-5.75E-02 - 3.29E-01)	0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Air Particulates (cont)								
Quarterly Composite (E-03 pCi/m3)	Co-58	24		-1.76E-02 (16 / 16) (-3.02E-01 - 4.75E-01)	3S2 0.5 mi NE	1.35E-01 (4 / 4) (-6.89E-02 - 4.75E-01)	-9.01E-02 (8 / 8) (-3.55E-01 - 4.86E-02)	0
	Fe-59	24		-9.55E-02 (16 / 16) (-1.15E+00 - 1.08E+00)	12S1 0.4 mi WSW	5.03E-01 (4 / 4) (1.05E-01 - 1)	4.05E-01 (8 / 8) (-8.34E-01 - 1.27E+00)	0
	Co-60	24		2.38E-02 (16 / 16) (-1.48E-01 - 1.76E-01)	8G1 12 mi SSE	8.38E-02 (4 / 4) (-3.44E-03 - 2.13E-01)	5.70E-02 (8 / 8) (-3.17E-02 - 2.13E-01)	0
	Zn-65	24		-2.88E-01 (16 / 16) (-1.34E+00 - 6.25E-01)	12S1 0.4 mi WSW	-7.97E-03 (4 / 4) (-5.66E-01 - 6.25E-01)	-2.46E-01 (8 / 8) (-1.01E+00 - 2.93E-01)	0
	Zr-95	24		1.78E-02 (16 / 16) (-5.13E-01 - 4.77E-01)	13S6 0.4 mi W	8.62E-02 (4 / 4) (-3.07E-01 - 4.77E-01)	-7.31E-02 (8 / 8) (-2.42E-01 - 9.69E-02)	0
	Nb-95	24		0.00E+00 (16 / 16) (0.00E+00 - 0.00E+00)	6G1 13.5 mi ESE	0.00E+00 (4 / 4) (0.00E+00 - 0.00E+00)	0.00E+00 (8 / 8) (0.00E+00 - 0.00E+00)	0
	Cs-134	24	50	0.00E+00 (16 / 16) (-8.96E-01 - 8.91E-02)	12S1 0.4 mi WSW	-3.46E-02 (4 / 4) (-9.70E-02 - 4.42E-02)	-3.00E-01 (8 / 8) (-8.09E-01 - 2.49E-02)	0
	Cs-137	24	60	4.15E-02 (16 / 16) (-9.46E-02 - 1.61E-01)	13S6 0.4 mi W	1.19E-01 (4 / 4) (6.29E-02 - 1.61E-01)	2.07E-02 (8 / 8) (-6.52E-02 - 1.03E-01)	0
	Ba-140	24		-4.59E+00 (16 / 16) (-2.38E+01 - 1.74E+01)	12E1 4.7 mi WSW	5.54E+00 (4 / 4) (-4.03E+00 - 1.74E+01)	2.12E-01 (8 / 8) (-1.19E+01 - 8.17E+00)	0
	La-140	24		-2.94E+00 (16 / 16) (-2.42E+01 - 4.81E+00)	12S1 0.4 mi WSW	1.97E+00 (4 / 4) (-4.43E-01 - 4.81E+00)	4.77E-01 (8 / 8) (-5.49E+00 - 1.25E+01)	0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Milk (pCi/l)	I-131	76	1	5.32E-02 (57 / 57) (-1.70E-01 - 4.40E-01)	10G1 14 mi SSW	9.08E-02 (19 / 19) (-8.00E-02 - 4.50E-01)	9.08E-02 (19 / 19) (-8.00E-02 - 4.50E-01)	0
	Gamma Spec							
	K-40	76		1.38E+03 (57 / 57) (9.40E+02 - 1.55E+03)	10G1 14 mi SSW	1.41E+03 (19 / 19) (8.19E+02 - 1.53E+03)	1.41E+03 (19 / 19) (8.19E+02 - 1.53E+03)	0
	Mn-54	76		-1.88E-01 (57 / 57) (-4.30E+00 - 2.50E+00)	10D2 3.1 mi SSW	-5.26E-02 (19 / 19) (-2.60E+00 - 2.50E+00)	-4.42E-01 (19 / 19) (-3.10E+00 - 1.60E+00)	0
	Co-58	76		-4.00E-01 (57 / 57) (-4.10E+00 - 3.30E+00)	10G1 14 mi SSW	-7.89E-02 (19 / 19) (-3.70E+00 - 2.30E+00)	-7.89E-02 (19 / 19) (-3.70E+00 - 2.30E+00)	0
	Fe-59	76		4.60E-01 (57 / 57) (-1.20E+01 - 1.22E+01)	10D2 3.1 mi SSW	8.32E-01 (19 / 19) (-4.00E+00 - 8.00E+00)	1.42E-01 (19 / 19) (-4.60E+00 - 7.30E+00)	0
	Co-60	76		2.47E-01 (57 / 57) (-4.70E+00 - 5.40E+00)	10D1 3 mi SSW	6.11E-01 (19 / 19) (-3.00E+00 - 3.30E+00)	2.21E-01 (19 / 19) (-2.90E+00 - 2.90E+00)	0
	Zn-65	76		-2.77E+00 (57 / 57) (-1.60E+01 - 7.00E+00)	10D2 3.1 mi SSW	-9.21E-01 (19 / 19) (-1.60E+01 - 7.00E+00)	-2.92E+00 (19 / 19) (-1.34E+01 - 4.20E+00)	0
	Zr-95	76		-2.63E-02 (57 / 57) (-7.20E+00 - 3.60E+00)	12B2 1.7 mi WSW	3.58E-01 (19 / 19) (-4.30E+00 - 3.60E+00)	-2.58E-01 (19 / 19) (-4.30E+00 - 7.50E+00)	0
	Nb-95	76		2.56E-01 (57 / 57) (-2.80E+00 - 4.70E+00)	10G1 14 mi SSW	4.37E-01 (19 / 19) (-2.00E+00 - 2.70E+00)	4.37E-01 (19 / 19) (-2.00E+00 - 2.70E+00)	0
	Cs-134	76	15	-8.77E-03 (57 / 57) (-4.00E+00 - 4.10E+00)	10D2 3.1 mi SSW	4.11E-01 (19 / 19) (-1.70E+00 - 2.80E+00)	-2.21E-01 (19 / 19) (-2.80E+00 - 2.60E+00)	0
	Cs-137	76	18	-8.77E-03 (57 / 57) (-3.20E+00 - 3.50E+00)	10G1 14 mi SSW	5.58E-01 (19 / 19) (-1.20E+00 - 2.60E+00)	5.58E-01 (19 / 19) (-1.20E+00 - 2.60E+00)	0
	Ba-140	76	60	-2.49E-01 (57 / 57) (-4.80E+00 - 5.00E+00)	10G1 14 mi SSW	1.89E-01 (19 / 19) (-2.70E+00 - 3.90E+00)	1.89E-01 (19 / 19) (-2.70E+00 - 3.90E+00)	0
	La-140	76	15	-2.88E-01 (57 / 57) (-5.50E+00 - 5.80E+00)	10G1 14 mi SSW	2.16E-01 (19 / 19) (-3.10E+00 - 4.40E+00)	2.16E-01 (19 / 19) (-3.10E+00 - 4.40E+00)	0

TABLE G
SUMMARY OF DATA FOR SSES
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION				MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Soil	Gamma Spec													
(pCi/kg dry)	K-40	8		1.44E+04	(6 / 6)	13S6				1.62E+04	(2 / 2)	1.06E+04	(2 / 2)	0
				(1.03E+04	- 1.82E+04)		0.4	mi	W	(1.43E+04	- 1.82E+04)	(1.02E+04	- 1.10E+04)	
	Mn-54	8		-1.50E+00	(6 / 6)	13S6				-5.00E-01	(2 / 2)	-1.20E+01	(2 / 2)	0
				(-9.00E+00	- 4.00E+00)		0.4	mi	W	(-5.00E+00	- 4.00E+00)	(-1.90E+01	- -5.00E+00)	
	Co-58	8		-6.33E+00	(6 / 6)	3S2				1.00E+00	(2 / 2)	0.00E+00	(2 / 2)	0
				(-1.80E+01	- 9.00E+00)		0.5	mi	NE	(-7.00E+00	- 9.00E+00)	(-5.00E+00	- 5.00E+00)	
	Fe-59	8		-6.17E+00	(6 / 6)	13S6				4.00E+00	(2 / 2)	-4.05E+01	(2 / 2)	0
				(-2.80E+01	- 3.60E+01)		0.4	mi	W	(-2.80E+01	- 3.60E+01)	(-7.20E+01	- -9.00E+00)	
	Co-60	8		-4.00E+00	(6 / 6)	3S2				7.00E+00	(2 / 2)	-1.00E+01	(2 / 2)	0
				(-1.80E+01	- 1.20E+01)		0.5	mi	NE	(2.00E+00	- 1.20E+01)	(-1.80E+01	- -2.00E+00)	
	Zn-65	8		-1.87E+01	(6 / 6)	12S1				9.00E+00	(2 / 2)	5.00E+00	(2 / 2)	0
				(-1.10E+02	- 6.00E+01)		0.4	mi	WSW	(-3.20E+01	- 5.00E+01)	(-3.00E+01	- 4.00E+01)	
	Zr-95	8		-1.15E+03	(6 / 6)	8G1				4.80E+01	(2 / 2)	4.80E+01	(2 / 2)	0
				(-6.70E+03	- 3.00E+01)		12	mi	SSE	(4.70E+01	- 4.90E+01)	(4.70E+01	- 4.90E+01)	
	Nb-95	8		-4.67E+00	(6 / 6)	8G1				1.70E+01	(2 / 2)	1.70E+01	(2 / 2)	0
				(-4.30E+01	- 1.60E+01)		12	mi	SSE	(-5.00E+00	- 3.90E+01)	(-5.00E+00	- 3.90E+01)	
	Cs-134	8		3.83E+00	(6 / 6)	8G1				3.30E+01	(2 / 2)	3.30E+01	(2 / 2)	0
				(-7.00E+00	- 2.40E+01)		12	mi	SSE	(1.40E+01	- 5.20E+01)	(1.40E+01	- 5.20E+01)	
	Cs-137	8		4.28E+01	(6 / 6)	12S1				8.60E+01	(2 / 2)	7.45E+01	(2 / 2)	0
				(-2.10E+01	- 9.60E+01)		0.4	mi	WSW	(7.60E+01	- 9.60E+01)	(5.20E+01	- 9.70E+01)	
	Ba-140	8		6.67E-01	(6 / 6)	3S2				2.50E+01	(2 / 2)	-1.80E+01	(2 / 2)	0
				(-5.00E+01	- 8.00E+01)		0.5	mi	NE	(1.00E+01	- 4.00E+01)	(-2.50E+01	- -1.10E+01)	
	La-140	8		-1.13E+01	(6 / 6)	3S2				1.05E+01	(2 / 2)	-2.05E+01	(2 / 2)	0
				-(4.90E+01	- 1.40E+01)		0.5	mi	NE	(7.00E+00	- 1.40E+01)	-(2.80E+01	- -1.30E+01)	

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE		LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION				LOCATION WITH HIGHEST MEAN MEAN (3) RANGE		CONTROL LOCATION MEAN (3) RANGE		NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Soil (cont) (pCi/kg dry)	Ra-226	0												0
	Th-228	8		7.89E+02	(6 / 6)	3S2				1.02E+03	(2 / 2)	8.15E+02	(2 / 2)	0
				(-2.00E+00	- 1.04E+03)		0.5	mi	NE	(1.00E+03	- 1.04E+03)	(7.30E+02	- 9.00E+02)	
Food/Garden Crops (pCi/kg wet)	Gamma Spec													
	Be-7	2		8.43E+00	(2 / 2)	11F2				1.39E+01	(1 1)			0
				(2.95E+00	- 1.39E+01)		5.5	mi	SW	(1.39E+01	- 1.39E+01)			
	K-40	2		4.56E+03	(2 / 2)	11D2				4.66E+03	(1 / 1)			0
				(4.47E+03	- 4.66E+03)		3.5	mi	SW	(4.66E+03	- 4.66E+03)			
	Mn-54	2		-4.75E-01	(2 / 2)	11D2				1.36E+00	(1 / 1)			0
				(-2.31E+00	- 1.36E+00)		3.5	mi	SW	(1.36E+00	- 1.36E+00)			
	Co-58	2		-1.28E+00	(2 / 2)	11D2				-1.07E+00	(1 / 1)			0
				(-1.48E+00	- -1.07E+00)		3.5	mi	SW	(-1.07E+00	- -1.07E+00)			
	Fe-59	2		-3.75E-01	(2 / 2)	11F2				1.97E+00	(1 / 1)			0
				(-2.72E+00	- 1.97E+00)		5.5	mi	SW	(1.97E+00	- 1.97E+00)			
	Co-60	2		3.48E+00	(2 / 2)	11F2				5.53E+00	(1 / 1)			0
				(1.42E+00	- 5.53E+00)		5.5	mi	SW	(5.53E+00	- 5.53E+00)			
	Zn-65	2		-2.01E+01	(2 / 2)	11F2				-1.69E+01	(1 / 1)			0
				(-2.33E+01	- -1.69E+01)		5.5	mi	SW	(-1.69E+01	- -1.69E+01)			
	Zr-95	2		7.40E-01	(2 / 2)	11F2				5.73E+00	(1 / 1)			0
				(-4.25E+00	- 5.73E+00)		5.5	mi	SW	(5.73E+00	- 5.73E+00)			
	Nb-95	2		0.00E+00	(2 / 2)	11D2				0.00E+00	(1 / 1)			0
				(0.00E+00	- 0.00E+00)		3.5	mi	SW	(0.00E+00	- 0.00E+00)			
	I-131	2		-6.32E+00	(2 / 2)	11F2				-6.01E+00	(1 / 1)			0
				(-6.63E+00	- -6.01E+00)		5.5	mi	SW	(-6.01E+00	- -6.01E+00)			

TABLE G
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OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - 2003
NAME OF FACILITY: SUSQUEHANNA STEAM ELECTRIC STATION
LOCATION OF FACILITY: LUZERNE COUNTY, PENNSYLVANIA

Reporting Period: December 30, 2002 to January 30, 2004

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED (1)		LOWER LIMIT OF DETECTION (LLD) (2)	ALL INDICATOR LOCATIONS MEAN (3) RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST MEAN MEAN (3) RANGE	CONTROL LOCATION MEAN (3) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS(4)
Food/Garden Crops (cont)								
(pCi/kg wet)	Cs-134	2		-1.91E+01 (2 / 2) (-2.00E+01 - -1.82E+01)	11F2 5.5 mi SW	-1.82E+01 (1 / 1) (-1.82E+01 - -1.82E+01)		0
	Cs-137	2		-3.54E+00 (2 / 2) (-6.00E+00 - -1.07E+00)	11D2 3.5 mi SW	-1.07E+00 (1 / 1) (-1.07E+00 - -1.07E+00)		0
	Ba-140	2		1.89E+01 (2 / 2) (-6.32E+00 - 4.41E+01)	11F2 5.5 mi SW	4.41E+01 (1 / 1) (4.41E+01 - 4.41E+01)		0
	La-140	2		-1.84E+00 (2 / 2) (-4.24E+00 - 5.58E-01)	11D2 3.5 mi SW	5.58E-01 (1 / 1) (5.58E-01 - 5.58E-01)		0

1. The total number of analysis does not include duplicates, splits, or repeated analyses.
2. The Technical Requirement LLD's are shown when applicable.
3. The means are based on all available measured results. When possible, this includes those below the MDCs as well as those above them.
4. USNRC reporting levels are specified in the Technical Requirements.

