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May 14, 2001
L-01-069

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit No. 1 and No. 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Beaver Valley Power Station Annual Environmental Report, Radiological

The enclosed Year 2000 Annual Radiological Environmental Operating Report for Beaver Valley Power Station (BVPS) Units 1 and 2 is being forwarded, in accordance with BVPS Technical Specification 6.9.2. The report indicates that the Environmental Monitoring Program outlined in the BVPS Offsite Dose Calculation Manual for Units 1 and 2 was followed throughout 2000. The program results demonstrate the adequacy of radioactive effluent control at the Beaver Valley Power Station and that the operations of Units 1 and 2 did not adversely affect the surrounding environment.

The findings of this report are summarized in the Executive Summary which is presented at the beginning of the report. Some observations from the report include the following:

- Based on the analytical results of environmental samples during 2000, the Beaver Valley Power Station reporting levels were not exceeded.

- Year 2000 analytical results continue to be at or below the pre-operational (1974-75) baseline results.

- Based on the estimated dose to individuals from the natural background radiation exposure, the incremental increase in total body dose to the 50-mile population (approximately 4 million) from the operation of BVPS Units 1 and 2, is less than 0.0001% of the annual background dose.

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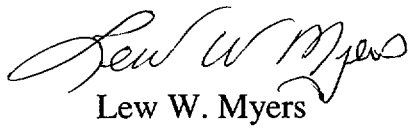
If you have any questions regarding this submittal, please contact Mr. Thomas S. Cosgrove, Manager, Regulatory Affairs at 724-682-5203.

Sincerely,



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Attachment

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BEAVER VALLEY POWER STATION
UNITS 1 AND 2
LICENSES DPR-66 AND NPF-73
2000 ANNUAL RADIOLOGICAL
ENVIRONMENTAL OPERATING REPORT

EXECUTIVE SUMMARY

This document is a detailed report of the 2000 Beaver Valley Power Station Radiological Environmental Monitoring Program (REMP). Radioactivity levels in the vicinity of Unit 1 and Unit 2 from January 1 through December 31, 2000 in air, water, shoreline sediment, milk, fish, soil, food crops, vegetation, and direct radiation measurement have been analyzed, evaluated, and summarized. The results of the REMP are intended to supplement the results of the radiological effluent monitoring by verifying that the measurable concentration of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurement and modeling of the environmental exposure pathways.

Radiation and radioactivity in the environment is monitored within a 10 mile radius of the site. Two types of samples are taken. The first type, control samples, are collected from areas that are beyond measurable influence of Beaver Valley Power Station. These samples are used as reference data. Normal background radiation levels, or radiation present due to causes other than Beaver Valley Power Station, can thus be compared to the environment surrounding the nuclear power station. Indicator samples are the second sample type obtained. These samples show how much radiation is contributed to the environment by the site. Indicator samples are taken from areas close to the station where any plant contribution will be at the highest concentration. In 2000, samples were taken from over 60 sites around Beaver Valley Power Station that included the aquatic, atmospheric and terrestrial environments. More than 2400 analyses were performed on these samples. The environmental program for 2000 is outlined in Table 3-1.

In 1974 and 1975, prior to station operation, samples were collected and analyzed to determine the amount of radioactivity present in the area. The resulting values are used as a "pre-operational baseline". Current analysis results from the indicator samples are compared to both current control sample values and the pre-operational baseline to determine if changes in radioactivity levels are attributable to station operations. The 2000 analytical results and pre-operational baseline results are summarized in Table 3-2 and Table 3-3.

A report is required to be submitted to the Nuclear Regulatory Commission when the level of radioactivity in an environmental sampling medium exceeds the limits specified in the Offsite Dose Calculation Manual (ODCM) when averaged over any calendar quarter. Also, when more than one of the radionuclides are detected in the sampling medium, this report shall be submitted if:

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

Based on the analytical results of environmental samples during 2000, the Beaver Valley Power Station reporting levels were not exceeded.

Positive results attributable to the Beaver Valley Power Station were consistent with station data of authorized radioactive discharges and were within limits permitted by the NRC license. 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).

In 2000, the radioactivity releases from BVPS Units 1 and 2 did not exceed the effluent limits identified in the Beaver Valley Power Station Operating License Technical Specification/Offsite Dose Calculation Manual (ODCM). Based on the estimated dose to individuals from the natural background radiation exposure, the incremental increase in total body dose to the 50 mile population (approximately 4 million), from the operation of Beaver Valley Power Station Units 1 and 2, is less than 0.0001% of the annual background dose. The National Academy of Sciences 1990 BEIR Report shows that the typical dose to an individual from background (natural radiation exposure including radon) is 296 mrem per year.

Analytical results are divided into four ODCM required categories based on exposure pathways: Airborne, direct radiation, ingestion and waterborne. Each of these pathways is described below:

- The airborne exposure pathway includes airborne iodine and airborne particulates. The 2000 results 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.

- The direct exposure pathway measures environmental radiation doses by use of thermoluminescent dosimeters (TLDs). TLD results have indicated a stable trend and compare well with previous years.

- The ingestion exposure pathway includes milk, fish, and food product (leafy vegetable) samples. For milk samples, strontium-90, attributable to past atmospheric nuclear weapons testing, was detected at levels similar to the past five years. The gamma spectroscopy counting only indicated positive results for potassium-40 at average environmental levels. No other radionuclides were identified.

  The fish samples taken indicated only naturally occurring potassium-40 in each of the samples at average environmental levels. Vegetation samples revealed naturally occurring potassium-40 and beryllium-7 at average environmental levels.

- The waterborne exposure pathway includes drinking water, surface (river) water, and river sediment. Water samples were analyzed for tritium and gamma-emitting radionuclides. Tritium was identified in one of twenty samples. The positive result was near typical lower limit of detection for tritium-3 analysis. Gamma analysis of samples indicated no gamma-emitting radionuclides above detection limits except one sample had naturally occurring K-40. Iodine-131 analysis of weekly samples (156 total) indicated 80 positive results. None of the positive results exceeded the reporting level. It was also noted that the surface water samples, which are upstream of the plant and considered outside the influence of the site had similar results to the downstream drinking water samples.

Sediment samples are taken from three locations, upstream of the site, at the discharge point of liquid releases and downstream of the site. Analysis of samples indicated naturally occurring radionuclides potassium-40 and thorium-228 in all results. Small amounts of cesium-137 from previous nuclear weapons tests was also detected in all six samples (including the Control location) at levels consistent with previous years. The samples from the discharge point of the site also indicated small amounts of other radionuclides, including cobalt-58, cobalt-60, and Mn-54 which are consistent with authorized station liquid discharges.

- In addition to the required samples discussed above, groundwater, precipitation, soil, and feedcrops were also taken. Results were consistent with previous years and no degrading trends were identified.

The environmental monitoring program outlined in the Beaver Valley Power Station ODCM for Units 1 and 2 was followed throughout 2000. The REMP results demonstrate the adequacy of radioactive effluent control at the Beaver Valley Power Station and that the operations of Units 1 and 2 did not adversely affect the surrounding environment.

Beaver Valley Power Station
2000 Annual Radiological Environmental Operating Report

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SECTION 1 - INTRODUCTION

A. Scope and Objectives of the Program

The environmental program consists of environmental monitoring for radioactivity in the vicinity of the Beaver Valley Power Station. Environmental sampling and analyses included air, water, milk, vegetation, river sediments, soil, 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 Report for the Beaver Valley Power Station summarizes the radiological environmental program conducted by the FirstEnergy Nuclear Operating Company in 2000.

B. Description of the Beaver Valley Site

The Beaver Valley Power Station is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 501 acre tract of land. Figure 1-1 is a view of the Beaver Valley Power Station. The site is approximately one mile from Midland, Pennsylvania; five miles from East Liverpool, Ohio; and twenty-five miles from Pittsburgh, Pennsylvania. Figure 1-2 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 18,000 and the only area within the radius of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 3,320.

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 1,160 feet. Plant ground level is approximately 735 feet above sea level.

The Beaver Valley Power Station 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. For 2000, the flow ranged from a minimum monthly average of 14,200 cubic feet per second (CFS) to a maximum monthly average of 77,900 CFS. The mean flow for 2000 was 34,842 CFS.

Water temperature of the Ohio River varies from 32°F to 84°F, the minimum temperatures occur in January and/or February and maximum temperatures in July and 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. Annual precipitation is approximately 36 inches, typical yearly temperatures vary from approximately –3°F to 95°F with an annual average temperature of 52.3°F. The predominant wind direction is typically from the southwest in summer and from the northwest in winter.

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

	Beaver Valley Unit 1	Beaver Valley Unit 2
Maximum Power Level	2652 - megawatts thermal	2652 - 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 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.

C. 2000 Operation

The Unit Capability Factor for 2000 was as follows: Unit 1 – 82.4% and Unit 2 – 86.8%.

