RTL A9.690E
Enclosure 3

Beaver Valley Power Station - Units 1 & 2

2010 Annual Radiological Environmental Operating Report

FirstEnergy Nuclear Operating Company
FENOC

Beaver Valley Power Station - Units 1 & 2
Unit 1 License No. DPR-66
Unit 2 License No. NPF-73

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Report Preparation and Submittal Requirements: The Beaver Valley Power Station (BVPS) Annual Radiological Environmental Operating Report (AREOR) was prepared and submitted in accordance with the requirements contained in the following documents:

- BVPS Integrated Technical Specifications, Administrative Control 5.6.1
- Offsite Dose Calculation Manual (ODCM) procedure 1/2-ODC-3.03, Attachment T, Control 6.9.2, "*Controls for RETS and REMP Programs*"
- BVPS procedure 1/2-ENV-01.05, "*Compliance with Regulatory Guide 1.21 and Technical Specifications*"
- BVPS procedure 1/2-ENV-02.01, "*Description of Overall Radiological Environmental Monitoring Program*"
- NUREG-1301, "*Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, Generic Letter 89-01, Supplement No.1, April 1991*"
- BVPS CR 10-71609: REMP Samples Affected by Snow Storms
- BVPS CR 10-72229: REMP Drinking Water Station OOS Due to Leaking Valve
- BVPS CR 10-77489: Revision Needed for 1/2-ODC-2.03
- BVPS CR 10-79484: I-131 Detected in Upstream Surface Water REMP Sample Station No 49A
- BVPS CR 10-80141: REMP Surface Water Sample Station #2.1 Out of Service
- BVPS CR 10-81504: REMP Air Station OOS due to Power Outages
- BVPS CR 10-82446: I-131 Detected in Upstream Surface Water REMP Sample Station No 49A
- BVPS CR 10-82742: Inability to Meet REMP ODCM Milk Sample Requirements
- BVPS CR 10-82745: New Software Catches REMP Location Sector Designation Inaccuracies
- BVPS CR 10-82503: Inaccurate Reporting of Sample Analysis from Vendor Lab for REMP Sample Results
- BVPS CR 11-88282: REMP TLD Station #88 Vandalized During 4th Qtr 2010
- BVPS CR 11-88355: Correction to Annual Environmental Radiological Operating Report (REMP)

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Report Overview:

The AREOR provides a detailed summary of the BVPS Radiological Environmental Monitoring Program (REMP). During the report period, samples of air, water, shoreline sediment, milk, fish, food crops, feed crops, vegetation, and direct radiation (in the vicinity of the BVPS site) have been measured, analyzed, evaluated, and summarized. During the report period, the BVPS radioactive effluent releases (as performed in accordance with the Radiological Effluent Technical Specification (RETS) program), did not exceed the limits identified in the BVPS Operating License Technical Specifications, and/or the ODCM. The results of the REMP verify that the effluent releases did not impact the environment with measurable concentration of radioactive materials and/or levels of radiation that are higher than expected.

Description of Pre-operational REMP (1974 – 1975):

A pre-operational REMP program was performed during the period 1974 through 1975. At that time, samples were collected and analyzed to determine the amount of radioactivity present in the environment prior to BVPS operation. The resulting values are considered a "baseline" to which current sample analyses can be compared. A summary of the pre-operational data is summarized in Table 2-3 of this report.

Description of Operational REMP (1976 – Present):

The operational REMP program was initiated during calendar year 1976 and continued through the report period. During the past thirty-five (35) years, radiation and radioactivity in the environment was monitored within a 10-mile radius of the site. A description of the operational REMP program is outlined in Table 2-1 of this report. In general, two (2) types of samples were collected and compared during the report period, and are described as follows:

- **Control Samples:** These samples are collected from areas that are beyond measurable influence of BVPS operation, and are used as reference data. Normal background radiation levels, or radiation present due to causes other than BVPS operation, can thus be compared to the environment surrounding the BVPS site. During the report period, three hundred fifty eight (358) analyses were performed on samples from the control locations. In addition, eight (8) analyses were completed for TLDs at the control locations. Results of the analyses from the control locations are summarized in Table 2-2 of this report.

- **Indicator Samples:** Indicator samples are collected to determine the radiological impact of BVPS operation in the environment. These samples are collected from various locations near the BVPS site. At a minimum, the samples are collected from areas where the BVPS contribution would indicate the most significant radiological impact. During the report period, one thousand four hundred seventy one (1471) analyses were performed on samples collected from eighty (80) indicator locations. In addition, five hundred two (502) analyses were completed for TLDs at the indicator locations. Results of the analyses from the indicator locations are also summarized in Table 2-2 of this report.

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- **Comparisons:** Current analysis results from the indicator samples were compared to both current control sample values and the pre-operational baseline to determine if changes in radioactivity levels were attributable to BVPS operation.

Determination of Environmental Impact

- **2010 Sample Media and Analyses:** Results for drinking water, surface water, precipitation, groundwater, shoreline stream sediment, fish, cow milk, goat milk, feedstuff, foodcrops, air particulate and air radioiodine media remained consistent with previous data. Minor increases and decreases were noted in most sample media, and any positive results attributable to the BVPS operation were consistent with station data of authorized radioactive discharges, and were within limits permitted by the operating license and the ODCM. Other radioactivity detected was attributable to naturally occurring radionuclides, previous nuclear weapons tests, other man-made sources, and to the normal statistical fluctuation for activities near the Lower Limit of Detection (LLD).

- **Airborne Exposure Pathway:** This ODCM required pathway was evaluated via sampling of airborne radioiodine and airborne particulates. The results during this report period were similar to previous years. There was no notable increase in natural products and no detectable fission products or other radionuclides in the airborne particulate media during the year.

- **Direct Exposure Pathway:** This ODCM required pathway was evaluated via measurement of environmental radiation doses by use of Thermo-Luminescent Dosimeters (TLDs). The results of TLD processing have indicated a stable trend and compare well with previous years.

- **Ingestion Exposure Pathway:** This ODCM required pathway was evaluated via sampling of milk, fish, and foodcrops (leafy vegetables).

  For milk samples, Strontium-90 (attributable to past atmospheric weapons testing), was detected at levels similar to those of previous years. The gamma spectrometry analyses only indicated positive results for naturally occurring Potassium-40 at average environmental levels. No other radionuclides were identified.

  The fish samples indicated below LLD levels in each of the sample analyses.

  Foodcrop (leafy vegetation) samples indicated naturally occurring Potassium-40 at average environmental levels.

- **Waterborne Exposure Pathway:** This ODCM pathway was evaluated via samples of drinking water, ground (well) water, surface (river) water and river sediment.

  Water samples were analyzed for tritium and gamma-emitting radionuclides. Tritium was identified in two of these water samples, both of which were only slightly above lower limits of detection. Iodine-131 analysis of drinking water indicated positive analyses, but the

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values were consistent with Iodine-131 at the upstream surface (river) water control location, and was not due to liquid effluent releases from BVPS.

Sediment samples were collected from upstream of the site, at the discharge point of BVPS liquid effluent releases, and downstream of the site. Analysis of samples indicated naturally occurring radionuclides Potassium-40, Thallium-208, Bismuth-214, Lead-212, Lead-214, Radium-226, and Actinium-228 in all results. The analyses also indicated Cesium-137, but the values were consistent with Cesium-137 at the control location, and most likely caused by previous nuclear weapons tests. Cobalt-58 and Cobalt-60 were identified in some of the samples that were obtained at the shorelines of the BVPS Main Outfall Facility and Upstream of the New Cumberland Dam. This is not unusual because the BVPS site discharges Cobalt-58 and Cobalt-60 in liquid waste effluents. The activity detected at these sample locations are consistent with discharge data of authorized liquid effluent releases, and all liquid effluent releases during the report period did not exceed the release concentration limits set forth in the ODCM.

- **Other Exposure Pathways:** In addition to the samples collected from the exposure pathways described above, other media (i.e., precipitation and feedstuff) were also collected. Results were consistent with previous years, with no degrading trends.

- **Offsite Groundwater Monitoring:** A total of six (6) offsite groundwater samples were collected and analyzed for Tritium and by gamma spectrometry during the report period. The samples were collected on a semi-annual basis from three (3) locations within four (4) miles of the site. The locations included one (1) well in Shippingport PA, one (1) well in Hookstown PA, and one (1) well in Georgetown PA. No gamma-emitting radionuclides were detected in the analyses. All tritium results were less than the pre-operational value.

- **Supplemental Sample Sites:** The REMP program includes supplemental sampling sites in addition to the required sites set forth in the ODCM. The supplemental sites include five (5) air sampling sites, one (1) surface water site, three (3) groundwater sites, three (3) precipitation sites, two (2) sediment sites, ten (10) soil sites, one (1) local large dairy, and one (1) milk animal feedstuff site. The soil sites are on a triennial sample frequency. They were sampled in 2009 and are scheduled to be sampled again in 2012.

- **Population Dose vs. Natural Background:** During the report period, the total calculated 0-50 mile population dose was 352 man-mrem (liquid releases), and 124 man-mrem (gaseous releases). The average individual population dose from BVPS operation was much less than <1 mrem. For information, the National Academy of Sciences 1990 BEIR Report shows that the typical dose to an individual from background (natural radiation exposure including radon) is an estimated average of 296 mrem per year. The following graph illustrates that the average individual population dose was not affected from BVPS operation.

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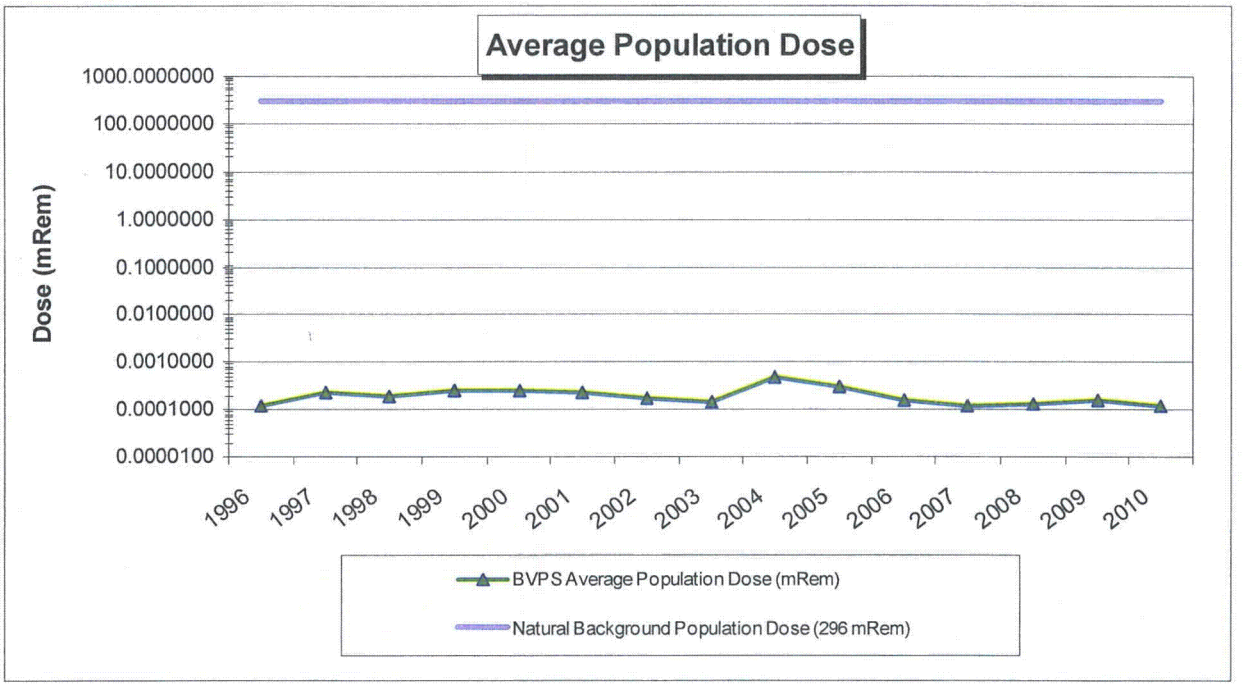
Figure i-1
Graph of Annual Average Population Dose: BVPS Dose and Natural Background Dose



- **Summary:** During the report period, radioactive effluent releases from the BVPS site did not exceed the limits identified in the BVPS Operating License Technical Specifications, and/or the ODCM. The BVPS operational REMP program was followed throughout the report period. The results demonstrate the adequacy of radioactive effluent control at BVPS, and that BVPS operation did not adversely affect the surrounding environment. Positive results attributable to BVPS operation were consistent with station data of authorized radioactive discharges and were within limits permitted by the NRC license and the ODCM. Other radioactivity detected was attributable to naturally occurring radionuclides, previous nuclear weapons tests, other man-made sources, and to the normal statistical fluctuation for activities near the Lower Limit of Detection (LLD).

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Inter-laboratory Comparison Programs:

- **Split Sample Program:** BVPS shared split samples with the Pennsylvania Department of Environmental Protection (PADEP) in support of their nuclear power plant monitoring program. The shared media and number of locations were typically comprised of; milk (2), surface water (3), river sediment (1), fish (1), foodcrops (2), co-located air particulate/air iodine (4), and TLD (24). The split sample program was coordinated by the state, and the results are not provided with this report.

- **Spike Sample Program:** Spiked samples were provided by an independent laboratory and then analyzed by the REMP contractor laboratory. The samples were provided throughout the report period and included water samples, milk samples, filter paper samples and charcoal cartridge samples. All one-hundred-ten (110) analyses performed by the contactor laboratory on the spiked samples met the NRC comparison criteria.

Special Reports:

- **SINCE** no reporting levels were exceeded during 2010, **THEN** no Special Reports were required. For information, a Special Report shall be submitted to the NRC when (1) levels of radioactivity in an environmental sampling medium exceeds the limits specified in ODCM procedure 1/2-ODC-3.03, Attachment Q Table 3.12-2, and when (2) the results of the following calculation are ≥ 1.0 (for calculations performed when more than one radionuclide is detected in the sampling medium):

$$\frac{\text{Concentration (1)}}{\text{Limit Level (1)}} + \frac{\text{Concentration (2)}}{\text{Limit Level (2)}} + \cdots \geq 1.0$$

Land Use Census Results:

Highlights from the most recent Land Use Census are documented in letter NPD3NRE:0713, dated September 22, 2010 and are summarized as follows:

- Nearest Residence: The location of the Nearest Residence has not changed since the previous census. The Nearest Residence location remains at the Terwilliger Residence, 211 Ferry Hill Road, Shippingport, PA (0.406 miles, in the NE Sector).

- Nearest Garden: The location has not changed since the previous census. The location remains at the Knisley Residence, 175 Kerona Road, Shippingport, PA (0.7 miles, NE). However, this garden has not joined our sampling program because it did not contain leafy vegetables most appropriate for sampling (cabbage) this year.

- Nearest Dairy Cow: The nearest dairy cow milked has not changed since the previous census. The location remains at the Searight Dairy, 948 McCleary Road, RD 1, Hookstown, PA (2.097 miles SSW).

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- Nearest Doe Goat: The location has not changed since the previous census. The location remains at the Ferry Farm, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE). However, goat milk samples were not available from this location, nor from any other location within the 5 mile radius this year.

- Prevailing Winds: The prevailing wind direction for Ground Releases was identified by showing the highest D/Q in the East Sector. The prevailing wind direction for Elevated Releases was identified by showing the highest D/Q in the ESE Sector. The REMP properly monitors the environment with air particulate sampling stations in some Sectors and direct radiation TLDs in all Sectors.

- 2011 Dairy Cow and Doe Goat Sampling Locations: The Dairy Cow sampling locations will remain at the same locations used in 2010; Searight Dairy, 948 McCleary Road, RD1, Hookstown, PA (2.097 miles, SSW), Halstead Dairy, 104 Tellish Drive, Hookstown, PA (5.079 miles, SSW), Brunton Dairy, 3681 Ridge Road, Aliquippa, PA (6.158 miles, SE), and Windsheimer Dairy, RD 1 Burgettstown, PA (10.476 miles, SSW). The Doe Goat sampling location remains at the Ferry Farm, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE), although it is unknown at this time whether or not goat milk samples will be available from the Ferry Farm next season.

- D/Q for Milch Animal Locations: None of the 2010 milch animal sampling locations experienced a >20% increase in deposition parameter (D/Q).

- D/Q for Offsite Dose Determination: There was no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, a linear regression analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% more than the offsite dose previously calculated using current ODCM methodology.

- D/Q Historical Comparison: There was no adverse trend in D/Q when comparing data to the ODCM default D/Q values, which validates that there was no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, the analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% more than the offsite dose previously calculated using current ODCM methodology. Therefore, a change in ODCM Receptor location and/or a change to meteorology at the current ODCM Receptor location were not required.

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Deviations, Changes and Adjustments to the Normal Sampling Program

- **Deviation from Normal Milk Sampling & Analysis Schedule:** There was a deviation from the required milk sampling and analysis schedule for the reporting period. The Doe Goat location identified at the Ferry Farm, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE) has not been able to provide enough milk to participate in the sampling program for 2010, and it is unknown as to whether or not it will be able to in the future. Goat milk samples were also not available from any other location within the 5 mile radius this year. The unavailability of goat milk caused the REMP to not meet the ODCM sample requirements in 1/2-ODC-2.03 and in 1/2-ODC-3.03, Attachment Q Table 3.12-1 stating that a minimum of four (4) milk locations shall be sampled. There are no other milk animal locations available to add to the REMP, as all milk animals sites located within the 5 mile radius of BVPS are currently participating in the sampling program. This condition was documented in CR 10-82742.

- **Deviation from Normal Surface and Drinking Water Sampling and Analysis Schedule:** The surface and drinking water sampling stations were interrupted on three (3) separate occasions during the report period. These issues were documented in CR 10-71609, 10-72229 and 10-80141.

- **Deviation from Normal Air Particulate & Iodine Sampling and Analysis Schedule:** The air particulate and iodine sampling stations were interrupted on five (5) separate occasions during the report period. These issues were documented in CR 10-71609 and 10-81504.

- **Deviation from Normal Direct Radiation Monitoring:** The Direct Radiation Monitoring by Thermoluminescent Dosimeters (TLDs) was missing data from one sample location for one quarterly sample period. This issue was documented in Condition Report 11-88282.

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SECTION 1 - INTRODUCTION

A. Radiation Fundamentals

Radiation is the conveyance of energy through space. For example, heat emanating from a stove is a form of radiation, as are light rays, microwaves, and radio waves. All matter consists of atoms, which are comprised of positively charged particles (protons), negatively charged particles (electrons), and non-charged/neutral particles (neutrons). The relatively large particles (protons and neutrons) are packed tightly together in a cluster at the center of the atom called the nucleus, while the smaller particles (electrons) orbit around the nucleus. In an electrically neutral atom, the negative charges of the electrons are balanced by the positive charges of the protons. Due to their dissimilar charges, the protons and electrons have a strong attraction for each other. This holds the atom together. Other attractive forces between the protons and neutrons keep the densely packed protons from repelling each other, and prevent the nucleus from breaking apart.

B. Radiation and Radioactivity

The following provides an alphabetical glossary of terms associated with radiation, radioactivity, and the radioactive decay process. The terms discussed include Alpha Particles, Beta Particles, Gamma Rays, Genetic Effects, Half-life, Ionization, Isotopes, Neutrons, Radiation, Radioactive Decay, Radionuclides and Somatic Effects.

Alpha Particles: Particulate and electromagnetic radiation each travel through matter differently because of their different properties. Alpha particles contain 2 protons and 2 neutrons, are relatively large, and carry an electrical charge of +2. Alpha particles are ejected from the nucleus of a radioactive atom at speeds ranging from 2,000 to 20,000 miles per second. However, due to its comparatively large size, an alpha particle usually does not travel very far before it loses most of its energy through collisions and interactions with other atoms. As a result, a sheet of paper or a few centimeters of air can easily stop alpha particles.

Beta Particles: Beta Particles: Beta particles are very small, and comparatively fast particles, traveling at speeds near the speed of light (186,000 miles per second). Beta particles have an electrical charge of either +1 or -1. Because they are so small and have a low charge, they do not collide and interact as often as alpha particles, so they can travel farther. Beta particles can usually travel through several meters of air, but may be stopped by a thin piece of metal or wood.

Gamma Rays: Gamma rays are pure energy and travel at the speed of light. They have no measurable charge or mass, and generally travel much farther than alpha or beta particles before being absorbed. After repeated interactions, the gamma ray loses its energy and vanishes. The range of a gamma ray in air varies, depending on the ray's energy and interactions. Very high-energy gamma radiation can travel a considerable distance, where as, low energy gamma radiation may travel only a few feet in air. Lead is used as shielding material for gamma radiation because of its density. Several inches of Lead or concrete may be needed to effectively shield gamma rays.

Genetic Effects: The effects of ionizing radiation which are observed in the offspring of the exposed individual that could occur as a result of ionizing radiation interacting with the genes in the human cells.

Half-life: The length of time an atom remains radioactive is defined in terms of half-life, which is the amount of time required for a radioactive substance to lose half of its activity through the process of radioactive decay. Radionuclides that have infrequent emissions have a long half-life, where as, radionuclides that have more frequent emissions have a short half-life.

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Ionization: Through interactions with atoms, alpha, beta, and gamma radiation lose their energy. When these forms of radiation interact with any form of material, the energy they impart may cause atoms in that material to become **ions**, or charged particles. Normally, an atom has the same number of protons as electrons, thus, the number of positive and negative charges cancel, in which the atom is electrically neutral. When one or more electrons are removed, an ion is formed. Ionization is one of the processes that may result in damage to biological systems.

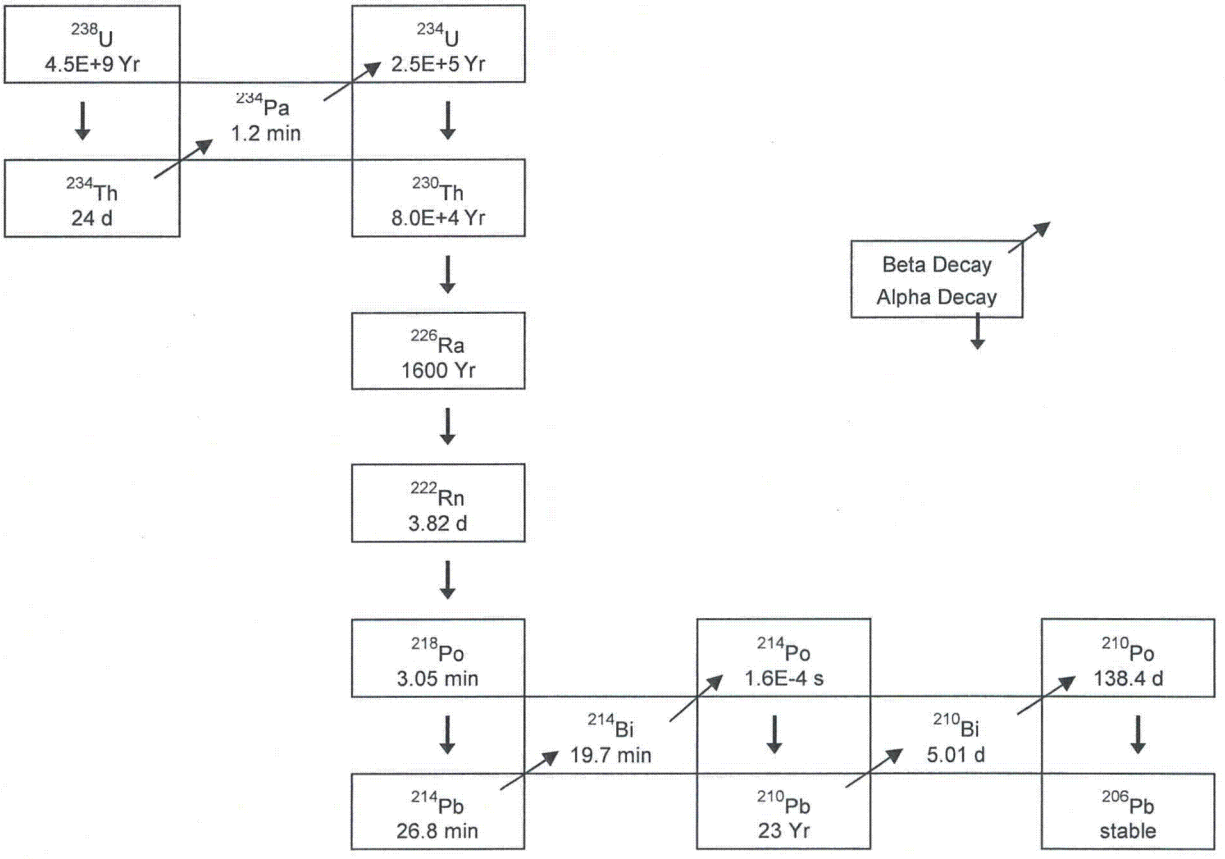
Isotopes: A group of identical atoms containing the same number of protons make up an element. In fact, the number of protons an atom contains determines its chemical identity. For instance, all atoms with one proton are hydrogen atoms, and all atoms with eight protons are oxygen atoms. However, the number of neutrons in the nucleus of an element may vary. Atoms with the same number of protons but different numbers of neutrons are called isotopes. Different isotopes of the same element have the same chemical properties, and many are stable or non-radioactive. An unstable or radioactive isotope of an element is called a radioisotope, a radioactive atom, or a radionuclide. Radionuclides usually contain an excess amount of energy in the nucleus. The excess energy is usually due to a surplus or deficit in the number of neutrons in the nucleus. Radionuclides such as Uranium-238, Berylium-7 and Potassium-40 occur naturally. Others are man-made, such as Iodine-131, Cesium-137, and Cobalt-60.