APPENDIX H

COMPARISON OF INDICATOR AND CONTROL 2003 REMP ANNUAL MEANS FOR SELECTED MEDIA ANALYSIS RESULTS WITH MEANS FROM PREOPERATIONAL AND PRIOR OPERATIONAL PERIODS

The data presented in the following tables were included if specific analysis results routinely exceeded the applicable MDCs in 2003 and/or routinely may have done so in previous years. The comparisons may be useful for observing any step changes that may occur in the environment over a wide area. However, the importance attached to these comparisons should be tempered by the understanding that changes in methods of analysis, typical MDCs achieved by the analyses, and averaging methods over the years may tend to blur the picture in some cases.

AMBIENT RADIATION MONITORING

TABLE H 1

AMBIENT RADIATION LEVELS AS MEASURED BY TLDS (mR/STD QTR)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1982-02	2003	1978-81	1982-02	2003
Range	18.5-19.2	14.7-20.8	--	15.0-17.9	14.8-20.8	--
Mean	18.9	18.2	20.2	16.3	17.9	19.0

AQUATIC PATHWAY MONITORING

TABLE H 2

SURFACE WATER GROSS BETA ACTIVITIES (pCi/l)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1982-02	2003	1978-81	1982-02	2003
Range	3.2-4.9	3.0-7.7	--	2.9-5.2	2.8-6.7	--
Mean	3.8	5.6	6.1	4.0	3.8	2.4

TABLE H 3

SURFACE WATER IODINE-131 ACTIVITIES (pCi/l)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1979-81	1982-02	2003	1979-81	1982-02	2003
Range	0.24-0.37	0.06-0.61	--	0.29-0.43	0.03-1.0	--
Mean	0.29	0.32	0.36	0.36	0.32	0.26

TABLE H 4

SURFACE WATER TRITIUM ACTIVITIES (pCi/l)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1982-02*	2003	1978-81	1982-02*	2003
Range	101-122	126-1363	--	119-319	-239 - +212	--
Mean	109	573	1,576	171	52	32

*1990 results were not averaged with 1982-01 data because the validity of the 1990 values is questionable in some instances. Laboratory analysis error is suspected. See the 1990 Annual Report.

TABLE H 5

DRINKING WATER GROSS ALPHA ACTIVITIES (pCi/l)			
Period	Preoperational	Operational	
	1980 - 81	1982 – 02	2003
Range	--	0.1 – 10.0	--
Mean	1.3	1.4	0.18

TABLE H 6

DRINKING WATER GROSS BETA ACTIVITIES (pCi/l)			
Period	Preoperational	Operational	
	1977 - 81	1982 - 02	2003
Range	2.2 - 3.2	2.1 - 5.4	--
Mean	2.7	3.1	2.1

TABLE H 7

DRINKING WATER TRITIUM ACTIVITIES (pCi/l)			
Period	Preoperational	Operational	
	1977 – 81	1982 - 02	2003
Range	101 – 194	-247 - +220	--
Mean	132	62	62

TABLE H 8

FISH POTASSIUM-40 ACTIVITIES (pCi/g wet)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1977-81	1982-02	2003	1977-81	1982-02	2003
Range	2.7 - 3.5	3.1 - 5.3	--	2.8 - 3.6	3.1 - 4.2	--
Mean	3.2	3.8	3.6	3.2	3.5	3.2

TABLE H 9

SEDIMENT POTASSIUM-40 ACTIVITIES (pCi/g dry)						
Location	**Indicator**			**Control**		
Period	**Pre-Op**	**Operational**		**Pre-Op**	**Operational**	
	1978-81	**1982-02**	**2003**	**1978-81**	**1982-02**	**2003**
Range	8.6-10.4	7.4-13.6	--	7.5-11.0	6.2-13.0	--
Mean	9.3	10.8	12.3	7.7	10.5	12.9

TABLE H 10

SEDIMENT RADIUM-226 ACTIVITIES (pCi/g dry)						
Location	**Indicator**			**Control**		
Period	**Pre-Op**	**Operational**		**Pre-Op**	**Operational**	
	1978-81	**1982-02**	**2003**	**1978-81**	**1982-02**	**2003**
Range	0.5-0.7	0.5-2.0	--	0.6-1.9	0.4-2.1	--
Mean	0.6	1.5	2.4	0.7	1.5	1.6

TABLE H 11

SEDIMENT THORIUM-228 ACTIVITIES (pCi/g dry)				
Location	**Indicator**		**Control**	
Period	**1984 - 02***	**2003**	**1984 - 02***	**2003**
Range	0.9 - 1.7	--	0.8 – 2.1	--
Mean	1.1	3.2	1.1	3.0

*Th-232 was reported instead of Th-228 in 1990.

TABLE H 12

SEDIMENT CESIUM-137 ACTIVITIES (pCi/g dry)						
Location	**Indicator**			**Control**		
Period	**Pre-Op**	**Operational**		**Pre-Op**	**Operational**	
	1978-81	**1982-02**	**2003**	**1978-81**	**1982-02**	**2003**
Range	0.08-0.15	0.04-0.17	--	0.08-0.21	0.06-0.21	--
Mean	0.10	0.09	0.07	0.11	0.11	0.08

ATMOSPHERIC PATHWAY MONITORING

TABLE H 13

AIR PARTICULATE GROSS BETA ACTIVITIES (E-3 pCi/m^3)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1982-02	2003	1978-81	1982-02	2003
Range	24 - 97	13 - 29	--	24 - 102	12 – 28	--
Mean	61	16	15	62	16	13

TABLE H 14

AIR PARTICULATE BERYLLIUM-7 ACTIVITIES (E-3 pCi/m^3)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1982-02*	2003	1978-81	1982-02*	2003
Range	69 - 81	50 - 137	--	59 - 85	49 - 126	--
Mean	76	95	91	72	88	82

*1990 results were not averaged with 1982-01 data because the validity of the 1990 values is questionable in some instances. Laboratory analysis error is suspected. See the 1990 Annual Report.

TERRESTRIAL PATHWAY MONITORING

TABLE H 15

SOIL POTASSIUM-40 ACTIVITIES (pCi/g dry)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1979&81	1984-02	2003	1979&81	1984-02	2003
Range	9.2 - 9.7	9.4-15.3	--	9.1-11.0	7.4-14.1	--
Mean	9.5	11.7	14.4	10.1	10.5	10.6

TABLE H 16

SOIL RADIUM-226 ACTIVITIES (pCi/g dry)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1979&81	1984-02*	2003*	1979&81	1984-02	2003
Range	0.8 - 1.3	0.8 - 2.5	--	0.8 - 1.2	1.0 - 2.2	--
Mean	1.1	1.6	0	1.0	1.7	0

* Radium-226 was not measured in 2002 or 2003.

TABLE H 17

SOIL THORIUM-228 ACTIVITIES (pCi/g dry)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1979&81	1984-02	2003	1979&81	1984-02	2003
Range	0.9 - 1.3	0.8 – 2.0	--	--	0.7 – 2.4	--
Mean	1.1	1.0	0.8	1.0	1.0	0.8

TABLE H 18

SOIL CESIUM-137 ACTIVITIES (pCi/g dry)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1979&81	1982-02	2003	1979&81	1982-02	2003
Range	0.5 - 0.7	0.02 - 0.5	--	0.2 - 1.2	0.09 - 1.2	--
Mean	0.6	0.2	0.04	0.7	0.4	0.07

TABLE H 19

MILK POTASSIUM-40 ACTIVITIES (pCi/l)						
Location	Indicator			Control		
Period	Pre-Op	Operational		Pre-Op	Operational	
	1978-81	1985-02	2003	1978-81	1985-02	2003
Range	1222-1500	1241-1422	--	1273-1500	1247-1472	--
Mean	1325	1333	1383	1390	1331	1406

TABLE H 20

GROUND WATER TRITIUM ACTIVITIES (pCi/l)						
Location	**Indicator**			**Control**		
Period	**Pre-Op**	**Operational**		**Pre-Op**	**Operational**	
	1980-81	**1982-02**	**2003**	**1980-81**	**1982-02**	**2003**
Range	94-109	-206 - +180	--	117 - 119	-206 - +260	--
Mean	101	59	54	118	67	17

APPENDIX I

SPECIFIC ANALYSIS RESULTS TABULATED BY MEDIA AND SAMPLING PERIOD

Results of analyses are generally reported in the following tables to two significant figures. Random uncertainties of counting are reported to the same decimal place as the result.

Calculated values for analysis results are reported with the random uncertainty of counting at two standard deviations (2S), determined by considering both the sample and background count rates. The uncertainty of an activity is influenced by the volume or mass of the sample, the background count rate, the count times, the method used to round off the value obtained to reflect its degree of significance, and other factors. The uncertainties of activities determined by gamma spectrometric analyses are also influenced by the relative concentrations of the radionuclides in the sample, the energies and intensities of the gammas emitted by those radionuclides, and the assumptions used in selecting the radionuclides to be quantitatively determined.

Results reported as less than (<) in these tables are below the minimum detectable concentrations (MDCs). The MDC is an estimate of the detection capabilities of the overall measurement method, taking into account not only the counting system, but also the characteristics of the sample being counted. When the MDC is used as the level to decide whether or not to enter a measured value into a table, there is a 50% chance that the value will be entered when the actual sample activity is equivalent to the MDC. There is only a five percent chance that a value representing a fluctuation in background activity will be entered as sample activity in such an instance.

Measured values for the activities of specific radionuclides, such as the man-made gamma-emitting radionuclides beryllium-7 and cesium-137, only appear in the following tables for each specific medium when the levels that are measured exceed the MDC values for those measurements and those radionuclides are actually identified as present in the samples. Measured values for the analyses that are not radionuclide specific, such as gross alpha and beta analyses, also are presented in the tables for specific media only when the levels that are measured actually exceed the MDCs.

TABLE I-1
ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results (1) are in mR/std. qtr (2) ± 2S (3)

Location	First Quarter 01/29/03 to 05/01/03	Second Quarter 04/29/03 to 07/24/03	Third Quarter 07/22/03 to 10/23/03	Fourth Quarter 10/21/03 to 01/30/04
ONSITE				
1S2	23.6 ± 1.4	24.3 ± 1.9	23.6 ± 1.2	26.5 ± 2.1
2S2	17.5 ± 1.8	15.8 ± 1.3	20.5 ± 0.8	17.9 ± 1.1
2S3	20.4 ± 0.8	20.5 ± 1.5	23.6 ± 0.4	23.2 ± 2.3
3S2	17.6 ± 1.4	16.0 ± 1.1	19.5 ± 1.2	18.4 ± 1.5
3S3	17.0 ± 1.6	15.0 ± 1.3	19.1 ± 2.6	18.1 ± 0.9
3S4	17.2 ± 1.4	(4)	19.4 ± 1.8	18.3 ± 1.1
4S3	22.0 ± 1.2	21.0 ± 1.1	24.2 ± 1.0	23.5 ± 1.9
4S6	17.8 ± 1.6	16.9 ± 1.3	20.8 ± 1.2	18.4 ± 1.3
5S4	16.1 ± 1.0	14.9 ± 1.3	18.4 ± 1.6	17.2 ± 0.9
5S7	17.8 ± 1.8	16.6 ± 1.1	19.6 ± 1.4	18.3 ± 1.5
6S4	23.8 ± 1.2	24.3 ± 2.1	27.9 ± 1.2	26.8 ± 0.9
6S9	22.6 ± 0.6	23.2 ± 1.1	27.6 ± 1.8	25.7 ± 0.8
7S6	22.9 ± 1.8	23.3 ± 1.3	26.7 ± 1.2	25.8 ± 1.3
7S7	17.3 ± 1.0	15.9 ± 1.5	19.9 ± 1.2	19.1 ± 0.9
8S2	22.9 ± 1.4	22.5 ± 1.7	27.4 ± 3.0	25.5 ± 0.9
9S2	31.7 ± 1.8	41.9 ± 6.4	44.7 ± 2.6	44.1 ± 3.0
10S1	17.1 ± 1.8	15.9 ± 1.7	19.1 ± 2.4	18.1 ± 1.1
10S2	26.6 ± 1.2	29.2 ± 1.1	33.3 ± 2.4	31.6 ± 1.9
10S3	16.3 ± 0.6	15.1 ± 1.3	18.6 ± 1.4	16.8 ± 0.9
11S3	24.8 ± 1.6	24.6 ± 1.1	28.1 ± 1.4	27.4 ± 0.9
11S7	18.0 ± 1.2	16.9 ± 1.1	20.8 ± 2.4	20.1 ± 1.3

TABLE I-1
ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results (1) are in mR/std. qtr (2) ± 2S (3)

Location	First Quarter 01/29/03 to 05/01/03	Second Quarter 04/29/03 to 07/24/03	Third Quarter 07/22/03 to 10/23/03	Fourth Quarter 10/21/03 to 01/30/04
12S1	19.0 ± 1.2	17.4 ± 1.1	21.5 ± 1.4	19.6 ± 1.3
12S3	24.2 ± 1.2	22.8 ± 1.5	25.9 ± 0.8	24.3 ± 1.7
12S4	24.9 ± 1.0	23.0 ± 2.1	26.5 ± 2.0	24.9 ± 0.9
12S5	21.0 ± 0.6	20.3 ± 1.3	22.6 ± 1.6	21.8 ± 0.9
12S6	21.4 ± 1.0	19.9 ± 1.7	23.6 ± 1.4	21.8 ± 1.7
12S7	16.8 ± 1.2	14.9 ± 0.9	17.7 ± 1.8	17.2 ± 0.6
13S2	23.4 ± 1.2	21.7 ± 1.7	26.1 ± 1.4	24.3 ± 0.8
13S4	22.9 ± 1.6	20.7 ± 1.1	25.9 ± 1.6	22.8 ± 0.6
13S5	24.5 ± 2.4	22.4 ± 2.6	27.1 ± 1.4	25.4 ± 1.7
13S6	22.5 ± 2.0	21.1 ± 1.3	24.2 ± 1.8	23.0 ± 1.5
14S5	21.4 ± 1.2	20.6 ± 1.7	23.5 ± 1.4	21.2 ± 1.5
14S6	19.9 ± 1.0	19.1 ± 1.5	22.7 ± 0.4	20.3 ± 1.5
15S5	19.5 ± 1.0	17.8 ± 0.6	21.8 ± 1.0	21.2 ± 4.5
16S1	22.3 ± 1.8	22.2 ± 1.1	24.4 ± 1.0	23.8 ± 1.3
16S2	23.3 ± 1.2	21.1 ± 1.5	25.3 ± 1.4	23.9 ± 1.5

See the comments at the end of this table.

TABLE I-1
ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results (1) are in mR/std. qtr (2) ± 2S (3)

Location	First Quarter 01/29/03 to 05/01/03	Second Quarter 04/29/03 to 07/24/03	Third Quarter 07/22/03 to 10/23/03	Fourth Quarter 10/21/03 to 01/30/04
0-1 MILE OFFSITE				
6A4	20.7 ± 1.6	18.7 ± 1.3	22.7 ± 1.2	21.1 ± 0.9
8A3	17.5 ± 0.8	15.4 ± 1.7	19.2 ± 1.6	18.3 ± 0.7
15A3	18.9 ± 2.0	17.7 ± 1.9	20.9 ± 1.4	19.4 ± 1.7
16A2	16.4 ± 1.6	14.3 ± 1.3	18.6 ± 1.2	17.1 ± 0.9
1-2 MILES OFFSITE				
1B1	17.7 ± 1.8	16.1 ± 1.1	21.3 ± 1.4	19.0 ± 1.1
2B3	18.9 ± 0.8	16.6 ± 0.9	20.8 ± 0.4	18.8 ± 0.6
2B4	17.5 ± 0.2	16.4 ± 0.9	21.4 ± 1.8	19.1 ± 1.1
5B3	16.2 ± 1.4	14.6 ± 1.1	17.5 ± 1.2	16.5 ± 2.2
7B2	17.3 ± 0.8	15.7 ± 0.9	18.7 ± 1.0	17.4 ± 0.6
8B2	16.9 ± 1.2	15.1 ± 1.1	18.1 ± 1.4	17.3 ± 0.7
9B1	16.7 ± 0.6	15.6 ± 1.3	18.9 ± 1.6	17.8 ± 1.5
10B2	14.8 ± 1.6	12.7 ± 1.3	16.7 ± 0.8	14.9 ± 1.5
10B3	17.5 ± 1.2	15.2 ± 0.4	19.2 ± 1.0	(4)
10B4	18.0 ± 1.6	18.0 ± 1.5	20.4 ± 1.0	20.4 ± 1.1
12B4	18.3 ± 1.0	17.0 ± 1.5	20.1 ± 1.0	18.6 ± 0.7
13B1	18.4 ± 1.6	16.4 ± 1.5	19.1 ± 1.6	18.3 ± 1.7
14B3	18.7 ± 1.8	16.4 ± 1.5	19.9 ± 1.0	(4)
15B1	17.1 ± 1.8	16.0 ± 1.1	18.9 ± 1.4	18.0 ± 2.4
16B2	16.1 ± 0.8	15.4 ± 1.9	19.2 ± 0.4	17.3 ± 0.7
2-3 MILES OFFSITE				
11C1	21.2 ± 1.6	19.4 ± 0.9	22.4 ± 1.0	21.7 ± 0.7

See the comments at the end of this table.