Figure 1-1

View of the Beaver Valley Power Station

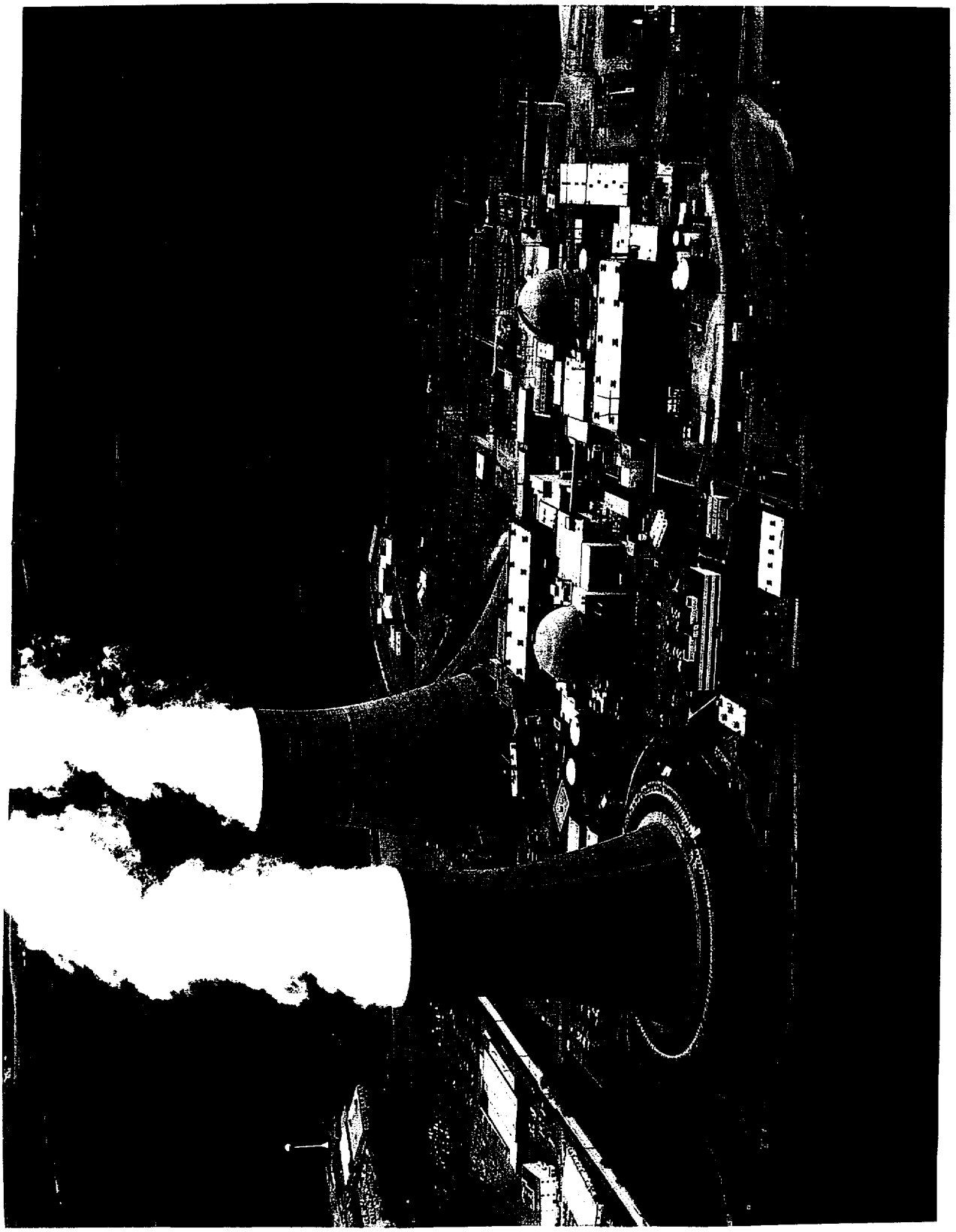
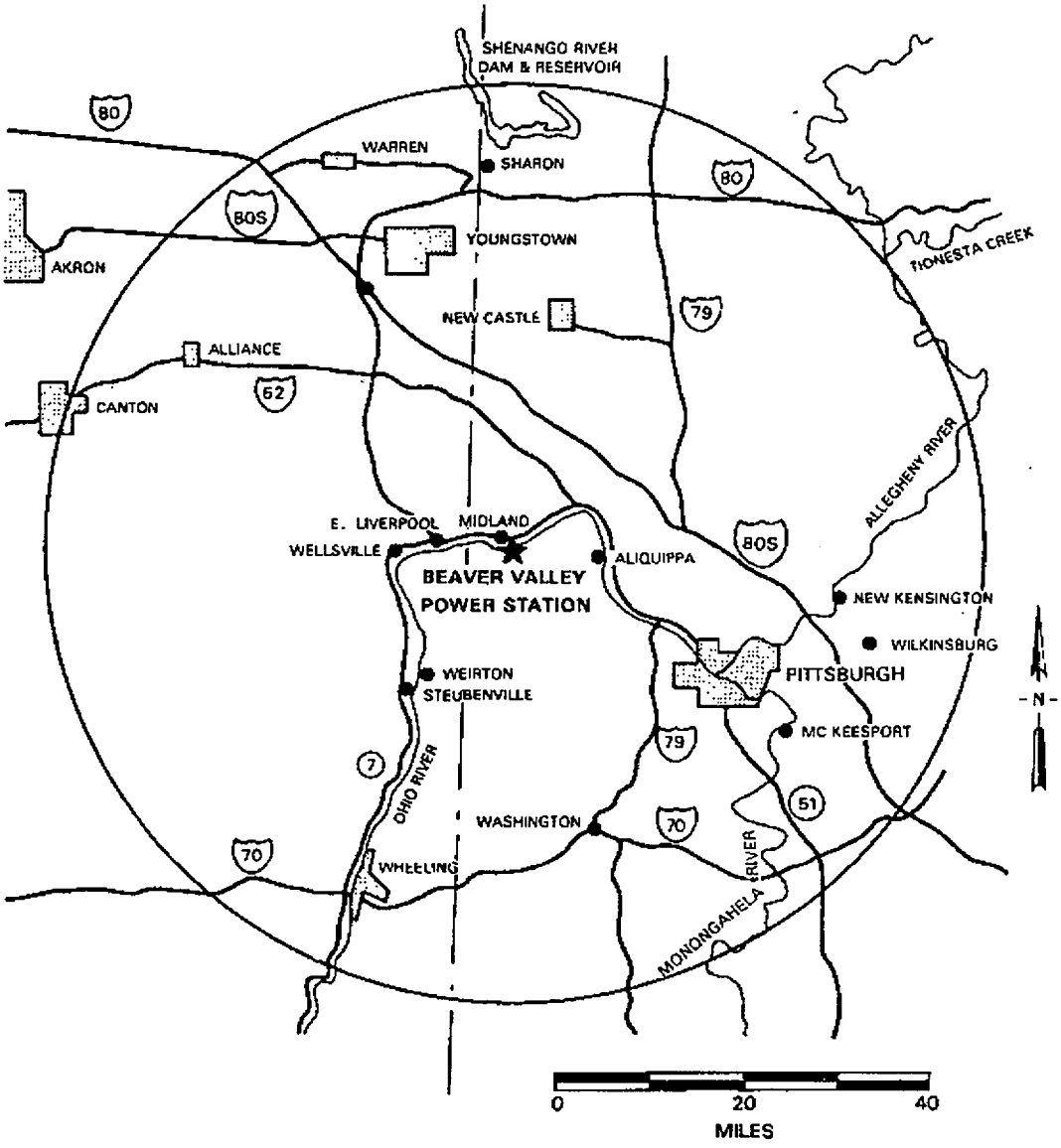


Figure 1-2

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



SECTION 2 - MONITORING EFFLUENTS

The Beaver Valley Power Station is governed by rules and regulations of the Federal Government and the Commonwealth of Pennsylvania. Effluent releases are controlled to ensure that limits set by Federal or State governments are not exceeded. In addition, self-imposed goals have been established to further limit discharges to the environment.

A. Monitoring of Liquid Effluents

1. Description of Liquid Effluents at the Beaver Valley Power Station

   Most of the water required for the operation of the Beaver Valley station is taken from the Ohio River, and returned to the river, used for makeup to various plant systems, or discharged via a sanitary waste system. In addition, liquid effluents are discharged to the Ohio River using discharge points shown in Figure 2-1. Schematic diagrams of liquid flow paths for the Beaver Valley Power Station are shown in Figure 2-2, Figure 2-3, Figure 2-4 and Figure 2-5.

2. Radioactive Liquid Waste Sampling and Analysis Program

   See Table 2-1.

3. Results of Liquid Effluent Discharge to the Environment

   See Table 2-2.