Neutrons: Neutrons come from several sources, including the interactions of cosmic radiation with the earth's atmosphere and nuclear reactions within operating nuclear power reactors. However, neutrons are not of environmental concern since the neutron source at nuclear power stations is sealed within the containment building. Because neutrons have no charge, they are able to pass very close to the nuclei of the material through which they are traveling. As a result, neutrons may be captured by one of these nuclei or they may be deflected. When deflected, the neutron loses some of its energy. After a series of these deflections, the neutron has lost most of its energy. At this point, the neutron moves about as slowly as the atoms of the material through which it is traveling, and is called a thermal neutron. In comparison, fast neutrons are much more energetic than thermal neutrons and have greater potential for causing damage to the material through which they travel. Fast neutrons can have from 200 thousand to 200 million times the energy of thermal neutrons. Neutron shielding is designed to slow fast neutrons and absorb thermal neutrons. Neutron shielding materials commonly used to slow neutrons down are water or polyethylene. The shield is then completed with a material such as Cadmium, to absorb the now thermal neutrons. Concrete is also used to form an effective neutron shield because it contains water molecules and can be easily molded around odd shapes.

Radiation: This is the conveyance of energy through space. For instance, heat emanating from a stove is a form of radiation, as are light rays, microwaves, and radio waves. Ionizing radiation is another type of radiation and has similar properties to those of the examples listed above. Ionizing radiation consists of both electromagnetic radiation and particulate radiation. Electromagnetic radiation is energy with no measurable mass that travels with a wave-like motion through space. Included in this category are gamma rays and X-rays. Particulate radiation consists of tiny, fast moving particles which, if unhindered, travel in a straight line through space. The three types of particulate radiation of concern to us are alpha particles, which are made up of 2 protons and 2 neutrons; beta particles, which are essentially free electrons; and neutrons. The properties of these types of radiation will be described more fully in the Range and Shielding section.

SECTION 1 - INTRODUCTION

Radioactive Decay: Radioactive atoms, over time, will reach a stable, non-radioactive state through a process known as radioactive decay, which is the release of energy from an atom through the emission of ionizing radiation. Radioactive atoms may decay directly to a stable state or may go through a series of decay stages, called a radioactive decay series, and produce several daughter products that eventually result in a stable atom. The loss of energy through radioactive decay may transform the atom into a chemically different element. For example, when Uranium-238 decays, it emits an alpha particle and, as a result, the atom loses 2 protons and 2 neutrons. Since the number of protons in the nucleus of an atom determines its chemical identity, then when the Uranium-238 atom loses the 2 protons and 2 neutrons, it is transformed into an atom of Thorium-234. Thorium-234 is one of the 14 successive daughter products of Uranium-238. Radon is another daughter product, and the decay series ends with stable Lead-206. The following example is part of a known radioactive decay series, called the Uranium series, which begins with Uranium-238 and ends with Lead-206. The information provided in the upper portion of each block is the isotope name, while the information provided in the lower portion of each block is the half-life.



Radionuclides: See description for "isotopes".

Somatic Effects: The effects of ionizing radiation which develop in the directly exposed individual, including an unborn child. Somatic effects can be divided further into acute and chronic effects. Acute effects develop shortly after exposure to large amount of radiation. Chronic effects are a result of exposure to radiation over an extended period of time.

SECTION 1 - INTRODUCTION

C. Units of Measurement

Activity (Curie): This relates the number of atoms in a sample that disintegrate (decay) per unit of time. Each time an atom disintegrates, radiation is emitted. The curie (Ci) is the unit used to describe the activity of a material and indicates the rate at which the atoms of a radioactive substance are decaying. One curie indicates the disintegration of 37 billion atoms per second. A curie is a unit of activity, not a quantity of material. Thus, the amount of material required to produce one curie varies. A smaller unit of the curie is used when discussing the low concentrations of radioactivity detected in environmental samples. For instance, the picocurie (pCi) represents one trillionth of a curie.

Absorbed Dose (rad): This is a term used to describe the radiation energy absorbed by any material exposed to ionizing radiation, and can be used for both particulate and electromagnetic radiation. The rad is the unit used to measure the absorbed dose. It is defined as the energy of ionizing radiation deposited per gram of absorbing material (1 rad = 100 erg/gm). The rate of absorbed dose is usually given in rad/hr. The rad is not used to quantify biological damage caused by ionizing radiation.

Dose Equivalent (rem): Biological damage due to alpha, beta, gamma and neutron radiation may result from ionizing radiation. Some types of radiation, especially alpha particles which cause dense local ionization, can result in up to 20 times the amount of biological damage for the same energy imparted as do gamma or X-rays. Therefore, a quality factor must be applied to account for the different ionizing capabilities of various types of ionizing radiation. When the quality factor is multiplied by the absorbed dose (Rad), the result is the dose equivalent, which is an estimate of the possible biological damage resulting from exposure to a particular type of ionizing radiation. The dose equivalent is measured in rem. An example of this conversion from absorbed dose (rad) to dose equivalent (rem) uses the quality factor for alpha radiation, which is equal to 20. Thus, 1 Rad of alpha radiation = 20 rem. Since beta and gamma radiation each have a quality factor of 1, then 1 Rad of either beta or gamma radiation = 1 rem. Neutrons have a quality factor ranging from 2 to 10. In terms of radiation, the rem is a relatively large unit. Therefore, a smaller unit, the millirem, is often used, where as, one millirem (mrem) is equal to 1/1000 of a rem.

D. Lower Limit of Detection

The Lower Limit of Detection (LLD) for environmental samples is a calculated value that represents an a-priori (before-the-fact) limit for the smallest concentration (i.e.; pCi per unit mass or volume) of radioactive material in a sample that will be detected with 95% probability, and with 5% probability of falsely concluding that a blank observation represents a real signal. A calculated LLD must consider such analytical variables as standard deviation of the background counting rate, the counting efficiency, the sample size, the fractional radiochemical yield, the radioactive decay constant, and the elapsed time between sample collection and time of counting.

E. Scope and Objectives of the REMP Program

The environmental program consists of environmental monitoring for radioactivity in the vicinity of BVPS. Environmental sampling and analyses include air, water, milk, vegetation, river sediments, fish, and ambient radiation levels in areas surrounding the site. The results of these media are assessed to determine impacts of the plant operation on the environment. The Annual Radiological Environmental Operating Report (AREOR) for BVPS summarizes the Radiological Environmental

SECTION 1 - INTRODUCTION

Monitoring Program (REMP) conducted by the FirstEnergy Nuclear Operating Company during the report period.

F. Description of the Beaver Valley Site

BVPS is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 453 acre tract of land. The site is approximately one mile from Midland, Pennsylvania; five miles from East Liverpool, Ohio; and twenty-five miles from Pittsburgh, Pennsylvania. Figure 1-1 shows the site location in relation to the principal population centers. Population density in the immediate vicinity of the site is relatively low. The population within a five mile radius of the plant is approximately 15,493 and the only area within the radius, of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 3,321.

The site lies in a valley along the Ohio River. It extends from the river (elevation 665 feet above sea level) to a ridge along the border south of the Beaver Valley Power Station at an elevation of 1,078 feet. Plant grade level is approximately 735 feet above sea level.

BVPS is on the Ohio River at river mile 34.8, at a location on the New Cumberland Pool that is 3.3 river miles downstream from Montgomery Lock and Dam, and 19.4 miles upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is located 5.2 river miles downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela and Ohio Rivers and their tributaries. During the report period, the Ohio River flow (as obtained from the Corps of Engineers – Water Resources Engineering) at the New Cumberland Dam ranged from 7,800 cubic feet per second (minimum monthly average) to 83,800 cubic feet per second (maximum monthly average). The mean flow during the report period was 33,900 cubic feet per second.

Water temperature of the Ohio River typically varies from 34° Fahrenheit to 75° Fahrenheit. The minimum temperatures occur in January and/or February and maximum temperatures in July and/or August. Water quality in the Ohio River at the site location is affected primarily by the water quality of the Allegheny, Monongahela and Beaver rivers.

The climate of the area may be classified as humid continental. The predominant wind direction is typically from the southwest in summer and from the west southwest in winter. The National Climate Data Center (http://www.ncdc.noaa.gov/oa/climate/research/cag3/v4.html) indicates the following data for the Pittsburgh, PA area:

- The total annual precipitation during the report period was 37.18 inches
- The average mean temperature during the report period was 51.8° Fahrenheit

SECTION 1 - INTRODUCTION

The basic features of the Beaver Valley Power Station Units 1 and 2 are tabulated below:

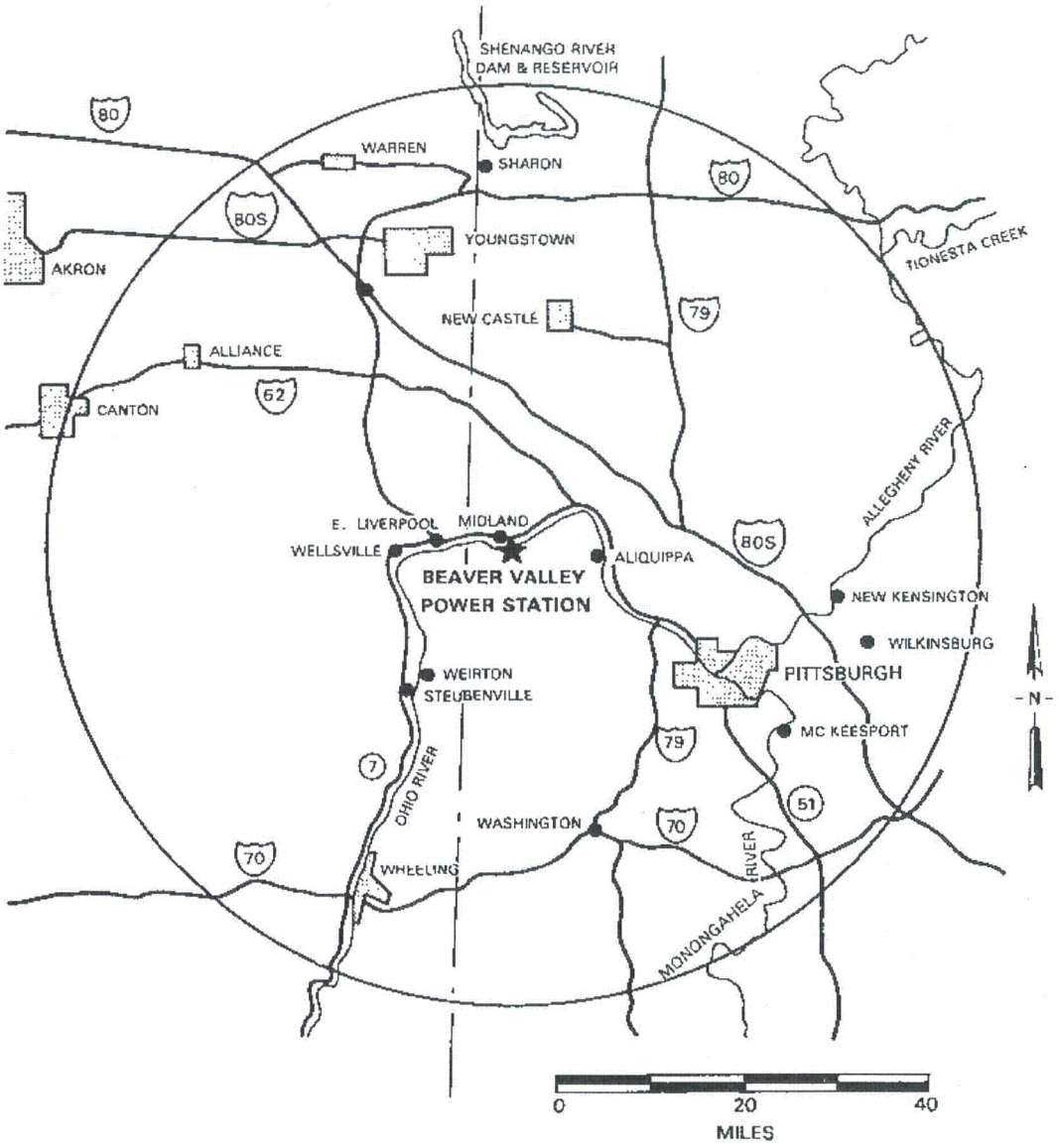
	Beaver Valley Unit 1	Beaver Valley Unit 2
Licensed Power Level	2900 – megawatts thermal	2900 – megawatts thermal
Type of Power	PWR	PWR
No. of Reactor Coolant Loops	3	3
No. of Steam Generators & Type	3 - Vertical	3 - Vertical
Steam Used by Main Turbine	Saturated	Saturated

The BVPS units utilize two separate systems (primary and secondary) for transferring heat from the source (the reactor) to the receiving component (turbine-generator). Because the two systems are isolated from each other, primary and secondary waters do not mix; therefore, radioactivity in the primary system water is normally isolated from the secondary system. Reactor coolant in the primary system is pumped through the reactor core and steam generators by means of reactor coolant pumps. Heat is given up from the primary system to the secondary system in the steam generators, where steam is formed and delivered to the main unit turbine, which drives the electrical generator. The steam is condensed after passing through the turbine, and returned to the steam generators to begin another steam/water cycle.

SECTION 1 - INTRODUCTION

Figure 1-1

Geographical Map and Principal Communities in 50-mile Radius of the Beaver Valley Power Station



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

A. Radiological Environmental Monitoring Program

1. Program Description

The program consists of monitoring water, air, soil, river bottoms (sediment), feedstuff, vegetation, foodcrops, cow's milk, ambient radiation levels in areas surrounding the site, and aquatic life as summarized in Table 2-1. Further description of each portion of the program (Sampling Methods, Sample Analysis, Discussion and Results) are included in Sections 2-B through 2-I of this report.

2-B - **Air Monitoring**

2-C - **Monitoring of Shoreline Stream Sediment and Soil**

2-D - **Monitoring of Feedstuff and Foodcrops**

2-E - **Monitoring of Local Cow and Goat Milk**

2-F - **Environmental Radiation Monitoring**

2-G - **Monitoring of Fish**

2-H - **Monitoring of Surface Water, Drinking Water, Groundwater and Precipitation**

2-I - **Estimates of Radiation Dose to Man**

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1

Operational Radiological Environmental Monitoring Program

Section	Sample Type	Sample Site No.	Sample Location	Sample Frequency	Sample Preparation / Analysis Frequency	Analysis
1	Air Particulate & Radionuclide	13	Hookstown, PA (Old Meyer Farm)	Continuous Sampling with Sample Collection at least weekly	Weekly - Air Particulate Weekly – Charcoal Quarterly Composite [c]	Gross Beta [b] Iodine-131 Gamma Scan
		27	Aliquippa, PA (Brunton Farm)			
		28	Sherman Farm			
		29B	Beaver, Pa (Friendship Ridge)			
		30	Shippingport, PA (Cook's Ferry Substation)			
		32	Midland, PA (North Substation)			
		46.1	Industry, PA (McKeel's Service - Rt. 68)			
		47	East Liverpool, OH (Water Department)			
		48 [a]	Weirton, WV (Water Tower - Collier Way)			
		51	Aliquippa, PA (Sheffield Substation)			
2	Direct Radiation	10	Shippingport, PA (Post Office)	Continuous (TLD)	Quarterly [i]	Gamma Dose
		13	Hookstown, PA (Old Meyer Farm)			
		14	Hookstown, PA			
		15	Georgetown, PA (Post Office)			
		27	Aliquippa, PA (Brunton Farm)			
		28	Sherman Farm			
		29B	Beaver, PA (Friendship Ridge)			
		30	Shippingport, PA (Cook's Ferry Substation)			
		32	Midland, PA (North Substation)			
		33-44	BVPS Site Perimeter Locations			
		45	Raccoon Township, PA (Christian House Baptist Chapel - Rt. 18)			
		45.1	Raccoon Township, PA (Kennedy's Corner)			
		46	Industry, PA (Midway Drive)			
		46.1	Industry, PA (McKeel's Service - Rt. 68)			
		47	East Liverpool, OH (Water Department)			
		48 [a]	Weirton, WV (Water Tower - Collier Way)			
		51	Aliquippa, PA (Sheffield Substation)			
		52-56	BVPS Site Perimeter Locations			
		59	236 Green Hill Road			
		60	Georgetown, PA (444 Hill Road)			
		70	Industry, PA (236 Engle Road)			
		71	Brighton Township, PA (First Western Bank)			
		72	Ohioview, PA (Lutheran Church – Rear)			
		73	618 Squirrel Run Road			
		74	Monaca, PA (37 Poplar Avenue – CCBC)			
		75	Aliquippa, PA (117 Holt Road)			
		76	Raccoon Township, PA (Elementary School)			
		77	Aliquippa, PA (3614 Green Garden Road)			
		78	Raccoon Township, PA (Municipal Building)			
		79	106 Rt. 151 - Ted McWilliams Auto Body			
		80	Raccoon Township, PA (Park Office -Rt. 18)			
		81	Millcreek United Presbyterian, Church			
		82	2697 Rt. 18			
		83	735 Mill Creek Road			
		84	Hancock County, WV (Senior Center)			
		85	2048 Rt. 30			
		86	East Liverpool, OH (1090 Ohio Avenue)			
		87	50103 Calcutta Smith's Ferry Road			
		88	Midland, PA (110 Summit Road)			
		89	Ohioville, PA (488 Smith Ferry Road)			
		90	Midland, PA (6286 Tuscarawras Road)			
		91	Pine Grove Road & Doyle Road			
		92	Georgetown, PA (Georgetown Road Substation)			
		93	104 Linden - Sunrise Hills			
		94	Hookstown, PA (McCleary & Pole Cat Hollow Roads)			
		95	Hookstown, PA (832 McCLeary Road)			
		111-112	BVPS Site Perimeter Locations			

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1

Operational Radiological Environmental Monitoring Program

Section	Sample Type	Sample Site No.	Sample Location	Sample Frequency	Sample Preparation / Analysis Frequency	Analysis
3	Surface Water	49A [a]	Industry, PA (Upstream of Montgomery Dam)	Weekly Grab Sample [h]	Weekly Sample from Site49 only	Iodine-131
		2.1	Midland, PA (ATI Allegheny Ludlam)	Weekly Intermittent Composite Sample [h]	Monthly Composite of Weekly Sample [c]	Gamma Scan
		5	East Liverpool, OH (Water Department)	Daily Grab Sample Collected Weekly [h]	Quarterly Composite [c]	Tritium (H-3)
4	Groundwater	11 [a] 14A 15B	Shippingport, PA (Upstream) Hookstown, PA (Downstream) Georgetown, PA (Downstream)	Semi-Annual	Semi-Annual	Gamma Scan Tritium (H-3)
5	Drinking Water	4 5	Midland, PA (Water Department) East Liverpool, OH (Water Department)	Intermittent [d] Sample Collected Weekly	Weekly Composite of Daily sample [d] Monthly Composite [d] Quarterly Composite [d]	Iodine-131 Gamma Scan Tritium (H-3)
6	Shoreline Sediment	2A 49A[a] 50	BVPS Outfall Vicinity Industry, PA (Upstream of Montgomery Dam) New Cumberland, WV (Upstream of Dam)	Semi-Annual	Semi-Annual	Gamma Scan
7	Milk	25	Hookstown, PA (Searight Farm)	Weekly [e]	Weekly Samples from Searight only	Weekly Iodine-131 from Searight only
		27 [k] 69 [k] 96 [a] 102 [k] 113 [k]	Aliquippa, PA (Brunton Farm) Aliquippa, PA (Collins Farm) Burgettstown, PA (Windsheimer Farm) Aliquippa, PA (Ferry Farm) Hookstown, PA (Halstead Farm)	Biweekly [f] When animals are on pasture; monthly at other times	All other samples & analyses are Biweekly during grazing, but Monthly during other times	Gamma Scan Iodine-131 Strontium-89 Strontium-90
8	Fish	2A 49A[a]	BVPS Outfall Vicinity Industry, PA (Upstream of Montgomery Dam)	Semi-Annual	Composite of edible parts by species [g]	Gamma Scan on edible parts
9	Food Products	10A/B 15A 46A 48A[a]	Shippingport, PA Georgetown, PA Industry, PA Weirton, WV	Annual at Harvest if available	Composite of each sample species	Gamma Scan Iodine-131 on green leafy vegetables
10	Feedstuff & Summer Forage	25	Hookstown, PA (Searight Farm)	Monthly	Monthly	Gamma Scan
11	Soil	13A 22 27B 29A 30A 32A 46B 47A 48 [a] 51A	Hookstown, PA (Old Meyer Farm) South of BVPS, Transmission Lines Aliquippa, PA (Brunton Farm) Beaver, PA (Nicol Farm) Shippingport, PA (Cook's Ferry Substation) Midland, PA (North Substation) Industry, PA (Willows Inn - Rt. 68) East Liverpool, OH (Water Department) Weirton WV (Water Tower - Collier Way) Aliquippa, PA (Sheffield Substation)	Every Three (3) Years (1997, 2000, 2003)	12 Core Samples 3" Deep (2" diameter at each location approx. 10' radius)	Gamma Scan
12	Precipitation	30 47 48 [a]	Shippingport, PA (Cook's Ferry Substation) East Liverpool, OH (Water Department) Weirton WV (Water Tower–Collier Way)	Weekly grab samples when available	Quarterly Composite [c]	Gamma Scan Tritium (H-3)

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1

Operational Radiological Environmental Monitoring Program

Notes for Table 2-1

(a) Control Sample Station: These Locations which are presumed to be outside the influence of plant effluents.

(b) Particulate Samples are not counted within 24 hours after filter change. Perform Gamma isotopic analysis on each sample when gross beta is greater than 10 times the yearly mean of control samples.

(c) Long-term composite samples are obtained from short-term composite samples at the specified locations.

(d) Composite samples are collected at intervals not exceeding 2 hours.

(e) Weekly milk sample from the Searight Dairy is analyzed for Iodine-131 only.

(f) Milk samples are collected bi-weekly when animals are grazing. The milk samples are collected monthly at other times.

(g) The fish samples contain whatever species are available.
IF adequate sample size is available, THEN the sample is separated according to species, and compositing will provide one sample of each species.
IF adequate sample size is not available, THEN separation by species is not practical. Therefore edible parts of all fish in the sample are mixed to provide one sample.

(h) Composite samples are obtained by collecting an aliquot at intervals not exceeding 2 hours at location 2.1. The water treatment plant operator at location 5 obtains the weekly grab sample from the daily composite grab samples. For location 49A, the weekly grab sample is obtained by a field technician.

(i) Two (2) TLDs are collected quarterly from each monitoring location.

(k) ODCM procedure 1/2-ODC-3.03, Attachment Q, Table 3.12-1 requires three (3) dairies to be selected on basis of highest potential thyroid dose using milch census data. See Section 2-E of this report (Monitoring of Local Cows Milk) for specific locations sampled.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

2. Summary of Results

All results of this monitoring program are summarized in Table 2-2. This table is prepared in the format specified by the NRC via the Branch Technical Position in NUREG-1301, and in accordance with Beaver Valley Power Station Offsite Dose Calculation Manual. Summaries of results of analysis of each media are discussed in Sections 2-B through 2-H and an assessment of radiation doses are given in Section 2-I. Table 2-3 summarizes BVPS pre-operational ranges for the various sampling media during the years 1974 and 1975. Comparisons of pre-operational data with operational data indicate the ranges of values are generally in good agreement for both periods of time.