TABLE I-1
ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results (1) are in mR/std. qtr (2) ± 2S (3)

Location	First Quarter 01/29/03 to 05/01/03	Second Quarter 04/29/03 to 07/24/03	Third Quarter 07/22/03 to 10/23/03	Fourth Quarter 10/21/03 to 01/30/04
3-4 MILES OFFSITE				
1D5	19.9 ± 0.8	18.6 ± 0.9	22.5 ± 0.0	20.3 ± 1.1
6D1	18.9 ± 1.4	17.9 ± 1.3	21.3 ± 1.2	19.8 ± 0.6
8D3	18.6 ± 1.2	17.3 ± 0.6	19.1 ± 0.8	18.1 ± 1.1
9D4	18.4 ± 1.6	17.7 ± 1.1	20.4 ± 2.6	18.8 ± 1.3
10D1	18.5 ± 1.2	16.7 ± 1.3	19.9 ± 1.2	18.3 ± 2.4
12D2	21.2 ± 1.8	19.9 ± 1.1	22.0 ± 2.4	21.5 ± 0.9
14D1	19.9 ± 1.2	17.9 ± 1.5	20.7 ± 2.4	20.3 ± 1.7
4-5 MILES OFFSITE				
3E1	15.7 ± 0.6	14.9 ± 1.7	18.6 ± 1.5	16.2 ± 0.6
4E2	19.2 ± 1.6	18.8 ± 0.6	21.7 ± 1.4	19.6 ± 0.7
5E2	18.0 ± 1.4	16.3 ± 1.5	20.9 ± 2.0	18.9 ± 0.7
6E1	20.5 ± 2.2	20.1 ± 0.6	21.6 ± 1.0	20.7 ± 1.7
7E1	18.7 ± 2.0	17.5 ± 0.6	20.5 ± 1.0	18.9 ± 1.3
11E1	16.0 ± 0.8	14.3 ± 0.9	17.4 ± 1.0	16.1 ± 0.7
12E1	17.4 ± 1.8	16.1 ± 1.3	18.6 ± 0.6	17.8 ± 1.1
13E4	20.5 ± 1.6	20.1 ± 1.1	22.9 ± 1.6	22.3 ± 1.1
5-10 MILES OFFSITE				
2F1	17.0 ± 1.6	17.0 ± 1.5	20.2 ± 0.4	18.4 ± 1.7
8F2	17.4 ± 0.8	16.4 ± 1.1	18.6 ± 1.0	17.5 ± 0.7
12F2	19.1 ± 1.2	17.9 ± 1.1	20.8 ± 1.2	20.4 ± 0.7
15F1	19.1 ± 1.2	18.7 ± 1.3	21.9 ± 2.0	20.9 ± 1.7
16F1	20.8 ± 0.6	19.8 ± 1.5	22.2 ± 1.8	20.9 ± 1.9

See the comments at the end of this table.

TABLE I-1
ENVIRONMENTAL THERMOLUMINESCENT DOSIMETRY RESULTS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results (1) are in mR/std. qtr (2) ± 2S (3)

Location	First Quarter 01/29/03 to 05/01/03	Second Quarter 04/29/03 to 07/24/03	Third Quarter 07/22/03 to 10/23/03	Fourth Quarter 10/21/03 to 01/30/04
10-20 MILES				
3G4	19.9 ± 1.2	19.7 ± 1.7	21.2 ± 0.6	21.2 ± 0.0
4G1	20.0 ± 1.4	19.9 ± 0.6	21.7 ± 1.8	21.3 ± 0.6
6G1	19.5 ± 2.0	20.2 ± 1.7	23.6 ± 1.0	21.9 ± 0.6
7G1	17.1 ± 1.2	16.5 ± 0.9	19.1 ± 1.0	18.5 ± 0.6
7G2	17.3 ± 1.0	16.9 ± 0.4	20.2 ± 0.7	18.8 ± 1.9
8G1	15.9 ± 1.0	14.1 ± 1.1	17.3 ± 1.8	16.9 ± 0.7
12G1	17.2 ± 2.0	15.2 ± 1.1	17.8 ± 0.8	18.0 ± 0.7
12G4	20.3 ± 1.4	17.8 ± 0.9	21.3 ± 1.4	20.4 ± 0.4

See the comments at the end of this table.

Location	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Indicator Average (5)	19.6 ± 11.8	18.6 ± 12.9	21.9 ± 12.9	20.7 ± 12.2
Control Average (5)	18.4 ± 4.1	17.5 ± 3.2	20.3 ± 3.5	19.6 ± 2.4

COMMENTS

(1) Individual monitor location results are normally the average of the elemental doses of six calcium elements from the two TLDs assigned to each monitoring location.

(2) A standard (std.) quarter (qtr.) is considered to be 91.25 days. Results obtained for monitoring periods of other durations are normalized by multiplying them by 91.25/x, where x is the actual duration in days of the period.

(3) Uncertainties for individual monitoring location results are two standard deviations of the elemental doses of six calcium elements from the two TLDs assigned to each monitoring location, representing the variability between the elemental doses of each of the six TLD elements.

(4) No measurement could be made because the TLDs were lost, stolen or damaged.

(5) Uncertainties associated with quarterly indicator and control averages are two standard deviations, representing the variability between the results of the individual monitoring locations.

TABLE I-2
GROSS BETA, TRITIUM, AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE		TRITIUM	GR-BETA	OTHER ACTIVITY	COMMENTS
6S6	12/30/02	01/27/03	<129	1.9 ± 1.2		
2S7	12/30/02	01/27/03	170 ± 87.3	15.9 ± 2.9		
6S5	01/06/03	01/27/03	<126	3.2 ± 1.4		
LTAW	01/20/03		<149	4.6 ± 1.6		
6S6	01/27/03	03/03/03	<135	<2.01		
2S7	01/27/03	03/03/03	4770 ± 177	8.3 ± 2.4		
6S5	02/03/03	03/03/03	1310 ± 114	4.5 ± 1.8		
LTAW	02/18/03		246 ± 90.1	3.7 ± 1.6		
6S6	03/03/03	03/31/03	<146	4.3 ± 1.5		*
2S7	03/03/03	03/31/03	16600 ± 307	9.9 ± 2.2		
6S5	03/10/03	03/31/03	< 149	3.2 ± 1.4		
LTAW	03/17/03		<147	4.0 ± 1.4		
6S6	03/31/03	04/28/03	<134	<1.87		
6S7	03/31/03	04/28/03	293 ± 91.7	7.2 ± 2.1		
6S5	04/07/03	04/28/03	<123	2.6 ± 1.4		
LTAW	04/14/03		244 ± 87.5	2.6 ± 1.4		
6S6	04/28/03	06/02/03	<141	<1.76		
2S7	04/28/03	06/02/03	261 ± 95.3	10.9 ± 2.4		
6S5	05/05/03	06/02/03	<142	3.9 ± 1.4		
LTAW	05/12/03		225 ± 92.7	3.7 ± 1.6		
6S6	06/02/03	06/30/03	<134	<1.88		*
2S7	06/02/03	06/30/03	3790 ± 166	7.1 ± 2.1		
6S5	06/09/03	06/30/03	<140	3.1 ± 1.4		
LTAW	06/09/03		192 ± 95.7	3.6 ± 1.6		

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-2

GROSS BETA, TRITIUM, AND GAMMA SPECTROSCOPIC ANALYSES OF SURFACE WATER

SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE		TRITIUM	GR-BETA	OTHER ACTIVITY	COMMENTS
6S6	06/30/03	07/28/03	<146	3.0 ± 1.5		
2S7	06/30/03	07/28/03	182 ± 97.6	11.8 ± 2.5		
6S5	07/07/03	07/28/03	<150	2.8 ± 1.5		
LTAW	07/14/03		<129	2.8 ± 1.3		
6S6	07/28/03	08/25/03	<132	4.2 ± 1.6		
2S7	07/28/03	08/25/03	9800 ± 257	11.8 ± 2.5		
6S5	08/04/03	08/25/03	<128	4.2 ± 1.6		
LTAW	08/11/03		163 ± 94.2	4.1 ± 1.6		
6S6	08/25/03	09/29/03	137 ± 71.2	2.8 ± 1.3		
2S7	08/25/03	09/29/03	135 ± 72.2	11.9 ± 2.3		
6S5	09/02/03	09/29/03	<114	3.8 ± 1.4		
LTAW	09/08/03		213 ± 94.2	4.7 ± 1.5		
6S6	09/29/03	11/03/03	<122	3.2 ± 1.4		
2S7	09/29/03	11/03/03	15800 ± 268	13.7 ± 2.6		*
6S5	10/06/03	11/03/03	<114	4.2 ± 1.5		
LTAW	10/13/03		147 ± 82.8	3.9 ± 1.5		
6S6	11/03/03	12/01/03	<124	2.7 ± 1.3		
2S7	11/03/03	12/01/03	231 ± 89.3	11.8 ± 2.4		
6S5	11/10/03	12/01/03	<123	3.1 ± 1.3		
LTAW	11/10/03		293 ± 86.7	3.9 ± 1.3		
6S6	12/01/03	12/29/03	<132	2.2 ± 1.2		
2S7	12/01/03	12/29/03	<128	12.2 ± 2.4		
6S5	12/08/03	12/29/03	<134	2.4 ± 1.3		
LTAW	12/15/03		<120	3.3 ± 1.4		

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-3
IODINE-131 ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	I-131	COMMENTS
6S6	12/30/02 - 01/13/03	.01 ± .15	
2S7	12/30/02 - 01/13/03	.21 ± .29	
6S5	01/06/03 & 01/13/03	.24 ± .25	
6S6	01/13/03 - 01/27/03	.33 ± .31	
2S7	01/13/03 - 01/27/03	.21 ± .29	
6S5	01/20/03 & 01/27/03	.25 ± .23	
LTAW	1/20/2003	-.01 ± .11	
6S6	01/27/03 - 02/10/03	.11 ± .21	
2S7	01/27/03 - 02/10/03	1.33 ± .58	
6S5	02/03/03 & 02/10/03	.39 ± .33	
LTAW	2/18/2003	.10 ± .12	
6S6	02/10/03 - 02/24/03	.72 ± .30	
2S7	02/10/03 - 02/24/03	1.61 ± .46	
6S5	02/18/03 & 02/24/03	.31 ± .29	
6S6	02/24/03 - 03/10/03	.64 ± .41	
2S7	02/24/03 - 03/10/03	1.24 ± .53	
6S5	03/03/03 & 03/10/03	.80 ± .39	
LTAW	3/17/2003	<0.18	
6S6	03/10/03 - 03/24/03	.16 ± .21	
2S7	03/10/03 - 03/24/03	.77 ± .42	
6S5	03/17/03 & 03/24/03	.30 ± .29	
6S6	03/24/03 - 04/07/03	.05 ± .12	
6S7	03/24/03 - 04/07/03	.52 ± .32	
6S5	03/31/03 & 04/07/03	<0.43	
LTAW	4/14/2003	.05 ± .15	

Comments:

*Ref[illegible] to Appendix F of this report for additional details regarding exceptio[illegible] to SSES Technical Requirements for sampling and analyses.

TABLE I-3
IODINE-131 ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	I-131	COMMENTS
6S6	04/07/03 - 04/21/03	.06 ± .17	
2S7	04/07/03 - 04/21/03	.59 ± .36	
6S5	04/14/03 & 04/21/03	.10 ± .21	
6S6	04/21/03 - 05/05/03	.32 ± .32	
2S7	04/21/03 - 05/05/03	.53 ± .41	
6S5	04/28/03 & 05/05/03	.14 ± .20	
LTAW	5/12/2003	0.00 ± .11	
6S6	05/05/03 - 05/19/03	.50 ± .39	
2S7	05/05/03 - 05/19/03	1.19 ± .60	
6S5	05/12/03 & 05/19/03	.06 ± .20	
6S6	05/19/03 - 06/02/03	.61 ± .38	
2S7	05/19/03 - 06/02/03	1.01 ± .50	
6S5	05/27/03 & 06/02/03	.30 ± .24	
6S6	06/02/03 - 06/16/03	.18 ± .26	
6S7	06/02/03 - 06/16/03	.48 ± .38	
6S5	06/09/03 & 06/16/03	.28 ± .28	
LTAW	6/9/2003	.16 ± .25	
6S6	06/16/03 - 06/30/03	.47 ± .36	
2S7	06/16/03 - 06/30/03	1.18 ± .53	
6S5	06/23/03 &- 06/30/03	.15 ± .19	
6S6	06/30/03 - 07/14/03	.39 ± .33	
2S7	06/30/03 - 07/14/03	.91 ± .50	
6S5	07/07/03 & 07/14/03	.16 ± .23	
LTAW	7/14/2003	.10 ± .22	

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-3
IODINE-131 ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	I-131	COMMENTS
6S6	07/14/03 - 07/28/03	.27 ± .26	
2S7	07/14/03 - 07/28/03	1.15 ± .51	
6S5	07/21/03 & 07/28/03	.98 ± .52	
6S6	07/28/03 - 08/11/03	.19 ± .23	
2S7	07/28/03 - 08/11/03	.40 ± .32	
6S5	08/04/03 & 08/11/03	.19 ± .19	
LTAW	8/11/2003	.12 ± .23	
6S6	08/11/03 - 08/25/03	.04 ± .19	
2S7	08/11/03 - 08/25/03	.63 ± .38	
6S5	08/18/03 & 08/25/03	.09 ± .23	
6S6	08/25/03 - 09/08/03	.26 ± .29	
2S7	08/25/03 - 09/08/03	1.42 ± .62	
6S5	09/02/03 & 09/08/03	.24 ± .24	
LTAW	9/8/2003	<0.24	
6S6	09/08/03 - 09/22/03	.31 ± .29	
2S7	09/08/03 - 09/22/03	.13 ± .25	
6S5	09/15/03 & 09/22/03	.07 ± .18	
6S6	09/22/03 - 10/06/03	.15 ± .25	
2S7	09/22/03 - 10/06/03	<0.45	
6S5	09/29/03 & 10/06/03	.02 ± .16	
6S6	10/6/03 - 10/20/03	<0.34	
2S7	10/06/03 - 10/20/03	.05 ± .22	
6S5	10/13/03 & 10/20/03	<0.40	
LTAW	10/13/2003	.19 ± .27	