Figure 2-1

Liquid Discharge Points to Ohio River

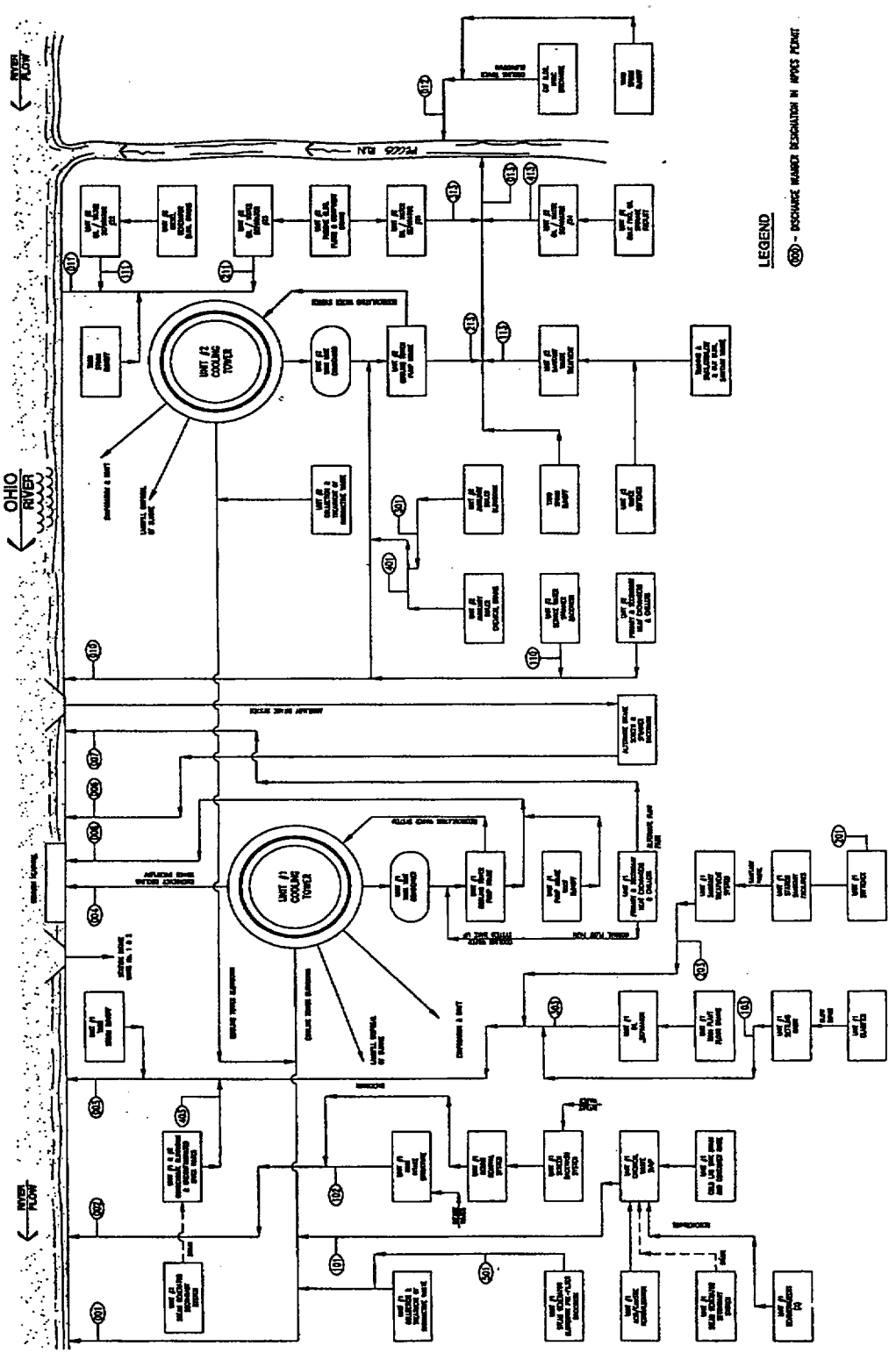


Figure 2-2

Unit 1 Water Flow Schematic

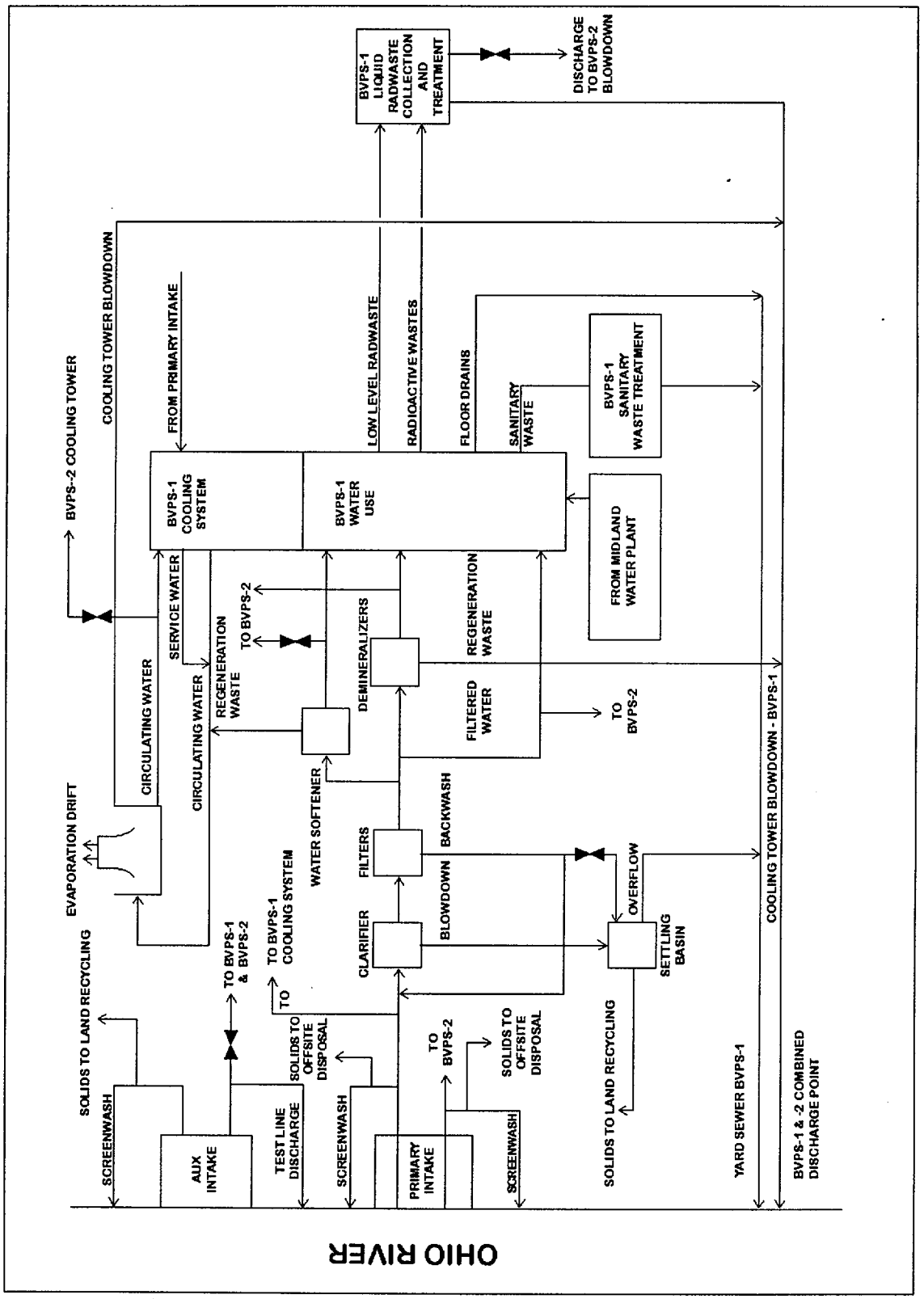


Figure 2-3

Unit 2 Water Flow Schematic

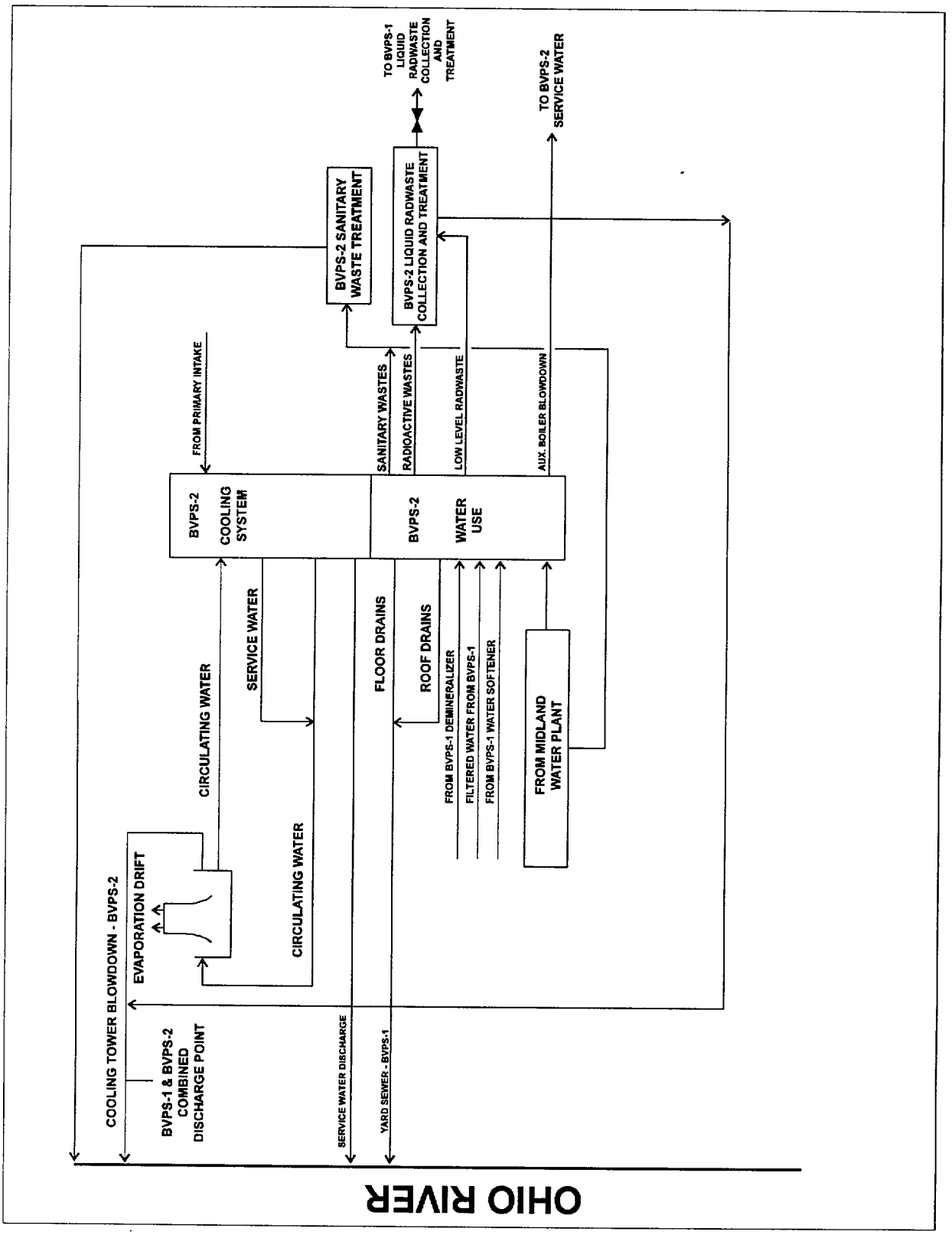


Figure 2-4

Unit 1 Liquid Waste System

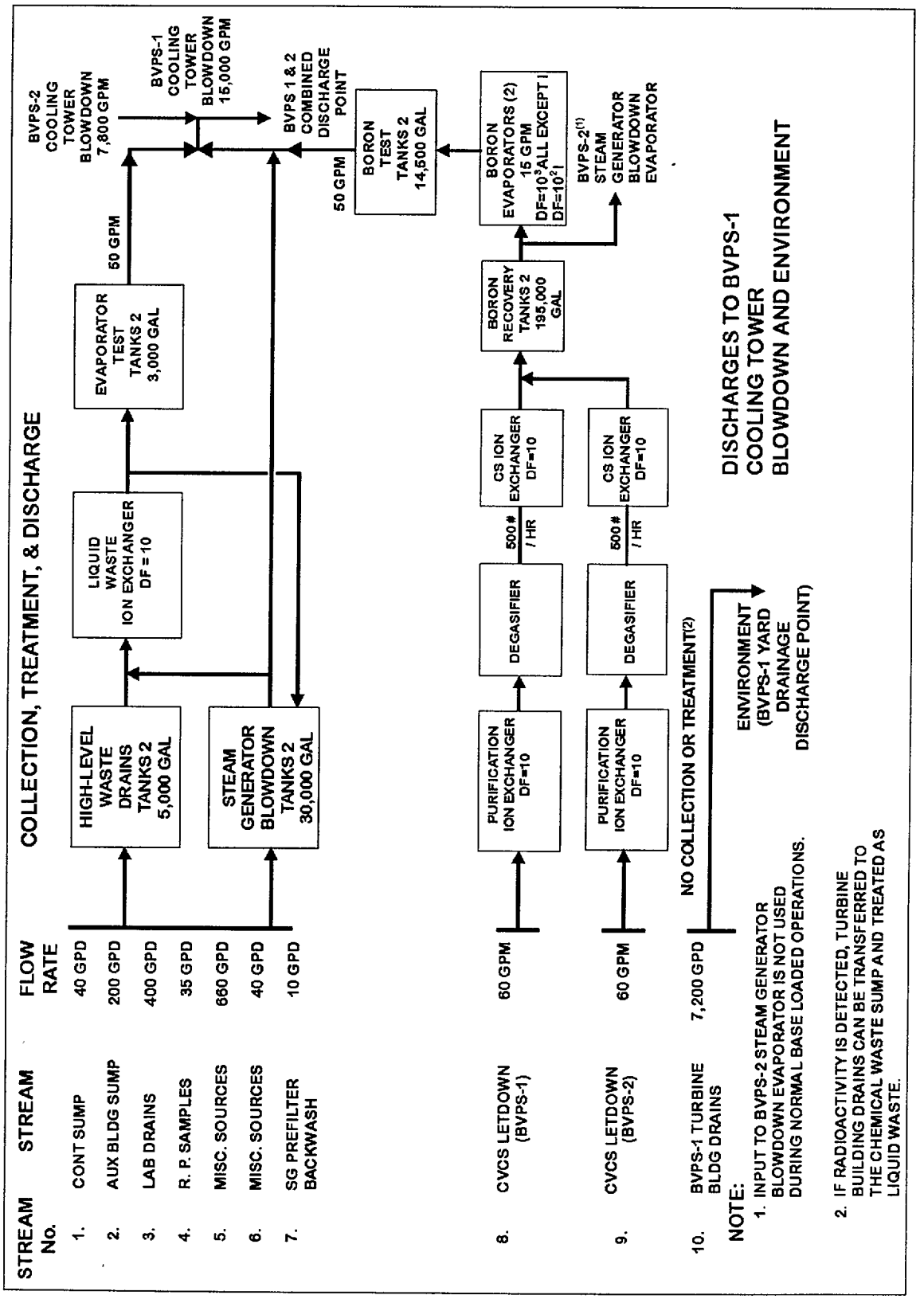


Figure 2-5

Unit 2 Liquid Waste System

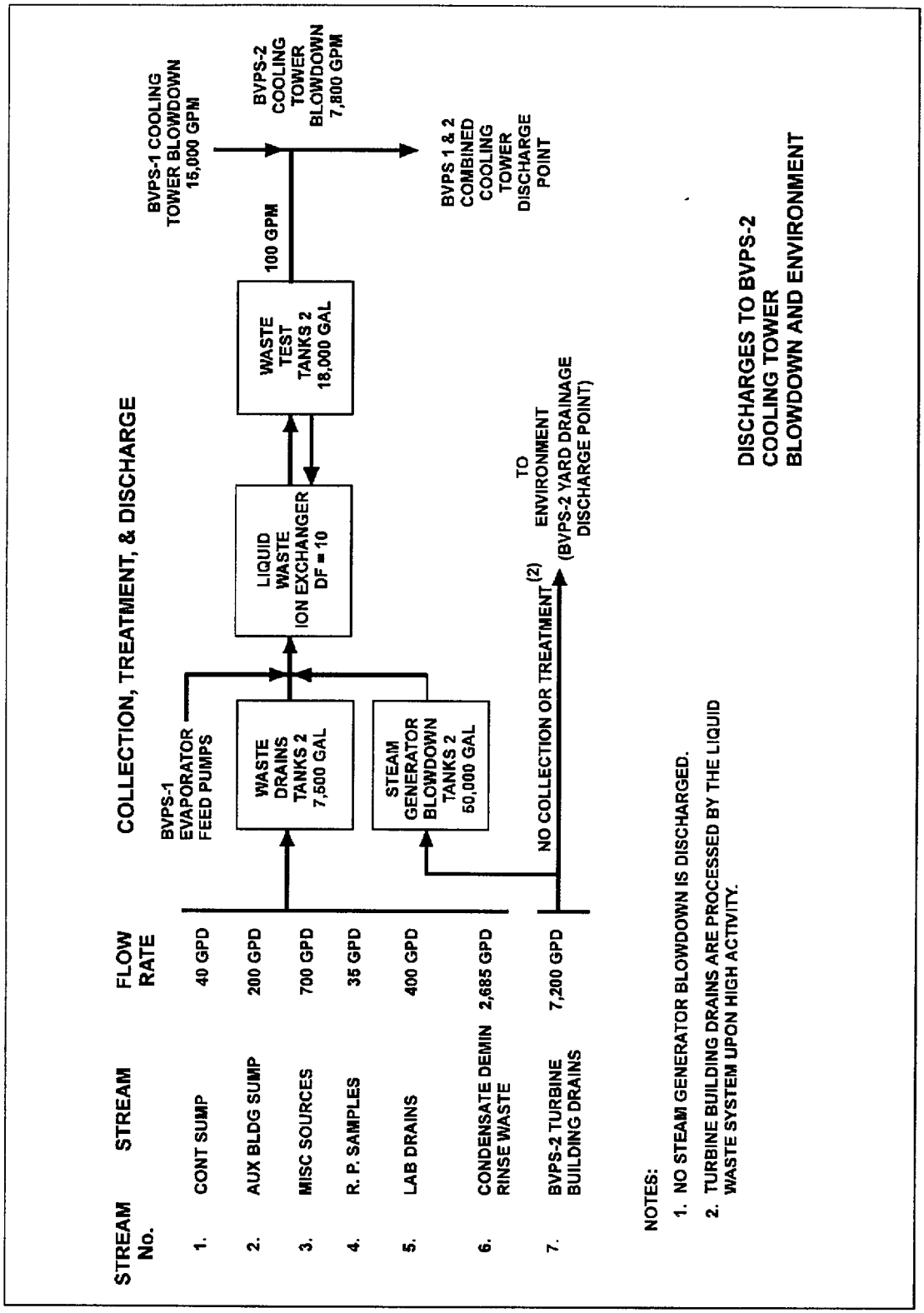


Table 2-1

Radioactive Liquid Waste Sampling and Analysis Program

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/ml)[a]
A Batch Waste Release Tanks[d]	P Each Batch[h]	P Each Batch[h]	Principal Gamma Emitters[f]	5E-7
			I-131	1E-6
	P One Batch/M[h]	M	Dissolved and Entrained Gases (Gamma Emitters)	1E-5
	P Each Batch[h]	M Composite[b]	H-3	1E-5
			Gross Alpha	1E-7
	P Each Batch[h]	Q Composite[b]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
B Continuous Releases[e,g]	Grab Sample[g]	W Composite[c]	Principal Gamma Emitters[f]	5E-7
			I-131	1E-6
	Grab Sample[g]	M	Dissolved and Entrained Gases (Gamma Emitters)	1E-5
	Grab Sample[g]	M Composite[c]	H-3	1E-5
			Gross Alpha	1E-7
	Grab Sample[g]	Q Composite[c]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6