Activity detected was attributed to naturally occurring radionuclides, BVPS effluents, previous nuclear weapons tests or to the normal statistical fluctuation for activities near the Lower Limit of Detection (LLD).

The conclusion from all program data is that the operation of BVPS has resulted in no significant changes to the environment.

3. Quality Control Program

The Quality Control Program implemented by BVPS to assure reliable performance by the contractor and the supporting QC data are presented and discussed in Section 4 of this report.

4. Program Changes

There were no changes of significance to the sampling program during the report period.

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Air Particulate and Radioiodine
Unit of Measurement: (pico Curies / cubic meter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gross Beta 530	< 0.002	0.024 (477 / 477) 0.010 - 0.05	No. 47 East Liverpool, OH Water Department 4.9 miles WNW	0.025 (53 / 53) 0.010 - 0.046	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	0.024 (53 / 53) 0.010 - 0.045	0
I-131 530	< 0.04	LLD (0 / 477)		LLD (0 / 477)		LLD (0 / 53)	0
Gamma 40							
Be-7	NA	0.081 (36 / 36) 0.063 - 0.105	No. 32 Midland, PA North Substation 0.8 miles NW	0.089 (4 / 4) 0.080 - 0.102	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	0.080 (4 / 4) 0.060 - 0.095	NA
Co-60	NA	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	NA
Cs-134	< 0.0005	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	0
Cs-137	< 0.0005	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	0
Ba-La-140	NA	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	NA

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Drinking Water
Unit of Measurement: (pico Curies / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
I-131 158	< 0.5	0.7 (56 / 106) 0.3 - 1.5	No. 5 East Liverpool Water 4.9 miles WNW	0.7 (28 / 53) 0.3 - 1.5	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.8 (45 / 52) 0.2 - 2.1	0
H-3 12	< 200	259 (1 / 8)	No. 5 East Liverpool Water 4.9 miles WNW	259 (1 / 4)		LLD (0 / 4)	0
Gamma 36							
Mn-54	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Fe-59	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-58	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-60	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zn-65	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zr-Nb-95	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-134	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-137	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Ba-La-140	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Surface Water
Unit of Measurement: (pico Curies / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
I-131 52	< 0.5				No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.8 (45 / 52) 0.2 - 2.1	0
H-3 12	< 200	274 (1 / 8)	No. 5 East Liverpool Water 4.9 miles WNW	274 (1 / 4)		LLD (0 / 4)	0
Gamma 36							
Mn-54	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Fe-59	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-58	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-60	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zn-65	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zr-Nb-95	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-134	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-137	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Ba-La-140	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Ground Water
Unit of Measurement: (pico Curies / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
H-3 6	< 200	LLD (0 / 4)		LLD (0 / 4)	No. 11 Shippingport, PA Upstream 0.8 miles NE	LLD (0 / 2)	0
Gamma 6							
Mn-54	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Fe-59	< 10	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Co-58	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Co-60	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Zn-65	< 10	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Zr-Nb-95	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Cs-134	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Cs-137	< 5	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Ba-La-140	< 10	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Precipitation Water
Unit of Measurement: (pico Curies / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
H-3 12	< 200	LLD (0 / 8)		LLD (0 / 8)	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	LLD (0 / 4)	0
Gamma 12							
Mn-54	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Fe-59	< 10	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Co-58	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Co-60	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Zn-65	< 10	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Zr-Nb-95	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Cs-134	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Cs-137	< 5	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Ba-La-140	< 10	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Milk
Unit of Measurement: (pico Curies / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
I-131 112	< 0.5	LLD (0 / 92)		LLD (0 / 92)		LLD (0 / 20)	0
Sr-89 80	< 2.0	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Sr-90 80	< 0.7	1.0 (45 / 60) 0.5 - 2.2	No. 25 Hookstown, PA Searight's Dairy 2.1 miles SSW	1.5 (20 / 20) 0.9 - 2.2	No. 96 Burgettstown, PA Windsheimer Farm 10.4 miles SSW	1.1 (20 / 20) 0.7 - 2.0	NA
Gamma 80							
K-40	< 150	1309 (60 / 60) 1091 - 1576	No. 113 Hookstown, PA Halstead Farm 5.1 miles SSW	1387 (20 / 20) 1256 - 1576	No. 96 Burgettstown, PA Windsheimer Farm 10.4 miles SSW	1367 (20 / 20) 1214 - 1558	NA
Mn-54	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Fe-59	< 10	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Co-58	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Co-60	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Zn-65	< 10	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Zr-Nb-95	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	NA
Cs-134	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	0
Cs-137	< 5	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	0
Ba-La-140	< 10	LLD (0 / 60)		LLD (0 / 60)		LLD (0 / 20)	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Fish
Unit of Measurement: (pico Curies / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gamma					No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE		
Mn-54	< 0.05	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Fe-59	< 0.10	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Co-58	< 0.05	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Co-60	< 0.05	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Zn-65	< 0.10	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Zr-Nb-95	< 0.01	LLD (0 /)		LLD (0 /)		LLD (0 /)	NA
Cs-134	< 0.05	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Cs-137	< 0.05	LLD (0 /)		LLD (0 /)		LLD (0 /)	0
Ba-La-140	< 0.01	LLD (0 /)		LLD (0 /)		LLD (0 /)	NA

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Foodcrops
Unit of Measurement: (pico Curies / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
I-131 4	< 0.06	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	0
Gamma 4							
K-40	NA	2.46 (3 / 3) 2.22 - 2.63	No. 46A Industry, PA 1.7 miles NNE	2.63 (1 / 1) 2.63 - 2.63	No. 48B Weirton, WV 16.5 miles SSW	4.21 (1 / 1) 4.21 - 4.21	NA
Mn-54	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Fe-59	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Co-58	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Co-60	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Zn-65	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Zr-Nb-95	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA
Cs-134	0.04	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	0
Cs-137	0.06	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	0
Ba-La-140	NA	LLD (0 / 3)		LLD (0 / 3)		LLD (0 / 1)	NA

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Feedstuff
Unit of Measurement: (pico Curies / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gamma 12							
Be-7	< 0.2	0.54 (5 / 12) 0.33 - 1.03	No. 25 Searight Farm 948 McCleary Road Hookstown, PA 2.1 miles SSW	0.54 (5 / 12) 0.33 - 1.03	No. 25 Searight Farm 948 McCleary Road Hookstown, PA 2.1 miles SSW	0.54 (5 / 12) 0.33 - 1.03	NA
K-40	< 0.15	9.52 (12 / 12) 5.05 - 11.10	No. 25 Searight Farm 948 McCleary Road Hookstown, PA 2.1 miles SSW	9.52 (12 / 12) 5.05 - 11.10	No. 25 Searight Farm 948 McCleary Road Hookstown, PA 2.1 miles SSW	9.52 (12 / 12) 5.05 - 11.10	NA
Mn-54	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Fe-59	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Co-58	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Co-60	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Zn-65	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Zr-Nb-95	< 0.03	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Ru-103	< 0.03	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
I-131	< 0.06	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Cs-134	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Cs-137	< 0.06	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Ba-La-140	< 0.01	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Sediment (page 1 of 2)
Unit of Measurement: (pico Curies / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gamma 6							
K-40	NA	9.70 (4 / 4) 8.58 - 10.88	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	10.14 (2 / 2) 9.39 - 10.88	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	12.28 (2 / 2) 11.23 - 13.33	NA
Mn-54	< 0.02	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Fe-59	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Co-58	< 0.02	0.19 (2 / 4) 0.09 - 0.28	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	0.28 (1 / 2) 0.28 - 0.28		LLD (0 / 2)	NA
Co-60	< 0.02	0.41 (2 / 4) 0.40 - 0.41	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.41 (1 / 2) 0.41 - 0.41		LLD (0 / 2)	NA
Zn-65	< 0.04	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Zr-95	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Nb-95	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Cs-134	< 0.06	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Cs-137	< 0.08	0.09 (4 / 4) 0.05 - 0.12	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.09 (2 / 2) 0.05 - 0.12	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.10 (2 / 2) 0.09 - 0.10	0
Ba-La-140	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Tl-208	NA	0.30 (4 / 4) 0.27 - 0.33	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	0.31 (2 / 2) 0.29 - 0.33	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.35 (2 / 2) 0.31 - 0.39	NA

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Sediment (page 2 of 2)
Unit of Measurement: (pico Curies / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Bi-214	NA	0.79 (4 / 4) 0.70 - 0.92	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	0.81 (2 / 2) 0.70 - 0.92	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.92 (2 / 2) 0.87 - 0.96	NA
Pb-212	NA	1.08 (4 / 4) 0.97 - 1.18	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	1.08 (2 / 2) 0.97 - 1.18	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.14 (2 / 2) 1.12 - 1.15	NA
Pb-214	NA	0.88 (4 / 4) 0.76 - 0.97	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	0.91 (2 / 2) 0.84 - 0.97	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.08 (2 / 2) 0.92 - 1.23	NA
Ra-226	NA	1.67 (4 / 4) 1.45 - 1.79	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	1.71 (2 / 2) 1.67 - 1.74	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.97 (2 / 2) 1.77 - 2.16	NA
Ac-228	NA	1.02 (4 / 4) 0.94 - 1.12	No. 50 Upstream of New Cumberland Dam 11.8 miles WSW	1.04 (2 / 2) 0.95 - 1.12	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.16 (2 / 2) 1.11 - 1.21	NA

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Soil (page 1 of 2)
Unit of Measurement: (pico Curies / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gamma							
Note: Soil Sampling performed every three (3) years. Sampling was performed in 2009, and is next due in 2012.							
K-40							
Mn-54							
Fe-59							
Co-58							
Co-60							
Zn-65							
Zr-95							
Nb-95							
Cs-134							
Cs-137							

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2010

Medium: Soil (page 2 of 2)
Unit of Measurement: (pico Curies / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Note: Soil Sampling performed every three (3) years. Sampling was performed in 2009, and is next due in 2012.							
Ba-La-140							
Tl-208							
Bi-214							
Pb-212							
Pb-214							
Ra-226							
Ac-228							

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2
Docket No.: 50-334 / 50-412
Location of Facility: Beaver County, Pennsylvania
Reporting Period: Calendar Year - 2006

Medium: External Radiation
Unit of Measurement: (mR / Quarter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD [a]	All Indicator Locations Mean (fraction) [b] Range [b]	Locations with Highest Annual Mean Name Distance and Direction	Mean (fraction) [b] Range [b]	Control Location Name Distance and Direction	Mean (fraction) [b] Range [b]	Number of Nonroutine Reported Measurements [c]
Gamma 510	4.6	18.6 (502 / 502) 12.5 - 26.1	No. 35 BVPS Site Perimeter Location 0.1 miles NNE/NE	23.5 (8 / 8) 21.8 - 26.1	No. 48 Weirton, WV Water Tower Collier Way 16.4 miles SSW	20.8 (8 / 8) 19.0 - 22.6	0

[a] Nominal Lower Limit of Detection

[b] Mean and range based upon detectable measurements only.
Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

[c] Nonroutine Reported Measurements (Reference: ODCM procedure 1/2-ODC-3.03, Attachment Q, Control 3.12.1)

NA = Not Applicable (Naturally Occurring Radionuclides Not required by ODCM)

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility: Beaver Valley Power Station **Docket No.:** 50-334
Location of Facility: Beaver County, Pennsylvania **Reporting Period:** Calendar years 1974 - 1975

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean, (f) Range		
Sediments (pico Curie /gram) dry	Gross Alpha	(0)	--		--	
	Gross Beta	(33)	1	18	(33/33)	5 - 30
	Sr-90	(0)	--		--	
	U-234, 235, 238	(0)	--		--	
	Gamma	(33)	--	13	(33/33)	2 - 30
	K-40		1.5	13	(33/33)	2 - 30
	Cs-137		0.1	0.4	(21/33)	0.1 - 0.6
	Zr/Nb-95		0.05	0.8	(12/33)	0.2 - 3.2
	Ce-144		0.3	0.5	(3/33)	0.4 - 0.7
	Ru-106(a)		0.3	1.5	(3/33)	1.3 - 1.8
	Others		--		< LLD	
Foodcrops (pico Curie /gram) dry	Gamma	(8)	--		--	
	K-40		1	33	(8/8)	10 - 53
	Cs-137		0.1	0.2	(1/8)	--
	Zr/Nb-95		0.05	0.2	(1/8)	--
	Ru-106(a)		0.3	0.8	(1/8)	--
	Others		--		< LLD	
Feedstuff (pico Curie /gram) dry	Gross Beta	(80)	0.05	19	(80/80)	8 - 50
	Sr-89	(81)	0.025	0.2	(33/81)	0.04 - 0.93
	Sr-90	(81)	0.005	0.4	(78/81)	0.02 - 0.81
	Gamma	(81)	--		--	
	K-40		1	19	(75/81)	5 - 46
	Cs-137		0.1	0.5	(6/81)	0.2 - 1.6
	Ce-144		0.3	1.5	(5/81)	0.9 - 2.6
	Zr/Nb-95		0.05	0.8	(13/81)	0.2 - 1.8
	Ru-106(a)		0.3	1.4	(12/81)	0.6 - 2.3
	Others		--		< LLD	
Soil - Template Samples - (pico Curie /gram) dry	Gross Alpha	(0)	--		--	
	Gross Beta	(64)	1	22	(64/64)	14 - 32
	Sr-89	(64)	0.25	0.4	(1/64)	--
	Sr-90	(64)	0.05	0.3	(48/64)	0.1 - 1.3
	U-234, 235, 238	(0)	--		--	
	Gamma	(64)	--		--	
	K-40		1.5	13	(63/64)	5 - 24
	Cs-137		0.1	1.5	(56/64)	0.1 - 6.8
	Ce-144		0.3	1.1	(7/64)	0.2 - 3
	Zr/Nb-95		0.05	0.3	(13/64)	0.1 - 2
	Ru-106(a)		0.3	1.1	(3/64)	0.5 - 2
	Others		--		< LLD	

(f) Fraction of detectable measurements at specified location.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility: Beaver Valley Power Station **Docket No.:** 50-334
Location of Facility: Beaver County, Pennsylvania **Reporting Period:** Calendar years 1974 - 1975

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean, (f) Range		
Soil	Gross Alpha	(0)	--		--	
- Core Samples -	Gross Beta	(8)	1	21	(8/8)	16 - 28
(pico Curie /gram) dry	Sr-89	(8)	0.25		< LLD	
	Sr-90	(8)	0.05	0.2	(5/8)	0.08 - 0.5
	Gamma	(8)	--		--	
	K-40		1.5	13	(8/8)	7 - 20
	Cs-137		0.1	1.2	(7/8)	0.2 - 2.4
	Co-60		0.1	0.2	(1/8)	--
	Others		--		< LLD	
Surface Water	Gross Alpha	(40)	0.3	0.75	(5/40)	0.6 - 1.1
(pico Curie / liter)	Gross Beta	(120)	0.6	4.4	(120/120)	2.5 - 11.4
	Gamma	(1)	10 - 60		< LLD	
	Tritium	(121)	100	300	(120/121)	180 - 800
	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
	C-14	(0)	--		--	
Drinking Water	I-131	(0)	--		--	
(pico Curie / liter)	Gross Alpha	(50)	0.3	0.6	(4/50)	0.4 - 0.8
	Gross Beta	(208)	0.6	3.8	(208/208)	2.3 - 6.4
	Gamma	(0)	--		--	
	Tritium	(211)	100	310	(211/211)	130 - 1000
	C-14	(0)	--		--	
	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
Ground Water	Gross Alpha	(19)	0.3		< LLD	
(pico Curie / liter)	Gross Beta	(76)	0.6	2.9	(73/75)(b)	1.3 - 8.0
	Tritium	(81)	100	440	(77/81)	80 - 800
	Gamma	(1)	10 - 60		< LLD	
Air Particulates	Gross Alpha	(188)	0.001	0.003	(35/188)	0.002 - 0.004
and Gaseous	Gross Beta	(927)	0.006	0.07	(927/927)	0.02 - 0.32
(pico Curie /cubic meter)	Sr-89	(0)	--		--	
	Sr-90	(0)	--		--	
	I-131	(816)	0.04	0.08	(2/816)	0.07 - 0.08
	Gamma	(197)	--		--	
	Zr/Nb-95		0.005	0.04	(122/197)	0.01 - 0.16
	Ru-106		0.010	0.04	(50/197)	0.02 - 0.09
	Ce-141		0.010	0.02	(3/197)	0.01 - 0.04
	Ce-144		0.010	0.02	(44/197)	0.01 - 0.04
	Others				< LLD	

(f) Fraction of detectable measurements at specified location.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility: Beaver Valley Power Station **Docket No.:** 50-334
Location of Facility: Beaver County, Pennsylvania **Reporting Period:** Calendar years 1974 - 1975

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean, (f) Range		
Milk	I-131	(91)	0.25	0.6	(4/91)	0.3 - 0.8
(pico Curie / liter)	Sr-89	(134)	5	7	(4/134)	6 - 11
	Sr-90	(134)	1	5.3	(132/134)	1.5 - 12.8
	Gamma	(134)	--		--	
	Cs-137		10	13	(19/134)	11 - 16
	Others				< LLD	
External Radiation	γ - Monthly	(599)	0.5 mR*	0.20	(599/599)	0.08 - 0.51
(milli Roentgen / day)	γ - Quarterly	(195)	0.5 mR*	0.20	(195/195)	0.11 - 0.38
	γ - Annual	(48)	0.5 mR*	0.19	(48/48)	0.11 - 0.30
Fish	Gross Beta	(17)	0.01	1.9	(15/17)	1.0 - 3.2
(pico Curie / gram) wet	Sr-90	(17)	0.005	0.14	(17/17)	0.02 - 0.50
	Gamma	(17)	0.5			
	K-40		--	2.4	(17/17)	1.0 - 3.7
	Others		--		< LLD	

* LLD in units of mR - Lower end of useful integrated exposure detectability range for a passive radiation detector (TLD).

(a) May include Ru-106, Ru-103, Be-7.

(b) One outlier not included in mean. (Water taken from dried-up spring with high sediment and potassium content. Not considered typical groundwater sample).

(f) Fraction of detectable measurements at specified location.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

B. Air Monitoring

1. Characterization of Air and Meteorology

The air in the vicinity of the site contains pollutants typical for an industrial area. Air flow is generally from the southwest in summer and from the northwest in the winter.

2. Air Sampling Program and Analytical Techniques

a. Program

The air is sampled for gaseous radioiodine and radioactive particulates at each of ten (10) offsite air sampling stations. The locations of these stations are listed in Table 2-1 and shown on a map in Figure 2-1.

Samples are collected at each of these stations by continuously drawing two cubic feet per minute of atmosphere air through a glass fiber filter paper and a charcoal cartridge. The glass fiber filter paper is used for collection of airborne particulates, while the charcoal cartridge is used for collection of radioiodine. Samples are collected on a weekly basis.

The charcoal cartridge is used in the weekly analysis of airborne Iodine-131. The glass fiber filter papers are analyzed each week for gross beta, then composited by station each quarter for gamma spectrometry analysis. In order to reduce interference from short-lived naturally occurring radioactivity (e.g.; radon and thorium), the glass fiber filter papers are decayed prior to performing beta analysis in a low background counting system.

b. Procedures

Gross Beta Analysis of Filter Paper: Analysis is performed by placing the glass fiber filter paper from the weekly air sample in a 2 inch planchet and analyzing it in a low background, gas flow proportional counter.

Gamma Emitter Analysis of Filter Paper: Analysis is performed by stacking all of the glass fiber filter papers collected from each monitoring station during the quarter and scanning this composite on a high resolution germanium gamma spectrometer.

Iodine-131 Analysis of Charcoal Cartridge: Analysis is performed by a gamma scan of each charcoal cartridge.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

3. Results and Conclusions

A summary of data is presented in Table 2-2.

a. Airborne Radioactive Particulates

Gross Beta: A total of five-hundred-thirty (530) weekly samples from ten (10) locations were analyzed for gross beta. Results were comparable to previous years. Figure 2-2 indicates the weekly average concentration of gross beta in air particulates.

Gamma Spectrometry: The weekly air particulate samples were composited into forty (40) quarterly samples which were analyzed by gamma spectrometry. Naturally occurring Beryllium-7 was identified in thirty-six of thirty-six (36 of 36) indicator samples, and four of four (4 of 4) control samples. No other radionuclides were detected. A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-2.

Deviations from Required Sampling and Analysis Schedule: There were some deviations from the required airborne particulate sampling and analysis schedule during the report period. Specifically, the following events occurred:

During the sampling period of 02/08/10-02/12/10, large snow accumulation and associated power outages affected numerous REMP Air Particulate and Iodine sampling stations. The following stations were affected during this time period: Old Meyer Farm (Site No. 13, 1.4 miles SW) was out of service for 26 hours and 38 minutes; Brunton Farm (Site No. 27, 6.1 miles SE) was out of service for 27 hours and 24 minutes; Shippingport-Cook's Ferry Substation (Site No. 30, 0.5 miles ENE) was out of service for 155 hours and 1 minute; Midland-North Substation (Site No. 32, 0.8 miles NW) was out of service for 94 hours and 15 minutes; Weirton Water Tower (Site No. 48, 16.3 miles SSW) was out of service for 6 hours and 41 minutes. This condition is documented in CR 10-71609.

During the sampling period of 02/08/10-02/12/10, large snow accumulation and associated power outages affected the availability of Duquesne Light Company escort services to access REMP Air Particulate and Iodine Sample Stations located within locked substations. Air monitors were unable to be sampled on Monday February 8, 2010 as scheduled, but were sampled on Friday February 12, 2010. The following sites were affected: Shippingport-Cook's Ferry Substation (Site No. 30, 0.5 miles ENE); Midland-North Substation (Site No. 32, 0.8 miles NW); Aliquippa-Sheffield Substation (Site No. 51, 8.0 miles E). This condition is documented in CR 10-71609.

During the sampling period 05/24/10-06/02/10, severe thunderstorms and associated power outages affected the availability of Duquesne Light Company escort services to access REMP Air Particulate and Iodine Sample Stations located within locked substations. Air monitors were unable to be sampled on Tuesday June 1, 2010 as scheduled, but were sampled on Wednesday June 2, 2010. Upon sampling, it was determined that one sample station had lost power due to the storm. The Aliquippa-Sheffield Substation (Site No. 51, 8.0 miles E) was affected and was out of service for approximately 27 hrs and 42 minutes. This condition is documented in CR 10-81504.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

During the sampling period 07/12/10-07/19/10, a tripped breaker caused a power outage that affected REMP Air Particulate and Iodine sampling at Aliquippa-Sheffield Substation (Site No. 51, 8.0 miles E). Upon sampling, it was determined that this sample station had lost power due to a tripped breaker on the air totalizer component and was out of service for approximately 112 hours and 12 minutes. This condition is documented in CR 10-81504.

During the sampling period 08/09/10-08/16/10, a tripped breaker caused a power outage that affected REMP Air Particulate and Iodine sampling at Aliquippa-Sheffield Substation (Site No. 51, 8.0 miles E). Upon sampling, it was determined that this sample station had lost power due to a tripped breaker on the air totalizer component and was out of service for approximately 37 hours and 37 minutes. This condition is documented in CR 10-81504.

Because BVPS uses ten (10) airborne particulate sample stations versus five (5) required by the ODCM, then there was no consequence to interruption of sample collection during these periods.

Summary: Based on the analytical results, the operation of BVPS did not contribute any measurable increase in air particulate radioactivity during the report period.

b. Airborne Radioiodine

Iodine-131: A total of five-hundred-thirty (530) weekly charcoal filter samples were analyzed for Iodine-131. No detectable concentrations were present at any locations.

Deviations from Required Sampling and Analysis Schedule: The deviations are the same as described above for airborne particulates.

Summary: Based on analytical results, the operation of BVPS did not contribute any measurable increase in airborne radioiodine during the report period.