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-3
IODINE-131 ANALYSES OF SURFACE WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	I-131	COMMENTS
6S6	10/20/03 - 11/03/03	.15 ± .27	
2S7	10/20/03 - 11/03/03	1.91 ± .70	
6S5	10/27/03 & 11/03/03	.26 ± .23	
LTAW	11/10/2003	<0.41	
6S6	11/03/03 - 11/17/03	.31 ± .51	
2S7	11/03/03 - 11/17/03	.68 ± .60	
6S5	11/10/03 & 11/17/03	.24 ± .44	
6S6	11/17/03 - 12/01/03	.14 ± .26	
2S7	11/17/03 - 12/01/03	.23 ± .29	
6S5	11/24/03 & 12/01/03	.01 ± .15	
6S6	12/01/03 - 12/15/03	.21 ± .50	
2S7	12/01/03 - 12/15/03	1.02 ± .64	
6S5	12/08/03 & 12/15/03	.32 ± .45	
LTAW	12/15/2003	.33 ± .45	
6S6	12/15/03 - 12/29/03	.15 ± .46	
2S7	12/15/03 - 12/29/03	.92 ± .78	
6S5	12/22/03 & 12/29/03	.27 ± .45	

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-4

GROSS ALPHA, GROSS BETA, TRITIUM, IODINE-131 GAMMA* SPECTROSCOPIC ANALYSES OF DRINKING WATER

SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	GR-ALPHA	GR-BETA	TRITIUM	OTHER ACTIVITY	COMMENTS
12H2	12/30/02 - 01/27/03	<1.24	1.86 ± .9	<127		
12H2	01/27/03 - 03/03/03	<1.62	2.7 ± 1.4	<135		
12H2	03/03/03 - 03/31/03	<1.30	2.19 ± 1.3	<142		
12H2	04/07/03 - 04/28/03	<1.74	<1.87	<130		*
12H2	04/28/03 - 06/02/03	<1.87	<1.90	<141		
12H2	06/02/03 - 06/30/03	<1.53	2.04 ± 1.3	<134		
12H2	06/30/03 - 07/28/03	<1.90	<2.01	<133		
12H2	07/28/03 - 08/28/03	<1.06	3.54 ± 1.4	<146		
12H2	08/25/03 - 09/29/03	<1.07	2.29 ± 1.3	193 ± 72		
12H2	09/29/03 - 11/03/03	<1.78	4.26 ± 1.4	<119		
12H2	11/03/03 - 12/01/03	<1.55	<1.57	149 ± 76		
12H2	12/01/03 - 12/29/03	<1.68	2.01 ± 1.2	<128		

Comments:

* Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-5
GROSS BETA AND GAMMA* SPECTROSCOPIC ANALYSES OF FISH
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/gm (wet) ± 2S

LOCATION	SAMPLE TYPE	COLLECTION DATE	K-40	COMMENTS
IND	Smallmouth Bass	04/28/03 - 04/28/03	4.15 ± .37	
IND	Shorthead Redhorse	04/28/03 - 04/28/03	4.39 ± .43	
IND	Channel Catfish	04/29/03 - 04/30/03	3.89 ± .33	
2H	Smallmouth Bass	05/12/03 - 05/12/03	3.92 ± .28	
2H	Shorthead Redhorse	05/12/03 - 05/12/03	3.20 ± .26	
2H	Channel Catfish	05/12/03 - 05/13/03	3.49 ± .25	
IND	Channel Catfish	10/07/03 - 10/08/03	3.69 ± .33	
IND	Smallmouth Bass	10/08/03 - 10/08/03	3.99 ± .37	
IND	White Sucker	10/08/03 - 10/08/03	1.30 ± .14	
2H	Channel Catfish	10/15/03 - 10/16/03	3.44 ± .37	
2H	Smallmouth Bass	10/16/03 - 10/16/03	1.30 ± .24	
2H	White Sucker	10/16/03 - 10/16/03	3.58 ± .24	
LTAW	Largemouth Bass	10/20/03 - 10/20/03	3.67 ± .30	

TABLE I-6
GAMMA* SPECTROSCOPIC ANALYSES OF SHORELINE SEDIMENT
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/gm (dry) ± 2S

LOCATION	COLLECTION DATE	K-40	Cs-137	Ra-226	TH-228	OTHER ACTIVITY
2B	5/20/2003	17.3 ± .8	.11 ± .03	2.45 ± .65	4.74 ± .67	
7B	5/20/2003	15.8 ± .5	.10 ± .02	2.86 ± .59	3.56 ± .54	
12F	5/20/2003	11.8 ± .8	.09 ± .04	2.12 ± .85	3.34 ± .82	
LTAW	5/20/2003	15.8 ± .8	<.03	1.96 ± .61	3.21 ± .60	
2B	10/27/2003	7.22 ± .24	.04 ± .01	.75 ± .16	1.28 ± .18	
7B	10/27/2003	13.6 ± .5	.07 ± .02	2.36 ± .46	3.47 ± .43	
12F	10/27/2003	10.4 ± .4	<.02	2.17 ± .40	2.46 ± .38	
LTAW	10/27/2003	14.7 ± .4	<.01	2.18 ± .37	3.23 ± .41	

TABLE I-7
TRITIUM AND GAMMA* SPECTROSCOPIC ANALYSES OF GROUND WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	TRITIUM	OTHER ACTIVITY
12F3	1/20/2003	<145	
2S2	1/20/2003	<149	
4S4 Treated	1/20/2003	<140	
12F3	2/18/2003	<135	
2S2	2/18/2003	<137	
4S4 Treated	2/18/2003	178 ± 87.3	
12F3	3/17/2003	<143	
2S2	3/17/2003	<141	
4S4 Treated	3/17/2003	<143	
12F3	4/14/2003	<131	
2S2	4/14/2003	167 ± 83.1	
4S4 Treated	4/14/2003	142 ± 83.2	
12F3	5/12/2003	<136	
2S2	5/12/2003	<136	
4S4 Treated	5/12/2003	<137	
12F3	6/9/2003	<146	
2S2	6/9/2003	<145	
4S4 Treated	6/9/2003	<146	
12F3	7/14/2003	<147	
2S2	7/14/2003	<137	
4S4 Treated	7/14/2003	<143	
12F3	8/11/2003	<138	
2S2	8/11/2003	<140	
4S4 Treated	8/11/2003	<139	

TABLE I-7
TRITIUM AND GAMMA* SPECTROSCOPIC ANALYSES OF GROUND WATER
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	TRITIUM	OTHER ACTIVITY
12F3	9/8/2003	<139	
2S2	9/8/2003	<138	
4S4 Treated	9/8/2003	193 ± 89.6	
12F3	10/13/2003	<125	
2S2	10/13/2003	<124	
4S4 Treated	10/13/2003	<122	
12F3	11/10/2003	<127	
2S2	11/10/2003	<122	
4S4 Treated	11/10/2003	<125	
12F3	12/15/2003	<121	
2S2	12/15/2003	<120	
4S4 Treated	12/15/2003	<126	

TABLE I-8
GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in E-03 pCi/Cu. M. ± 2S

COLLECTION MONTH	DATE	6G1	8G1	3S2	12E1	12S1	13S6	COMMENTS
JAN	1/2/03 - 1/8/03	12.8 ± 2.2	11.1 ± 2.3	14.6 ± 2.8	13.6 ± 2.5	13.1 ± 2.6	10.8 ± 2.3	
	1/8/03 - 1/15/03	14.3 ± 2.1	14.2 ± 2.2	13.8 ± 2.3	15.9 ± 2.2	13.7 ± 2.2	16.0 ± 2.3	
	1/15/03 - 1/22/03	14 ± 2.2	18.6 ± 2.5	20.6 ± 2.8	18.7 ± 2.5	17.6 ± 2.5	16.3 ± 2.4	
	1/22/03 - 1/29/03	14.1 ± 2.3	14.6 ± 2.3	17.3 ± 2.6	15.7 ± 2.3	18.2 ± 2.5	17.1 ± 2.4	
FEB	1/29/03 - 2/5/03	13.8 ± 2.3	16.2 ± 2.4	15.7 ± 2.3	15.2 ± 2.4	16.7 ± 2.6	15.2 ± 2.3	
	2/5/03 - 2/12/03	14.8 ± 2.2	16.2 ± 2.4	17.8 ± 2.4	17.5 ± 2.3	17.8 ± 2.4	18.1 ± 2.4	
	2/12/03 - 2/19/03	9.9 ± 2.0	12.2 ± 2.1	14.2 ± 2.2	14.2 ± 2.2	14.9 ± 2.2	14.1 ± 2.2	
	2/19/03 - 2/26/03	12.6 ± 2.3	17.7 ± 2.5	19.2 ± 2.3	16.0 ± 2.4	14.9 ± 2.4	16.1 ± 2.4	
MAR	2/26/03 - 3/5/03	14.5 ± 2.3	18.8 ± 2.6	19.7 ± 2.6	17.9 ± 2.5	18.1 ± 2.5	19.5 ± 2.6	
	3/5/03 - 3/12/03	21.6 ± 2.7	19.4 ± 2.5	25.9 ± 2.8	18.2 ± 2.5	23.6 ± 2.8	18.6 ± 2.5	
	3/12/03 - 3/19/03	18.3 ± 2.5	17.8 ± 2.4	17.6 ± 2.4	17.9 ± 2.4	18.4 ± 2.6	18.4 ± 2.5	
	3/19/03 - 3/26/03	10.4 ± 2.1	10.5 ± 2.0	12.6 ± 2.5	9.8 ± 2.0	11.8 ± 2.2	11.7 ± 2.1	
	3/26/03 - 4/2/03	9.5 ± 2.0	11.6 ± 2.0	10.5 ± 2.0	10.4 ± 2.0	10.7 ± 2.0	12.6 ± 2.1	
APR	4/2/03 - 4/9/03	7.6 ± 1.9	9.6 ± 2.0	9.5 ± 2.0	10.0 ± 2.0	9.9 ± 2.1	9.6 ± 2.0	
	4/9/03 - 4/16/03	13.0 ± 2.2	15.9 ± 2.3	14.3 ± 2.1	14.7 ± 2.2	12.7 ± 2.1	14.3 ± 2.2	
	4/16/03 - 4/23/03	10.5 ± 2.0	13.6 ± 2.1	15.0 ± 2.3	12.8 ± 2.1	14.3 ± 2.2	13.3 ± 2.1	
	4/23/03 - 4/30/03	11.3 ± 2.0	14.7 ± 2.2	15.3 ± 2.3	11.4 ± 2.0	13.3 ± 2.2	12.8 ± 2.1	
MAY	4/30/03 - 5/7/03	9.4 ± 2.1	10.5 ± 2.1	13.5 ± 2.4	10.5 ± 2.2	11.1 ± 2.3	11.2 ± 2.2	
	5/7/03 - 5/14/03	9.3 ± 2.1	7.3 ± 1.9	11.2 ± 2.2	8.9 ± 2.0	9.3 ± 2.1	7.5 ± 1.9	
	5/14/03 - 5/21/03	7.9 ± 2.0	9.1 ± 2.0	6.6 ± 1.9	6.7 ± 1.9	7.0 ± 2.0	8.4 ± 2.0	
	5/21/03 - 5/28/03	3.2 ± 1.5	4.1 ± 1.5	4.9 ± 1.7	3.6 ± 1.5	5.2 ± 1.7	4.9 ± 1.6	
JUN	5/28/03 - 6/4/03	7.0 ± 2.1	8.5 ± 2.3	10.6 ± 2.3	8.7 ± 2.1	9.2 ± 2.2	8.5 ± 2.1	
	6/4/03 - 6/11/03	5.8 ± 2.2	10.5 ± 2.2	10.0 ± 2.1	7.1 ± 1.8	8.5 ± 2.0	7.9 ± 1.9	*
	6/11/03 - 6/18/03	7.0 ± 2.1	9.4 ± 2.1	12.5 ± 2.2	9.3 ± 2.0	11.0 ± 2.2	10.3 ± 2.0	
	6/18/03 - 6/25/03	10.5 ± 2.1	11.4 ± 2.2	9.7 ± 2.1	10.6 ± 2.1	10.4 ± 2.1	11.7 ± 2.2	
	6/25/03 - 7/2/03	16.9 ± 2.6	23.5 ± 3.0	17.3 ± 2.6	18.1 ± 2.8	21.9 ± 2.8	21.9 ± 2.8	

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-8
GROSS BETA ANALYSES OF AIR PARTICULATE FILTERS
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in E-03 pCi/Cu. M. ± 2S

COLLECTION MONTH	DATE	6G1	8G1	3S2	12E1	12S1	13S6	COMMENTS
JUL	7/2/03 - 7/9/03	17.4 ± 2.6	17.7 ± 2.6	21.4 ± 2.7	20.8 ± 2.7	23.1 ± 2.9	20.4 ± 2.7	
	7/9/03 - 7/16/03	9.2 ± 2.0	11.6 ± 2.1	11.5 ± 2.1	12.0 ± 2.1	10.1 ± 2.0	10.4 ± 2.0	
	7/16/03 - 7/23/03	13.3 ± 2.5	8.4 ± 2.0	12.0 ± 2.3	13.6 ± 2.4	12.1 ± 2.5	11.5 ± 2.3	
	7/23/03 - 7/30/03	12.4 ± 2.4	12.1 ± 2.2	14.9 ± 2.4	14.5 ± 2.4	14.9 ± 2.5	13.5 ± 2.4	
AUG	7/30/03 - 8/6/03	9.3 ± 2.1	8.9 ± 2.0	11.7 ± 2.2	9.4 ± 2.1	12.4 ± 2.3	11.3 ± 2.2	
	8/6/03 - 8/13/03	10.8 ± 2.3	11.8 ± 2.3	12.4 ± 2.3	13.2 ± 2.3	11.2 ± 2.6	11.2 ± 2.3	
	8/13/03 - 8/20/03	15.3 ± 2.4	19.4 ± 2.6	16.7 ± 2.4	17.9 ± 2.5	16.8 ± 2.5	16.4 ± 2.5	
	8/20/03 - 8/27/03	19.9 ± 2.7	20.7 ± 2.8	22.8 ± 2.8	21.9 ± 2.7	20.4 ± 2.9	20.4 ± 2.8	
	8/27/03 - 9/3/03	10.2 ± 2.1	11.4 ± 2.2	11.9 ± 2.1	10.9 ± 2.1	10.7 ± 2.1	11.7 ± 2.2	
SEP	9/3/03 - 9/10/03	13.4 ± 2.2	12.6 ± 2.2	12.8 ± 2.1	13.5 ± 2.2	15.2 ± 2.3	13.4 ± 2.2	
	9/10/03 - 9/17/03	11.9 ± 2.20	11.0 ± 2.1	15.4 ± 2.2	11.8 ± 2.1	12.5 ± 2.2	13.2 ± 2.2	
	9/17/03 - 9/24/03	16.7 ± 2.8	16.7 ± 2.7	13.2 ± 2.5	17.4 ± 2.7	13.4 ± 2.5	16.0 ± 2.7	*
	9/24/03 - 10/1/03	12.2 ± 2.8	11.2 ± 2.7	12.3 ± 2.7	13.3 ± 2.7	12.9 ± 2.7	13.2 ± 2.8	
OCT	10/1/03 - 10/8/03	13.3 ± 2.4	12.0 ± 2.2	12.1 ± 2.3	10.2 ± 5.4	12.7 ± 2.3	12.2 ± 2.3	*
	10/8/03 - 10/15/03	30.9 ± 3.6	31.0 ± 3.5	30.2 ± 3.4	29.9 ± 3.3	31.7 ± 3.5	26.6 ± 3.3	
	10/15/03 - 10/22/03	16.3 ± 2.6	16.8 ± 2.5	18.0 ± 2.6	17.3 ± 2.5	19.1 ± 2.6	20.7 ± 2.8	
	10/22/03 - 10/29/03	12.6 ± 2.2	10.0 ± 2.0	11.9 ± 2.1	14.6 ± 2.5	14.5 ± 2.2	14.3 ± 2.3	
NOV	10/29/03 - 11/5/03	21.1 ± 2.8	23.3 ± 2.8	30.0 ± 3.1	24.6 ± 2.8	22.0 ± 2.7	24.1 ± 2.9	
	11/5/03 - 11/12/03	10.7 ± 2.2	14.1 ± 2.4	15.3 ± 2.2	15.3 ± 2.3	16.3 ± 2.4	15.1 ± 2.4	
	11/12/03 - 11/19/03	13.2 ± 2.4	21.1 ± 2.7	19.0 ± 2.5	16.1 ± 2.4	17.2 ± 2.6	17.2 ± 2.5	
	11/19/03 - 11/26/03	19.3 ± 2.8	18.9 ± 2.7	24.1 ± 2.8	23.3 ± 2.7	25.0 ± 2.9	22.4 ± 2.9	
	11/26/03 - 12/3/03	11.1 ± 2.3	12.8 ± 2.3	13.4 ± 2.5	14.3 ± 2.3	12.8 ± 2.3	12.8 ± 2.4	
DEC	12/3/03 - 12/10/03	10.1 ± 2.1	12.1 ± 2.1	11.3 ± 2.1	11.7 ± 2.0	12.4 ± 2.1	10.1 ± 2.0	
	12/10/03 - 12/16/03	9.1 ± 2.3	9.0 ± 2.1	11.0 ± 2.3	9.3 ± 2.1	9.5 ± 2.3	9.5 ± 2.2	
	12/16/03 - 12/23/03	13.7 ± 2.3	13.0 ± 2.2	13.5 ± 2.3	13.6 ± 2.2	14.9 ± 2.3	15.8 ± 2.4	
	12/23/03 - 12/30/03	14.1 ± 2.3	13.4 ± 2.1	18.5 ± 2.5	16.8 ± 2.3	16.9 ± 2.3	18.3 ± 2.4	