W - At least once per 7 days
M - At least once per 31 days
Q - At least once per 92 days
P - Completed prior to each release

Table 2-1 Notation

a. The Lower Limit of Detection (LLD).

b. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analyses, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

d. A batch release exists when the discharge of liquid wastes is from a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed to assure representative sampling.

e. A continuous release exists when the discharge of liquid wastes is from a non-discrete volume; e.g., from a volume of a system having an input flow during the continuous release. Releases from the Turbine Building drains and the Auxiliary Feedwater Pump Bay Drain System and Chemical Waste Sump are considered continuous when the primary to secondary leak rate exceeds 0.1 gpm (142 gpd).

f. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should be reported as "less than" the nuclide's LLD, and should not be reported as being present at the LLD level for that nuclide. The "less than" values should not be used in the required dose calculations. When unusual circumstances result in LLDs higher than required, the reasons shall be documented in the Annual Radioactive Effluent Release Report.

g. When radioactivity is identified in the secondary system, a Radioactive Waste Discharge Authorization--Liquid should be prepared on a monthly basis to account for the radioactivity that will eventually be discharged to the Ohio River.

h. Whenever the BV-2 Recirculation Drain Pump(s) are discharging to Catch Basin 16, sampling will be performed by means of a grab sample taken every 4 hours during pump operation.

Table 2-2

Results of Liquid Effluent Discharges to the Environment

Effluent Type	Results for 2000
Steam System Blowdown	The Steam System Blowdown was recycled.
Batch Radioactive Waste Liquids	Routine planned releases of liquid effluents from the Beaver Valley Power Station were released in accordance with conditions noted in Section 6.8.6a of the Technical Specifications and Appendix C of the ODCM. No limits were exceeded. Values for all liquid releases have been reported in the Beaver Valley Power Station Annual Radioactive Effluent Release Report for 2000.
Continuous Radioactive Waste Liquids	Radioactive waste liquids were not discharged in a continuous mode during 2000.

B. Monitoring of Atmospheric Effluents

1. Description of Atmospheric Effluent Sources

Beaver Valley Power Station (Units 1 and 2)

The Beaver Valley Power Station identifies radionuclides according to Section 6.8.6a of the Technical Specifications, Appendix C of the ODCM and Regulatory Guide 1.21. Prior to waste gas decay tank batch releases and containment purge releases, an analysis of the principal gamma emitters is performed. The principal gamma emitters include noble gases, iodines, and particulates. Tritium concentrations are estimated prior to release and followed up with a grab sample from the ventilation system used during release. Figure 2-6 shows the gaseous radwaste system at Beaver Valley Power Station.

The environmental continuous gaseous release points also require specific nuclide identification. These points include:

a. Unit 1 Release Points:

   1) The Ventilation Vent located on top of the Unit 1 Primary Auxiliary Building.

   2) The Supplementary Leak Collection and Release System (SLCRS Filtered Pathway) Vent located on top of the Unit 1 Containment Building.

b. Unit 2 Release Points:

   1) The Ventilation Vent (also called the SLCRS Unfiltered Pathway) located on top of the Unit 2 Primary Auxiliary Building.

   2) The Supplementary Leak Collection and Release System (SLCRS Filtered Pathway) Vent located on top of the Unit 2 Containment Building.

   3) The Decontamination Building Vent located on top of the Unit 2 Decontamination Building.

   4) The Waste Gas Storage Vault Vent located on top of the Unit 2 Decontamination Building.

   5) The Condensate Polishing Building Vent located on top of the Unit 2 Condensate Polishing Building.

c. Unit 1 and Unit 2 shared Release Point:

1) The Process Vent located near the top of the Unit 1 Cooling Tower.

2) The Turbine Building vent located on top of Unit 2 Turbine Building.

These points are continuously monitored for particulates iodines and noble gases. Grab samples are obtained on a weekly basis and are analyzed for noble gas gamma-emitting isotopes. Grab samples are obtained on a weekly basis for the two SLCRS filtered release points and on a monthly basis for the other six release points and analyzed for tritium. Continuous filter paper and charcoal cartridge samples are changed on a weekly basis. The filter papers are analyzed for particulate gamma-emitting radionuclides. Composites of the filter papers are analyzed monthly for Sr-89, Sr-90, and gross alpha. The charcoal cartridges are analyzed for radioactive iodine.

Figure 2-7 shows these gaseous release points.

Figure 2-6

Units 1 and 2 Gaseous Radwaste System

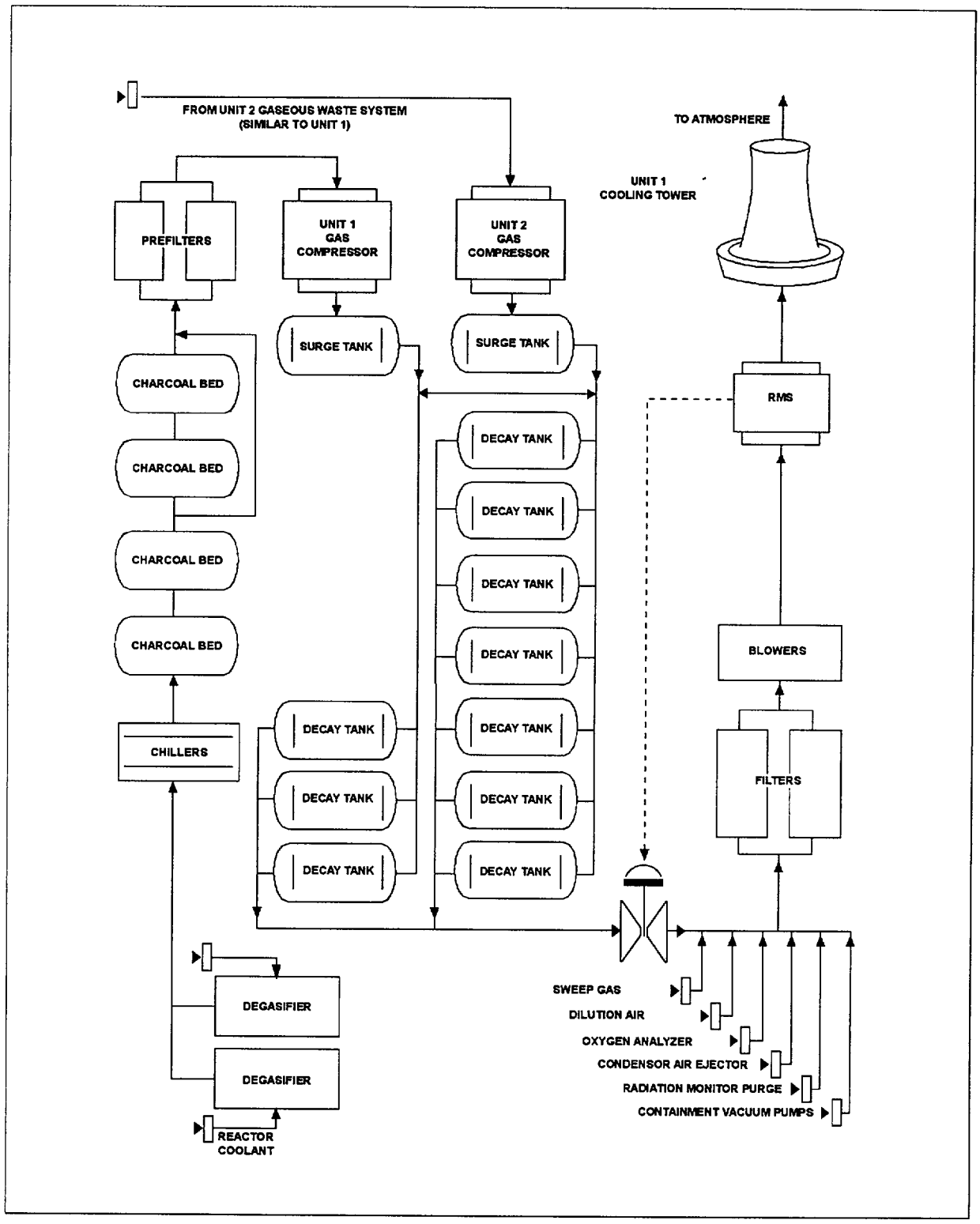
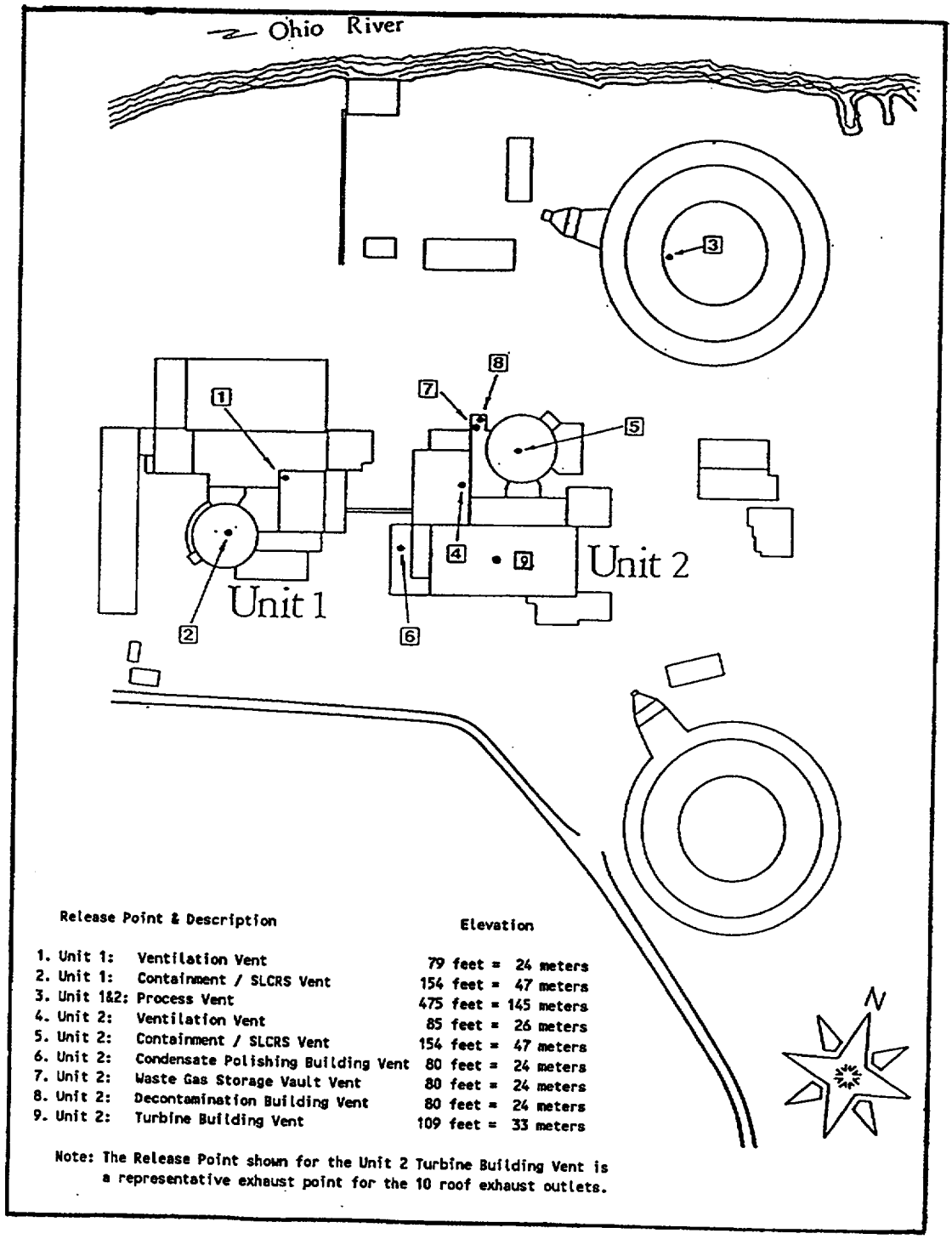