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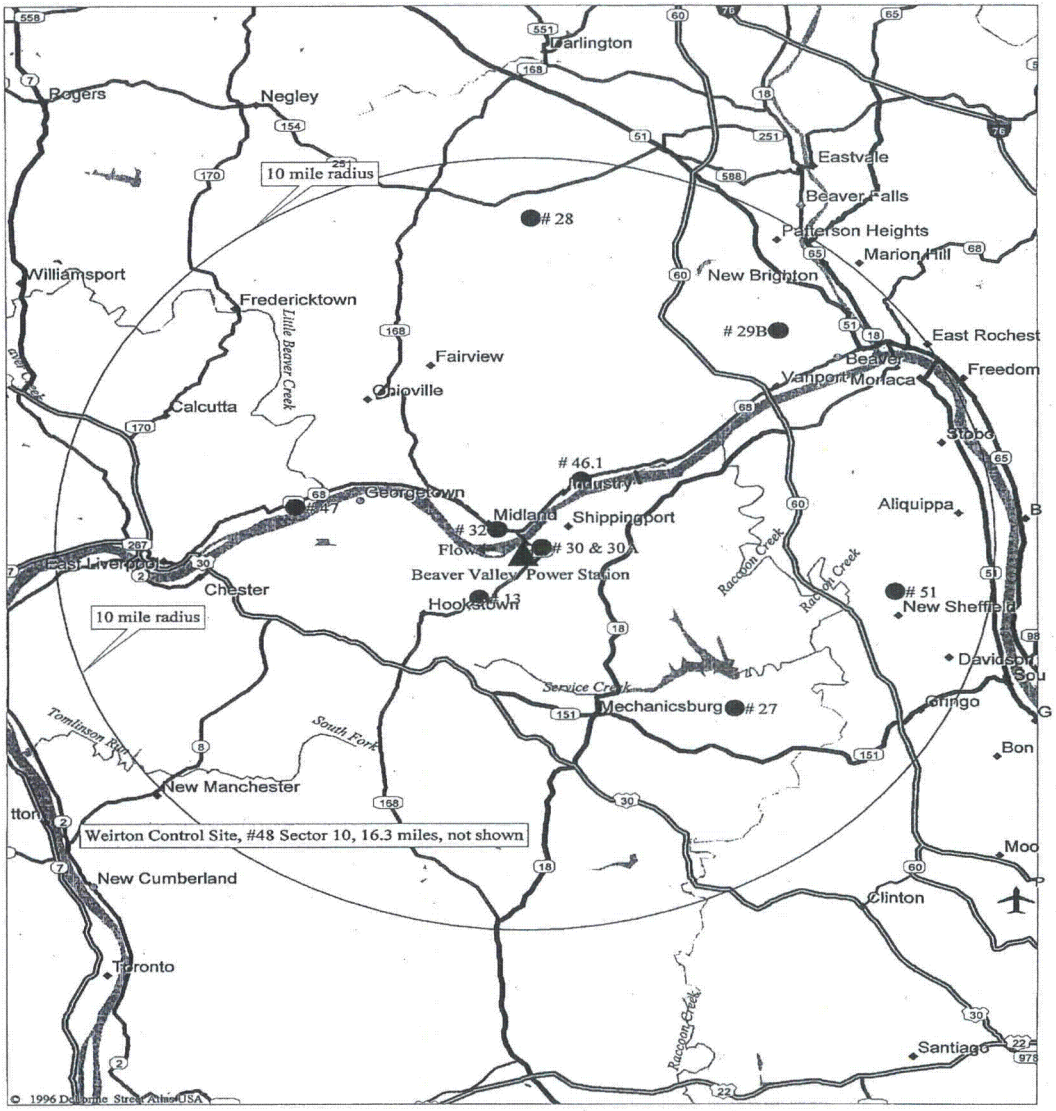
Figure 2-1

Environmental Monitoring Locations - Air Sampling Stations



Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Air Particulate & Radioiodine	13	11-SW	1.49	Hookstown, PA (Old Meyer Farm)
	27	7-SE	6.14	Aliquippa, Pa (Brunton Farm)
	28	1-N	8.60	Beaver Falls, PA (Sherman Farm)
	29B	3-NE	7.97	Beaver, PA (Friendship Ridge)
	30	4-ENE	0.43	Shippingport, PA (Cook's Ferry Substation)
	32	15-NW 2-NNE	0.75	Midland, PA (North Substation - Rt. 68)
	46.1	3-NE	2.28	Industry, PA (McKeels Service - Rt. 68)
	47	14-WNW	4.88	East Liverpool, OH (Water Department)
	48	10-SSW	16.40	Weirton, WV (Water Tower, Collier Way)
	51	5-E	8.00	Aliquippa, PA (Sheffield Substation)

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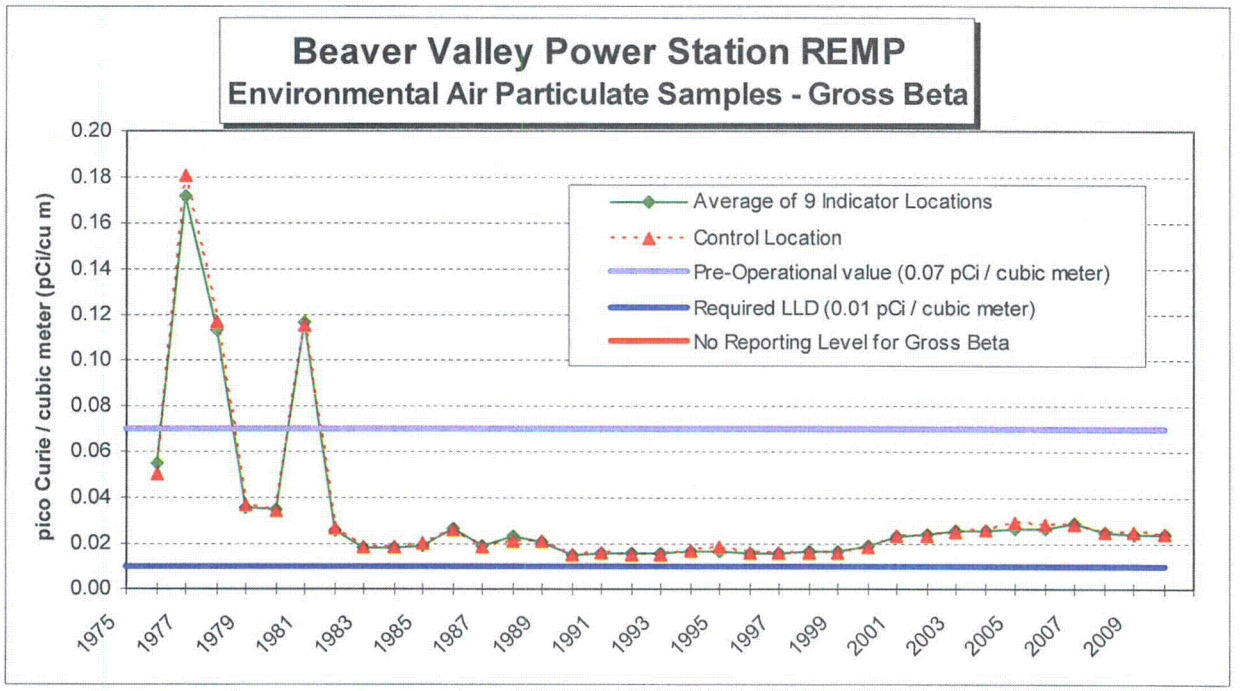
Figure 2-2

Graph of Annual Average Concentration: Gross Beta in Air Particulates



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

C. Monitoring of Shoreline Stream Sediment and Soil

1. Characterization of Shoreline Stream Sediment and Soil

The stream sediment (river bottoms) consists largely of sand and silt. Soil samples may vary from sand and silt to a heavy clay with variable amounts of organic material.

2. Sampling Program and Analytical Techniques

a. Program

Shoreline stream sediment were collected semi-annually above the Montgomery Dam, in the vicinity of the BVPS outfall structure, and above the New Cumberland Dam. A Ponar or Eckman dredge is used to collect the sample. The sampling locations are also listed in Table 2-1 and are shown in Figure 2-3.

Although not required by the ODCM, soil samples are collected every three years. They were collected at each of ten (10) locations during 2009 and are scheduled to be collected again in 2012. At each location, twelve (12) core samples (3" diameter by 2" deep) are gathered at prescribed points on a 10 foot radius circle. Each location is permanently marked with reference pins. Each set of samples is systematically selected by moving along the radius in such a manner as to assure representative undisturbed samples. Sampling locations are listed in Table 2-1 and are shown in Figure 2-3.

Shoreline stream sediment and soil are analyzed for gamma-emitting radionuclides.

b. Analytical Procedures

Gamma Emitter Analysis of Stream Sediment: Analysis is performed in a 300 ml plastic bottle, which is analyzed by gamma spectrometry.

Gamma Emitter Analysis of Soil: Although not required by the ODCM, analysis is performed in a 300 ml plastic bottle, which is analyzed by gamma spectrometry

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

3. Results and Conclusions

A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-4 and Figure 2-5.

a. Shoreline Stream Sediment

Gamma Spectrometry: A total of six (6) sediment samples were analyzed by gamma spectrometry during the report period. Naturally occurring Potassium-40, Thalium-208, Lead-212, Lead-214, Bismuth-214, Radium-226 and Actinum-228, were detected in four of four (4 of 4) indicator samples and two of two (2 of 2) control samples.

Cesium-137: Radionuclide Cesium-137 was identified in four of four (4 of 4) indicator samples and two of two (2 of 2) control samples. The results were similar to previous years (current year range = 0.05 to 0.12 pico Curie / gram) and less than the pre-operational level of 0.4 pico Curie / gram. Also, because Cesium-137 was identified at the control location (upstream), then it was not due to plant effluent releases and is most likely residual contamination due from previous nuclear weapons tests.

Cobalt-58: Radionuclide Cobalt-58 was identified in two of four (2 of 4) indicator samples and zero of two (0 of 2) control samples. The samples which indicated Cobalt-58 were obtained at the shore line of both the BVPS Main Outfall Facility and Upstream of the New Cumberland Dam. The results were similar to previous years (current range = 0.09 to 0.28 pico Curie / gram), although this data is NOT currently less than the BVPS Main Outfall Facility pre-operational level of 0.098 pico Curie / gram.

Cobalt-60: Radionuclide Cobalt-60 was identified in two of four (2 of 4) indicator samples and zero of two (0 of 2) control samples. The samples which indicated Cobalt-60 were obtained at the shore line of both the BVPS Main Outfall Facility and Upstream of the New Cumberland Dam. The results were similar to previous years (current range = 0.40 to 0.41 pico Curie / gram), and is approximately equal to the pre-operational level of 0.4 pico Curie / gram.

Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required sediment sampling and analysis schedule during the report period.

Summary: The identification of Cobalt-58 and Cobalt-60 in the shoreline stream sediment near the main outfall facility and a downstream location is not unusual, because the plant discharges these radionuclides in liquid effluent releases. The analyses are consistent with discharge data of authorized liquid effluent releases, and all liquid effluent releases during the report period did not exceed the release limits set forth in the ODCM.

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b. Soil

Although not required by the ODCM, soil is sampled every three years and was sampled in 2009. Soil sampling will be performed during the calendar year 2012.

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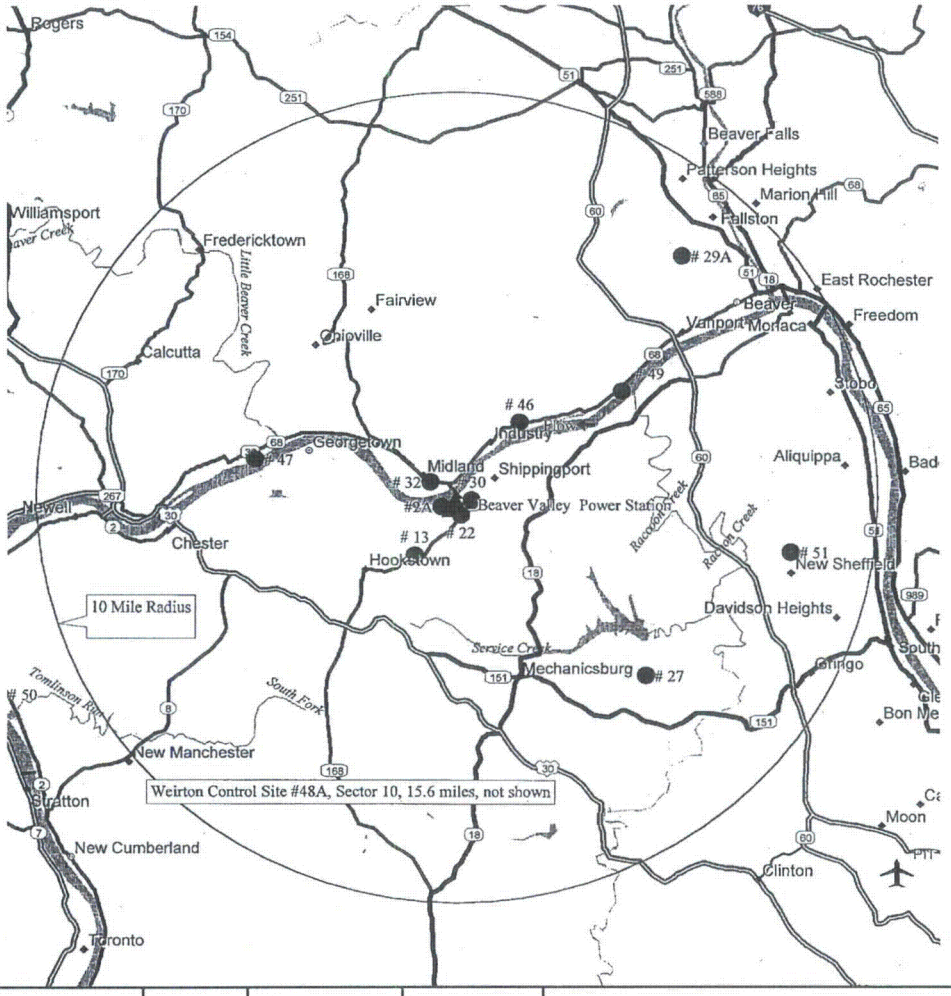
Figure 2-3

Environmental Monitoring Locations - Shoreline Sediments and Soil



Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Soil	13A	11-SW	1.49	Hookstown, PA (Old Meyer Farm)
	22	8-SSE	0.28	South of BVPS, Transmission Lines
	27B	7-SE	6.19	Aliquippa, PA (Brunton Farm)
	29A	3-NE	8.09	Beaver, PA (Nicol Farm)
	30A	4-ENE	0.43	Shippingport, PA (Cooks Ferry Substation)
	32A	15-NW	0.74	Midland, PA (North Substation)
	46B	3-NE	2.66	Industry, PA (Willows Inn – Rt. 68)
	47A	14-WNW	4.89	East Liverpool, OH (Water Department)
	48	10-SSW	16.40	Weirton, WV (Collier Way Water Tower)
	51A	5-E	7.99	Aliquippa, PA (Sheffield Substation)
Sediment	2A	12-WSW	0.31	Shippingport, PA (BVPS Outfall Vicinity)
	49A	3-NE	4.93	Industry, PA (Upstream Montgomery Dam)
	50	12-WSW	11.77	New Cumberland, WV (Upstream of Dam

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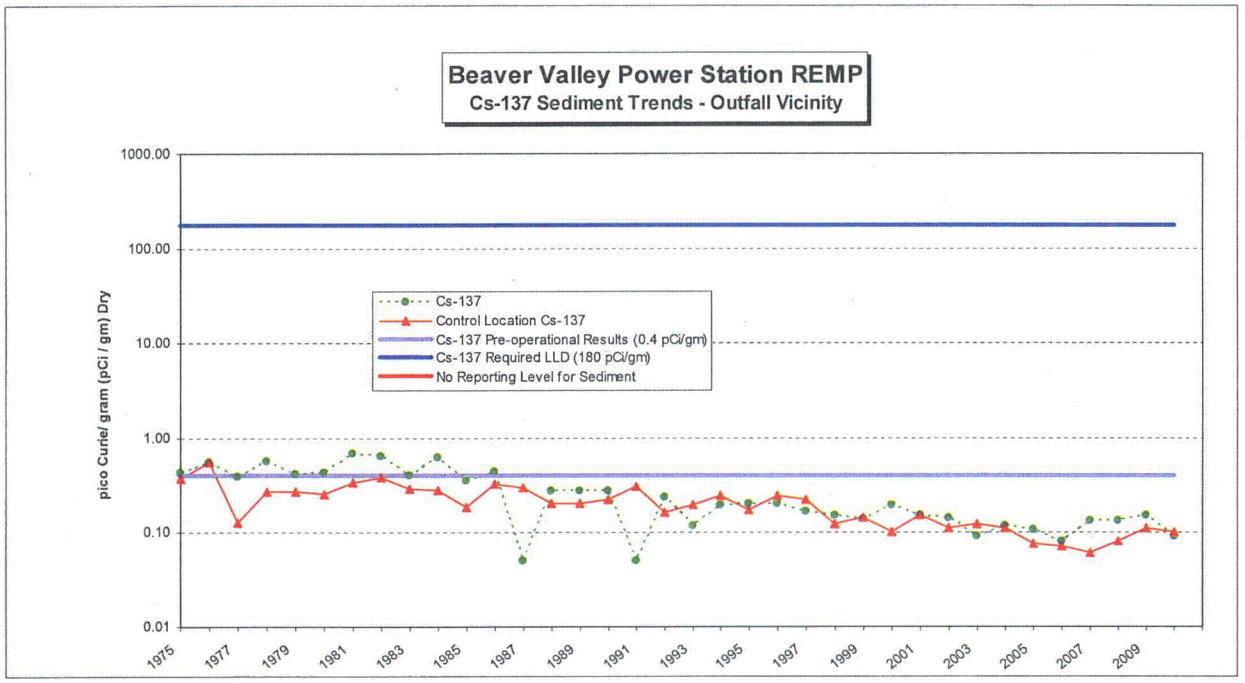
Figure 2-4

Graph of Annual Average Concentration: Cesium-137, Cobalt-58 & Cobalt-60 in Sediment



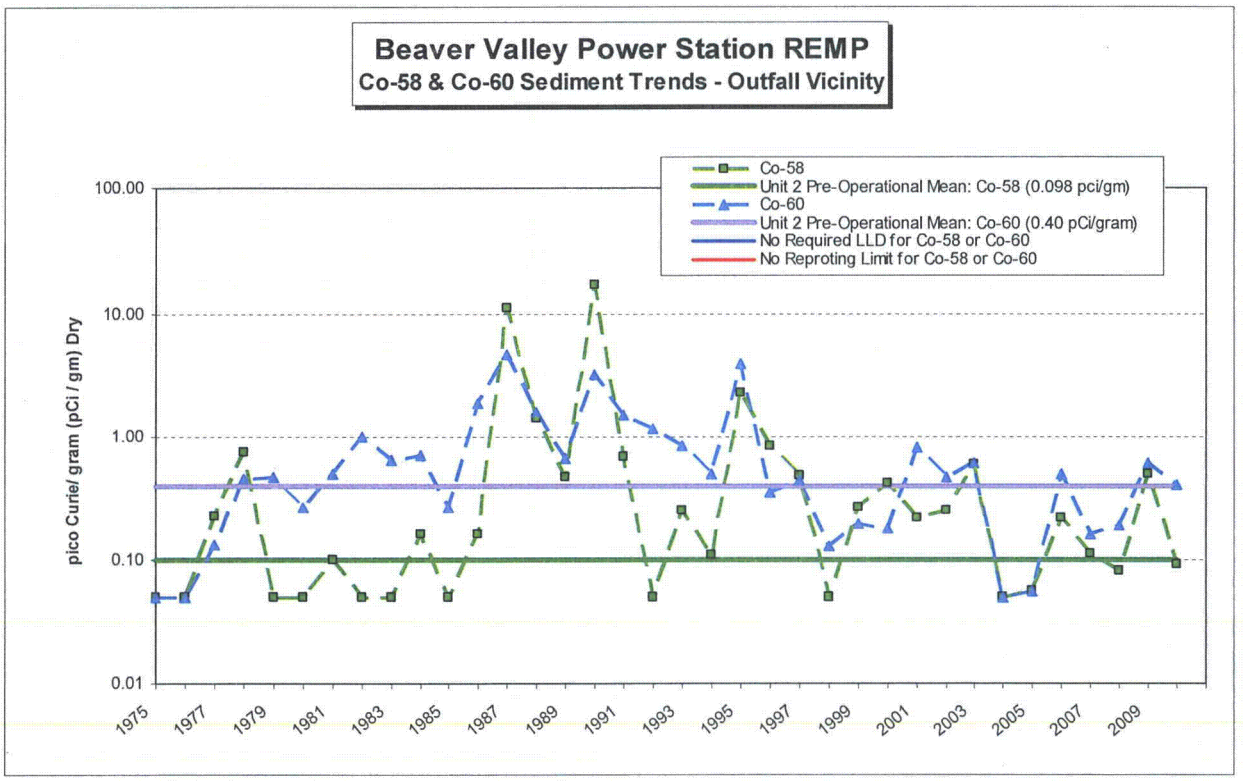


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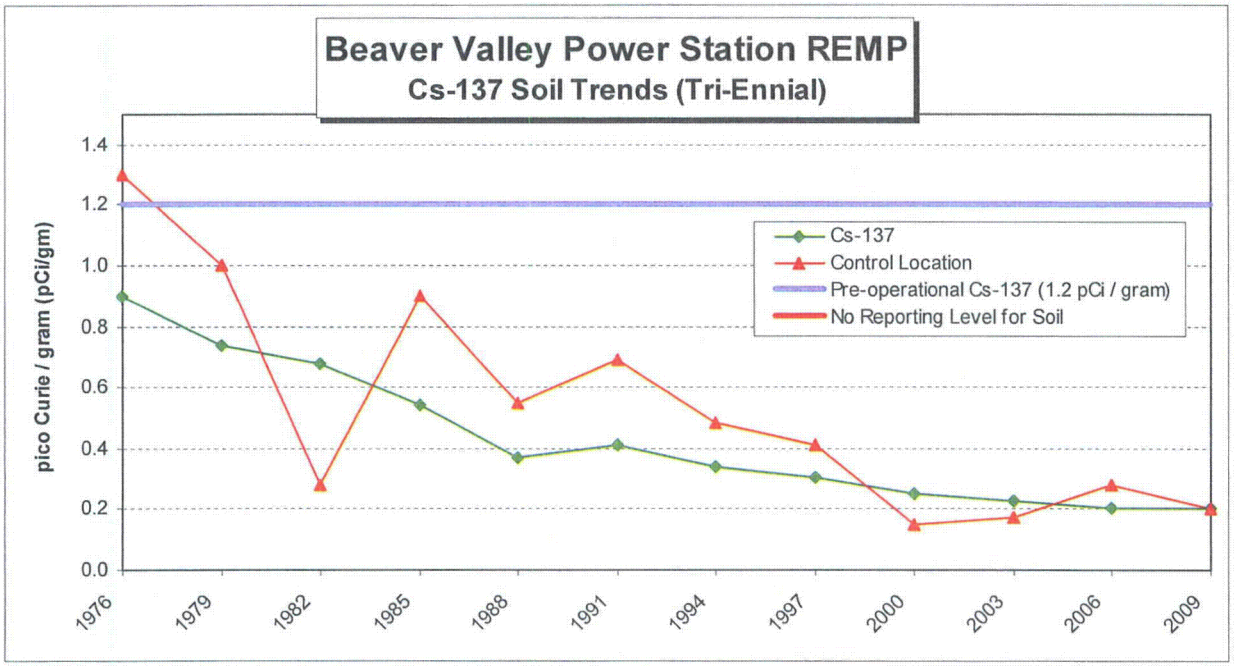
Figure 2-5

Graph of Annual Average Concentration: Cesium-137 in Soil



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

D. Monitoring of Feedstuff and Foodcrops

1. Characterization of Farm Products

According to the 2007 Census of Agriculture [(1)], there were 824 farms in Beaver County. Total market value of production (Crops and Livestock) was $15,187,000.00. Some of the principal sources of revenue (>$50,000.00) are as follows:

Milk and Other Dairy Products from Cows	$5,647,000.00
Nursery, Greenhouse, Floriculture and Sod	$2,813,000.00
Grains, Oil Seeds, Dry Beans and Dry Peas	$1,243,000.00
Other Crops and Hay	$1,120,000.00
Vegetables, Melons, Potatoes and Sweet Potatoes	$989,000.00
Fruits, Tree Nuts and Berries	$449,000.00
Poultry and Eggs	$327,000.00
Cut Christmas Trees, and Short Rotation Woody Crops	$204,000.00
Horses, Ponies, Mules, Burros, and Donkeys	$182,000.00
Sheep, Goats and their Products	$90,000.00
Hogs & Pigs	Undisclosed Amount
Aquaculture	Undisclosed Amount
Cattle and Calves	Undisclosed Amount
Other Animals and Other Animal Products	Undisclosed Amount

(1) http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Pennsylvania/index.asp

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

2. Sampling Program and Analytical Techniques

a. Program

Feedstuff: Although not required by the ODCM, representative samples of Feedstuff (cattle feed) are collected monthly from the nearest dairy farm (Searight Dairy). See Figure 2-6. Each sample is analyzed by gamma spectrometry.