Comments:

*Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-9

GAMMA* SPECTROSCOPIC ANALYSES OF COMPOSITED AIR PARTICULATE FILTERS

SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in E-03 pCi/Cu. M. ± 2S

LOCATION	COLLECTION DATE	Be-7	K-40	OTHER ACTIVITY
6G1	01/02/03 - 04/02/03	91.1 ± 10.3	<5.01	
8G1	01/02/03 - 04/02/03	93.4 ± 7.03	<1.97	
3S2	01/02/03 - 04/02/03	106 ± 8.29	<3.05	
12E1	01/02/03 - 04/02/03	109 ± 8.69	<1.78	
12S1	01/02/03 - 04/02/03	106 ± 7.54	<6.66	
13S6	01/02/03 - 04/02/03	99.1 ± 7.15	<6.30	
6G1	04/02/03 - 07/2/03	74.7 ± 9.41	4.16 ± 2.31	
8G1	04/02/03 - 07/2/03	88.5 ± 9.42	<1.78	
3S2	04/02/03 - 07/2/03	86.6 ± 10.4	<3.40	
12E1	04/02/03 - 07/2/03	91.4 ± 8.50	<2.03	
12S1	04/02/03 - 07/2/03	83.2 ± 12.2	<1.99	
13S6	04/02/03 - 07/2/03	111 ± 11.1	<5.17	
6G1	07/02/03 - 10/01/03	89.2 ± 8.23	<2.81	
8G1	07/02/03 - 10/01/03	83.8 ± 7.33	<7.31	
3S2	07/02/03 - 10/01/03	101 ± 2.47	<.794	
12E1	07/02/03 - 10/01/03	86.7 ± 9.03	<3.27	
12S1	07/02/03 - 10/01/03	97.7 ± 8.28	<2.22	
13S6	07/02/03 - 10/01/03	85.5 ± 9.95	<8.26	
6G1	10/01/03 - 12/30/03	70.3 ± 6.57	<2.80	
8G1	10/01/03 - 12/30/03	66.3 ± 7.22	<7.83	
3S2	10/01/03 - 12/30/03	69.3 ± 5.85	<2.02	
12E1	10/01/03 - 12/30/03	74.9 ± 7.10	<2.60	
12S1	10/01/03 - 12/30/03	76.5 ± 4.33	<1.38	
13S6	10/01/03 - 12/30/03	67.0 ± 6.96	<1.60	

TABLE I-10
IODINE-131, AND GAMMA* SPECTROSCOPIC ANALYSES OF MILK
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	K-40	OTHER ACTIVITY	COMMENTS
10G1	01/07/03	1480 ± 120		
10D1	01/06/03	1470 ± 120		
10D2	01/06/03	1410 ± 120		
12B2	01/06/03	1390 ± 130		
10G1	02/03/03	1520 ± 110		
10D1	02/03/03	1540 ± 130		
10D2	02/03/03	1280 ± 140		
12B2	02/03/03	1400 ± 150		
10G1	03/03/03	1390 ± 110		
10D1	03/03/03	1330 ± 130		
10D2	03/03/03	1420 ± 110		
12B2	03/03/03	1400 ± 110		
10G1	04/07/03	1530 ± 110		
10D1	04/07/03	1360 ± 130		
10D2	04/07/03	1220 ± 140		
12B2	04/07/03	1330 ± 150		
10G1	04/21/03	1480 ± 110		
10D1	04/21/03	1350 ± 130		
10D2	04/21/03	1440 ± 160		
12B2	04/21/03	1360 ± 150		
10G1	05/05/03	1470 ± 110		
10D1	05/05/03	1430 ± 160		
10D2	05/05/03	1310 ± 110		
12B2	05/05/03	1530 ± 140		
10G1	05/19/03	1470 ± 130		
10D1	05/19/03	1460 ± 110		

TABLE I-10
IODINE-131, AND GAMMA* SPECTROSCOPIC ANALYSES OF MILK
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	K-40	OTHER ACTIVITY	COMMENTS
10D2	05/19/03	1480 ± 110		
12B2	05/19/03	1350 ± 110		
10G1	06/04/03	1340 ± 110		
10D1	06/04/03	1390 ± 140		
10D2	06/04/03	1190 ± 160		
12B2	06/04/03	1390 ± 120		
10G1	06/19/03	1400 ± 160		
10D1	06/19/03	1460 ± 160		
10D2	06/19/03	1400 ± 150		
12B2	06/19/03	1350 ± 150		
10G1	07/06/03	1350 ± 130		
10D1	07/06/03	1340 ± 130		
10D2	07/06/03	1420 ± 110		
12B2	07/06/03	1500 ± 110		
10G1	07/21/03	1470 ± 110		
10D1	07/21/03	1340 ± 150		
10D2	07/21/03	1550 ± 160		
12B2	07/21/03	1520 ± 170		

TABLE I-10
IODINE-131, AND GAMMA* SPECTROSCOPIC ANALYSES OF MILK
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	K-40	OTHER ACTIVITY	COMMENTS
10G1	08/04/03	1360 ± 180		
10D1	08/04/03	1330 ± 110		
10D2	08/04/03	1500 ± 120		
12B2	08/04/03	1410 ± 170		
10G1	08/18/03	1420 ± 160		
10D1	08/18/03	1340 ± 150		
10D2	08/18/03	1410 ± 110		
12B2	08/18/03	1330 ± 110		
10G1	09/03/03	1484 ± 94		
10D1	09/03/03	1380 ± 160		
10D2	09/03/03	1380 ± 110		
12B2	09/03/03	1471 ± 95		
10G1	09/18/03	1490 ± 110		
10D1	09/18/03	1410 ± 140		
10D2	09/18/03	1390 ± 110		
12B2	09/18/03	1370 ± 110		
10G1	10/05/03	1470 ± 110		
10D1	10/05/03	1330 ± 130		
10D2	10/05/03	1350 ± 150		
12B2	10/05/03	1200 ± 150		

TABLE I-10
IODINE-131, AND GAMMA* SPECTROSCOPIC ANALYSES OF MILK
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/liter ± 2S

LOCATION	COLLECTION DATE	K-40	OTHER ACTIVITY	COMMENTS
10G1	10/20/03	1420 ± 120		
10D1	10/20/03	1450 ± 140		
10D2	10/20/03	1380 ± 160		
12B2	10/20/03	1250 ± 150		
10G1	11/03/03	1350 ± 110		
10D1	11/03/03	1550 ± 160		
10D2	11/03/03	1360 ± 150		
12B2	11/03/03	1380 ± 150		
10G1	12/08/03	819 ± 86		
10D1	12/08/03	1361 ± 58		
10D2	12/08/03	1452 ± 62		
12B2	12/08/03	940 ± 94		

TABLE I-11
GAMMA* SPECTROSCOPIC ANALYSES OF SOIL
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/gm (dry) ± 2S

LOCATION	COLLECTION DATE	K-40	Cs-137	Th-228
8G1 TOP	9/15/2003	11.0 ± 1.1	0.17 ± .05	0.90 ± .14
8G1 BOT	9/15/2003	10.2 ± 1.1	0.097 ± .053	0.73 ± .13
3S2 TOP	9/15/2003	14.7 ± 1.1	0.030 ± .035	1.04 ± .13
3S2 BOT	9/15/2003	16.2 ± 1.2	0.049 ± .039	1.00 ± .13
12S1 TOP	9/15/2003	10.3 ± 1.0	0.096 ± .047	0.82 ± .12
12S1 BOT	9/15/2003	12.5 ± 0.8	0.076 ± .029	0.84 ± .85
13S6 TOP	9/15/2003	18.2 ± 0.9	<0.042	1.04 ± .95
13S6 BOT	9/15/2003	14.3 ± 1.0	0.027 ± .024	0.95 ± .11

TABLE I-11
GAMMA* SPECTROSCOPIC ANALYSES OF SOIL
SUSQUEHANNA STEAM ELECTRIC STATION - 2003
Results in pCi/gm (dry) ± 2S

LOCATION	COLLECTION DATE	K-40	Cs-137	Th-228
8G1 TOP	9/15/2003	11.0 ± 1.1	0.17 ± .05	0.90 ± .14
8G1 BOT	9/15/2003	10.2 ± 1.1	0.097 ± .053	0.73 ± .13
3S2 TOP	9/15/2003	14.7 ± 1.1	0.030 ± .035	1.04 ± .13
3S2 BOT	9/15/2003	16.2 ± 1.2	0.049 ± .039	1.00 ± .13
12S1 TOP	9/15/2003	10.3 ± 1.0	0.096 ± .047	0.82 ± .12
12S1 BOT	9/15/2003	12.5 ± 0.8	0.076 ± .029	0.84 ± .85
13S6 TOP	9/15/2003	18.2 ± 0.9	<0.042	1.04 ± .95
13S6 BOT	9/15/2003	14.3 ± 1.0	0.027 ± .024	0.95 ± .11

TABLE I-12

GAMMA* SPECTROSCOPIC ANALYSES OF FOOD PRODUCTS (FRUITS AND VEGETABLES)

SUSQUEHANNA STEAM ELECTRIC STATION - 2003

Results in pCi/gm (wet) ± 2S

LOCATION	SAMPLE TYPE	COLLECTION DATE	K-40	OTHER ACTIVITY
11D2	Potato	08/21/03	4.66 ± .19	
11F2	Potato	09/04/03	4.47 ± .29	

Comments:

* Refer to Appendix F of this report for additional details regarding exceptions to SSES Technical Requirements for sampling and analyses.

TABLE I-13
TYPICAL * MINIMUM DETECTABLE CONCENTRATIONS OF NUCLIDES SEARCHED FOR BUT NOT FOUND BY GAMMA SPECTROMETRY IN THE VICINITY OF SUSQUEHANNA STEAM ELECTRIC STATION, 2003

Nuclide	Fish (pCi/g wet)	Sediment (pCi/g dry)	Surface Water (pCi/l)	Ground Water (pCi/l)	Potable Water (pCi/l)
Mn-54	0.019	0.028	2.9	4.1	1.7
Co-58	0.023	0.035	2.1	4.6	1.8
Fe-59	0.050	0.110	5.1	10.2	8.3
Co-60	0.015	0.028	3.3	5.3	2.5
Zn-65	0.028	0.071	7.8	14.4	6.7
Zr-95	0.020	0.070	6.4	7.8	5.4
Nb-95	N/A	N/A	4.3	5.8	3.2
Ru-103	N/A	N/A	4.9	5.3	2.6
I-131	0.100	0.173	15.4	8.1	13.2
Cs-134	0.010	0.032	2.3	5.2	2.6
Cs-137	0.015	0.033	2.4	4.8	2.5
Ba-140	0.300	0.310	7.8	9.0	9.2
La-140	0.040	0.100	12.1	10.1	10.2
Ce-141	N/A	N/A	6.8	7.8	6.8

Nuclide	Air Particulate (10-3 pCi/m3)	Milk (pCi/l)	Fruit/Veg. (pCi/g wet)	Soil (pCi/g dry)
Mn-54	0.33	5.5	0.008	0.037
Co-58	0.51	5.1	0.008	0.039
Fe-59	2.31	12.4	0.032	0.993
Co-60	0.28	5.7	0.009	0.055
Zn-65	0.75	13.4	0.025	0.176
Zr-95	0.88	7.7	0.016	0.995
Nb-95	N/A	6.1	N/A	0.071
Ru-103	N/A	5.2	N/A	0.051
I-131	70.3	8.2	0.019	0.097
Cs-134	0.27	4.8	0.007	0.057
Cs-137	0.29	4.4	0.008	0.047
Ba-140	36.2	6.7	0.055	0.255
La-140	11.5	7.8	0.016	0.11
Ce-141	N/A	8.1	N/A	0.078

APPENDIX J

PERFORMANCE SUMMARY FOR THE RADIOANALYSES OF SPIKED ENVIRONMENTAL SAMPLE MEDIA – 2003

FRAMATOME ANP ENV. LABORATORY AND TELEDYNE BROWN ENGINEERING

The data in the tables that follow show how well Framatome ANP Environmental Laboratory and Teledyne Brown Engineering Environmental Services (TBE) performed in the analysis of radioactively spiked media. Tables J-1 through J-5 provide the performance results for Framatome ANP. Tables J-6 through J-10 provide the performance results for TBE. In addition to the Analytics' spikes analyzed as part of PPL's REMP Laboratory Spike Program (Tables J-3 and J-8), Framatome ANP and TBE analyzed spikes procured independently from Analytics as part of their respective Quality Control Spike Programs (Tables J-2 and J-7), as well as spikes prepared as part of the following programs:

1. The Proficiency Testing Program of Environmental Resource Associates (Tables J-1 and J-6)

2. The Quality Assessment Program of DOE's Environmental Measurements Laboratory (EML) (Tables J-4 and J-9)

3. The Mixed Analyte Performance Evaluation Program (MAPEP) of the DOE (Tables J-5 and J-10)

It should be noted that program #1 above only provides spiked water for analyses. No other media are included in the spikes provided by this program. Also, it should be noted that the levels of activity in spikes of different media prepared for program #2 tend to be relatively high. They are relatively high compared to the levels of activity in the spikes prepared by Analytics as part of its Environmental Cross Check Program and for PPL's REMP Laboratory Spike Program. The following characteristics are important for the spiked environmental media:

1. When practical, the level of activity in, at least, some of the spiked environmental media should be within the range between required analysis sensitivities for the SSES REMP and the Reporting Levels, if applicable, of the NRC.

2. The spikes should be preserved in a manner as similar as possible to the way that actual samples of those media are prepared.

3. The variety of radionuclides with which environmental media are spiked should be as extensive as practical, including as many as of the activation and fission products that could be detected in the vicinity of the SSES as reasonable.

The spiked environmental media prepared by Analytics according to the requirements of PPL's REMP Laboratory Spike Program are intended to incorporate characteristics #1, #2, and #3 to the greatest degree that is practical.

The criteria for the acceptability of the analyses results for the spikes prepared as part of the PPL REMP Laboratory Spike Program (Tables J-3 & J-8) have been established by PPL. They are based on criteria that were originally developed by the NRC. The NRC bases these criteria on an empirical relationship that combines prior experience and accuracy needs. As the resolution of the measurement process improves (relative measurement uncertainty becomes smaller), the criteria for determining acceptability become tighter. Conversely, as the resolution of the process becomes poorer (relative measurement uncertainty becomes bigger), the criteria are widened.

The criteria for acceptability of DOE programs (EML's and MAPEP's programs – Tables J-4, J-5, J-9 and J-10) are based on control limits based on percentiles of historic data distributions.