Figure 2-7

Units 1 and 2 Gaseous Release Points



Release Point & Description		Elevation
1. Unit 1:	Ventilation Vent	79 feet = 24 meters
2. Unit 1:	Containment / SLCRS Vent	154 feet = 47 meters
3. Unit 1&2:	Process Vent	475 feet = 145 meters
4. Unit 2:	Ventilation Vent	85 feet = 26 meters
5. Unit 2:	Containment / SLCRS Vent	154 feet = 47 meters
6. Unit 2:	Condensate Polishing Building Vent	80 feet = 24 meters
7. Unit 2:	Waste Gas Storage Vault Vent	80 feet = 24 meters
8. Unit 2:	Decontamination Building Vent	80 feet = 24 meters
9. Unit 2:	Turbine Building Vent	109 feet = 33 meters

Note: The Release Point shown for the Unit 2 Turbine Building Vent is a representative exhaust point for the 10 roof exhaust outlets.

2. Atmospheric Effluent Treatment and Sampling

Gaseous Waste Disposal System (Units 1 and 2)

Radioactive gases enter the gaseous waste disposal system from the degasifier vent chiller of the boron recovery system, and are directed to the gaseous waste charcoal delay subsystem upstream of the overhead gas compressor where the gas is chilled to condense most of the water vapor. Gases from the degasifier vent chillers contain primarily hydrogen and water vapor. A small amount of nitrogen and radioisotopes consisting of noble gases, particulates and radioiodines are also present in this system.

The overhead gas compressor directs the radioactive gas stream to a gas surge tank. Gas is periodically transferred from the Unit 1 or Unit 2 surge tank to one of the three (3) decay tanks at Unit 1 or to the seven (7) storage tanks at Unit 2. The tanks are then sampled and authorization obtained for discharge in accordance with the ODCM. The discharge of the waste gases from the decay tanks or the storage tanks (2 scfm) is then diluted with about 1000 scfm of air. The gases are then combined with nitrogen purge from the oxygen analyzers, calibration gas from the oxygen analyzers, the main condenser air ejector exhaust, the containment vacuum system exhaust, aerated vents of the sweep gas system, discharge of the overhead gas compressor and the purge from the applicable multi sample point radiation monitor. The mixture is normally filtered through one of the gaseous waste disposal filters, each of which consists of a charcoal bed and a high efficiency filter. The filtered gases are then discharged by one of the gaseous waste disposal blowers to the atmosphere via the process vent on the top of the Unit 1 cooling tower. The radioactivity levels of the stream are continuously monitored in accordance with the ODCM.

Should the radioactivity release concentration of the stream exceed the allowable setpoint, a signal from the radiation monitor will stop the discharge from the applicable Unit 1 decay tanks or the Unit 2 storage tanks.

Reactor Containment Purge (Units 1 and 2)

During a shutdown period the Unit 1 or Unit 2 containment is sampled and authorized for discharge in accordance with the ODCM. Purging may commence through the Ventilation Vent located on top of the Auxiliary Building or the Supplementary Leak Collection and Release System (SLCRS) Vent located on top of the Reactor Containment Building or the Process Vent located on top of the Unit 1 Cooling Tower.

Building Ventilation Systems (Units 1 and 2)

Most areas in the Unit 1 Auxiliary Building are monitored for radioactivity by individual radiation monitors which aid in identifying any sources of contaminated air. The normal exhaust is through the Ventilation Vent effluent pathway. This pathway is monitored continuously by several redundant channels of the Radiation Monitoring System (RMS) in accordance with the ODCM. Particulate and iodine samples are obtained continuously while grab noble gas samples are obtained weekly in accordance with the ODCM. When activity alarm setpoints are reached, automatic dampers divert the system's exhaust air stream through one of the main filter banks in the Supplementary Leak Collection and Release System (SLCRS) which exhausts through the SLCRS Vent effluent pathway.

Areas in the Unit 2 Auxiliary Building (subject to radioactive contamination) are monitored for radioactivity prior to entering the filter banks in the Supplementary Leak Collection and Release System (SLCRS). This system is sampled continuously for particulates and iodines and is sampled weekly for noble gases, in accordance with the ODCM. This system is monitored continuously by the Digital Radiation Monitoring System (DRMS) in accordance with the ODCM.

Each Unit 1 and Unit 2 SLCRS filter bank consists of roughing filters, charcoal filters, and pleated glass fiber type HEPA filters. The roughing filters remove large particulates to prevent excessive pressure drop due to buildup on the charcoal and HEPA filters. The charcoal filters are effective for radioactive iodine removal and the HEPA filters remove particulates and charcoal fines.

Some of these release points discharge small amounts of radioisotopes consisting of noble gases, particulates and radioiodines.

See Table 2-3 for the Radioactive Gaseous Waste Sampling and Analysis Program. This program is an excerpt of the requirements contained in the ODCM.

3. Results

Gaseous effluents from the Beaver Valley Power Station were released in accordance with conditions noted in Section 6.8.6a of the Technical Specifications and Appendix C of the ODCM. No limits were exceeded. These values have been reported in the Beaver Valley Power Station Annual Radioactive Effluent Release Report for 2000.

Table 2-3

Radioactive Gaseous Waste Sampling and Analysis Program

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE PF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (µCi/cc)[a]
A. Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[g]	1E-4
	Each Tank* Grab Sample	Each Tank*	H-3*	1E-6
B. Containment Purge	P Each Purge[b] Grab Sample	P Each Purge[b]	Principal Gamma Emitters[g]	1E-4
			H-3	1E-6
C. Ventilation Systems[h] 1. Unit 1 Ventilation Vent 2. Unit 1 Containment/SLCRS Vent 3. Unit 1/2 Process Vent 4. Unit 2 Ventilation Vent 5. Unit 2 Containment/SLCRS Vent 6. Unit 2 Decon. Bldg. Vent 7. Unit 2 Waste Gas Storage Vault Vent 8. Unit 2 Condensate Polishing Bldg. Vent	M[b, c, e] Grab Sample	M[b]	Principal Gamma Emitters[g]	1E-4
			H-3	1E-6
D. All Systems Listed Above Which Produce Continuous Release	Continuous[f]	W[d] Charcoal Sample	I-131	1E-12
			I-133	1E-10
	Continuous[f]	W[d] Particulate Sample	Principal Gamma Emitters[g] (I-131, Others)	1E-11
	Continuous[f]	M Composite Particulate Sample	Gross Alpha	1E-11
	Continuous[f]	Q Composite Particulate Sample	Sr-89, Sr-90	1E-11
	Continuous[f]	Noble Gas Monitor	Noble Gases Gross Beta and Gamma	1E-6

W - At least once per 7 days
M - At least once per 31 days
Q - At least once per 92 days
P - Completed prior to each release

* The H-3 concentration shall be estimated prior to release and followed up with an H-3 grab sample from the Ventilation System during release.

Table 2-3 Notation

a. The Lower Limit of Detection (LLD).

b. Sampling and analysis shall also be performed following SHUTDOWN, STARTUP, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1 hour period. This requirement does not apply if (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

   All samples or surveillances used to satisfy note[b] above shall be obtained within 24 hours of reaching the intended steady state power level, and analyzed within 48 hours of reaching the intended steady state power level.

c. Tritium grab samples shall be taken at least once per 24 hours (from the appropriate ventilation release path) when the refueling canal is flooded.

d. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each SHUTDOWN, STARTUP, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1 hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

e. Tritium grab samples shall be taken at least once per 7 days (from the appropriate ventilation release path of the spent fuel pool area) whenever spent fuel is in the spent fuel pool.

f. The average ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with ODCM Appendix C CONTROLS 3.11.2.1, 3.11.2.2 and 3.11.2.3.

g. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLDs higher than required, the reasons shall be documented in the Annual Radioactive Effluent Release Report.

h. Only when release path is in use.

SECTION 3 - ENVIRONMENTAL MONITORING PROGRAM

A. Environmental Radioactivity Monitoring Program

1. Program Description

The program consists of monitoring water, air, soil, river bottoms, vegetation and foodcrops, cows milk, ambient radiation levels in areas surrounding the site, and aquatic life as summarized in Table 3-1. Further description of each portion of the program (Sampling Methods, Sample Analysis, Discussion and Results) are included in Sections 3-B through 3-I of this report.

3-B - Air Monitoring

3-C - Monitoring of Sediments and Soils

3-D - Monitoring of Feedcrops and Food Products

3-E - Monitoring of Local Cows Milk

3-F - Environmental Radiation Monitoring

3-G - Monitoring of Fish

3-H - Monitoring of Surface, Drinking, Ground Waters and Precipitation

3-I - Estimates of Radiation Dose to Man

Table 3-1
Operational Radiological Environmental Monitoring Program

	Type of Sample	Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis (b)
1	Air Particulate and Radioiodine	13	11	1.4	Meyer's Farm	Continuous sampling with sample collection at least weekly	Weekly AP	Gross Beta (c)
		30	4	0.5	Shippingport (S.S.)		Weekly Charcoal	I-131
		46.1	3	2.3	Industry, Rt. 68 – Garage		Quarterly Composite (d)	Gamma - scan
		32	15	0.8	Midland (S.S.)			
		48(a)	10	16.3	Weirton, W.Va., - Weirton Water Tower, Collier Way			
		51	5	8.0	Aliquippa (S.S.)			
		47	14	4.9	East Liverpool, Oh. - Water Treatment Plant			
		27	7	6.1	Brunton's Farm			
		28	1	8.6	Sherman's Farm			
		29B	3	8.0	Beaver Valley Geriatric Center			
2	Direct Radiation	30	4	0.5	Shippingport (S.S.)	Continuous (TLD)	Quarterly (j)	Gamma Dose
		13	11	1.4	Meyer's Farm			
		46	3	2.5	Industry, Midway Dr.			
		32	15	0.8	Midland (S.S.)			
		48(a)	10	16.3	Weirton, W.Va. - Weirton Water Tower, Collier Way			
		45.1	6	1.9	Raccoon Twp., Kennedy's Corners			
		51	5	8.0	Aliquippa (S.S.)			
		47	14	4.9	East Liverpool, Oh. - Water Treatment Plant			
		70	1	3.4	North of Western Beaver School – Engle Rd.			
		80	9	8.2	Raccoon Park Office (Rt. 18)			
		81	9	3.6	Millcreek United Pres. Church			
		82	9	6.9	Hanover Municipal Bldg.			
		83	10	4.2	735 Mill Creek Rd.			
		14	11	2.5	Hookstown			
		84	11	8.3	Hancock Parks & Recreation Complex			
		85	12	5.7	Rts. 8 & 30 Intersection			
		86	13	6.2	E. Liverpool, Oh. 1090 Ohio Ave.			
		92	12	2.8	Georgetown Rd. (S.S.)			