Foodcrops (leafy vegetables): Foodcrops are collected at garden locations during the growing season. Leafy vegetables, (e.g.; cabbage) are obtained from Shippingport, Georgetown, and Industry, Pennsylvania. Samples are also obtained from the control location in Weirton, West Virginia. All samples are analyzed for gamma emitters by gamma spectrometry. Samples are also analyzed by radiochemical analysis for Iodine-131.

b. Procedures

Gamma Emitter Analysis of Foodcrops: Analysis is performed by scanning a dried, homogenized sample with a gamma spectrometry system. A high resolution germanium detector is utilized with this system. Samples of feedstuff and foodcrops are loaded into tare weight 300 or 150 ml plastic bottles or 1-liter Marinelli containers, weighed and the net weight of the sample is determined prior to scanning for gamma emitters.

Gamma Emitter Analysis of Feedstuff: Although not required by the ODCM, analysis is performed by scanning a dried, homogenized sample with a gamma spectrometry system. A high resolution germanium detector is utilized with this system. Samples of feedstuff and foodcrops are loaded into tare weight 300 or 150 ml plastic bottles or 1-liter Marinelli containers, weighed and the net weight of the sample is determined prior to scanning for gamma emitters.

Iodine-131 Analysis of Foodcrops: Analysis is performed by radiochemistry. A stable iodide carrier is added to a chopped sample, which is then leached with a sodium hydroxide solution, evaporated to dryness and fused in a muffle furnace. The melt is dissolved in water, filtered and treated with sodium hypochlorite. The iodate is then reduced to iodine with hydroxylamine hydrochloride and is extracted into toluene. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchet for low level beta counting.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

3. Results and Conclusions

A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-7.

a. Feedstuff

Gamma Spectrometry: Although not required by the ODCM, a total of twelve (12) samples were analyzed by gamma spectrometry. Naturally occurring Potassium-40 was identified in twelve of twelve (12 of 12) samples. Naturally occurring Beryllium-7 was found in five of twelve (5 of 12) samples.

Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required feedstuff sampling and analysis schedule during the report period.

Summary: The data from the feedstuff analyses was consistent with previous data. Based on the analytical results, the operation of BVPS did not contribute any measurable increase in radioactivity in the feedstuff in the vicinity of the site during the report period

b. Foodcrops

Iodine-131: A total of four (4) samples were analyzed for Iodine-131. No detectable concentrations were present in the three (3) indicator samples or the one (1) control sample.

Gamma Spectrometry: A total of four (4) samples were analyzed by gamma spectrometry. Naturally occurring Potassium-40 was identified in three of three (3 of 3) indicator samples and one of one (1of 1) control samples. No other radionuclides were identified.

Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required foodstuff sampling and analysis schedule during the report period.

Summary: The data from the foodcrops analyses was consistent with previous data. Based on the analytical results, the operation of BVPS did not contribute any measurable increase in radioactivity in the foodcrops in the vicinity of the site during the report period.

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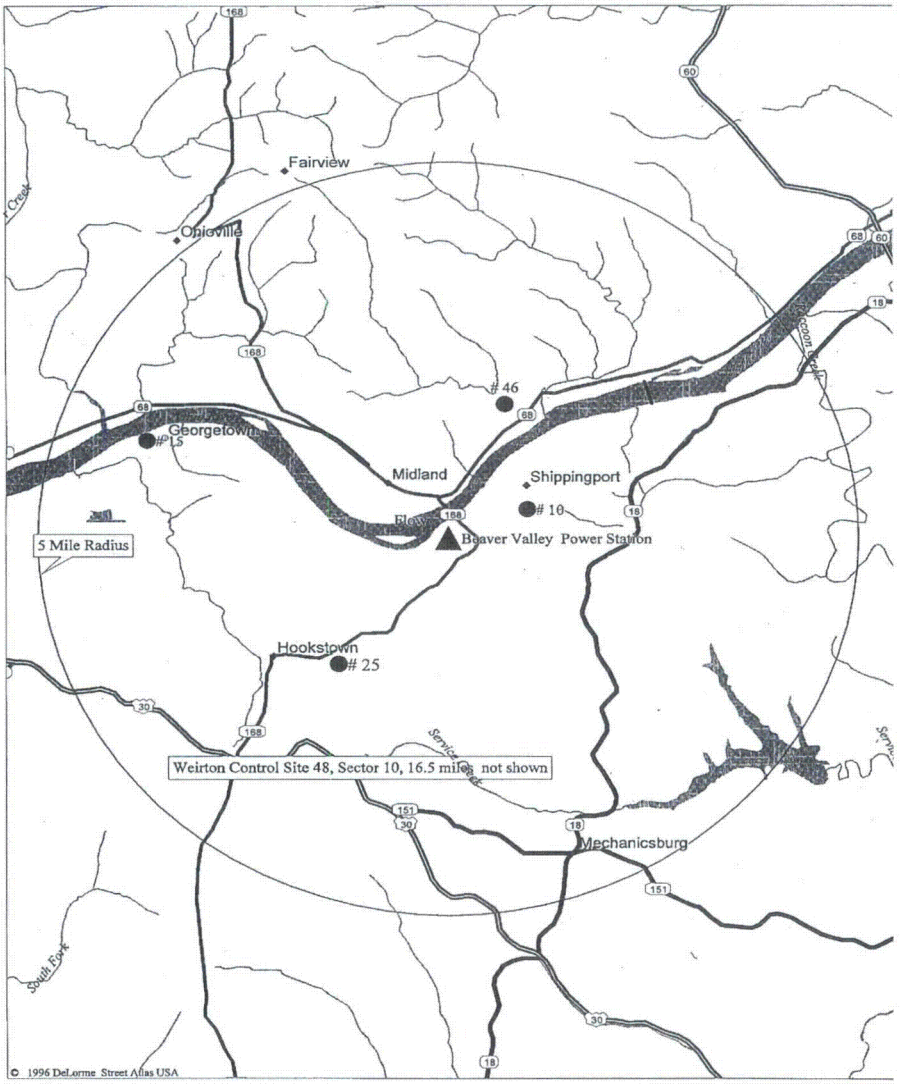
Figure 2-6



Environmental Monitoring Locations – Feedstuff and Foodcrops

Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Feed	25	10-SSW	2.10	Hookstown, PA (Searight Farm)
Food	10A	4-ENE	0.8	Shippingport, PA
	10B	*	*	Shippingport, PA
	15A	*	*	Georgetown, PA
	46A	*	*	Industry, PA
	48B	*	*	Weirton, WV
Individual garden locations may change based upon availability. The requirements are met as long as one garden is sampled from each of these communities.				

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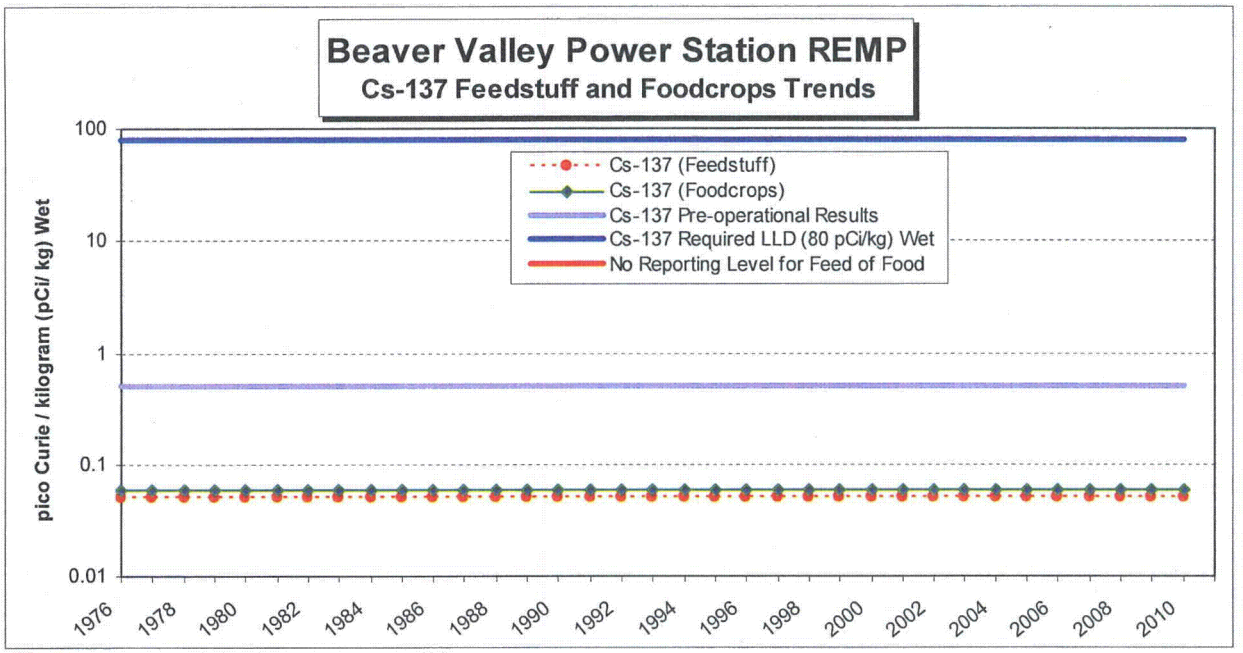
Figure 2-7

Graph of Annual Average Concentration: Cesium-137 in Feedstuff and Foodcrops



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

E. Monitoring of Local Cow and Goat Milk

1. Description - Milch Animal Locations

Samples of fresh milk are obtained from milch animals at locations and frequencies noted in Table 2-1. The milk is analyzed for its radioiodine content, gamma emitters, Strontium-89 and Strontium-90.

Detailed field surveys are performed during the grazing season to locate and enumerate milch animals within a five (5) mile radius of the site. Survey data for the most recent survey conducted is shown in Section 3, Land Use Census.

2. Sampling Program and Analytical Techniques

a. Program

Cow milk was collected from the two (2) reference dairy farms within a 10-mile radius of the BVPS. These milk samples were obtained at the Searight Dairy Farm (2.1 miles SSW) and the Brunton Dairy Farm (6.1 miles SE).

Cow milk was also collected from one (1) other dairy farm within a 10-mile radius of the BVPS site. The cow milk samples obtained at the Halstead Dairy Farm (5.1 miles SSW) was selected based on milch animal surveys and evaluations of meteorological data (i.e.; deposition parameters). It was added to the sampling program to ensure the highest potential milk pathway for radioiodine uptake is evaluated. Had goat milk been available from either the Collins Farm (3.5 miles SE) or the Ferry Farm (3.3 miles SE) samples may have been obtained at these locations as well. The dairies are subject to change based upon availability of milk or when more recent data (milch animal census, and/or change in meteorological conditions) indicate other locations are more appropriate.

Cow milk was also collected from the one (1) control location dairy farm outside of the 10-mile radius. These milk samples were obtained at the Windsheimer Dairy Farm (10.4 miles SSW).

The cow milk sample from the Searight Dairy Farm (2.1 miles SSW) is collected and analyzed weekly for Iodine-131 using a method that ensures a high sensitivity. Samples from each of the other dairies are collected monthly when cows are indoors and bi-weekly when cows are grazing. The monthly and/or bi-weekly sample is analyzed for principle gamma emitters (including Cesium-137 by high resolution germanium gamma spectrometry), and Iodine-131 high sensitivity analysis. Although not required by the ODCM, the monthly and/or bi-weekly sample is also analyzed for Strontium-89, Strontium-90.

It was determined early in the year that all doe goats from the Collin's Dairy Farm (3.5 miles SE) would be dry for the entire milking season. The Ferry Farm (3.3 miles SE) had one doe milking doe goat but did not want to participate in the sampling program during the milking season. Both sampling locations will be evaluated during 2011 for participation in the sampling program.

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The location of each is shown in Figure 2-8 and described below.

Site	Dairy	Approximate Number of Animals being Milked	Distance and Direction from Midpoint between Unit 1 and Unit 2 Reactor	Collection Period
25	Searight Dairy 948 McCleary Road Hookstown, PA	36 Cows	2.1 miles SSW	January thru December
27	Brunton Dairy 3681 Ridge Road Aliquippa, PA	105 Cows	6.1 miles SE	January thru December
69	Collins Dairy 289 Calhoun Road Aliquippa, PA	0 Goats	3.5 miles SE	Not Applicable: No goat milk available during 2010
96	Windsheimer Dairy RD #11 Burgettstown, PA	73 Cows	10.4 miles SSW	January thru December
102*	Ferry Farm 227 Calhoun Rd Aliquippa, PA	1 Goat	3.3 miles SE	Not Applicable: No goat milk available for purchase during 2010
113*	Halstead Dairy 104 Tellish Drive Hookstown, PA	65 Cows	5.1 miles SSW	January thru December
* Highest potential pathway dairies based on evaluation of deposition parameters				

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b. Procedure

Iodine-131 Analysis of Milk: The milk samples are chemically prepared, and then analyzed with a low-level beta counting system.

Gamma Emitter Analysis of Milk: This is determined by gamma spectrometry analysis of a 1 liter Marinelli container of milk.

Strontium-90 Analysis of Milk: Although not required by the ODCM, the milk samples are prepared by adding a stable strontium carrier and evaporating to dryness, then ashing in a muffle furnace, followed by precipitating phosphates. Strontium is purified in all samples by the Argonne method using 3 grams of extraction material in a chromatographic column. Stable yttrium carrier is added and the sample is allowed to stand for a minimum of 5 days for the in-growth of Yttrium-90 (Y-90). Yttrium is then precipitated as hydroxide dissolved and re-precipitated as oxalate. The yttrium oxalate is mounted on a nylon planchet and is counted in a low-level beta counter to infer Strontium-90 activity.

Strontium-89 Analysis of Milk: Although not required by the ODCM, the Strontium-89 activity is determined by precipitating strontium carbonate ($SrCO_3$) from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and is covered with an 80 mg/cm^2 aluminum absorber for low level beta counting. Chemical yields of strontium and yttrium are determined by gravimetric means.

3. Results and Conclusions

A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of Iodine-131 and Strontium-90 analyses (including the pre-operational period through the report period) is shown on Figure 2-9.

a. Strontium-89: Although not required by the ODCM, a total of eighty (80) milk samples were analyzed for Strontium-89 during the report period. Strontium-89 was not detected in any of the sixty (60) indicator samples, nor was it detected in any of the twenty (20) control samples.

b. Strontium-90: Although not required by the ODCM, a total of eighty (80) milk samples were analyzed for Strontium-90 during the report period. Strontium-90 was detected in forty-five of sixty (45 of 60) indicator samples and twenty of twenty (20 of 20) control samples. The levels detected were attributable to previous nuclear weapons tests and are within the normally expected range.

c. Gamma Spectrometry: A total of eighty (80) milk samples were analyzed by gamma spectrometry during the report period. Naturally occurring Potassium-40 was present in sixty of sixty (60 of 60) indicator samples and twenty of twenty (20 of 20) control samples. No other gamma-emitting radionuclides were identified during analysis.

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d. Iodine-131: A total of one hundred twelve (112) milk samples were analyzed for Iodine-131 during the report period. Iodine-131 was not detected in any of the ninety two (92) indicator samples, nor was it detected in any of the twenty (20) control samples. All analyses were less than the 0.5 pico Curie / liter LLD value.

e. Deviations from Required Sampling and Analysis: There was a deviation from the required milk sampling and analysis schedule for the reporting period. The Doe Goat location identified at the Ferry Farm, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE) has not been able to provide enough milk to participate in the sampling program for 2010, and it is unknown as to whether or not it will be able to in the future. Goat milk samples were also not available from any other location within the 5 mile radius this year. The unavailability of goat milk caused the REMP to not meet the ODCM sample requirements in 1/2-ODC-2.03 and in 1/2-ODC-3.03, Attachment Q Table 3.12-1 stating that a minimum of four (4) milk locations shall be sampled. There are no other milk animal locations available to add to the REMP, as all milk animals sites located within the 5 mile radius of BVPS are currently participating in the sampling program. This condition was documented in CR 10-82742.

f. Summary: Based on all the analytical results and the comparison to pre-operational levels, the operation of BVPS did not contribute any measurable increase in radioactivity in the milk in the vicinity of the site during the report period.

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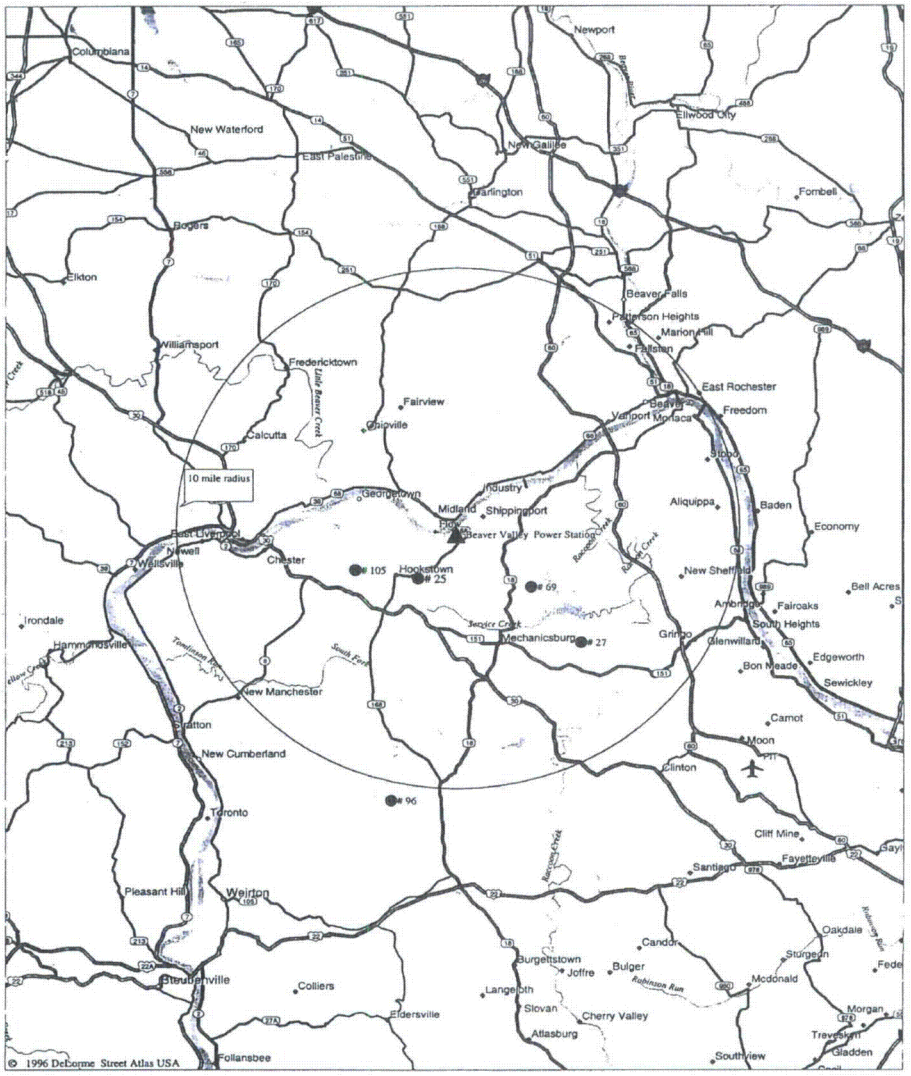
Figure 2-8

Environmental Monitoring Locations - Milk



Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Milk	25	10-SSW	2.1	Hookstown, PA (Searight Farm)
	27	7-SE	6.1	Aliquippa, PA (Brunton Farm)
	69	7-SE	3.5	Aliquippa, PA (Collins Farm)
	96	10-SSW	10.4	Burgettstown, PA (Windsheimer Farm)
	102	7-SE	3.3	Aliquippa, PA (Ferry Farm)
	113	10-SSW	5.1	Hookstown, PA (Halstead Farm)

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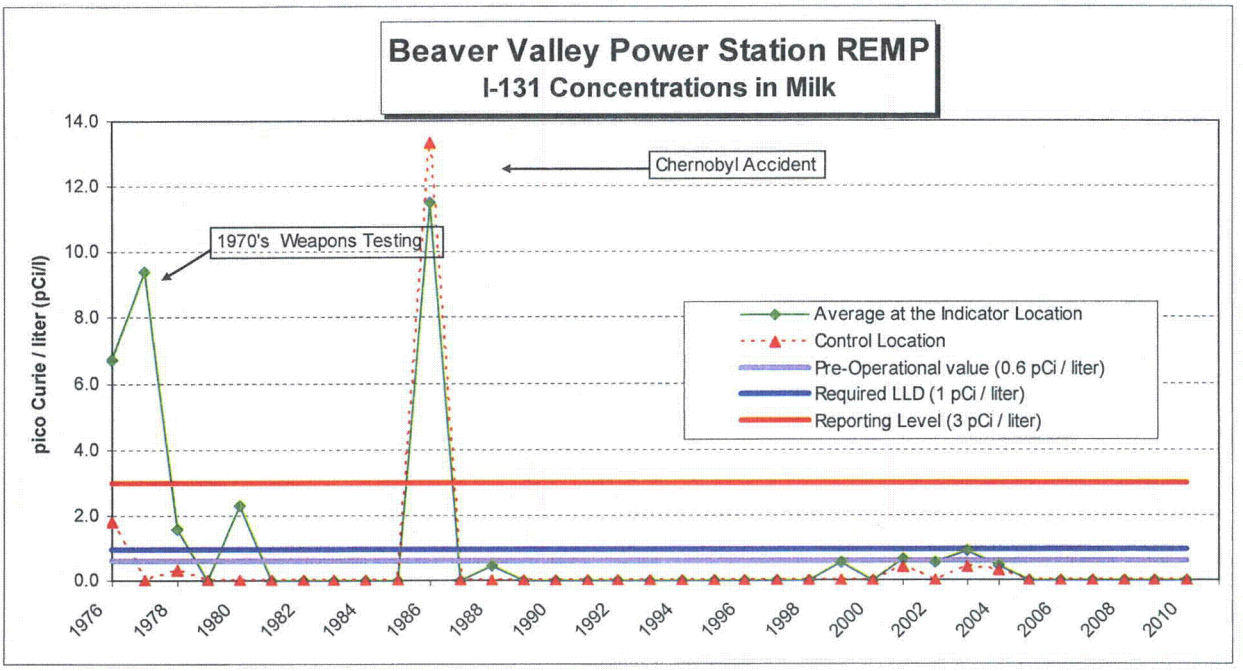
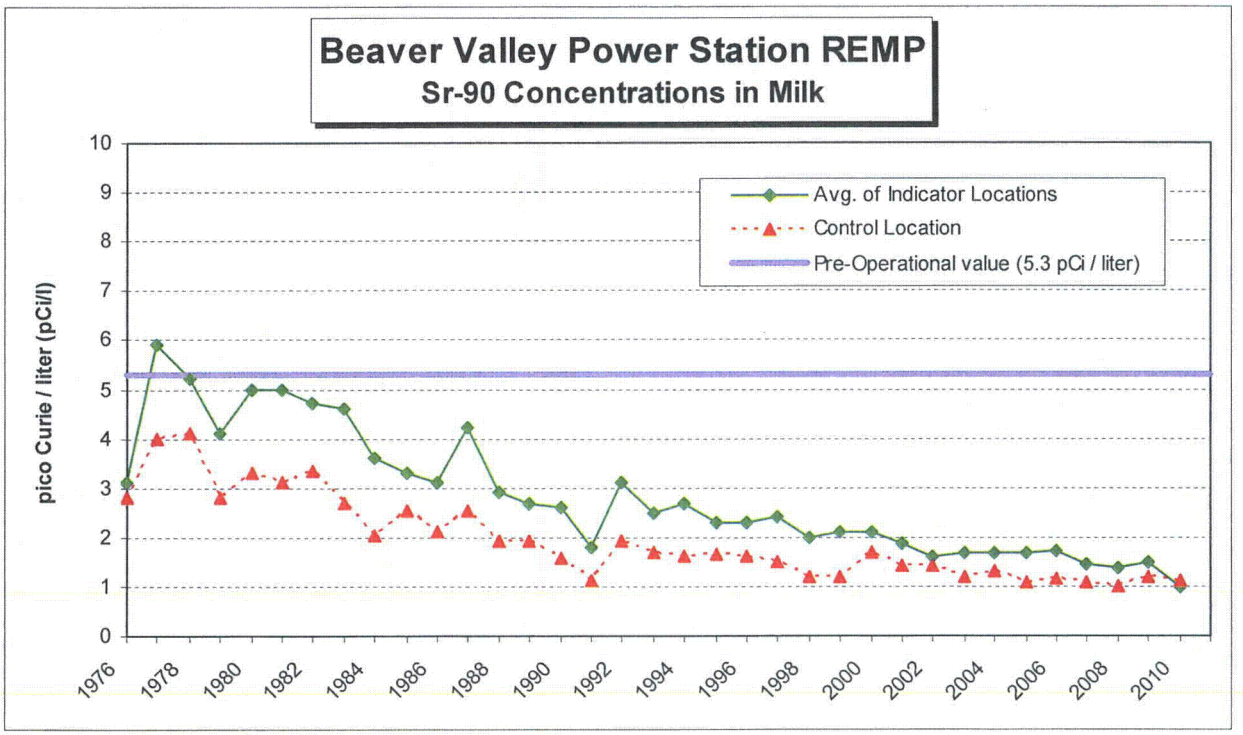
Figure 2-9

Graph of Annual Average Concentration: Iodine-131 & Sr-90 in Milk





SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

F. Environmental Radiation Monitoring

1. Description of Regional Background Radiation and Sources

Historical information for regional background was obtained from Reuter-Stokes instruments that were previously located within a five (5) mile radius of the BVPS site. Data is no longer available from these instruments, but historical data indicated that the background exposure rates ranged from 6 μR/hr to 12 μR/hr.