Note that comment numbers at the extreme right side of the tables denote unacceptable results in Tables J-1 through J-10. Discussions relevant to these comment numbers follow the presentations of the data, as applicable.

Radionuclide concentration results not available (due to loss of spectrum by Analytics) and therefore not included in Tables J-3 and J-8 for the following:

Analytics Sample Numbers: E3980-186 and E3976-186 (spiked milk).

TABLE J-1
ENVIRONMENTAL RESOURCE ASSOCIATES (ERA)
PROFICIENCY TESTING PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL SERVICES LABORATORY
(Page 1 of 2)

Identification No.	Medium	Units	Nuclide	ERA Known Result (a)	Framatome Results (a)	Framatome/ERA Ratio	ERA Control Limits (b)	Evaluation
Rad-52	Water	pCi/l	Gross Alpha	37.6	28	0.74	21.3-53.9	Acceptable
		pCi/l	Gross Beta	8.55	8.97	1.05	0.00-17.2	Acceptable
		pCi/l	Sr-89	15.9	13	0.82	7.24-24.6	Acceptable
		pCi/l	Sr-90	9.03	8.74	0.97	0.37-17.7	Acceptable
		pCi/l	Ba-133	19.5	17.9	0.92	10.8-28.2	Acceptable
		pCi/l	Co-60	37.4	36.6	0.98	28.7-46.1	Acceptable
		pCi/l	Cs-134	17.8	17.9	1.01	9.14-26.5	Acceptable
		pCi/l	Cs-137	44.2	45.4	1.03	35.5-52.9	Acceptable
		pCi/l	Zn-65	60.3	60	1.00	49.9-70.7	Acceptable
		pCi/l	Nat. Uranium	53.7	56	1.04	44.4-63.0	Acceptable
Rad-53	Water	pCi/l	H-3	1250.0	1080.0	0.86	678-1820	Acceptable
		pCi/l	I-131	20.8	21.4	1.03	15.6-26.0	Acceptable
Rad-54	Water	pCi/l	Gross Alpha	65.1	70.4	1.08	36.9-93.3	Acceptable
		pCi/l	Gross Beta	31.6	31.9	1.01	22.9-40.3	Acceptable
		pCi/l	Sr-89	58.8	55.5	0.94	50.1-67.5	Acceptable
		pCi/l	Sr-90	20.6	18.7	0.91	11.9-29.3	Acceptable
		pCi/l	Ba-133	20.7	19.9	0.96	12.0-29.4	Acceptable
		pCi/l	Co-60	37.4	37.4	1.00	28.7-46.1	Acceptable
		pCi/l	Cs-134	32.6	31.0	0.95	23.9-41.3	Acceptable
		pCi/l	Cs-137	44.3	47.0	1.06	35.6-53.0	Acceptable
		pCi/l	Zn-65	60.2	61.3	1.02	49.8-70.6	Acceptable
		pCi/l	Nat. Uranium	11.4	11.5	1.01	6.20-16.6	Acceptable
Rad-55	Water	pCi/l	I-131	28.2	28	0.99	23.0-33.4	Acceptable
		pCi/l	Tritium	14300	14800	1.03	11800-16800	Acceptable

(a) Results are the average of three measurements, reported in units of pCi/l.
(b) Per guidelines of the EPA'S National Standards for Water Proficiency Testing Criteria Document, December 1998.

TABLE J-1
ENVIRONMENTAL RESOURCE ASSOCIATES (ERA)
PROFICIENCY TESTING PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL SERVICES LABORATORY
(Page 2 of 2)

COMMENTS

1 The equations used to calculate the sample activity were all independently verified to be correct. No problems were identified with sample documentation. The chemists were trained to process strontium samples expeditiously and to utilize the full 15-day yttrium-90 in-growth period.

2 Equipment problem with iodide probe identified. When sample was re-analyzed with new iodide probe, mean result was 14.5 pCi/L, a bias of -1.4%.

3 No problems identifed via test data evaluation using internal calibrations. The grand mean of the RAD-50 test compared favorably (1% bias) with the Framatome ANP result yet indicated a significant bias from the ERA stated known. No actions were taken based on the favorable QC history for Cs-137.

TABLE J-2
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP QUALITY CONTROL SPIKE PROGRAM
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	Framatome Results	Framatome/Analytics Ratio
March-03	E3600-162	Milk	pCi/l	I-131LL*	74	72.5	0.98
			pCi/l	I-131	74	73	0.99
			pCi/l	Ce-141	173	170	0.98
			pCi/l	Cr-51	246	244	0.99
			pCi/l	Cs-134	90	86	0.96
			pCi/l	Cs-137	200	196	0.98
			pCi/l	Co-58	47	44	0.94
			pCi/l	Mn-54	64	61	0.95
			pCi/l	Fe-59	47	47	1.00
			pCi/l	Zn-65	93	96	1.03
			pCi/l	Co-60	162	162	1.00
March-03	E3597-162	Water	pCi/l	Gr. Alpha	53	55	1.04
	E3597-162	Water	pCi/l	Gr. Beta	186	146	0.78
	E3598-162	Water	pCi/l	I-131LL*	70	67.7	0.97
			pCi/l	I-131	70	68	0.97
			pCi/l	Ce-141	168	163	0.97
			pCi/l	Cr-51	238	243	1.02
			pCi/l	Cs-134	88	83	0.94
			pCi/l	Cs-137	195	188	0.96
			pCi/l	Co-58	42	44	1.05
			pCi/l	Mn-54	63	61	0.97
			pCi/l	Fe-59	46	48	1.04
			pCi/l	Zn-65	90	88	0.98
			pCi/l	Co-60	157	156	0.99

* I-131 LL = radiochemical separation analysis

TABLE J-2
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP QUALITY CONTROL SPIKE PROGRAM
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	Framatome Results	Framatome/Analytics Ratio
March-03	E3599-162	AP Filter	pCi	Gr. Alpha	49	52	1.06
			pCi	Gr. Beta	148	157	1.06
March-03	E3601-162	Milk	pCi/l	Sr-89	133	121	0.91
			pCi/l	Sr-90	12	13	1.08
March-03	E3608-162	Water	pCi/l	Sr-89	114	104	0.91
			pCi/l	Sr-90	10	11	1.10
June-03	E3704-162	Water	pCi/l	H-3	11953	10643	0.89
June-03	E3705-162	AP Filter	pCi	Gr. Alpha	21	20	0.95
			pCi	Gr. Beta	115	116	1.01
June-03	E3706-162	AP Filter	pCi	Ce-141	154	149	0.97
			pCi	Cr-51	130	134	1.03
			pCi	Cs-134	56	54	0.96
			pCi	Cs-137	125	135	1.08
			pCi	Co-58	50	53	1.06
			pCi	Mn-54	101	110	1.09
			pCi	Fe-59	54	60	1.11
			pCi	Zn-65	99	110	1.11
			pCi	Co-60	72	71	0.99
June-03	E3707-162	AP Filter	pCi	Sr-89	87	78	0.90
			pCi	Sr-90	24	24	1.00

TABLE J-2
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP QUALITY CONTROL SPIKE PROGRAM
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 3 of 4)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	Framatome Results	Framatome/Analytics Ratio
June-03	E3153-162	Milk	pCi/l	I-131	103	109	1.06
			pCi/l	I-131LL*	103	104	1.01
			pCi/l	Ce-141	283	283	1.00
			pCi/l	Cr-51	239	239	1.00
			pCi/l	Cs-134	103	98	0.95
			pCi/l	Cs-137	230	232	1.01
			pCi/l	Co-58	93	92	0.99
			pCi/l	Mn-54	186	186	1.00
			pCi/l	Fe-59	99	100	1.01
			pCi/l	Zn-65	181	181	1.00
			pCi/l	Co-60	132	134	1.02
September-03	E3866-162	Water	pCi/l	Gross Alpha	36	37	1.03
			pCi/l	Gross Beta	246	242	0.98
September-03	E3867-162	Water	pCi/l	I-131	76	69	0.91
			pCi/l	I-131LL*	76	78	1.03
			pCi/l	Ce-141	81	78	0.96
			pCi/l	Cr-51	221	198	0.90
			pCi/l	Cs-134	113	108	0.96
			pCi/l	Cs-137	84	85	1.01
			pCi/l	Co-58	94	92	0.98
			pCi/l	Mn-54	88	93	1.06
			pCi/l	Fe-59	75	74	0.99
			pCi/l	Zn-65	166	170	1.02
			pCi/l	Co-60	117	118	1.01
September-03	E3868-162	AP Filter	pCi	Gr. Alpha	28	30	1.07
			pCi	Gr. Beta	189	197	1.04

* I-131 LL = radiochemical separation analysis

TABLE J-2
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP QUALITY CONTROL SPIKE PROGRAM
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 4 of 4)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	Framatome Results	Framatome/Analytics Ratio
September-03	E3869-162	Milk	pCi/l	I-131	74	66	0.89
			pCi/l	I-131LL*	74	74	1.00
			pCi/l	Ce-141	86	90	1.05
			pCi/l	Cr-51	233	228	0.98
			pCi/l	Cs-134	119	123	1.03
			pCi/l	Cs-137	88	94	1.07
			pCi/l	Co-58	99	99	1.00
			pCi/l	Mn-54	93	101	1.09
			pCi/l	Fe-59	79	84	1.06
			pCi/l	Zn-65	176	178	1.01
			pCi/l	Co-60	123	129	1.05
September-03	E3870-162	Milk	pCi/l	Sr-89	100	80	0.80
			pCi/l	Sr-90	14	11	0.79

* I-131 LL = radiochemical separation analysis

TABLE J-3
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	Framatome Results (a)	Framatome/Analytics Ratio
March-03	E3573-186	Sediment	pCi/kg	Ce-141	358 ± 18	351 ± 14	0.98
			pCi/kg	Cr-51	508 ± 25	511 ± 41	1.01
			pCi/kg	Cs-134	186 ± 9	189 ± 6	1.02
			pCi/kg	Cs-137	497 ± 25	536 ± 9	1.08
			pCi/kg	Co-58	96 ± 5	97 ± 5	1.01
			pCi/kg	Mn-54	133 ± 65	132 ± 11	0.99
			pCi/kg	Fe-59	98 ± 5	104 ± 7	1.06
			pCi/kg	Zn-65	192 ± 1	197 ± 10	1.03
			pCi/kg	Co-60	335 ± 17	340 ± 6	1.01
March-03	E3575-186	Milk	pCi/l	I-131	75 ± 3	73 ± 9	0.97
			pCi/l	Ce-141	188 ± 17	193 ± 7	1.03
			pCi/l	Cr-51	267 ± 35	244 ± 31	0.91
			pCi/l	Cs-134	98 ± 5	95 ± 4	0.97
			pCi/l	Cs-137	217 ± 22	221 ± 6	1.02
			pCi/l	Co-58	51 ± 2	50 ± 3	0.98
			pCi/l	Mn-54	70 ± 3	70 ± 4	1.00
			pCi/l	Fe-59	51 ± 2	51 ± 5	1.00
			pCi/l	Zn-65	101 ± 5	101 ± 8	1.00
			pCi/l	Co-60	176 ± 16	179 ± 4	1.02
March-03	E3576-186	AP Filter	pCi	Ce-141	160 ± 6	143 ± 2	0.89
			pCi	Cr-51	227 ± 8	219 ± 11	0.96
			pCi	Cs134	83 ± 3	78 ± 2	0.94
			pCi	Cs-137	185 ± 6	179 ± 3	0.97
			pCi	Co-58	43 ± 2	41 ± 2	0.96
			pCi	Mn-54	59 ± 2	59 ± 2	0.99
			pCi	Fe-59	44 ± 2	45 ± 2	1.01
			pCi	Zn-65	86 ± 3	87 ± 4	1.01
			pCi	Co-60	149 ± 5	133 ± 2	0.89

(a) Counting error is two standard deviations.

TABLE J-3
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	Framatome Results (a)	Framatome/Analytics Ratio
March-03	E3577-186	AP Filter	pCi	Ce-141	133 ± 5	121 ± 2	0.91
			pCi	Cr-51	189 ± 7	172 ± 9	0.91
			pCi	Cs134	69 ± 2	62 ± 1	0.89
			pCi	Cs-137	154 ± 5	153 ± 3	0.99
			pCi	Co-58	36 ± 1	36 ± 2	0.99
			pCi	Mn-54	50 ± 2	50 ± 2	1.01
			pCi	Fe-59	36 ± 1	40 ± 2	1.11
			pCi	Zn-65	72 ± 3	71 ± 4	0.98
			pCi	Co-60	125 ± 4	113 ± 2	0.90
March-03	E3578-186	AP Filter	pCi	Ce-141	171 ± 6	162 ± 2	0.95
			pCi	Cr-51	242 ± 8	235 ± 11	0.97
			pCi	Cs134	89 ± 3	82 ± 2	0.93
			pCi	Cs-137	197 ± 7	200 ± 3	1.02
			pCi	Co-58	46 ± 2	44 ± 2	0.96
			pCi	Mn-54	63 ± 2	68 ± 2	1.08
			pCi	Fe-59	47 ± 2	53 ± 2	1.12
			pCi	Zn-65	91 ± 3	95 ± 4	1.05
			pCi	Co-60	159 ± 6	148 ± 2	0.93
June-03	E3770-186	AP Filter	pCi	Ce-141	230 ± 8	209 ± 2	0.91
			pCi	Cr-51	194 ± 7	190 ± 11	0.98
			pCi	Cs134	84 ± 3	78 ± 2	0.93
			pCi	Cs-137	188 ± 7	191 ± 3	1.02
			pCi	Co-58	76 ± 3	74 ± 2	0.98
			pCi	Mn-54	151 ± 5	157 ± 3	1.04
			pCi	Fe-59	81 ± 3	85 ± 3	1.04
			pCi	Zn-65	148 ± 5	157 ± 5	1.06
			pCi	Co-60	108 ± 4	100 ± 2	0.92

(a) Counting error is two standard deviations.

TABLE J-3
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	Framatome Results (a)	Framatome/Analytics Ratio	
June-03	E3771-186	AP Filter	pCi	Ce-141	203 ± 7	189 ± 2	0.93	
			pCi	Cr-51	171 ± 6	170 ± 10	0.99	
			pCi	Cs134	74 ± 3	69 ± 2	0.94	
			pCi	Cs-137	165 ± 6	170 ± 3	1.03	
			pCi	Co-58	67 ± 2	66 ± 2	0.99	
			pCi	Mn-54	133 ± 5	142 ± 3	1.06	
			pCi	Fe-59	71 ± 2	78 ± 3	1.09	
			pCi	Zn-65	130 ± 5	138 ± 5	1.06	
			pCi	Co-60	95 ± 3	89 ± 2	0.94	
June-03	E3772-186	AP Filter	pCi	Ce-141	225 ± 8	203 ± 2	0.90	
			pCi	Cr-51	190 ± 1	177 ± 10	0.93	
			pCi	Cs134	82 ± 3	76 ± 2	0.93	
			pCi	Cs-137	183 ± 6	186 ± 3	1.02	
			pCi	Co-58	74 ± 3	71 ± 2	0.96	
			pCi	Mn-54	148 ± 5	152 ± 3	1.03	
			pCi	Fe-59	79 ± 3	84 ± 3	1.06	
			pCi	Zn-65	144 ± 5	154 ± 5	1.07	
			pCi	Co-60	105 ± 4	97 ± 2	0.92	
June-02	E3773-186	Charcoal Filter	pCi	I-131	66 ± 2	80 ± 7	1.22	
	E3774-186	Charcoal Filter	pCi	I-131	51 ± 2			(1)
	E3775-186	Charcoal Filter	pCi	I-131	59 ± 2	68 ± 6	1.15	

(a) Counting error is two standard deviations.