Table 3-1 (Continued)
Operational Radiological Environmental Monitoring Program

	Types of Sample	Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis (b)
2	Direct Radiation (continued)	87	14	7.0	Calcutta, Oh. – Calcutta Smith's Ferry Rd. & Valley Dr.	Continuous (TLD)	Quarterly (j)	Gamma-Dose
		88	15	2.8	Midland Heights – 110 Summit Rd.			
		89	15	4.8	Ohioville, 488 Smith's Ferry Rd.			
		90	16	5.2	Opposite Fairview School			
		10	3	1.0	Shippingport Boro			
		45	5	2.2	Rt. 18 & Anderson St.			
		60	13	2.5	444 Hill Rd.			
		93	16	1.1	Midland, Sunrise Hills			
		95	10	2.3	832 McCleary Rd.			
		28	1	8.6	Sherman's Farm			
		71	2	6.0	Brighton Twp. First West. Bank			
		72	3	3.3	Industry, Logan Park			
		29B	3	8.0	Beaver Valley Geriatric Center			
		73	4	2.5	618 Squirrel Run Rd.			
		74	4	7.0	CCBC – 137 Poplar Ave.			
		75	5	4.1	117 Holt Road			
		76	6	3.8	Raccoon Elementary School			
		77	6	5.6	3614 Green Garden Rd			
		59	6	1.0	236 Green Hill Rd.			
		78	7	2.7	Raccoon Mun. Bldg.			
		27	7	6.1	Brunton's Farm			
		79	8	4.4	Rt. 151 & Pross Ln.			
		15	14	3.7	Georgetown Post Office			
		46.1	3	2.3	Industry, Rt. 168 – Garage			
		91	2	3.9	Pine Grove Rd and Doyle Rd			
		94	8	2.2	McCleary Rd. & Pole Cat Hollow Rd.			
3	Surface Water	49(a)	3	5.0	Upstream Side of Montgomery Dam	Weekly Grab Sample (i)	Weekly Sample from Site 49	I-131
		2.1	14	1.5	Downstream (Midland) J&L	Weekly, Intermittent Composite Sample (i)	Monthly composite of Weekly Sample (d)	Gamma-scan
		5	14	4.9	East Liverpool, Oh. - Water Treatment Plant (raw water)	Daily Grab Sample Only - Collected Weekly (i)		
							Quarterly Composite (d)	H-3

Table 3-1 (Continued)
Operational Radiological Environmental Monitoring Program

	Type of Sample	Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis (b)
4	Groundwater	14	11	2.5	Hookstown	Semi-Annual	Semi-Annual	Gamma-scan H-3
		15	14	3.7	Georgetown			
		11	3	0.8	Shippingport Boro			
5	Drinking	4	15	1.3	Midland, Water Treatment Plant	Intermittent (e) Sample Collected Weekly	Weekly Composite	I-131
							Monthly Composite (d)	Gamma-scan
							Quarterly Composite (d)	H-3
		5	14	4.9	East Liverpool, Oh. - Water Treatment Plant			
6	Shoreline Sediment	2A	13	0.2	BVPS Outfall Discharge	Semi-Annual	Semi-Annual	Gamma-scan
		49(a)	3	5.0	Upstream side of Montgomery Dam			
		50	12	11.8	Upstream side of New Cumberland Dam			
7	Milk	25	10	2.1	Searight's Farm	Weekly (f)	Weekly sample from Searight's only	I-131
		* * *				Biweekly (g) when animals are on pasture; monthly at other times.	Biweekly (grazing) Monthly (indoors)	Gamma-scan Sr-89, Sr-90, I-131
		96(a)	10	10.4	Windsheimer's Farm			
		27	7	6.1	Brunton's Farm			

* BVPS ODCM, Appendix C, Table 3.12-1 requires three (3) dairies to be selected on basis of highest potential thyroid dose using milch census data. See Section 3-E for specific locations sampled.

Table 3-1 (Continued)
Operational Radiological Environmental Monitoring Program

Type of Sample		Sample Points	Sector	Miles	Sample Point Description	Sample Frequency	Sample Preparation	Analysis (b)
8	Fish	2A	13	0.2	BVPS Outfall Discharge	Semi-Annual	Composite of edible parts by species (h)	Gamma-scan
		49(a)	3	5.0	Upstream side of Montgomery Dam			
9	Food Crops					Annual at harvest if available	Composite of each sample species	Gamma-scan I-131 on green leafy vegetables
	(Shippingport)	10	3	1.0	Three locations within 5 miles selected by BVPS.			
	(Georgetown)	15	14	3.7				
	(Industry)	46	3	2.5				
		48(a)	10	16.3	Weirton, W.Va.			
10	Feedstuff and Summer Forage	25	10	2.1	Searight's Farm	Monthly	Monthly	Gamma-scan
11	Soil	13	11	1.4	Meyer's Farm	Every 3 years (1994, 1997, etc.)	12 Core Samples 3" Deep (2" Dia. at each location) (approx. 10' radius)	Gamma-scan
		30	4	0.5	Shippingport (S.S.)			
		46	3	2.5	Industry, Midway Dr.			
		32	15	0.8	Midland (S.S.)			
		48A(a)	10	15.6	Weirton, W.Va. – Weirton Water Tower, E. Belleview Dr.			
		51	5	8.0	Aliquippa (S.S.)			
		47	14	4.9	E. Liverpool, Oh. - Water Treatment Plant			
		27	7	6.1	Brunton's Farm			
		22	8	0.3	South of BVPS Transmission Line			
		29A	3	8.3	Nicol's Farm			
12	Precipitation	30	4	0.5	Shippingport (S.S.)	Weekly grab samples when available	Quarterly Composite (d)	Gamma-scan, H-3
		47	14	4.9	East Liverpool, Oh. - Water Treatment Plant			
		48	10	16.3	Weirton, W.Va. - Weirton Water Tower, Collier Way			

Table 3-1 - Notations

Operational Radiological Environmental Monitoring Program (Continued)

Notes:

(a) Control sample station: These are locations which are presumed to be outside the influence of plant effluents.

(b) Typical detection sensitivities for gamma spectrometry are shown in Table 3-4.

(c) Particulate samples are not counted within 24 hours after filter change. Perform gamma isotopic analysis on each sample when gross beta is > 10 times the yearly mean of control samples.

(d) Analysis composites are well mixed actual samples prepared of equal portions from each shorter term samples from each location.

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

(f) Weekly milk sample from Searight's Dairy is analyzed for I-131 only.

(g) Milk samples are collected bi-weekly when animals are in pasture and monthly at other times.

(h) The fish samples will contain whatever species are available. If the available sample size permits, then the sample will be separated according to species and compositing will provide one sample of each species. If the available size is too small to make separation by species practical, then edible parts of all fish in the sample will be mixed to give one sample.

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

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

2. Summary of Results

All results of this monitoring program are summarized in Table 3-2. This table is prepared in the format specified by NRC Regulatory Guide 4.8 and in accordance with Beaver Valley Power Station Offsite Dose Calculation Manual. Summaries of results of analysis of each media are discussed in Sections 3-B through 3-H and an assessment of radiation doses are given in Section 3-I. Table 3-3 summarizes Beaver Valley Power Station preoperational ranges for the various sampling media during the years 1974 and 1975. Comparisons of preoperational 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). Table 3-4 shows typical detection sensitivities for gamma spectroscopy detection by high resolution germanium detectors.

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

3. Quality Control Program

The Quality Control Program implemented by the Beaver Valley Power Station to assure reliable performance by the contractor and the supporting QC data are presented and discussed in Section 5 of this report.

4. Program Changes

The following changes were implemented in the 2000 sampling program.

None

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
Water Precipitation (pCi/l)	Gamma (12)						
	Be-7	(a)	78.8 (6/12) (38.0-100.0)	48, Weirton, WV 16.3 mi SSW	90.5 (2/4) (90.0-91.0)	Same as High location	0
	K-40	(a)	52.1 (1/12)	30, Shippingport, (S.S.) 0.5 mi ENE	52.1 (1/12)	LLD	0
	Mn-54	5	LLD	--	--	--	0
	Fe-59	15	LLD	--	--	--	0
	Co-58	5	LLD	--	--	--	0
	Co-60	5	LLD	--	--	--	0
	Zn-65	30	LLD	--	--	--	0
	Zr/Nb-95	15	LLD	--	--	--	0
	Cs-134	5	LLD	--	--	--	0
	Cs-137	5	LLD	--	--	--	0
	Ba/La-140	15	LLD (1)	--	--	--	0
	H-3 (12)	200	180 (6/12) (120-260)	30, Shippingport, (S.S.) 0.5 mi ENE	205 (4/4) (140-260)	140 (1/4)	0

(1) See Section 3-H.

(a) LLD for this nuclide for Water Precipitation not required by ODCM

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).

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Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Georgetown, PA No. 15	
Groundwater (pCi/l)	H-3 (6)	200	LLD	--	--	--	0
	Gamma (6)						
	Mn-54	5	LLD	--	--	--	0
	Fe-59	15	LLD	--	--	--	0
	Co-58	5	LLD	--	--	--	0
	Co-60	5	LLD	--	--	--	0
	Zn-65	30	LLD	--	--	--	0
	Zr/Nb-95	15	LLD	--	--	--	0
	Cs-134	5	LLD	--	--	--	0
	Cs-137	5	LLD	--	--	--	0
	Ba/La-140	15	LLD	--	--	--	0

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).

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Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
Drinking Water (pCi/l)	I-131 (104)	1.0	0.66 (52/104) (0.29-1.70)	5, E. Liverpool, Oh Water Treatment Plant 4.9 mi WNW	0.69 (25/52) (0.29-1.70)	--	0
	H-3 (8)	200	LLD		LLD	--	0
	Gamma (24)						
	Mn-54	5	LLD	--	--	--	0
	Fe-59	10	LLD	--	--	--	0
	Co-58	5	LLD	--	--	--	0
	Co-60	5	LLD	--	--	--	0
	Zn-65	30	LLD	--	--	--	0
	Zr/Nb-95	15	LLD	--	--	--	0
	Cs-134	5	LLD	--	--	--	0
	Cs-137	5	LLD	--	--	--	0
	Ba/La-140	15	LLD (1)	--	--	--	0

(1) See Section 3-H.

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).

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Table 3-2 (Continued)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						49, Upstream side of Montgomery Dam	
Surface Water (pCi/l)	I-131 (52)	1.0	0.80 (28/52) (0.29-2.80)	One Sample Location		One sample location	0
	H-3 (12)	200	380 (1/12)	2.1, Downstream Midland – J&L 1.5 mi WNW	380 (1/4)	LLD	0
	Gamma (36)						
	Mn-54	5	LLD	--	--	--	0
	Fe-59	15	LLD	--	--	--	0
	Co-58	5	LLD	--	--	--	0
	Co-60	5	LLD	--	--	--	0
	Zn-65	30	LLD	--	--	--	0
	Zr/Nb-95	15	LLD	--	--	--	0
	Cs-134	5	LLD	--	--	--	0
	Cs-137	5	LLD	--	--	--	0
	Ba/La-140	15	LLD (1)	--	--	--	0
	K-40	(a)	42.5 (1/36)	2.1, Downstream, Midland – J&L 1.5 mi WNW	42.5 (1/36)	--	0

(1) See Section 3-H.

(a) LLD for this nuclide for water not required by ODCM.