The sources of background radiation are affected by the terrain in the vicinity of BVPS, where as, the local hills (i.e., with altitude variations of 300-400 feet) and densely wooded areas contribute to differences in background radiation level. Other sources (e.g., Radon) are affected by the geological features of the region, which are characterized by nearly flat-laying sedimentary beds of the Pennsylvania Age. For information, the local sedimentary beds of limestone alternate with sandstone and shale with abundant interbedded coal layers. Pleistocene glacial deposits partially cover the older sedimentary deposits in the northwest. Most of the region is underlain by shale, sandstone, and some coal beds of the Conemaugh Formation. Outcrops of sandstone, shale, and limestone of the Allegheny Formation exist within the Ohio River Valley and along major tributary streams.

2. Locations and Analytical Procedures

Ambient external radiation levels around the site were measured using thermoluminescent dosimeters (TLDs).

During the report period, there were a total of sixty-four (64) environmental TLD locations. This is comprised of forty-four (44) offsite locations, along with twenty (20) fence perimeter locations. The offsite TLD locations are plotted on Figure 2-10, but the fence perimeter locations are not plotted due to the large scale of the figure.

The TLDs were annealed at the Contractor Central Laboratory shortly before placing the TLDs in their field locations. The radiation dose accumulated in-transit between the Central Laboratory, the field location, and the Central Laboratory was corrected by transit controls maintained in lead shields at both the Central Laboratory and the field office. All dosimeters were exposed in the field for a calendar quarter, in a specific holder that contains two (2) TLDs at each location.

3. Results and Conclusions

A summary of the TLD results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-11.

TLD Analysis: During the report period, the average quarterly external exposure rate (as measured from TLD) was 18.6 mR at the sixty-four (64) indicator locations, and 20.8 mR at the Control location. This external exposure rate is comparable to previous years. As expected, there was some variation in external exposure rate among locations and seasons.

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Deviations from Required Sampling and Analysis Schedule: There was one deviation from the required sampling schedule (i.e.; TLD change out frequency) and analysis schedule (i.e.; TLD processing frequency) during the report period. Specifically, REMP TLD location #88, 110 Summit Rd. Midland Heights (2.74 miles, NW Sector 15), was vandalized during the fourth quarter of 2010. The sample cage was damaged and both TLDs were missing. This condition was found on 1/6/11, during the scheduled quarterly TLD change-out. This condition was documented in CR 11-88282.

Summary: The quarterly TLD external exposure rates are comparable to those of previous years, except for the overall increase in 2001, as described in previous reports. There was no evidence of anomalies that could be attributed to the operation of BVPS. It should also be noted that the average external exposure rate at the indicator locations was less than average external exposure rate at the Control location. Based on all the analytical results and the comparison to pre-operational levels, the operation of BVPS did not contribute any measurable increase in external exposure in the vicinity of the site during the report period. The TLD exposure rates also confirm that changes from natural radiation levels, if any, are negligible.

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Figure 2-10

Environmental Monitoring Locations - TLDs

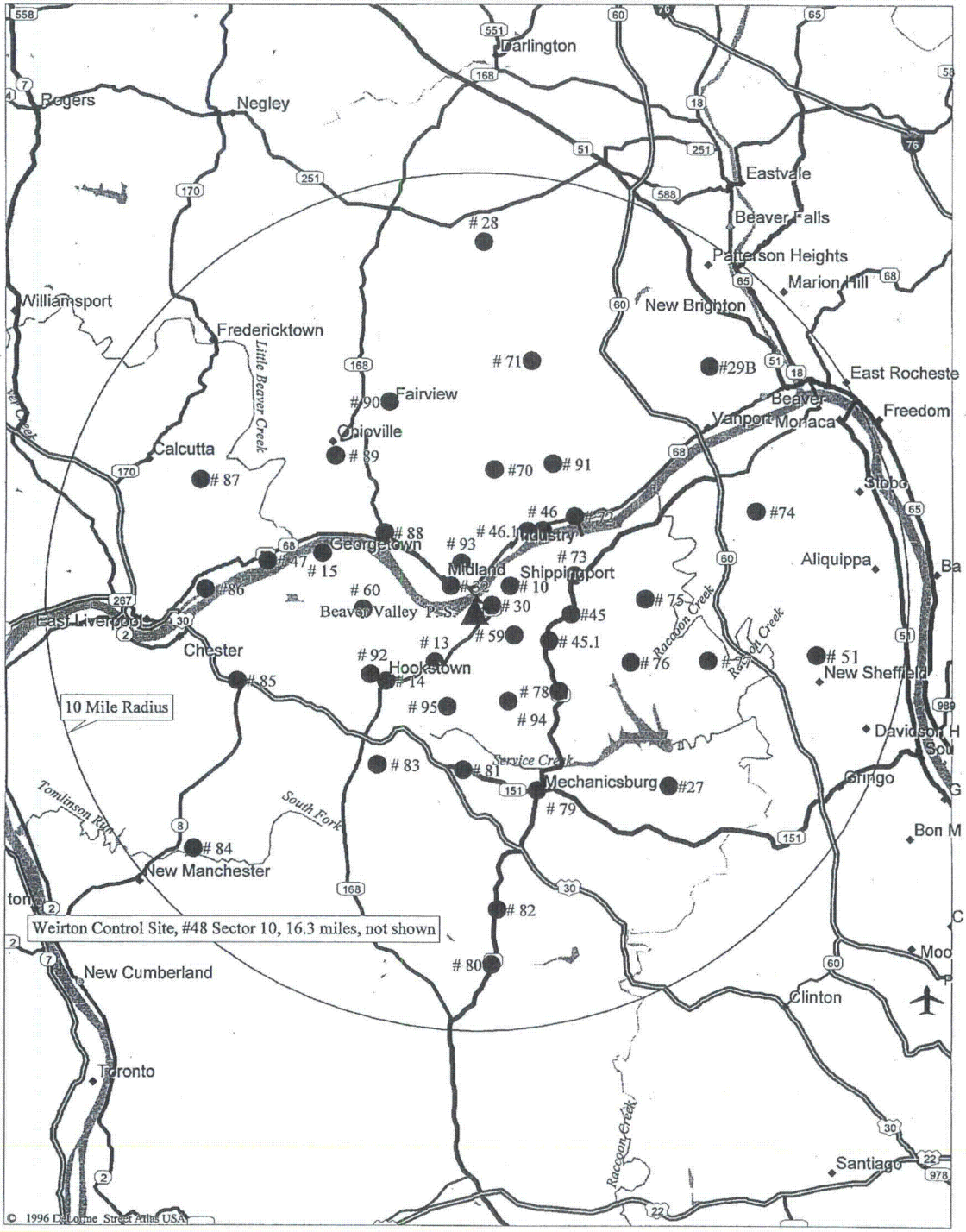

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Figure 2-10 (Continued)

TLD Locations

SOUTHEAST QUADRANT

Site No.	Sector	Distance (miles)	Location
27	7-SE	6.14	Brunton Dairy Farm Aliquippa, PA
45.1	6-ESE	1.92	Kennedy's Corners Raccoon Township, PA
51	5-E	8.00	Sheffield Substation Aliquippa, PA
59	6-ESE	0.99	236 Green Hill Road Aliquippa, PA
76	6-ESE	3.80	Raccoon Elementary School Raccoon Township, PA
77	6-ESE	5.52	3614 Green Garden Road Aliquippa, PA
78	7-SE	2.72	Racoon Twsp Municipal Building Raccoon Township, PA
79	8-SSE	4.46	106 State Route 151 Green Twp. Ted McWilliams Auto Body
80	9-S	8.27	Park Office, State Route 18 Raccoon Township, PA
82	9-S	6.99	2697 State Route 18 Raccoon Twp, PA
94	8-SSE	2.25	McCleary & Pole Cat Hollow Road Hookstown, PA

NORTHWEST QUADRANT

Site No.	Sector	Distance (miles)	Location
15	14-WNW	3.75	Post Office Georgetown, PA
32	15-NW	0.75	North Substation Midland, PA
47	14-WNW	4.88	Water Department East Liverpool, OH
60	13-W	2.51	444 Hill Road Georgetown, PA
86	13-W	6.18	1090 Ohio Avenue East Liverpool, OH
87	14-WNW	7.04	50103 Calcutta Smith's Ferry Road
88	15-NW	2.74	110 Summit Road Midland, PA
89	15-NW	4.72	488 Smith's Ferry Road Ohioville, PA
90	16-NNW	5.20	6286 Tuscarawras Road Midland, PA
93	16-NNW	1.10	104 Linden - Sunrise Hills Midland, PA

NORTHEAST QUADRANT

Site No.	Sector	Distance (miles)	Location
10	3-NE 4-ENE	0.94	Post Office Shippingport, PA
28	1-N	8.60	Sherman Farm Brighton Twp, PA
29B	3-NE	7.97	Friendship Ridge Beaver, PA
30	4-ENE	0.43	Cook's Ferry Substation Shippingport, PA
45	5-E	2.19	Christian House Baptist Chapel, State Rte 18 Raccoon Township, PA
46	3-NE	2.49	Midway Drive Industry, PA
46.1	2-NNE 3-NE	2.28	McKeel's Service, State Route 68 Industry, PA
70	1-N	3.36	236 Engle Road Industry, PA
71	2-NNE	6.01	First Western Bank Brighton Township, PA
72	3-NE	3.25	Ohioview Lutheran Church – Rear Raccoon Twp, PA
73	4-ENE	2.48	618 Squirrel Run Road Industry, PA
74	4-ENE	6.92	137 Poplar Avenue (CCBC) Monaca, PA
75	5-E	4.08	117 Holt Road Aliquippa, PA
91	2-NNE	3.89	Pine Grove Road & Doyle Road Industry

SOUTHWEST QUADRANT

Site No.	Sector	Distance (miles)	Location
13	11-SW	1.49	Old Meyer Farm Hookstown, PA
14	11-SW	2.53	Hookstown, PA
48	10-SSW	16.40	Collier Way Water Tower Weirton , WV
81	9-S	3.69	Millcreek United Presbyterian Church
83	10-SSW	4.26	735 Mill Creek Road, Hookstown
84	11-SW	8.35	Senior Center Hancock County, WV
85	12-WSW	5.73	2048 State Route 30 West Chester, WV
92	12-WSW	2.81	Georgetown Road Substation Georgetown, PA
95	10-SSW	2.37	832 McCleary Road Hookstown, PA

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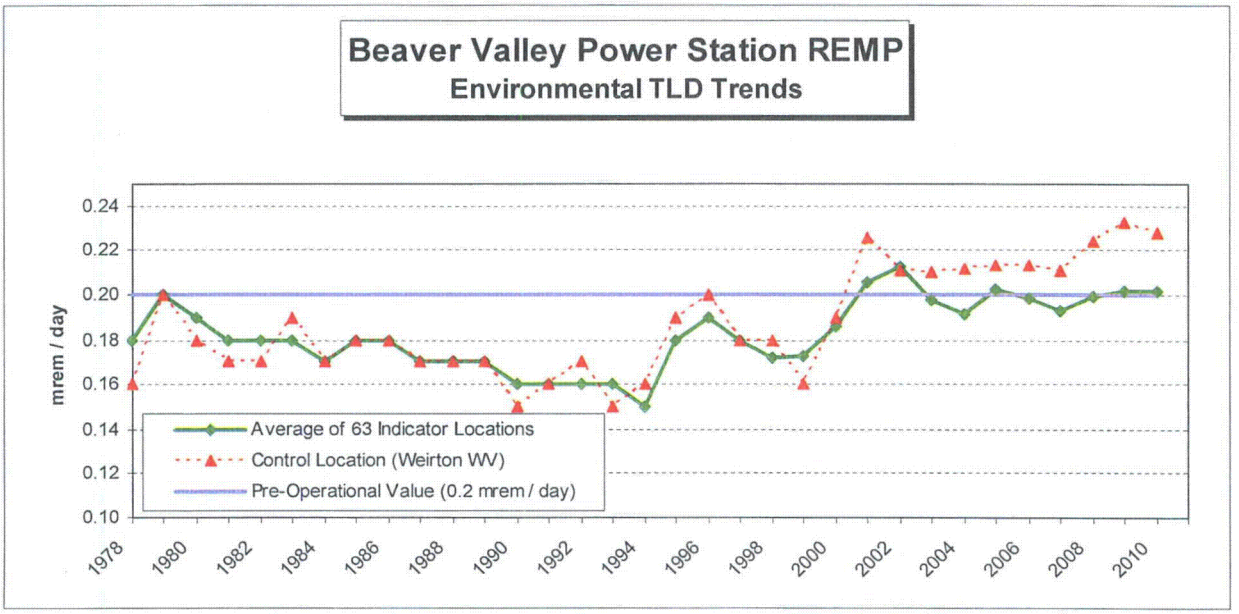
Figure 2-11

Graph of Annual Average Exposure: Direct Radiation in Environment



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

G. Monitoring of Fish

1. Description

During the report period, fish collected for the radiological monitoring program included carp, freshwater drum (sheepshead), sauger, brown catfish, red horse, and gizzard shad.

2. Sampling Program and Analytical Techniques

a. Program

Fish samples are collected semi-annually in the New Cumberland pool of the Ohio River at the Beaver Valley effluent discharge point and upstream of the Montgomery Dam. The edible portion of each different species caught is analyzed by gamma spectroscopy. Fish sampling locations are shown in Figure 2-12.

b. Procedure

A sample is prepared in a standard tare weight 300 ml plastic bottle and scanned for gamma emitting nuclides with gamma spectrometry system which utilizes a high resolution germanium detector.

3. Results and Conclusions

A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-13.

Gamma Spectrometry: A total of nine (9) fish samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the five (5) indicator samples, nor were they detected in any of the four (4) control samples.

Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required fish sampling and analysis schedule during the report period.

Summary: Based on the analytical results, the operation of BVPS did not contribute any measurable increase in radioactivity in the Ohio River fish population during the report period.

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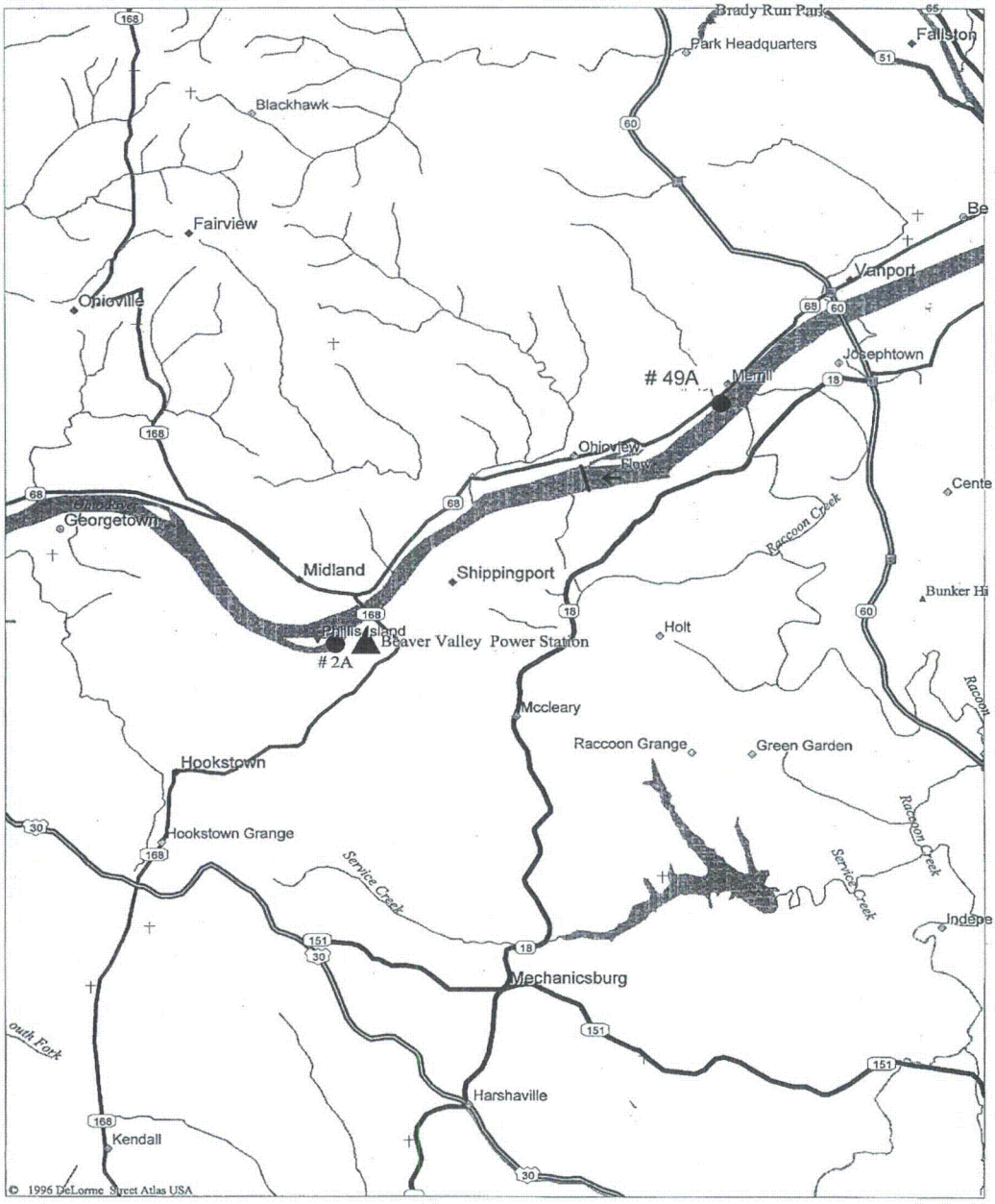
Figure 2-12

Environmental Monitoring Locations - Fish



Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Fish	2A	12-WSW	0.31	BVPS Outfall Vicinity
	49A	3-NE	4.93	Industry, PA (Upstream Montgomery Dam)

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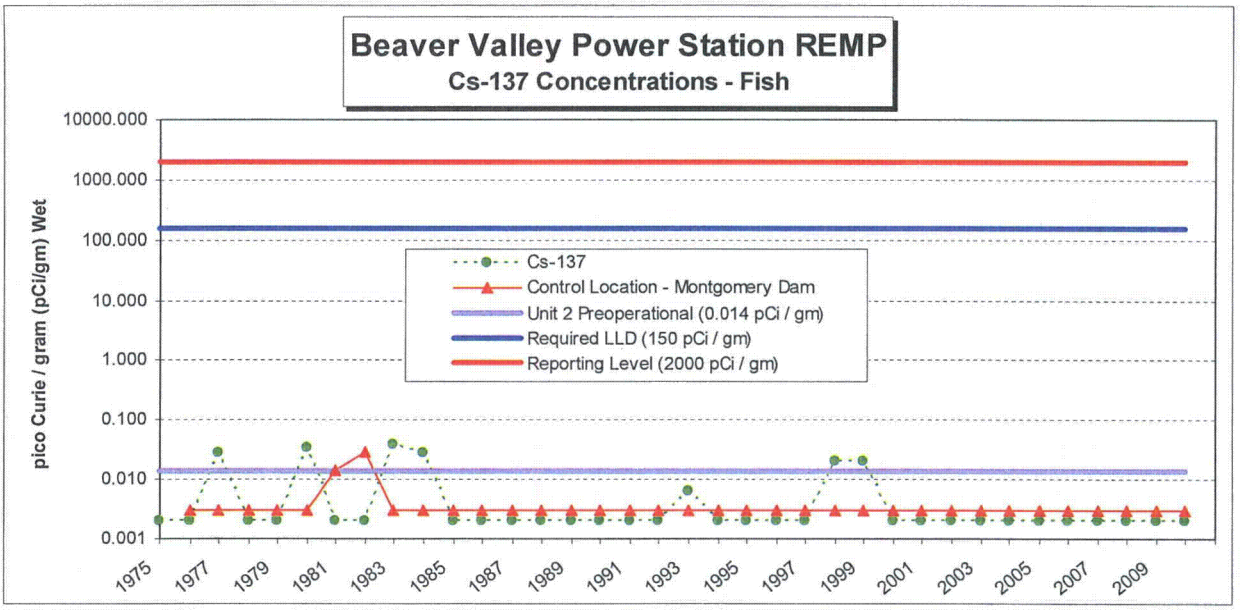
Figure 2-13

Graph of Annual Average Concentration: Cesium-137 in Fish



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

H. Monitoring of Surface Water, Drinking Water, Groundwater and Precipitation

1. Description of Water Sources

The Ohio River is the main body of water in the area. It is the main surface water supply for generation of drinking water in the area. The Beaver Valley Power Station obtains water from the Ohio River for plant make-up water and discharges water to the Ohio River via NPDES discharge points (e.g. cooling tower blowdown, liquid effluent releases, etc).

The Ohio River is the main surface water supply source for towns, municipalities and industries both upstream and downstream of the BVPS site. The nearest user of the Ohio River as a potable water source is Midland Borough Municipal Water Authority. The intake of the treatment plant is approximately 1.5 miles downstream and on the opposite side of the river. The next downstream user is East Liverpool, Ohio which is approximately 6 miles downstream. The heavy industries in Midland, as well as others downstream, also use river water for cooling purposes.

Groundwater occurs in large volumes in the gravel terraces which lie along the river, and diminishes considerably in the bedrock underlying the site. Normal well yields in the bedrock are less than 10 gallons per minute (gpm) with occasional wells yielding up to 60 gpm.

In general, the BVPS site experiences cool winters and moderately warm summers with ample annual precipitation evenly distributed throughout the year. The National Climate Data Center (http://www.ncdc.noaa.gov/oa/climate/research/cag3/v4.html) indicates the total annual precipitation during the report period for the Pittsburgh, PA area was 37.18 inches.

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2. Sampling and Analytical Techniques

a. Surface (Raw River) Water

The sampling program of river water includes three (3) sampling points along the Ohio River.

Raw water samples are collected daily at the East Liverpool (Ohio) Water Treatment Plant, sample location 5, [River Mile 41.2], and the made into a weekly composite sample. One automatic river water sampler is located at the ATI-Allegheny Ludlam (formerly J&L Steel) river water intake, sample location 2.1, [River Mile 36.2]. The automatic sampler takes a 20-40 ml sample every 15 minutes and samples are collected on a weekly basis. The weekly samples are then made into a monthly composite sample for each location. The monthly composite samples are analyzed for gamma emitters. In addition, a quarterly composite sample is prepared for each sample point from the monthly composites. Quarterly composites are analyzed for Hydrogen-3 (Tritium).

A weekly grab sample is taken upstream of the Montgomery Dam, sample location 49 [River Mile 29.6]. This upstream sample at the Montgomery Dam is the control sample. The weekly grab samples upstream of the Montgomery Dam are analyzed for Iodine-131. Weekly grab samples are then made into monthly composites are analyzed for gamma emitters. Quarterly composite are prepared from each of the monthly composites. The quarterly composites are analyzed for Tritium.