TABLE J-3
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 4 of 5)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	Framatome Results (a)	Framatome/Analytics Ratio
September-03	E3891-186	Milk	pCi/l	I-131	75 ± 2	83 ± 8	1.10
			pCi/l	Ce-141	188 ± 11	191 ± 6	1.01
			pCi/l	Cr-51	510 ± 87	543 ± 35	1.06
			pCi/l	Cs-134	261 ± 23	245 ± 6	0.94
			pCi/l	Cs-137	193 ± 12	196 ± 5	1.02
			pCi/l	Co-58	216 ± 15	214 ± 6	0.99
			pCi/l	Mn-54	203 ± 14	187 ± 5	0.92
			pCi/l	Fe-59	173 ± 10	173 ± 7	1.00
			pCi/l	Zn-65	385 ± 50	398 ± 12	1.03
			pCi/l	Co-60	270 ± 24	283 ± 5	1.05
December-03	E3977-186	Charcoal Filter	pCi	I-131	76 ± 2.5	85 ± 6	1.12
	E3978-186	Charcoal Filter	pCi	I-131	68 ± 2.3	78 ± 6	1.15
	E3979-186	Charcoal Filter	pCi	I-131	86 ± 2.9	94 ± 6	1.09

(a) Counting error is two standard deviations.

TABLE J-3
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
FRAMATOME ANP ENVIRONMENTAL LABORATORY

COMMENTS

1 Framatome ANP unable to analyze sample. Charcoal cartridge damaged during shipment from Analytics.

TABLE J-4
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 1 of 4)

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Results	Framatome Results	Framatome/EML Ratio	
March-03	QAP 58	AP Filter	Bq	Mn-54	43.8	43.2	0.99	
			Bq	Co-60	33.5	33.5	1.00	
			Bq	Sr-90	2.8	2.3	0.83	
			Bq	Cs-137	99.7	102.7	1.03	
			Bq	U-234	0.2	0.2	0.93	
			Bq	Pu-238	0.5	0.5	0.99	
			Bq	U-238	0.2	0.2	0.92	
			Bq	Pu-239	0.3	0.3	1.00	
			Bq	Am-241	0.3	0.3	0.98	
			Bq	Gross Alpha	1.2	1.1	0.93	
			Bq	Gross Beta	1.5	1.4	0.94	
March-03	QAP 58	Soil	Bq/kg	K-40	636.0	653.0	1.03	
			Bq/kg	Cs-137	1450.0	1497.6	1.03	
			Bq/kg	Ac-228	57.6	54.9	0.95	
			Bq/kg	U-234	120.0	115.7	0.96	
			Bq/kg	Pu-238	21.9	23.5	1.07	
			Bq/kg	U-238	125.0	122.9	0.98	
			Bq/kg	Pu-239	23.4	24.4	1.04	
			Bq/kg	Am-241	15.6	12.4	0.79	(1)
March-03	QAP 58	Vegetation	Bq/kg	K-40	1120	1172	1.05	
			Bq/kg	Co-60	12.1	13.02	1.08	
			Bq/kg	Sr-90	650	545.3	0.84	
			Bq/kg	Cs-137	444	469.1	1.06	
			Bq/kg	Pu-239	5.17	5.05	0.98	
			Bq/kg	Am-241	3.51	3.487	0.99	
			Bq/kg	Cm-244	2.01	2.05	1.02	

TABLE J-4
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 2 of 4)

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Results	Framatome Results	Framatome/EML Ratio	
March-03	QAP 58	Water	Bq/l	H-3	426.0	390.0	0.92	
			Bq/l	Co-60	219.0	234.0	1.07	
			Bq/l	Sr-90	4.1	4.3	1.07	
			Bq/l	Cs-134	29.4	30.5	1.04	
			Bq/l	Cs-137	59.6	63.8	1.07	
			Bq/l	U-234	2.3	2.1	0.90	
			Bq/l	Pu238	3.7	3.3	0.91	
			Bq/l	U-238	2.1	2.2	1.02	
			Bq/l	Pu-239	4.2	3.9	0.92	
			Bq/l	Am-241	2.2	2.1	0.99	
			Bq/l	Gr. Alpha	418.1	377.5	0.90	
			Bq/l	Gr. Beta	682.4	627.5	0.92	
September-03	QAP 59	AP Filters	Bq	Co-60	55.1	56.0	1.02	
			Bq	Cs-137	54.8	57.1	1.04	
			Bq	Gr. Alpha	3.1	2.8	0.88	
			Bq	Gr. Beta	3.9	3.1	0.80	(2)
			Bq	Mn-54	58.0	58.3	1.01	
September-03	QAP 59	Soil	Bq/kg	AcTh-228	50.8	51.7	1.02	
			Bq/kg	Cs-137	1973.0	2269.0	1.15	
			Bq/kg	K-40	488.0	547.0	1.12	

TABLE J-4
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
FRAMATOME ANP ENVIRONMENTAL LABORATORY

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Results	Framatome Results	Framatome/EML Ratio
September-03	QAP 59	Water	Bq/l	Co-60	469.4	513.0	1.09
			Bq/l	Cs-134	60.1	63.0	1.05
			Bq/l	Cs-137	73.9	80.3	1.09
			Bq/l	Gross Alpha	531.0	622.0	1.17
			Bq/l	Gross Beta	1790.0	1948.0	1.09
September-03	QAP 59	Vegetation	Bq/kg	(3)	(3)	(3)	(3)

TABLE J-4
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
FRAMATOME ANP ENVIRONMENTAL LABORATORY

COMMENTS

1 Low bias identified. Condition Report (CR No. 03-20) generated by Framatome Env. Lab to investigate Low Bias.

2 Low bias identified. Condition Report (CR No. 04-03) generated by Framatome Env. Lab to investigate Low Bias.

3 No vegetation sample was provided by DOEQAP for this test period.

TABLE J-5
DOE - MAPEP
MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM
FRAMATOME ANP ENVIRONMENTAL LABORATORY
(Page 1 of 2)

Month/Year	Identification No.	Medium	Units	Nuclide	MAPEP Known Results	Framatome Results	Framatome/MAPEP Ratio	Evaluation
March-03	02-W10	Water	Bq/L	Am-241	0.58	0.58	1.00	Agreement
			Bq/L	Cs-134	421.00	398.12	0.95	Agreement
			Bq/L	Cs-137	329.00	301.31	0.92	Agreement
			Bq/L	Co-57	57.00	52.44	0.92	Agreement
			Bq/L	Co-60	38.20	36.54	0.96	Agreement
			Bq/L	Fe-55	96.00	87.00	0.91	Agreement
			Bq/L	Mn-54	32.90	31.53	0.96	Agreement
			Bq/L	Ni-63	136.50	126.00	0.92	Agreement
			Bq/L	Pu-238	0.83	0.85	1.03	Agreement
			Bq/L	Pu-239/40	---	0.03		False Positive (1)
			Bq/L	Sr-90	12.31	11.09	0.90	Agreement
			Bq/L	U-233/234	1.54	1.63	1.06	Agreement
			Bq/L	U-238	1.60	1.63	1.02	Agreement
			Bq/L	Zn-65	516.00	509.10	0.99	Agreement
March-03	03-S10	Soil	Bq/Kg	Cs-134	238.00	248.60	1.04	Agreement
			Bq/Kg	Cs-137	832.00	848.80	1.02	Agreement
			Bq/Kg	Co-57	530.00	544.40	1.03	Agreement
			Bq/Kg	Co-60	420.00	439.20	1.05	Agreement
			Bq/Kg	Mn-54	137.00	143.70	1.05	Agreement
			Bq/Kg	Sr-90	714.00	626.60	0.88	Agreement
			Bq/Kg	K-40	652.00	673.70	1.03	Agreement
			Bq/Kg	Zn-65	490.00	516.50	1.05	Agreement

COMMENTS

1 False positive. Condition Report (CR No. CR 03-14) generated by Framatome Env Lab to investigate and verify MDC of sample with MAPEP.

TABLE J-6

ENVIRONMENTAL RESOURCE ASSOCIATES (ERA)

PROFICIENCY TESTING PROGRAM - 2003

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)

COMMENTS

1 The stable iodine carrier in the sample was unaccounted for in the calculation. When recalculated, the correct result of 20.0 pCi/L was within acceptance criteria. NCR 03-11 generated by Teledyne to investigate condition.

2 Although Cs-137 is evaluated as N, the TBE/ERA ratio of 1.10 falls within limits of 0.80 - 1.20 and is considered by TBE as acceptable.

3 The decay correction did not take into account the extended count time. When recalculated, the correct result of 23.2 was within acceptance criteria. NCR 04-06 generated by Teledyne to investigate condition.

4 Due to recalculating H-3 to required reporting units, a decimal place was dropped. The correct result of 16300 is within acceptance criteria. NCR 04-06 generated by Teledyne to investigate condition.

TABLE J-7
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(Page 1 of 5)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	TBE Results	TBE/Analytics Ratio	
March-03	E3585-396	Milk	pCi/l	Sr-89	133	80	0.60	(1)
			pCi/l	Sr-90	11.8	11.2	0.95	
March-03	E3586-396	Milk	pCi/l	I-131	74	75	1.01	
			pCi/l	Ce-141	173	168	0.97	
			pCi/l	Cr-51	246	243	0.99	
			pCi/l	Cs-134	90	83	0.92	
			pCi/l	Cs-137	200	207	1.04	
			pCi/l	Co-58	47	49	1.04	
			pCi/l	Mn-54	64	65	1.02	
			pCi/l	Fe-59	47	53	1.13	
			pCi/l	Zn-65	93	114	1.23	(4)
			pCi/l	Co-60	162	169	1.04	
March-03	E3588-396	AP Filter	pCi	Ce-141	224	239	1.07	
			pCi	Cr-51	318	348	1.09	
			pCi	Cs-134	117	101	0.86	
			pCi	Cs-137	259	277	1.07	
			pCi	Co-58	60	66	1.10	
			pCi	Mn-54	83	97	1.17	
			pCi	Fe-59	61	80	1.31	(2)
			pCi	Zn-65	120	152	1.27	
			pCi	Co-60	209	223	1.07	
			pCi	Fe-55	106	138	1.30	(4)
March-03	E3587-396	Charcoal Filter	pCi	I-131	74	68	0.92	

TABLE J-7

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	TBE Results	TBE/Analytics Ratio	
June-03	E3747-396	Milk	pCi/l	Sr-89	85	89	1.05	
			pCi/l	Sr-90	23	20	0.87	
June-03	E3748-396	Milk	pCi/l	I-131	103	115	1.12	
			pCi/l	Ce-141	283	285	1.01	
			pCi/l	Cr-51	239	266	1.11	
			pCi/l	Cs-134	103	99	0.96	
			pCi/l	Cs-137	230	236	1.03	
			pCi/l	Co-58	93	106	1.14	
			pCi/l	Mn-54	186	190	1.02	
			pCi/l	Fe-59	99	108	1.09	
			pCi/l	Zn-65	181	208	1.15	
			pCi/l	Co-60	132	142	1.08	
June-03	E3750-396	AP Filter	pCi	Ce-141	248	238	0.96	
			pCi	Cr-51	209	239	1.14	
			pCi	Cs-134	91	79	0.87	
			pCi	Cs-137	202	189	0.94	
			pCi	Co-58	81	71	0.88	
			pCi	Mn-54	163	164	1.01	
			pCi	Fe-59	87	91	1.05	
			pCi	Zn-65	159	155	0.97	
			pCi	Co-60	116	109	0.94	
			pCi	Fe-55	97	160	1.65	(3)
June-03	E3749-396	Charcoal Filter	pCi	I-131	62	78	1.26	(4)

TABLE J-7

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003

TELEDYNE QUALITY CONTROL SPIKE PROGRAM

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

(Page 3 of 5)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	TBE Results	TBE/Analytics Ratio	
September-03	E3898-396	Milk	pCi/l	Sr-89	100	45	0.45	(1)
			pCi/l	Sr-90	14	13	0.93	
September-03	E3899-396	Milk	pCi/l	I-131	74	73	0.99	
			pCi/l	Ce-141	86	85	0.99	
			pCi/l	Cr-51	233	220	0.94	
			pCi/l	Cs-134	119	106	0.89	
			pCi/l	Cs-137	88	90	1.02	
			pCi/l	Co-58	99	96	0.97	
			pCi/l	Mn-54	93	95	1.02	
			pCi/l	Fe-59	79	84	1.06	
			pCi/l	Zn-65	176	187	1.06	
			pCi/l	Co-60	123	132	1.07	
September-03	E3901-396	AP Filter	pCi	Ce-141	77	79	1.03	
			pCi	Cr-51	210	227	1.08	
			pCi	Cs-134	108	93	0.86	
			pCi	Cs-137	79	70	0.89	
			pCi	Co-58	89	80	0.90	
			pCi	Mn-54	84	73	0.87	
			pCi	Fe-59	71	74	1.04	
			pCi	Zn-65	158	143	0.91	
			pCi	Co-60	111	93	0.84	
			pCi	Fe-55	112	144	1.29	(4)
September-03	E3900-396	Charcoal Filter	pCi	I-131	86	74	0.86	
November-03	E3790-396	Milk	pCi/l	Sr-89	168	185	1.10	
			pCi/l	Sr-90	17	19	1.12	

TABLE J-7
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE QUALITY CONTROL SPIKE PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results	TBE Results	TBE/Analytics Ratio	
November-03	E3971-396	Milk	pCi/l	I-131	90	87	0.97	
			pCi/l	Ce-141	202	186	0.92	
			pCi/l	Cr-51	280	287	1.03	
			pCi/l	Cs-134	135	119	0.88	
			pCi/l	Cs-137	129	116	0.90	
			pCi/l	Co-58	111	111	1.00	
			pCi/l	Mn-54	173	176	1.02	
			pCi/l	Fe-59	102	94	0.92	
			pCi/l	Zn-65	197	190	0.96	
			pCi/l	Co-60	155	140	0.90	
November-03	E3973-396	AP Filter	pCi	Ce-141	142	144	1.01	
			pCi	Cr-51	198	203	1.03	
			pCi	Cs-134	96	90	0.94	
			pCi	Cs-137	91	85	0.93	
			pCi	Co-58	78	80	1.03	
			pCi	Mn-54	122	115	0.94	
			pCi	Fe-59	72	72	1.00	
			pCi	Zn-65	139	121	0.87	
			pCi	Co-60	109	102	0.94	
			pCi	Fe-55	96	62	0.65	(5)
November-03	E3972-396	Charcoal Filter	pCi	I-131	77	67	0.87	

COMMENTS

1 Incorrectly calculated. The recalculated March & September Sr-89 results of 138 & 95.8 pCi/L, respectively, are acceptable.
The efficiency required for these samples is different than the efficiency for regular samples.
NCR 04-02 generated by Teledyne to investigate conditon.

2 Using only the results from the 1099.2 keV photon, the Fe-59 would be 71 pCi, which is acceptable. Coincidental summing occurs only with significant Fe-59 activity levels. Therefore, there is no impact on environmental samples.
NCR 04-02 generated by Teledyne to investigate condition.

3 Reprocessed to separate Fe-55 peak. Reprocessed result of 103 total pCi is acceptable. NCR 04-02 generated by Teledyne to investigate the condition.

4 Acceptable with warning. Reported result falls within 0.70-0.80 or 1.20-1.30.

5 NCR 04-07 generated by Teledyne to investigate condition. The mylar film (not a filter) from Analytics is not typical of samples received from Teledyne clients. Since the analytics sample was mylar, the laboratory tried to adjust to the new matrix by ashing the filter before analysis.
Analytics thought Teledyne was performing a direct count of the mylar (no preparation or chemical separation).
Teledyne believes that some of the Fe-55 was lost during ashing.
Teledyne has changed their request to Analytics and will now receive glass fiber filters for analysis.
In addition, Teledyne has also verified the validity of their Fe-55 efficiencies by comparing to a standard from a different standards lot.