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

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Table 3-2 (Continued)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Montgomery Dam No. 49	
Sediment (pCi/g) (dry weight)	Gamma (6)						
	Be-7	(a)	1.01 (2/6) (0.77-1.25)	49, Upstream side of Montgomery Dam 5.0 mi NE	1.25 (1/2)	Same as High Location	0
	K-40	(a)	11.79 (6/6) (8.34-14.10)	49, Upstream side of Montgomery Dam 5.0 mi NE	12.88 (2/2) (12.86-12.90)	Same as High Location	0
	Co-58	(a)	0.43 (2/6) (0.16-0.70)	2A, BVPS Outfall 0.2 mi W	0.43 (2/2) (0.16-0.70)	None Detected	0
	Co-60	(a)	0.18 (1/6)	2A, BVPS Outfall 0.2 mi W	0.18 (1/2)	None Detected	0
	Cs-134	0.06	0.10 (1/6)	2A, BVPS Outfall 0.2 mi W	0.10 (1/6)	None Detected	0
	Cs-137	0.08	0.15 (6/6) (0.09-0.22)	2A, BVPS Outfall 0.2 mi W	0.20 (2/2) (0.17-0.22)	0.10 (2/2) (0.09-0.11)	0
	Ra-226	(a)	2.00 (2/6) (1.50-2.57)	2A, BVPS Outfall 0.2 mi W	2.19 (2/2) (1.80-2.57)	1.53 (2/2) (1.50-1.56)	0
	Th-228	(a)	1.11 (6/6) (0.84-1.42)	50, Upstream Side of New Cumberland Dam 11.8 mi WSW	1.17 (2/2) (0.92-1.42)	1.09(2/2) (1.07-1.11)	0
	Cr-51	(a)	0.09 (1/6)	2A, BVPS Outfall 0.2 mi W	0.09 (1/6)	None Detected	0
	Mn-54	(a)	0.03 (1/6)	2A, BVPS Outfall 0.2 mi W	0.03 (1/6)	None Detected	0
	Nb-95	(a)	0.24 (1/6)	2A, BVPS Outfall 0.2 mi W	0.24 (1/6)	None Detected	0
	Ag-110m	(a)	0.17(1/6)	2A, BVPS Outfall 0.2 mi W	0.17(1/6)	None Detected	0

(a) LLD for this nuclide for Sediment not required by ODCM

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

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						Windsheimer No. 96	
Milk (pCi/l)	I-131 (149)	1.0	LLD	--	--	LLD	0
	Sr-89 (114)	2.0	LLD				
	Sr-90 (114)	0.7	2.1 (98/114) (0.7-6.0)	69 Collins 3.5 mi SE	3.0 (17/19) (2.0-4.2)	1.7 (14/19) (0.8-4.9)	0
	Gamma (114)						
	K-40	(a)	1418 (114/114) (1090-1870)	96, Windsheimer's Farm 10.4 mi SSW	1469 (19/19) (1220-1640)	Same as High Location	0
	Cs-134	5	LLD	--	--	--	0
	Cs-137	5	LLD	--	--	--	0
	Ba/La-140	15	LLD	--	--	--	0

(a) LLD for this nuclide for Milk not required by ODCM

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).

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Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
Food and Garden Crops (pCi/g) (wet weight)	I-131 (4)	0.06	LLD	--	--	--	0
	Gamma (4)						
	K-40	(a)	2.0 (4/4) (1.4-2.7)	48, Weirton, WV 16.3 mi SSW	2.7 (1/1)	Same as High Location	0
	Cs-134	0.06	LLD (1)	--	--	--	0
	Cs-137	0.06	LLD	--	--	--	0

(1) See Section 3-D.

(a) LLD for this nuclide for Food and Garden Crops not required by ODCM

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 **Docket No.** 50-334/50-412

Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Table 3-2 (Continued)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Upstream Montgomery Dam No. 49	
Fish (pCi/g) (wet weight)	Gamma (8)						
	K-40	(a)	2.78 (8/8) (2.31-3.85)	2A BVPS Outfall Discharge 0.2 mi W	2.78 (4/4) (2.40-3.31)	2.76 (4/4) (2.09-3.85)	0
	Mn-54	0.05	LLD	--	--	--	0
	Fe-59	0.26	LLD	--	--	--	0
	Co-58	0.05	LLD	--	--	--	0
	Co-60	0.05	LLD	--	--	--	0
	Zn-65	0.10	LLD	--	--	--	0
	Cs-134	0.05	LLD	--	--	--	0
	Cs-137	0.06	LLD	--	--	--	0

(a) LLD for this nuclide for Fish not required by ODCM

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

Table 3-2 (Continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 **Docket No.** 50-334/50-412

Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
External Radiation (mR/day)	Gamma (173)	0.05	0.19 (173/173) (0.12-0.34)	84, Hancock Co. Parks & Recreation Center 8.3 mi SW	0.23 (4/4) (0.20-0.26)	0.19 (4/4) (0.18-0.21)	0
Feed and Forage (pCi/g) (dry weight)	Gamma (11)						
	Be-7	(a)	3.16 (6/11) (0.70-6.31)	One sample location	--	One sample location	0
	K-40	(a)	16.10 (11/11) (5.70-24.70)	One sample location	--	One sample location	0
	Th-228	(a)	0.13 (3/11) (0.08-0.18)	One sample location	--	One sample location	0
	I-131	(a)	None Detected	One sample location	--	One sample location	0
	Cs-134	(a)	None Detected	One sample location	--	One sample location	0
	Cs-137	(a)	None Detected	One sample location	--	One sample location	0
	Ra-226	(a)	0.16 (1/11)	One sample location	--	One sample location	0

(a) LLD for this nuclide for Feed and Forage not required by ODCM

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 **Docket No.** 50-334/50-412

Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48	
Air Particulate and Radioiodine	Gross Beta (520)	2	19 (519/520) (4-46)	47, E. Liverpool, Oh. Water Treatment Plant 4.9 mi. WNW	20 (52/52) (7-45)	18 (52/52) (6-44)	0
(X10-3 pCi/Cu.M.)	I-131(505)	70	LLD	--	--	--	0
	Gamma (40)						
	Be-7	(a)	97 (40/40) (64-124)	46.1, Industry, Rt. 68 Garage 2.3 mi NE	112 (4/4) (94-120)	90 (4/4) (64-107)	0
	K-40	(a)	6 (8/40) (1-11)	47, E. Liverpool, Oh. Water Treatment Plant 4.9 mi WNW	11 (1/4)	2 (2/4) (1-4)	0
	Cs-134	0.5	LLD	--	--	--	0
	Cs-137	0.5	LLD	--	--	--	0

(a) LLD for this nuclide for Air Particulate not required by ODCM

* Nominal Lower Limit of Detection (LLD)

** Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)

*** Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Beaver Valley Power Station Unit 1 and 2 **Docket No.** 50-334/50-412

Location of Facility Beaver, Pennsylvania **Reporting Period** Annual 2000

(County, State)

Medium of Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection * (LLD)	All Indicator Locations ** Mean (f) ** Range	Location with Highest Annual Mean Name Distance and Directions	** Mean (f) ** Range	Control Locations ** Mean (f) ** Range	Number of Nonroutine Reported Measurements***
						Weirton, WV No. 48A	
Soil (pCi/g) (dry weight)	Gamma (10)						
	K-40	(a)	13.2 (10/10) (10.2-17.4)	22, South of BVPS, Transmission Line 0.3 mi SSE	17.4 (1/1) --	16.6 (1/1) --	0
	Cs-134	0.06	LLD	--	--	--	0
	Cs-137	0.08	0.25 (9/10) (0.14-0.40)	51, Aliquippa (S.S.) 8.0 mi E	0.40 (1/1) --	0.15 (1/1) --	0
	Ra-226	(a)	1.84 (8/10) (1.25-2.45)	13, Meyer's Farm 1.4 mi SW	2.45 (1/1) --	1.77 (1/1) --	0
	Th-228	(a)	0.98 (10/10) (0.32-1.34)	22, South of BVPS, Transmission Line 0.3 mi SSE	1.34 (1/1) --	1.22 (1/1)	0

(a) LLD for this nuclide for Sediment not required by ODCM

* **Nominal Lower Limit of Detection (LLD)**

** **Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f)**

*** **Nonroutine reported measurements are defined in Regulatory Guide 4.8 (December 1975).**

Table 3-3

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975
(County) (State)

Pre-Operational Program Summary (Combined 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 pCi/g (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	
Foodstuff pCi/g (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 pCi/g (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 pCi/g (dry) (Template Samples)	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.

Table 3-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975
(County) (State)

Pre-Operational Program Summary (Combined 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)	--		--	
pCi/g (dry)	Gross Beta	(8)	1	21	(8/8)	16 - 28
(Core Samples)	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
pCi/l	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)	--		--	
pCi/l	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	
pCi/l	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
pCi/m^3	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.

Table 3-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

Name of Facility Beaver Valley Power Station **Docket No.** 50-334

Location of Facility Beaver, Pennsylvania **Reporting Level** CY 1974 - 1975
(County) (State)

Pre-Operational Program Summary (Combined 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 pCi/l	I-131 Sr-89 Sr-90 Gamma Cs-137 Others	(91) (134) (134) (134)	0.25 5 1 -- 10	0.6 7 5.3 13	(4/91) (4/134) (132/134) -- (19/134) < LLD	0.3 - 0.8 6 - 11 1.5 - 12.8 11 - 16
External Radiation mR/day	γ - Monthly γ - Quarterly γ - Annual	(599) (195) (48)	0.5 mR* 0.5 mR* 0.5 mR*	0.20 0.20 0.19	(599/599) (195/195) (48/48)	0.08 - 0.51 0.11 - 0.38 0.11 - 0.30
Fish pCi/g (wet)	Gross Beta Sr-90 Gamma K-40 Others	(17) (17) (17)	0.01 0.005 0.5 -- --	1.9 0.14 2.4 	(15/17) (17/17) (17/17) < LLD	1.0 - 3.2 0.02 - 0.50 1.0 - 3.7

* 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.

Table 3-4

Typical Detection Limits for Gamma Spectroscopy Detection by High Resolution Germanium

Nuclide	Milk Water (pCi/liter)	Air Particulates (pCi)	Vegetation (pCi/kg wet)	Sediment and Soil (pCi/g wet)	Fish (pCi/g wet)
Be-7	50	20	200	0.2	0.2
K-40	80	50	400	0.4	0.4
Mn-54	5	2	20	0.02	0.02
Co-58	5	2	20	0.02	0.02
Fe-59	10	3	40	0.04	0.04
Co-60	5	2	20	0.02	0.02
Zn-65	10	5	40	0.04	0.04
Zr/Nb-95	5	3	40	0.04	0.04
Ru-103	5	2	30	0.03	0.03
Ru-106	50	20	200	0.2	0.2
I-131	15	4	100	0.1	0.1
Cs-134	5	2	20	0.02	0.02
Cs-137	5	2	20	0.02	0.02
Ba/La-140	10	3	200	0.2	0.2
Ce-141	10	3	100	0.1	0.1
Ce-144	40	20	200	0.2	0.2
Ra-226	80	10	100	0.1	0.1
Th-228	10	10	20	0.02	0.02

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 3-1 and shown on a map in Figure 3-1.

Samples are collected at each of these stations by continuously drawing one cubic foot per minute of atmosphere air through a glass fiber filter and through a charcoal cartridge. The former collects airborne particulates; the latter is for radioiodine sampling. Samples are collected for analysis on a weekly basis.