Locations of each sample point are shown in Figure 2-14.

b. Drinking Water (Public Supplies)

Drinking water (i.e.; treated water) is collected at both the Midland, PA Water Treating Plant, sample location 4, and East Liverpool, OH Water Treating Plant, sample location 5. An automatic sampler at each location collects 20-40 ml every 20 minutes, which is then made into a weekly composite sample. The weekly composite sample from each location is analyzed for Iodine-131. Monthly composites are made from the weekly samples and are analyzed by gamma spectrometry. In addition, a quarterly composite sample is prepared for each sample point from the monthly composites. Quarterly composites are analyzed for Tritium.

A weekly grab sample is taken upstream of the Montgomery Dam, sample location 49 [River Mile 29.6]. This upstream sample at the Montgomery Dam is the control sample. The weekly grab samples upstream of the Montgomery Dam are analyzed for Iodine-131. Weekly grab samples are then made into monthly composites are analyzed by gamma spectrometry. Quarterly composite are prepared from each of the monthly composites. The quarterly composites are analyzed for Tritium.

Locations of each sample point are shown in Figure 2-14.

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c. Groundwater

Although not required by the ODCM, semi-annual grab samples were collected from three (3) locations within four (4) miles of the site (see Figure 2-14). These locations are:

One (1) well in Shippingport, PA

One (1) well in Hookstown, PA

One (1) well in Georgetown, PA

Each ground water sample is analyzed for tritium and is analyzed by gamma spectrometry.

d. Precipitation

Although not required by the ODCM, precipitation is collected in Shippingport PA, East Liverpool OH, and Weirton WV. Precipitation, when available, is collected each week and then made into quarterly composite samples from the weekly samples. The quarterly composites are analyzed for Tritium and gamma emitters. Locations of each of the sample points are shown in Figure 2-14.

e. Procedures

Gamma Analysis of Drinking Water and Surface Water: The analysis is performed on water samples by placing one liter of the sample into a Marinelli container and analyzing the sample on a high resolution germanium gamma spectrometry system. Although not required by the ODCM, this analysis is also performed on Groundwater and Precipitation.

Tritium Analysis of Drinking Water and Surface Water: The Tritium is determined in water samples by liquid scintillation analysis. Although not required by the ODCM, this analysis is also performed on Surface Water, Groundwater and Precipitation.

Iodine-131 Analysis of Drinking Water: The sample is chemically prepared and analyzed with a low-level beta counting system. Although not required by the ODCM, this analysis is also performed on Surface Water.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

3. Results and Conclusions

A summary of the analysis results of water samples (surface water, drinking water, ground water and precipitation) during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figures 2-15 through 2-18.

a. Surface Water

Tritium: A total of twelve (12) surface water samples were analyzed for Tritium during the report period. Tritium was detected in any of the one of eight (1 of 8) indicator samples, and zero of four (0 of 4) control samples.

Gamma Spectrometry: A total of thirty-six (36) surface water samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the twenty-four (24) indicator samples, nor were they detected in any of the twelve (12) control samples.

Iodine-131: Although not required by the ODCM, a total of fifty-two (52) surface water control samples were analyzed for Iodine-131 using radiochemical methods during the report period. Iodine131 was detected in forty-five of fifty-two (45 of 52) weekly control samples, of which one (1) analysis exceeded the reporting level of 2 pico Curie / liter. The results were similar to previous years, (current years range = 0.2 to 2.1 pico Curie / liter). The positive results were detected at the Control location, which is five (5) miles upstream (not influenced by BVPS operation). Identification of Iodine-131 during the report period was most likely due to medical diagnostic and treatment procedures from upstream facilities. This condition is documented in CR 10-82446.

b. Drinking Water

Tritium: A total of twelve (12) drinking water samples were analyzed for Tritium during the report period. Tritium was detected in any of the one of eight (1 of 8) indicator samples, and zero of four (0 of 4) control samples.

Gamma Spectrometry: A total of thirty-six (36) drinking water samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the twenty-four (24) indicator samples, nor were they detected in any of the twelve (12) control samples.

Iodine-131: A total of one hundred-fifty-eight (158) drinking water samples were analyzed for Iodine-131 (using radiochemical methods) during the report period. Iodine-131 was detected in fifty-six of one-hundred-six (56 of 106) indicator samples and forty-five of fifty-two (45 of 52) control samples. Some of the positive results at the downstream location exceeded the positive results from the upstream surface water Control location, but none of these analyses exceeded the reporting level of 2 pico Curie / liter. Because positive results were detected in the upstream control sample, some positive results are most likely due to medical diagnostic and treatment procedures from upstream facilities, and not caused by BVPS operations. However, the analyses are also consistent with

discharge data of authorized liquid effluent releases, and all liquid effluent releases during the report period did not exceed the release limits set forth in the ODCM.

c. Groundwater

Tritium: Although not required by ODCM, a total of six (6) groundwater samples were analyzed for Tritium during the report period. Tritium was not detected in any of the four (4) indicator samples, nor was it detected in any of the two (2) control samples.

Gamma Spectrometry: Although not required by ODCM, a total of six (6) groundwater samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the four (4) indicator samples, nor were they detected in any of the two (2) control samples.

d. Precipitation

Tritium: Although not required by ODCM, a total of twelve (12) precipitation samples were analyzed for Tritium during the report period. Tritium was not detected in any of the eight (8) indicator samples, nor was it detected in any of the four (4) control samples.

Gamma Spectrometry: Although not required by ODCM, a total of twelve (12) precipitation samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the eight (8) indicator samples, nor were they detected in any of the four (4) control samples.

e. Deviations from Required Sampling and Analysis Schedule: There were some deviations from the required water sampling and analysis schedule during the report period. Specifically, the following events occurred:

During the sampling period of 02/08/10-02/14/10, large snow accumulation and associated power outages affected REMP sampling at Midland Water Department (Station #04, 1.3 miles NW). Drinking water composite sampling was interrupted for 8 hours and 42 minutes. This condition was documented in CR 10-71609.

During the sampling period of 02/22/10-02/26/10, while performing routine maintenance of the drinking water sample station at Midland Water Department (Station #04, 1.3 miles NW), it was determined that the solenoid valve on the supply line to the composite sampling equipment was malfunctioning. This valve is owned by Midland Water Department and cannot be worked by FENOC or Environmental Inc personnel. Midland Water Department personnel were notified of the condition and returned the valve to service. The total time that the REMP composite sampling equipment was out of service was 23 hours and 17 minutes. This condition was documented in CR 10-72229.

During the sampling period of 07/20/10-07/27/10, while performing routine maintenance of the surface water sample station at Allegheny Ludlam (Station #2.1, 1.4 miles WNW), the inlet sample supply pipe to the composite sampling equipment sheered due to corrosion. This pipe is owned by Allegheny Ludlam and cannot be replaced by FENOC or Environmental Inc personnel. Allegheny Ludlam personnel were notified of the condition and repaired the line. The total time that the REMP composite sampling equipment was

out of service was 23 hours and 30 minutes. This condition was documented in CR 10-80141.

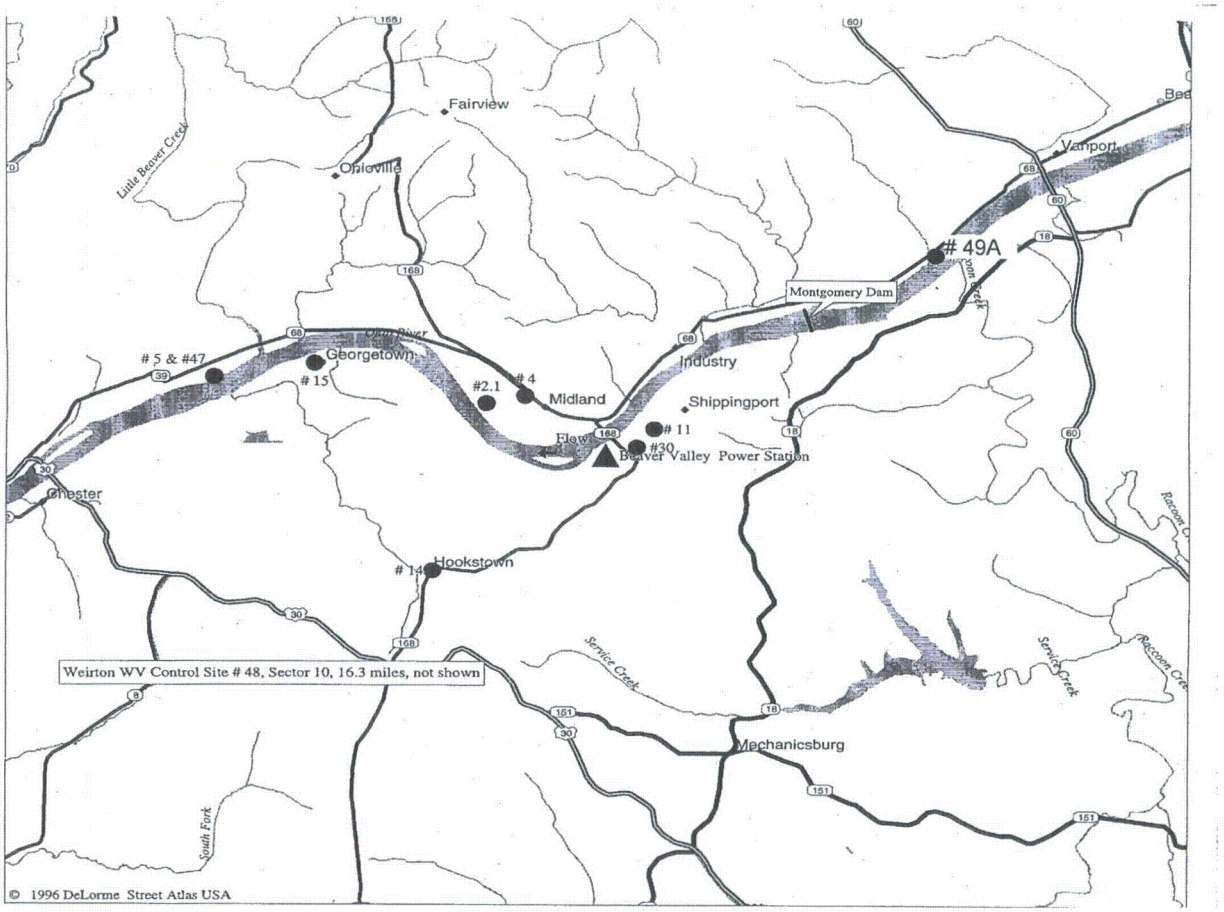
On July 8, 2010, the BVPS REMP Administrator was notified via email by Environmental Inc, Midwest Laboratories of a sample result for upstream sample point 49A being above the reporting limit of 2 pCi/L for I-131. This condition was previously documented in CR #10-79484. Upon receiving and reviewing the Monthly Progress Report from Midwest Laboratories, the REMP Administrator noticed that the value was not reported as previously discussed. The vendor lab was contacted immediately. The laboratory explained that the initial report above 2 pCi/L was inaccurately calculated based upon an error in the sample date. The calculation was corrected and the value became 1.7 pCi/L, which is less than the reporting limit. The laboratory did not notify the BVPS REMP Administrator of this correction until prompted by questioning by the REMP Administrator. This is not a direct deviation from the sampling or analysis program as no surveillances were missed and no additional analyses were performed. However, because Condition Report 10-79484 had been written explaining that the positive result would be included in this 2010 annual report, an explanation of the inaccurate documentation of positive results is being included instead. This condition has been documented in CR #10-82503.

f. Summary: Data from the water sample analyses demonstrate that BVPS did not contribute a significant increase of radioactivity in the local river, in the drinking water, in the well water, or in the precipitation. The analytical results confirm that the station assessments, prior to authorizing radioactive discharges, are adequate and that the environmental monitoring program is sufficiently sensitive.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-14

Environmental Monitoring Locations - Ground Water, Surface Water, Drinking Water and Precipitation

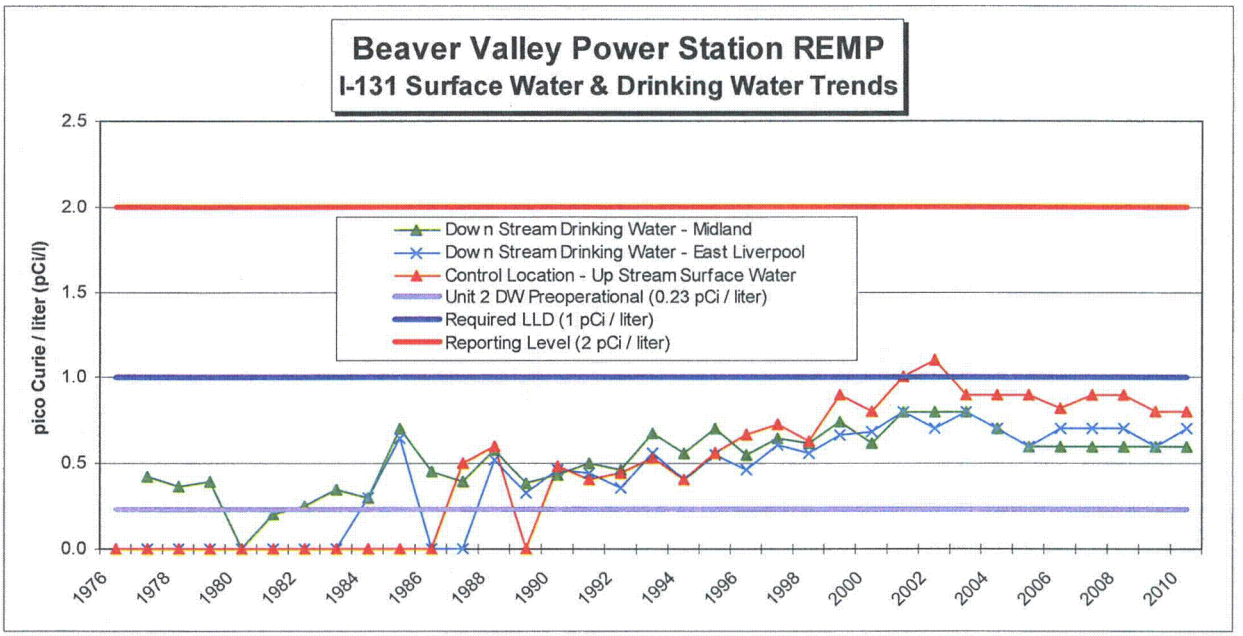


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Drinking Water	4	15-NW	1.26	Midland, PA (Water Department)
	5	14-WNW	4.90	East Liverpool, OH (Water Department)
Surface Water	2.1	14-WNW	1.43	Midland, PA (ATI Allegheny Ludlam)
	5	14-WNW	4.90	East Liverpool, OH (Water Department)
	49A	3-NE	4.93	Industry, PA (Upstream Montgomery Dam)
Ground Water	11	3-NE	0.94	Shippingport, PA
	14A	11-SW	2.61	Hookstown, PA
	15B	14-WNW	3.75	Georgetown, PA
Precipitation	30	4-ENE	0.43	Shippingport, PA (Cook's Ferry Substation)
	47	14-WNW	4.88	East Liverpool, OH (Water Department)
	48	10-SSW	16.40	Weirton WV (Water Tower, Collier Way)

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-15

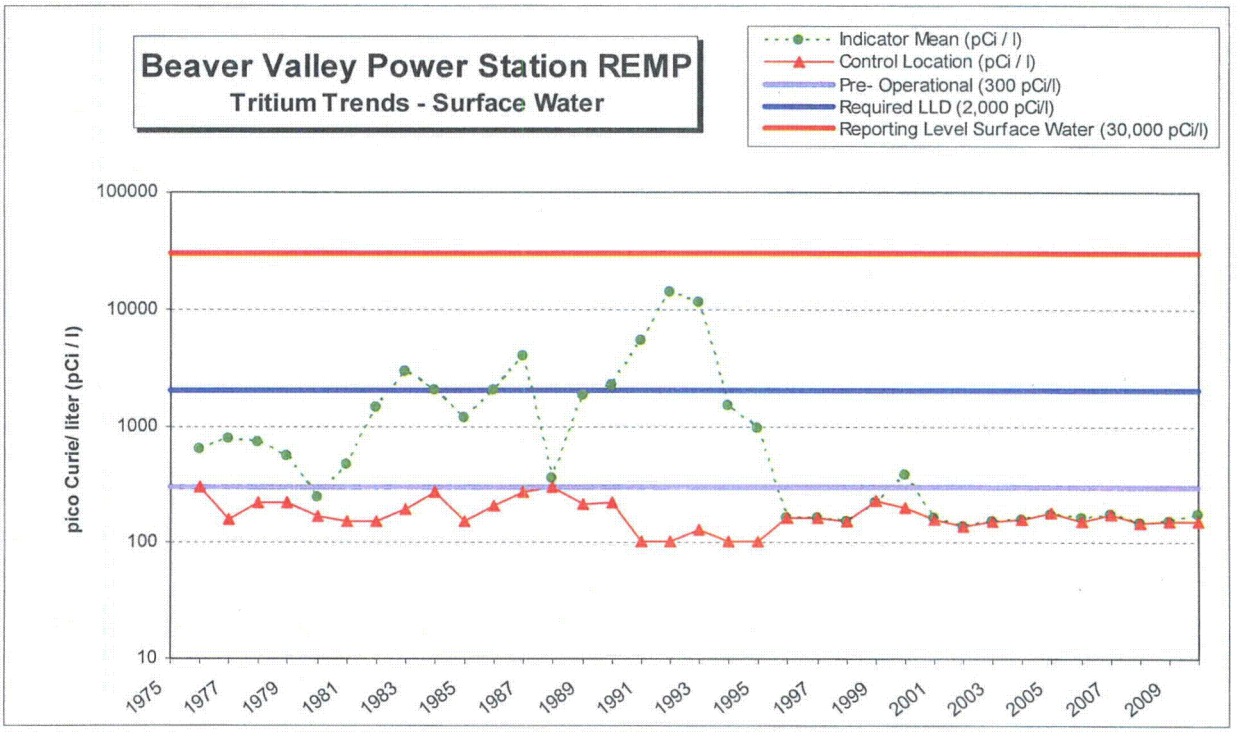
Graph of Annual Average Concentration: Iodine-131 in Surface Water & Drinking Water



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-16

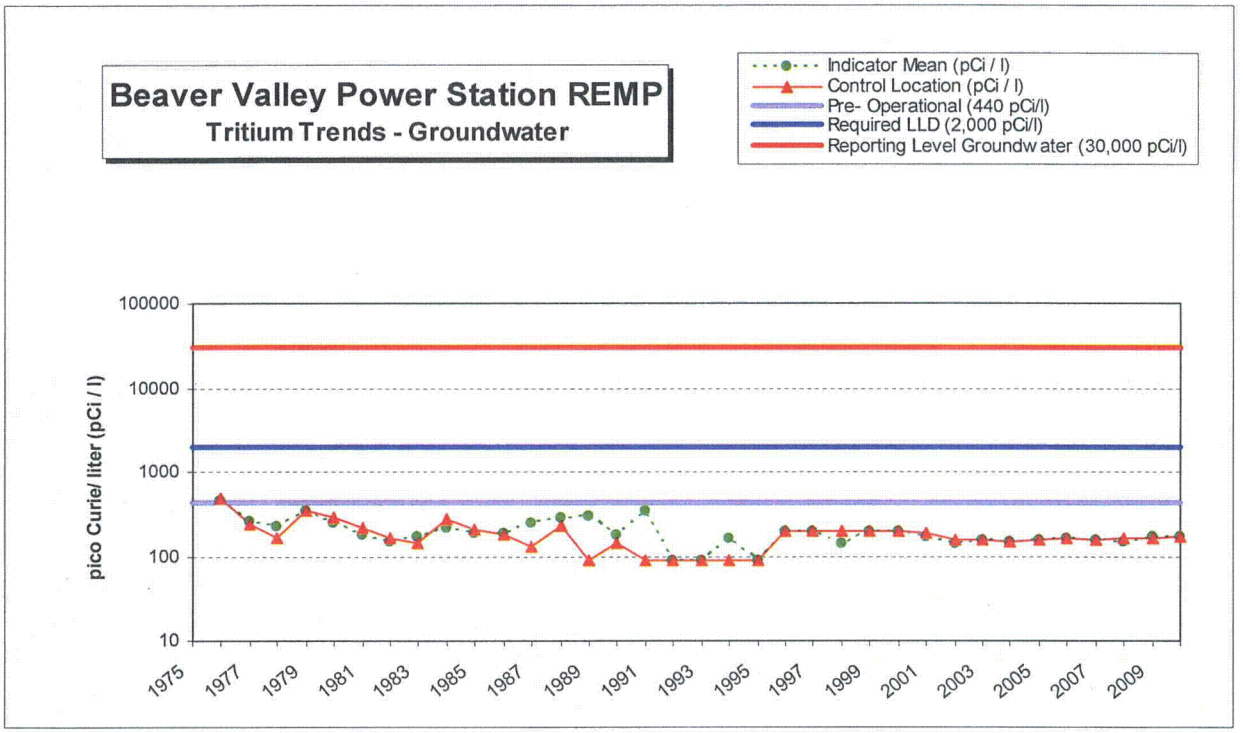
Graph of Annual Average Concentration: Tritium in Surface Water



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-17

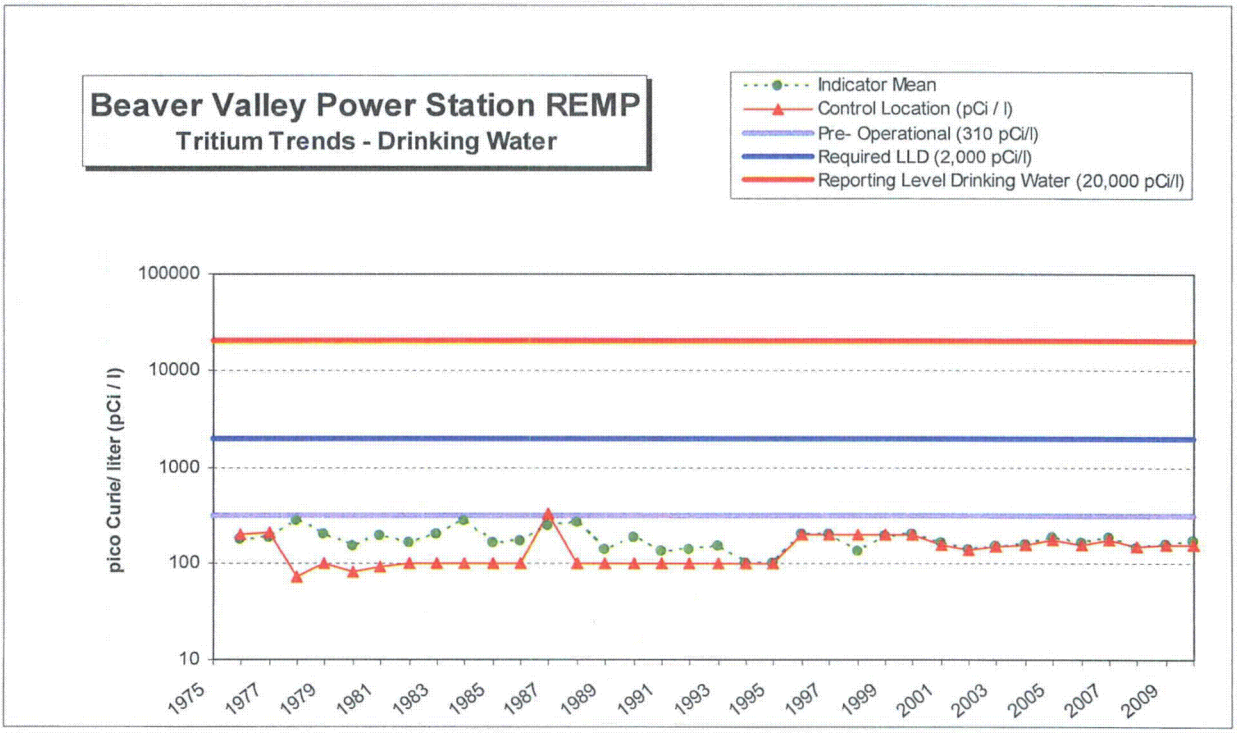
Graph of Annual Average Concentration: Tritium in Ground Water



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-18

Graph of Annual Average Concentration: Tritium in Drinking Water



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

I. Estimates of Radiation Dose to Man

1. Pathways to Man - Calculational Models

The radiation doses to man as a result of BVPS operations were calculated for both gaseous and liquid effluent pathways using computer codes for the ARERAS/MIDAS computer system. These computer codes are equivalent to NRC computer codes XOQDOQ2, GASPAR, and LADTAP. Dose factors listed in the ODCM are used to calculate doses from radioactive noble gases in discharge plumes. BVPS effluent data, based on sample analysis were used as the radionuclide activity input.