TABLE J-8
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio	
March-03	E3573-186	Sediment	pCi/kg	Ce-141	358 ± 18	409 ± 17	1.14	
			pCi/kg	Cr-51	508 ± 25	576 ± 99	1.13	
			pCi/kg	Cs-134	186 ± 9	180 ± 9	0.97	
			pCi/kg	Cs-137	497 ± 25	598 ± 19	1.20	
			pCi/kg	Co-58	96 ± 5	116 ± 13	1.21	
			pCi/kg	Mn-54	133 ± 65	157 ± 13	1.18	
			pCi/kg	Fe-59	98 ± 5	120 ± 17	1.22	
			pCi/kg	Zn-65	192 ± 1	271 ± 23	1.41	(1)
			pCi/kg	Co-60	335 ± 17	408 ± 13	1.22	
March-03	E3569-186	Milk	pCi/l	I-131	75 ± 3	67 ± 7	0.89	
			pCi/l	Ce-141	188 ± 17	188 ± 8	1.00	
			pCi/l	Cr-51	267 ± 35	262 ± 37	0.98	
			pCi/l	Cs-134	98 ± 5	86 ± 3	0.88	
			pCi/l	Cs-137	217 ± 22	214 ± 7	0.99	
			pCi/l	Co-58	51 ± 2	50 ± 4	0.98	
			pCi/l	Mn-54	70 ± 3	74 ± 5	1.05	
			pCi/l	Fe-59	51 ± 2	56 ± 6	1.10	
			pCi/l	Zn-65	101 ± 5	110 ± 9	1.09	
			pCi/l	Co-60	176 ± 16	173 ± 5	0.98	
March-03	E3570-186	AP Filter	pCi	Ce-141	151 ± 5	153 ± 7	1.01	
			pCi	Cr-51	215 ± 8	241 ± 38	1.12	
			pCi	Cs-134	79 ± 3	67 ± 4	0.84	
			pCi	Cs-137	175 ± 6	180 ± 9	1.03	
			pCi	Co-58	41 ± 1	45 ± 6	1.09	
			pCi	Mn-54	56 ± 2	59.5 ± 7	1.06	
			pCi	Fe-59	41 ± 1	52.9 ± 8	1.29	(1)
			pCi	Zn-65	81 ± 3	96.3 ± 13	1.19	
			pCi	Co-60	141 ± 5	148 ± 7	1.05	

(a) Counting error is two standard deviations.

TABLE J-8
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio	
March-03	E3571-186	AP Filter	pCi	Ce-141	156 ± 5	170 ± 8	1.09	
			pCi	Cr-51	221 ± 8	255 ± 46	1.15	
			pCi	Cs-134	81 ± 3	65.3 ± 5	0.81	
			pCi	Cs-137	180 ± 6	187 ± 9	1.04	
			pCi	Co-58	42 ± 1	39.5 ± 8	0.94	
			pCi	Mn-54	58 ± 2	59.1 ± 7	1.02	
			pCi	Fe-59	43 ± 2	51 ± 9	1.19	
			pCi	Zn-65	84 ± 3	110 ± 13	1.31	(1)
			pCi	Co-60	146 ± 5	148 ± 7	1.01	
March-03	E3572-186	AP Filter	pCi	Ce-141	182 ± 6	180 ± 7	0.99	
			pCi	Cr-51	259 ± 9	240 ± 40	0.93	
			pCi	Cs-134	95 ± 3	76.3 ± 4	0.80	
			pCi	Cs-137	211 ± 7	217 ± 9	1.03	
			pCi	Co-58	49 ± 2	51.5 ± 7	1.05	
			pCi	Mn-54	68 ± 2	75.5 ± 7	1.11	
			pCi	Fe-59	50 ± 2	60.3 ± 9	1.21	
			pCi	Zn-65	98 ± 3	115 ± 14	1.17	
			pCi	Co-60	170 ± 6	173 ± 7	1.02	
March-03	E3574-186	Water	pCi/L	H-3	4463 ± 230	4840 ± 176	1.08	
June-03	E3776-186	AP Filter	pCi	Ce-141	152 ± 5	157 ± 17	1.03	
			pCi	Cr-51	128 ± 4	142 ± 102	1.11	
			pCi	Cs-134	55 ± 2	58.3 ± 8	1.06	
			pCi	Cs-137	123 ± 4	147 ± 14	1.20	
			pCi	Co-58	50 ± 2	46.5 ± 14	0.93	
			pCi	Mn-54	99 ± 3	105 ± 14	1.06	
			pCi	Fe-59	53 ± 2	63 ± 19	1.19	
			pCi	Zn-65	97 ± 3	115 ± 18	1.19	
			pCi	Co-60	71 ± 2	87.9 ± 10	1.24	

(a) Counting error is two standard deviations.

TABLE J-8
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio	
June-03	E3777A-186	AP Filter	pCi	Ce-141	238 ± 8	267 ± 20	1.12	
			pCi	Cr-51	201 ± 7	176 ± 112	0.88	
			pCi	Cs-134	87 ± 3	91 ± 8	1.05	
			pCi	Cs-137	194 ± 7	219 ± 17	1.13	
			pCi	Co-58	78 ± 3	84.3 ± 13	1.08	
			pCi	Mn-54	156 ± 5	172 ± 17	1.10	
			pCi	Fe-59	83 ± 3	107 ± 20	1.29	(1)
			pCi	Zn-65	153 ± 5	179 ± 23	1.17	
			pCi	Co-60	111 ± 4	127 ± 11	1.14	
June-03	E3778A-186	AP Filter	pCi	Ce-141	140 ± 5	128 ± 20	0.91	
			pCi	Cr-51	118 ± 4	122 ± 89	1.03	
			pCi	Cs-134	51 ± 2	53.7 ± 6	1.05	
			pCi	Cs-137	114 ± 4	112 ± 12	0.98	
			pCi	Co-58	46 ± 2	35 ± 10	0.76	
			pCi	Mn-54	92 ± 3	96.2 ± 11	1.05	
			pCi	Fe-59	49 ± 2	42.4 ± 18	0.87	
			pCi	Zn-65	89 ± 3	74.1 ± 18	0.83	
			pCi	Co-60	65 ± 2	69.6 ± 7	1.07	
June-03	E3779-186	Charcoal Filter	pCi	I-131	66 ± 2	73.9 ± 3	1.12	
June-03	E3780-186	Charcoal Filter	pCi	I-131	59 ± 2	68.6 ± 3	1.16	
June-03	E3781-186	Charcoal Filter	pCi	I-131	51 ± 2	61.6 ± 4	1.21	

(a) Counting error is two standard deviations.

TABLE J-8
PPL REMP LABORATORY SPIKE PROGRAM
ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM - 2003
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(Page 4 of 5)

Month/Year	Identification No.	Medium	Units	Nuclide	Analytics Calculated Results (a)	TBE Results (a)	TBE/Analytics Ratio
September-03	E3889-186	Milk	pCi/l	I-131	75 ± 2	65.9 ± 8	0.88
			pCi/l	Ce-141	188 ± 11	171 ± 11	0.91
			pCi/l	Cr-51	510 ± 87	429 ± 48	0.84
			pCi/l	Cs-134	261 ± 23	212 ± 5	0.81
			pCi/l	Cs-137	193 ± 12	181 ± 8	0.94
			pCi/l	Co-58	216 ± 15	197 ± 8	0.91
			pCi/l	Mn-54	203 ± 14	202 ± 9	1.00
			pCi/l	Fe-59	173 ± 10	177 ± 10	1.02
			pCi/l	Zn-65	385 ± 50	368 ± 16	0.96
			pCi/l	Co-60	270 ± 24	264 ± 7	0.98
September-03	E3890-186	Water	pCi/l	H-3	8000 ± 300	8240 ± 222	1.03
December-03	E3981-186	Charcoal Filter	pCi	I-131	77 ± 3	83 ± 3	1.07
December-03	E3982-186	Charcoal Filter	pCi	I-131	68 ± 2	73 ± 2	1.07
December-03	E3983-186	Charcoal Filter	pCi	I-131	86 ± 3	92 ± 5	1.07

(a) Counting error is two standard deviations.

COMMENTS

1 High Bias identified. Evaluation of results requested by PPL via email on April 19, 2004.

TABLE J-9
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Result	TBE Results	TBE/EML Ratio	
March-03	QAP-58	AP Filter	Bq	Am-241	0.34	0.34	1.00	
			Bq	Co-60	33.5	35.9	1.07	
			Bq	Cs-137	99.7	113.7	1.14	
			Bq	Gr-Alpha	1.2	0.9	0.73	(1)
			Bq	Gr-Beta	2	1.6	1.07	
			Bq	Mn-54	43.8	49.4	1.13	
			Bq	Pu-238	0.52	0.59	1.13	
			Bq	Pu-239	0.3	0.4	1.06	
			Bq	Sr-90	2.8	2.4	0.86	
March-03	QAP-58	Soil	Bq/kg	Ac-228	57	70	1.23	(4)
			Bq/kg	Am-241	16	16	0.99	
			Bq/kg	Bi-212	61	73	1.20	(4)
			Bq/kg	Bi-214	67	76	1.14	
			Bq/kg	Cs-137	1450	1883	1.30	(2)
			Bq/kg	K-40	636	806	1.27	(4)
			Bq/kg	Pb-212	58	75	1.29	(4)
			Bq/kg	Pb-214	71	79	1.11	
			Bq/kg	Pu-239	23	25	1.09	
			Bq/kg	Sr-90	64	54	0.83	
			Bq/kg	Th-234	127	169	1.33	
March-03	QAP-58	Vegetation	Bq/kg	Co-60	12	14	1.19	
			Bq/kg	Cs-137	444	522	1.18	
			Bq/kg	K-40	1120	1360	1.21	
			Bq/kg	Sr-90	650	498	0.77	

TABLE J-9

DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Result	TBE Results	TBE/EML Ratio	
March-03	QAP-58	Water	Bq/l	Am-241	2.13	2.4	1.13	
			Bq/l	Co-60	234	252	1.08	
			Bq/l	Cs-134	31	31	1.02	
			Bq/l	Cs-137	64	72	1.12	
			Bq/l	Gr-Alpha	378	484	1.28	(4)
			Bq/l	Gr-Beta	628	821	1.31	(4)
			Bq/l	H-3	390	418	1.07	
			Bq/l	Pu-238	3.3	4.0	1.20	(3)
			Bq/l	Pu-239	3.9	4.6	1.16	
			Bq/l	Sr-90	4.3	3.6	0.84	
September-03	QAP 59	AP Filter	Bq	Mn-54	58	54	0.93	
			Bq	Co-60	55.1	53.3	0.97	
			Bq	Sr-90	2.1	1.7	0.81	
			Bq	Cs-137	54.8	51.2	0.93	
			Bq	U-234	0.4	0.4	0.92	
			Bq	Pu-238	0.2	0.2	1.00	
			Bq	U-238	0.4	0.4	0.93	
			Bq	Pu-239	0.4	0.4	1.00	
			Bq	Am-241	0.4	0.4	0.90	
			Bq	Gr-Alpha	3.1	3.1	1.00	
			Bq	Gr-Beta	3.9	3.4	0.87	

TABLE J-9
DOE - ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM (QAP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification No.	Medium	Units	Nuclide	EML Known Result	TBE Results	TBE/EML Ratio
September-03	QAP 59	Soil	Bq/kg	K-40	488	517	1.06
			Bq/kg	Sr-90	80	70	0.87
			Bq/kg	Cs-137	1973	2127	1.08
			Bq/kg	Bi-212	54	56	1.04
			Bq/kg	Pb-212	51	53	1.04
			Bq/kg	Bi-214	34	36	1.06
			Bq/kg	Pb-214	35	42	1.18
			Bq/kg	Ac-228	51	56	1.11
			Bq/kg	Th-234	116	145	1.25
			Bq/kg	U-234	127	115	0.91
			Bq/kg	Pu-238	15	14	0.92
			Bq/kg	U-238	127.1	114	0.90
			Bq/kg	Pu-239	30.4	28.3	0.93
			Bq/kg	Am-241	18.4	16.5	0.90
September-03	QAP 59	Water	Bq/l	H-3	446	511	1.14
			Bq/l	Co-60	513	491	0.96
			Bq/l	Sr-90	7	6	0.84
			Bq/l	Cs-134	63	62	0.99
			Bq/l	Cs-137	80	75	0.93
			Bq/l	U-234	2.79	2.7	0.97
			Bq/l	Pu-238	2.07	2.2	1.06
			Bq/l	U-238	2.8	2.6	0.93
			Bq/l	Pu-239	4.99	5.4	1.08
			Bq/l	Am-241	8.76	9.2	1.05
			Bq/l	Gr-Alpha	622	612	0.98
			Bq/l	Gr-Beta	1948	1663	0.85

COMMENTS

1 Gas flow Proportional efficiencies are established using Am-241, industry standard for client samples. EML requires an efficiency based on Th-230. Using Th-230 efficiency, the result of 1.18 is acceptable. NCR 03-07 generated by Teledyne to investigate condition.

2 Incorrect bottle size used. Sample was placed into a smaller container and recounted. All recount results were acceptable except Bi-212 which was acceptable with warning. Previously analyzed samples were examined and no other incorrect container sizes were noted. NCR 03-07 generated by Teledyne to investigate condition.

3 The electroplating cell was determined to have trace amounts of plutonium, causing an elevated activity. The electroplating cell has been taken out of service.

4 Acceptable with warning. Reported result falls within 0.70-0.80 or 1.20-1.30.

TABLE J-10
DOE - MAPEP
MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES (TBE)
(Page 1 of 2)

Identification No.	Medium	Units	Nuclide	MAPEP Known Result	TBE Results	TBE/MAPEP Ratio	Evaluation	
02-W10	Water	pCi/l	Am-241	0.578	0.61	1.06	Agreement	
		pCi/l	Cs-134	421	382.7	0.91	Agreement	
		pCi/l	Cs-137	329	329.3	1.00	Agreement	
		pCi/l	Co-57	57	58.17	1.02	Agreement	
		pCi/l	Co-60	38.2	41.2	1.08	Agreement	
		pCi/l	Fe-55	96	97.7	1.02	Agreement	
		pCi/l	Mn-54	32.9	35.07	1.07	Agreement	
		pCi/l	Ni-63	136.5	151.3	1.11	Agreement	
		pCi/l	Pu-238	0.83	0.91	1.10	Agreement	
		pCi/l	Sr-90	12.31	11.70	0.95	Agreement	
		pCi/l	Tc-99	132	84.00	0.64	Low Bias	(1)
		pCi/l	U-234/233	1.54	1.49	0.97	Agreement	
		pCi/l	U-238	1.6	1.61	1.01	Agreement	
		pCi/l	Zn-65	516	566	1.10	Agreement	
03-S10	Soil	pCi/kg	Cs-134	238	204	0.86	Agreement	
		pCi/kg	Cs-137	832	803	0.97	Agreement	
		pCi/kg	Co-57	530	499	0.94	Agreement	
		pCi/kg	Co-60	420	427	1.02	Agreement	
		pCi/kg	Fe-55	1020	892	0.87	Agreement	
		pCi/kg	Mn-54	137	136	0.99	Agreement	
		pCi/kg	Ni-63	770	803	1.04	Agreement	
		pCi/kg	Pu-238	66.9	69	1.03	Agreement	
		pCi/kg	Pu-239/240	52.7	57.7	1.09	Agreement	
		pCi/kg	K-40	652	686	1.05	Agreement	
		pCi/kg	Sr-90	714	651	0.91	Agreement	
		pCi/kg	U-234/233	89	70.2	0.79	Agreement	(2)
		pCi/kg	U-238	421	394	0.94	Agreement	
		pCi/kg	Zn-65	490	528	1.08	Agreement	

COMMENTS

1 Teledyne lab technician read the pipette incorrectly, delivering a 20 ml aliquot rather than the 30 ml aliquot used to calculate the result. The re-analyzed Tc-99 result of 127 Bq/L is acceptable.
NCR 03-05 generated by Teledyne to document/investigate the event.

2 Acceptable with warning. Reported result falls within 0.70-0.80 or 1.20-1.30.