All liquid and gaseous effluent radionuclides listed in the Annual Radioactive Effluent Release Report were input as source terms to the computer codes.

All batch and continuous gaseous effluent releases were included in the dose assessment calculations. The release activities are based on laboratory analysis. Meteorological data collected by the BVPS Meteorology System was also used as input to the computer codes. Except when more recent or specific data was available, the usage factors were obtained from the BVPS Final Environmental Statements or Regulatory Guide 1.109.

All radioactive liquid effluents are released by batch mode after analysis by gamma spectrometry. Each batch is diluted by cooling tower blowdown water prior to discharge into the Ohio River via the main outfall (River Mile 35.0). The actual data from these analyses are tabulated and used as the radionuclide source term input to the computer code. Except when more recent or specific data was available, the usage factors were obtained from the BVPS Final Environmental Statements or Regulatory Guide 1.109.

The total population doses were evaluated for all liquid and gaseous effluent pathways out to 50 miles. For these evaluations, a total population of ~4 million people was used. An estimate of the populations are listed in the BVPS-2 UFSAR Section 2.1.3.1 for 0-10 miles and Section 2.1.3.2 for 10-50 miles.

2. Results of Calculated Population Dose to Man - Liquid Effluent Releases

During the report period, the calculated dose to the entire population within 50 miles of the plant is presented in Table 2-4 for BVPS liquid effluent releases. Also shown in this table is a comparison to natural radiation exposure.

3. Results of Calculated Population Dose to Man – Gaseous Effluent Releases

During the report period, the calculated dose to the entire population within 50 miles of the plant is presented in Table 2-5 for BVPS airborne effluent releases. Also shown in this table is a comparison to natural radiation exposure. The doses include the contribution of all pathways.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

4. Conclusions

Based upon the estimated dose to individuals from the natural background radiation exposure in Tables 2-4 and 2-5, the incremental increase in total body dose to the 50-mile population from the operation of BVPS - Unit 1 and 2, is less than 0.00005% of the annual background dose.

The calculated doses to the public from the operation of BVPS - Unit 1 and 2, are below ODCM annual limits and resulted in only a small incremental dose to that which area residents already received as a result of natural background. The doses constituted no meaningful risk to the public.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-4

Comparison of Natural Radiation Exposure Versus Calculated Population Dose to Man - Liquid Effluent Releases

TYPICAL DOSE TO INDIVIDUALS FROM NATURAL RADIATION EXPOSURE [a]		
Ambient Gamma Radiation	=	58 millirem / year
Radionuclides in Body	=	40 millirem / year
Global Fallout	=	< 1 millirem / year
Radon	=	198 millirem / year
Average Individual	=	**296 millirem / year**
(Total from all sources shown above)		

(a) National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," BEIR Report, 1990

0-50 mile Population Dose from BVPS Liquid Effluent Releases		
	Man-millirem	**Largest Isotope Contributor**
Total Dose	**352**	**Tritium**
Average Dose (per Individual)	**0.0000880**	**Tritium**

Comparison of Individual Dose BVPS Liquid Effluent Releases Versus Natural Background Radiation	
	millirem
BVPS Liquid Effluent Release Dose	**0.0000880**
Natural Radiation Exposure	**296**

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-5

Comparison of Natural Radiation Exposure Versus

Calculated Population Dose to Man – Gaseous Effluent Releases

TYPICAL DOSE TO INDIVIDUALS FROM NATURAL RADIATION EXPOSURE [a]		
Ambient Gamma Radiation	=	58 millirem / year
Radionuclides in Body	=	40 millirem / year
Global Fallout	=	< 1 millirem / year
Radon	=	198 millirem / year
Average Individual	=	**296 millirem / year**
(Total from all sources shown above)		
[b] National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," BEIR Report, 1990		

0-50 mile Population Dose from BVPS Gaseous Effluent Releases		
	Man-millirem	**Largest Isotope Contributor**
Total	**124**	**Tritium**
Average (per Individual)	**0.0000310**	**Tritium**

Comparison of Individual Dose BVPS Gaseous Effluent Releases Versus Natural Background Radiation	
	millirem
BVPS Gaseous Effluent Release Dose	**0.0000310**
Natural Radiation Exposure	**296**

SECTION 3 – LAND USE CENSUS

A. **Land Use Census Overview**: A Land Use Census was conducted July 6 through September 22, 2010 to comply with:

- Offsite Dose Calculation Manual procedure 1/2-ODC-3.03, "*Controls for RETS and REMP Programs*", Attachment R, Control 3.12.2, and Surveillance Requirement 4.12.2.1

- BVPS REMP procedure 1/2-ENV-04.02, *"Milch Animal Sampling Location Determination & ODCM Procedure 1/2-ODC-3.03, Control 3.12.2 Action Statements a and b Compliance Determination"*

The Land Use census indicated that no changes were required in the current sampling locations, and no changes were required to the methodology used for determination of offsite dose from plant releases. A numerical summary of the Land Use Census results are provided in Table 3-1. The following information is also provided to clarify the Land Use Census as documented in letter NPD3NRE:0713, dated September 22, 2010:

B. **Nearest Residence:** The location of the Nearest Residence has not changed since the previous census. The Nearest Residence location remains at the Terwilliger Residence, 211 Ferry Hill Road, Shippingport, PA (0.406 miles, in the NE Sector).

C. **Nearest Garden >500 sqft**: The location has not changed since the previous census. The location remains at the Knisley Residence, 175 Kerona Road, Shippingport, PA (0.7 miles, NE). However, this garden has not joined our sampling program because it did not contain leafy vegetables most appropriate for sampling (cabbage) this year.

D. **Nearest Dairy Cow:** The location of the Nearest Dairy Cow has not changed since the previous census. The location remains at the Searight Dairy, 948 McCleary Road, RD1, Hookstown, PA (2.097 miles, in the SSW Sector).

E. **Nearest Doe Goat:** The location has not changed since the previous census. The location remains at the Ferry Farm, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE). However, goat milk samples were not available from this location, nor from any other location within the 5 mile radius this year. This condition was described in Section 2 of this report and documented in CR 10-82742.

SECTION 3 – LAND USE CENSUS

F. **Projection for 2011 Dairy Cow Sampling Locations:** Using a linear regression analysis of deposition parameters (D/Q), Dairy Cow sampling locations were determined to remain at the same locations used in 2010:
- **Searight Dairy**, 948 McCleary Road, RD1, Hookstown, PA (2.097 miles SSW)
- **Halstead Dairy**, 104 Tellish Drive, Hookstown, PA (5.079 miles SSW)
- **Brunton Dairy**, 3681 Ridge Road, Aliquippa, PA (6.158 miles SE)
- **Windsheimer Dairy**, RD 1 Burgettstown, PA (10.476 miles SSW)

G. **Projection for 2011 Doe Goat Sampling Locations:** The linear regression analysis also indicated that there may be a Doe Goat sampling location in 2011. The Doe Goat sampling location for 2011 may be as follows if Goat Milk becomes available from this site:
- **Ferry Farm**, 227 Calhoun Road, Aliquippa, PA (3.320 miles SE)

H. **D/Q for Milch Animal Locations:** None of the 2010 milch animal sampling locations experienced a >20% increase in D/Q. Therefore, a Special Report per ODCM procedure 1/2-ODC-3.03, Attachment R, Control 3.12.2 Action "a" and/or Action "b" was not required.

I. **D/Q for Offsite Dose Determination:** There was no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, a linear regression analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% more than the offsite dose previously calculated using current ODCM methodology. Therefore, a Special Report per ODCM procedure 1/2-ODC-3.03, Attachment R, Control 3.12.2 Action "a" and/or Action "b" was not required.

J. **D/Q Historical Comparison:** There was no adverse trend in D/Q when comparing historical data to the ODCM default D/Q values. This validates that there was no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, the analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% more than the offsite dose previously calculated using current ODCM methodology. Therefore, a change in ODCM Receptor location and/or a change to meteorology at the current ODCM Receptor location are not required.

SECTION 3 – LAND USE CENSUS

K. Discrepancies or Conditions of Note:

During performance of the 2010 Land Use Census, discrepancies were discovered and documented in Condition Report 10-82745. These discrepancies are summarized as follows:

The Google Earth software program was adopted as a new tool for the 2010 Land Use Census and REMP Program. All previous Nearest Residence Locations were verified using the program and it was determined that the Nearest Residence in Sector 6-ESE was being inaccurately reported. The reported residence (223 State Route 168, Hookstown, PA) was actually located in Sector 5-E. Therefore, a new Nearest Residence was determined for Sector 6 and recorded in the 2010 Land Use Census (230 Gillin Road, Aliquippa PA). All previous Garden Locations were then verified using the program and it was determined that the sector locations of a few gardens were being inaccurately reported. The following Gardens were evaluated and reassigned new sector designations for the 2010 Land Use Census Report: (1) Moore Residence, 237 McCleary Rd, Hookstown, PA 15050-1702 (1.983 miles, in the SE Sector- previously reported as SSE); (2) Searight Residence, 968 McCleary Road, Hookstown, PA 15050-1306 (2.000 miles, in the SW Sector – previously reported as SSW); (3) West Residence, 321 Third Street, Georgetown, PA 15043 (3.6 miles, in the WNW Sector – previously reported as WSW).

SECTION 3 – LAND USE CENSUS

Table 3-1

Location of Nearest Residences, Gardens, Dairy Cows and Doe Goats

SECTOR	RESIDENCES	GARDENS	DAIRY COWS	DOE GOATS
	0 to 5 miles (miles)	0 to 5 miles (miles)	0 to 5 miles (miles)	0 to 5 miles (miles)
N	1.584	1.584	None	None
NNE	1.661	2.0	None	None
NE	**0.406** [b]	**0.7** [b]	None	None
ENE	0.603	1.047	None	None
E	0.429	2.252	None	3.402
ESE	0.850	1.713	None	None
SE	1.583	1.5	None [a]	**3.320** [b]
SSE	1.102	3.1	None	None
S	1.399	2.2	3.851	None
SSW	0.760	2.215	**2.097** [b]	None
SW	1.453	1.453	None	None
WSW	1.394	2.5	None	None
W	2.204	2.2	None	None
WNW	2.742	2.8	None	None
NW	0.885	1.033	None	None
NNW	0.902	2.413	2.442	None

[a] Although there are no Dairy Cows within 5 miles in this sector, a large local dairy located at 6.158 miles is included in the milk sampling program.

[b] **Distances shown in Bold print are the nearest location for that receptor.**

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

A. **Split Sample Program (Inter-Laboratory Comparison, Part 1 of 2):** BVPS participates in a split sample program with the Pennsylvania Department of Environmental Protection (PADEP) in support of their nuclear power plant monitoring program.

- BVPS provided split samples to PADEP throughout the report period. The shared media and number of locations were typically comprised of; milk (1), surface water (3), sediment (1), fish (1), and food crops (2).
- PADEP has co-located continuous air particulate & air iodine sample stations with four (4) of the BVPS locations.
- PADEP has co-located TLDs with twenty-four (24) of the BVPS TLDs.

B. **Spike Sample Program (Inter-Laboratory Comparison, Part 2 of 2):** BVPS participates in a spike sample program with an Independent Laboratory. This program is used to independently verify sample analyses performed by the BVPS Contractor Laboratory.

- **Acceptance Criteria:** The NRC criteria listed in NRC Inspection Procedure 84750, 03/15/94, Inspection Guidance 84750-03 is used as acceptance criteria for comparisons of results of spiked samples between the Contractor Lab and the Independent Lab. These comparisons are performed by dividing the comparison standard (Independent Lab result) by its associated uncertainty to obtain the resolution. The comparison standard value is multiplied by the ratio values obtained from the following table to find the acceptance band for the result to be compared. However, in such cases where the counting precision of the standard yields a resolution of less than 4, a valid comparison is not practical, and therefore, not performed.

NRC Criteria	
Resolution	**Ratio**
< 4	--
4 - 7	0.50 - 2.00
8 - 15	0.60 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
> 200	0.85 - 1.18

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

Participation in an Inter-Laboratory Comparison Program is required by BVPS Unit 1 and 2 Offsite Dose Calculation Manual procedure 1/2-ODC-3.03 Attachment S Control 3.12.3. For the report period, the requirement was met by the Contractor Lab analyzing NIST traceable spiked samples supplied by an Independent Lab.

During the report period, BVPS used (Environmental, Inc., Midwest Laboratory – Northbrook, IL) as the Contractor Laboratory, and (Analytics – Atlanta, GA) as the Independent Laboratory.

The spiked samples included air particulate filter papers, charcoal cartridges, water samples, and milk samples. The samples were submitted by the Independent Laboratory to the Contractor Laboratory for analysis. The "spiked to" values were used for calculating comparison Acceptance Criteria.

- **Spiked Milk & Water Samples:** The spiked sample results (i.e.; the BVPS criteria) for each calendar quarter are reported in Table 4-1 through Table 4-4, respectively. The following summary is provided:

  - A total of forty-seven (47) gamma spectrometry radionuclide analyses were performed by the Contractor Laboratory on four (4) milk samples.

  - A total of forty-seven (47) gamma spectrometry radionuclide analyses were performed by the Contractor Laboratory on four (4) water samples.

  - A total of four (4) chemical analyses for I-131 were performed by the Contractor Laboratory on four (4) milk samples.

  - A total of four (4) chemical analyses for I-131 analyses were performed by the Contractor Laboratory on four (4) water samples.

  - A total of four (4) tritium analyses were performed by the Contractor Laboratory on four (4) water samples.

  - Comparison of results of the spiked milk and water samples showed acceptable agreement with the NRC acceptance criteria. All one-hundred-ten (110) analyses met the NRC acceptance criteria.

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

- **Spiked Filter Paper and Charcoal Cartridge Samples:** The spiked sample results for each calendar quarter are also reported in Table 4-1 through Table 4-4, respectively. The following summary is provided:

  - Gross Beta (Cesium-137) analyses were performed by the Contractor Laboratory on two (2) filter paper samples.

  - Iodine-131 analyses were performed by the Contractor Laboratory on two (2) charcoal cartridge samples.

  - Comparison of results of the spiked filter paper and charcoal cartridge samples showed acceptable agreement with the NRC acceptance criteria. All four (4) analyses performed by the Contractor Laboratory met the NRC acceptance criteria.

C. Conclusions

- **Results of Split Sample Program:**

  The split sample program is coordinated by the state, and the results are not provided with this report.

- **Results of Spike Sample Program:**

  Based on the Inter-Laboratory comparison data, BVPS considers all analyses provided throughout the report period by the Contractor Laboratory to be acceptable with respect to both accuracy and measurement. A comparison of the data is provided in the following tables. All analyses for the 2010 report period were within the NRC Acceptance Criteria.

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

Table 4-1

Inter-Laboratory Comparison Program Spiked Samples – 1st Quarter

Sample Date, Type and Identification No.	Resolution	Resolution	Required Ratio Band	Ratio Env Inc: Analytics	Comparison
03/18/10 Water Ind Lab: E7029-93 Con. Lab: SPW-1105	Sr-89	60	0.80 - 1.25	1.03	AGREEMENT
	Sr-90	60	0.80 - 1.25	1.00	AGREEMENT
	I-131	60	0.80 - 1.25	0.96	AGREEMENT
	I-131	60	0.80 - 1.25	1.00	AGREEMENT
	Ce-141	60	0.80 - 1.25	1.00	AGREEMENT
	Cr-51	60	0.80 - 1.25	1.01	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.94	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.05	AGREEMENT
	Co-58	60	0.80 - 1.25	1.02	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.05	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.09	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.08	AGREEMENT
	Co-60	60	0.80 - 1.25	1.00	AGREEMENT
03/18/10 Water Ind. Lab: E7028-93 Con. Lab: SPW-1103	H-3	60	0.80 - 1.25	1.06	AGREEMENT
03/18/10 Milk Ind. Lab: E7030-93 Con. Lab: SPMI-1106	Sr-89	60	0.80 - 1.25	1.06	AGREEMENT
	Sr-90	60	0.80 - 1.25	0.91	AGREEMENT
	I-131	60	0.80 - 1.25	0.92	AGREEMENT
	I-131	60	0.80 - 1.25	0.96	AGREEMENT
	Ce-141	60	0.80 - 1.25	1.00	AGREEMENT
	Cr-51	60	0.80 - 1.25	0.99	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.91	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.03	AGREEMENT
	Co-58	60	0.80 - 1.25	1.00	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.01	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.08	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.06	AGREEMENT
	Co-60	60	0.80 - 1.25	1.01	AGREEMENT
03/18/10 Filter Paper Ind. Lab: E7031-93 Con. Lab: SPAP-1107	Cs-137 (Gross Beta)	60	0.80 - 1.25	1.14	AGREEMENT
03/18/10 Charcoal Cartridge Ind. Lab: E7032-93 Con. Lab: SPCH-1108	I-131	60	0.80 - 1.25	0.85	AGREEMENT

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

Table 4-2

Inter-Laboratory Comparison Program Spiked Samples – 2nd Quarter

Sample Date, Type and Identification No.	Resolution	Resolution	Required Ratio Band	Ratio Env Inc: Analytics	Comparison
06/17/10 Water Ind Lab: E7115-93 Con. Lab: SPW-3107	Sr-89	60	0.80 - 1.25	0.98	AGREEMENT
	Sr-90	60	0.80 - 1.25	0.99	AGREEMENT
	I-131	60	0.80 - 1.25	0.88	AGREEMENT
	I-131	60	0.80 - 1.25	0.99	AGREEMENT
	Ce-141	60	0.80 - 1.25	0.99	AGREEMENT
	Cr-51	60	0.80 - 1.25	1.03	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.92	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.05	AGREEMENT
	Co-58	60	0.80 - 1.25	1.03	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.04	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.08	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.06	AGREEMENT
	Co-60	60	0.80 - 1.25	1.03	AGREEMENT
06/17/10 Water Ind. Lab: E7114-93 Con. Lab: SPW-3106	H-3	60	0.80 - 1.25	1.09	AGREEMENT
06/17/10 Milk Ind. Lab: E7116-93 Con. Lab: SPMI-3108	Sr-89	60	0.80 - 1.25	0.98	AGREEMENT
	Sr-90	60	0.80 - 1.25	0.90	AGREEMENT
	I-131	60	0.80 - 1.25	0.88	AGREEMENT
	I-131	60	0.80 - 1.25	0.98	AGREEMENT
	Ce-141	60	0.80 - 1.25	0.97	AGREEMENT
	Cr-51	60	0.80 - 1.25	0.99	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.90	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.03	AGREEMENT
	Co-58	60	0.80 - 1.25	1.03	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.04	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.06	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.03	AGREEMENT
	Co-60	60	0.80 - 1.25	0.99	AGREEMENT

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

Table 4-3

Inter-Laboratory Comparison Program Spiked Samples – 3rd Quarter

Sample Date, Type and Identification No.	Resolution	Resolution	Required Ratio Band	Ratio Env Inc: Analytics	Comparison
09/16/10 Water Ind Lab: E7199-93 Con. Lab: SPW-5204	Sr-89	60	0.80 - 1.25	0.97	AGREEMENT
	Sr-90	60	0.80 - 1.25	1.05	AGREEMENT
	I-131	60	0.80 - 1.25	0.89	AGREEMENT
	I-131	60	0.80 - 1.25	1.10	AGREEMENT
	Ce-141	60	0.80 - 1.25	1.02	AGREEMENT
	Cr-51	60	0.80 - 1.25	1.10	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.91	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.08	AGREEMENT
	Co-58	60	0.80 - 1.25	1.04	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.07	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.13	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.07	AGREEMENT
	Co-60	60	0.80 - 1.25	1.05	AGREEMENT
09/16/10 Water Ind. Lab: E7198-93 Con. Lab: SPW-5203	H-3	60	0.80 - 1.25	1.08	AGREEMENT
09/16/10 Milk Ind. Lab: E7200-93 Con. Lab: SPMI-5205	Sr-89	60	0.80 - 1.25	0.90	AGREEMENT
	Sr-90	60	0.80 - 1.25	0.85	AGREEMENT
	I-131	60	0.80 - 1.25	0.99	AGREEMENT
	I-131	60	0.80 - 1.25	1.06	AGREEMENT
	Ce-141	60	0.80 - 1.25	0.97	AGREEMENT
	Cr-51	60	0.80 - 1.25	1.04	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.91	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.04	AGREEMENT
	Co-58	60	0.80 - 1.25	0.99	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.03	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.09	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.02	AGREEMENT
	Co-60	60	0.80 - 1.25	0.98	AGREEMENT
09/16/10 Filter Paper Ind. Lab: E7201-93 Con. Lab: SPAP-5206	Cs-137 (Gross Beta)	60	0.80 - 1.25	1.06	AGREEMENT
09/16/10 Charcoal Cartridge Ind. Lab: E7202-93 Con. Lab: SPCH-5207	I-131	60	0.80 - 1.25	1.01	AGREEMENT

SECTION 4 - SPLIT SAMPLE PROGRAM and SPIKE SAMPLE INTER-LABORATORY COMPARISON PROGRAM

Table 4-4

Inter-Laboratory Comparison Program Spiked Samples – 4th Quarter

Sample Date, Type and Identification No.	Resolution	Resolution	Required Ratio Band	Ratio Env Inc: Analytics	Comparison
12/09/10 Water Ind Lab: E7341-93 Con. Lab: SPW-7228	Sr-89	60	0.80 - 1.25	0.99	AGREEMENT
	Sr-90	60	0.80 - 1.25	1.01	AGREEMENT
	I-131	60	0.80 - 1.25	0.90	AGREEMENT
	I-131	60	0.80 - 1.25	0.97	AGREEMENT
	Ce-141	60	0.80 - 1.25	not present	n/a
	Cr-51	60	0.80 - 1.25	0.98	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.91	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.02	AGREEMENT
	Co-58	60	0.80 - 1.25	1.03	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.09	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.07	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.06	AGREEMENT
	Co-60	60	0.80 - 1.25	1.00	AGREEMENT
12/09/10 Water Ind. Lab: E7340-93 Con. Lab: SPW-7227	H-3	60	0.80 - 1.25	0.97	AGREEMENT
12/09/10 Milk Ind. Lab: E7342-93 Con. Lab: SPMI-7229	Sr-89	60	0.80 - 1.25	0.95	AGREEMENT
	Sr-90	60	0.80 - 1.25	1.00	AGREEMENT
	I-131	60	0.80 - 1.25	0.93	AGREEMENT
	I-131	60	0.80 - 1.25	0.96	AGREEMENT
	Ce-141	60	0.80 - 1.25	not present	n/a
	Cr-51	60	0.80 - 1.25	0.97	AGREEMENT
	Cs-134	60	0.80 - 1.25	0.93	AGREEMENT
	Cs-137	60	0.80 - 1.25	1.02	AGREEMENT
	Co-58	60	0.80 - 1.25	0.99	AGREEMENT
	Mn-54	60	0.80 - 1.25	1.06	AGREEMENT
	Fe-59	60	0.80 - 1.25	1.09	AGREEMENT
	Zn-65	60	0.80 - 1.25	1.05	AGREEMENT
	Co-60	60	0.80 - 1.25	0.99	AGREEMENT

SECTION 5 – CORRECTIONS TO PREVIOUS RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT(S)

A. **Corrections to Previous Radiological Environmental Operating Report(s):** There is one correction to a previous Radiological Environmental Operating Report noted during this report period. A description of the error is as follows:

An incorrect sentence was discovered in a paragraph describing Interlaboratory Comparison Spike Sampling results in the 2009 Annual Radiological Environmental Operating Report submitted in May 2010. The sentence (on page 4-3) stated that one QC analytical result (-34.73%) was not within BVPS acceptance criteria, but was within the NRC acceptance criteria from NRC Inspection Procedure 84750. This statement was inaccurate because -34.73% was also outside of the NRC Inspection acceptance criteria.

Upon recognition of this inaccuracy, CR #11-88355 was written. The vendor laboratory (Environmental Inc.- Midwest Labs) also provides its own Interlaboratory Comparison Program on a quarterly basis. Results were acceptable from the 2nd quarter 2009, therefore no technical deficiencies are noted.