The charcoal is used in the weekly analysis of airborne I-131. The filters are analyzed each week for gross beta, then composited by station for quarterly analysis by gamma spectrometry. In order to reduce interference from natural radon and thoron radioactivities, all filters are allowed to decay for a few days after collection prior to counting for beta in a low background counting system.

b. Procedures

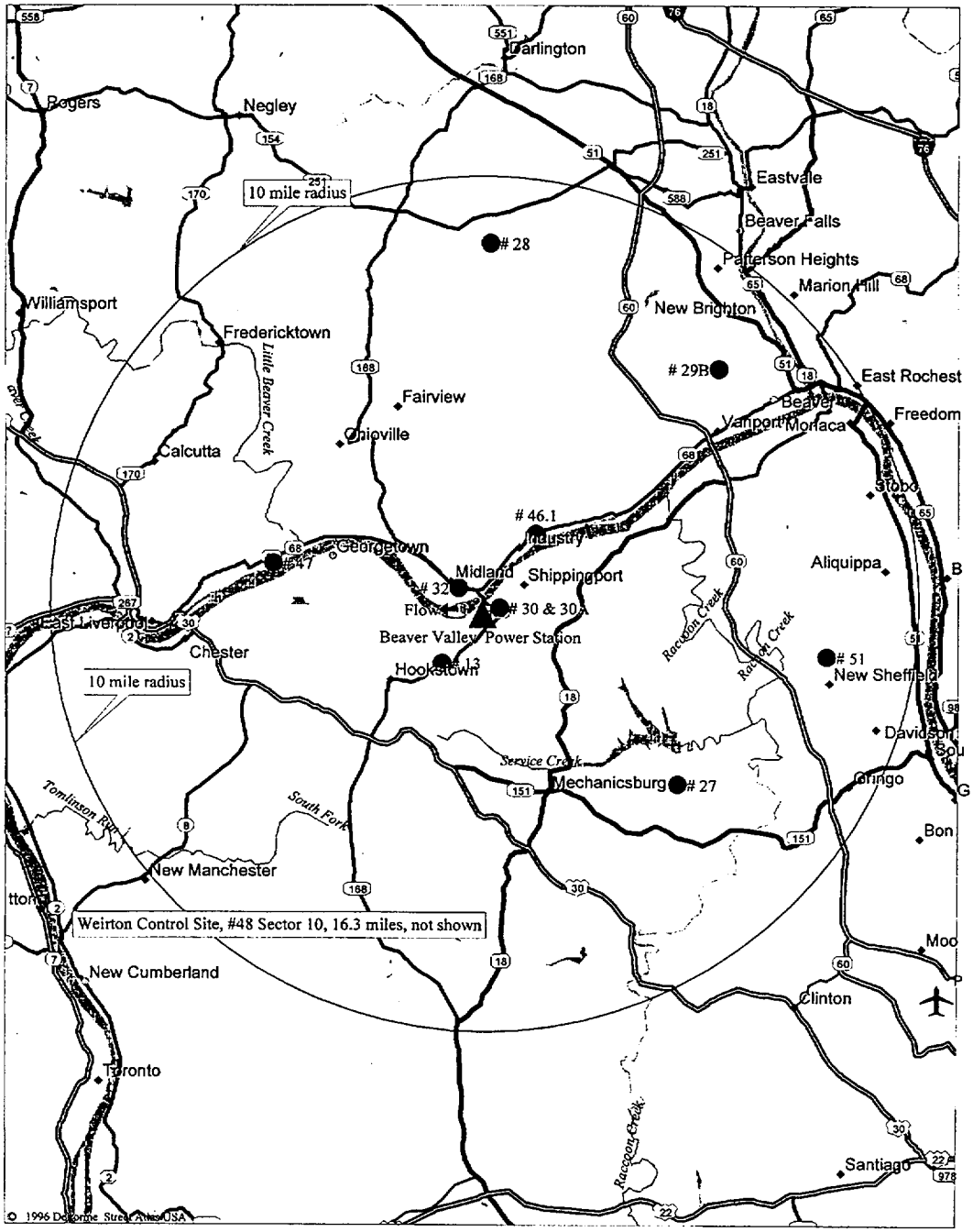
Gross beta analysis is performed by placing the filter paper from the weekly air sample in a 2" planchet and counting it in a low background, gas flow proportional counter.

Gamma emitters are determined by stacking all the filter papers from each monitoring station collected during the quarter and scanning this composite on a high resolution germanium gamma spectrometer.

Radioiodine (I-131) analysis is performed by a gamma scan of the charcoal in a weekly charcoal cartridge. The activity is referenced to the mid-collection time.

Figure 3-1

Air Sampling Stations



Site No.	Sector	Distance (miles)	Location
13	11	1.4	Meyer's Farm
27	7	6.1	Brunton's Farm
28	1	8.6	Sherman's Farm
29B	3	8.0	Beaver Valley Geriatric Center
30	4	0.5	Shippingport (S.S.)
30A	4	0.5	Shippingport (S.S.)

Site No.	Sector	Distance (miles)	Location
32	15	0.8	Midland (S.S.)
46.1	3	2.3	Industry Rt. 68 – Garage
47	14	4.9	East Liverpool, Oh. - Water Treatment Plant
48	10	16.3	Weirton, W.Va. – Weirton Water Tower, Collier Way
51	5	8.0	Aliquippa (S.S.)

3. Results and Conclusions

A summary of data is presented in Table 3-2.

a. Airborne Radioactive Particulates

A total of five hundred twenty-nine (520) weekly samples from ten (10) locations were analyzed for gross beta. Results were comparable to previous years. Figure 3-2 illustrates the weekly average concentration of gross beta in air particulates.

For the 4th quarter, the average for the air particulate gross beta counts were approximately double the results for the first three quarters. The Control location, which is considered outside the influence of the Beaver Valley Power Station, also indicated the same elevated readings in the 4th quarter. When the quarterly gamma spectroscopy analysis was performed, only naturally occurring isotopes were identified (see below). Three Mile Island, Limerick, and Peach Bottom, and Perry have also experienced elevated readings in the same range as BVPS. No evidence points to the elevated readings being the result of plant operations.

The weekly air particulate samples were composited to forty (40) quarterly samples which were analyzed by gamma spectrometry. Naturally occurring Be-7 was present in all samples. Naturally occurring K-40, Th-228 and Ra-226 was detected in eight (8), three (3), and one (1) respectively of the forty (40) monthly samples. No other radionuclides were detected. Results are listed in the summary Table 3-2.

Based on the analytical results, the operation of Beaver Valley Power Station did not contribute any measurable increase in air particulate radioactivity during 2000.

b. Radioiodine

A total of five hundred five (505) weekly charcoal filter samples were analyzed for I-131. No detectable concentrations were present at any locations.

Based on analytical results, the operation of Beaver Valley Power Station did not contribute any measurable increase in airborne radioiodine during 2000.

c. Deviations from required sampling/analysis schedule

ODCM required sites

Site 32, Midland SS air sampling station was out of service from 1836 7/28/00 to 1315 7/31/00 due to a loss of power at the Midland substation. Duquesne Light Company crews restored power to the substation on 7/31/00 and the air sampling station was returned to service. [Ref: Condition Report 00-2534]

Non-ODCM required sites

None

Other

During the second half of the year, four condition reports were written concerning air sample analysis. The following is a description of the four condition reports.

- CR 01-0826 was written because the vendor analysis lab lost one week worth of air charcoal cartridges for the week ending 7/31/00 (ten total) after they were received at the lab. The vendor has since moved into a new lab facility and the sample receipt and storage area practices have been reviewed by the vendor Quality Control Manager. His review concluded that the new facility will adequately prevent this from happening in the future. No other loses of samples has been noted since this incident. The state of Pennsylvania has co-located samplers at the BVPS ODCM required sites (except the control location). The state results for the period of interest at the four sites were all below the required LLD.

- CR 01-1358 was written because results for five of the ten air charcoal cartridges from the week ending 7/17/00 were lost due to overheating of a circuit board on the vendors counting system. Because of the circuit board problem, the data was not retrievable. The five samples that were reported from that week were all LLD. The state of Pennsylvania's four sample results (two of which were from the sites that the data was lost) all were below the required LLD for the period of interest.

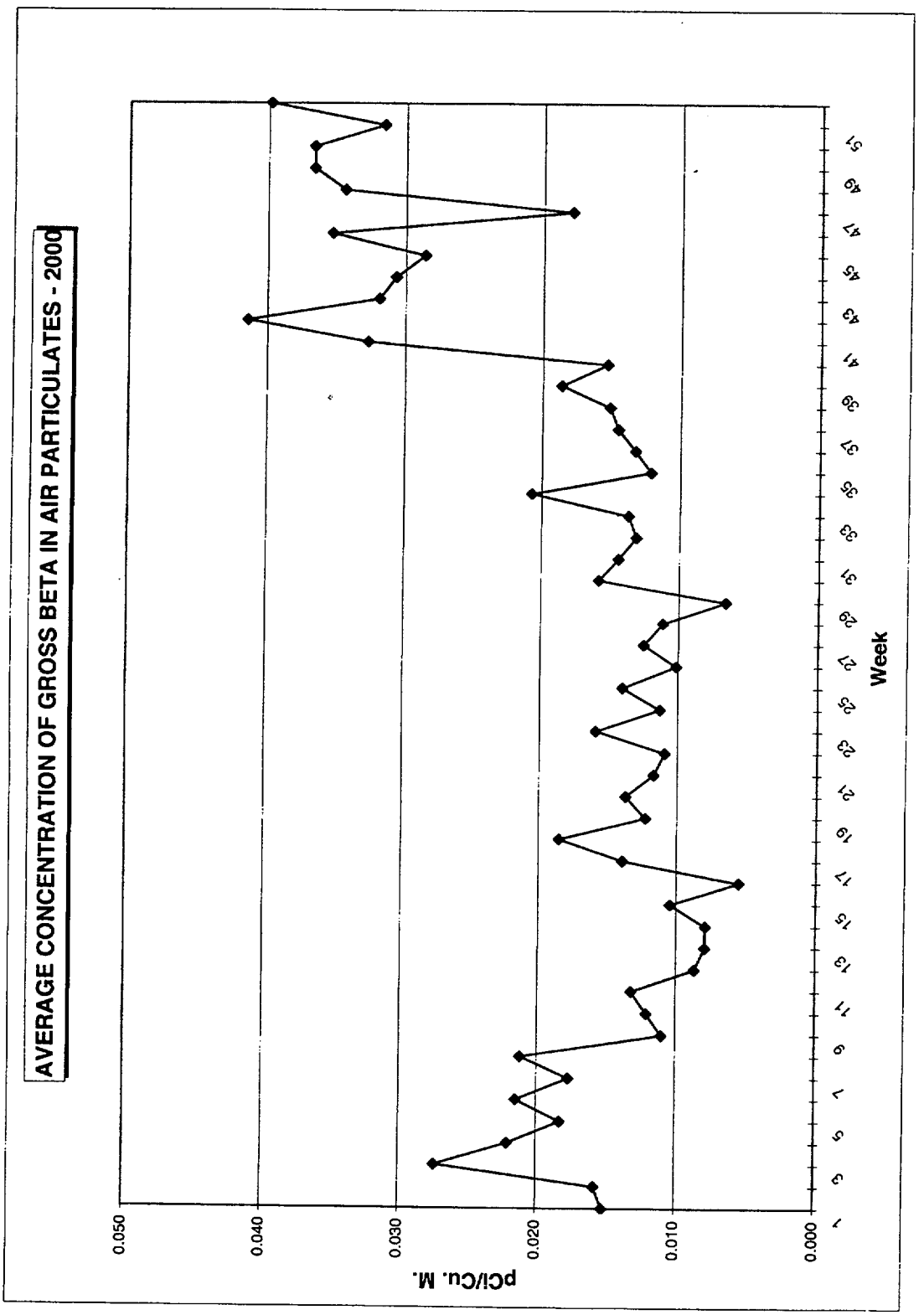
- CR 01-1515 was written because 29 air charcoal analyses had reported MDA values that were higher than expected and indicated that the LLD was not met. This occurred for the weeks ending 12/4/00, 12/11/00 and 12/18/00. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 0.07 pCi/m^3 for I-131. The increased time from sampling to counting caused the LLD value to increase. The MDA values reported ranged between 0.20 to 0.70 pCi/m^3. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. The state of Pennsylvania results (for all three weeks) for air charcoal samples from their four co-located sites were all below the required LLD.

- CR 01-2009 was written for ten air particulate samples that had reported MDA values that were higher than expected and indicated that the LLD was not met for Ba-140. This occurred for the 3rd quarter. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 0.01 pCi/m^3 for Ba-140. The increased time from sampling to counting caused the LLD value to increase. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. The state of Pennsylvania gamma spectroscopy results (for the 3rd quarter) for air particulate samples from their four co-located sites indicated there were no identified radionuclides.

- CR 01-2380 was written for ten air particulate samples that had reported MDA values that were higher than expected and indicated that the LLD was not met for Ba-140. This occurred for the 4th quarter. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 0.01 pCi/m^3 for Ba-140. The increased time from sampling to counting caused the LLD value to increase. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. The state of Pennsylvania gamma spectroscopy results (for the 4th quarter) for air particulate samples from their four co-located sites indicated there was no identified radionuclides.

Figure 3-2

Average Concentration of Gross Beta in Air Particulates



C. Monitoring of Sediments and Soils

1. Characterization of Stream Sediments and Soils

   The stream sediments consist 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

      River bottom sediments were collected semi-annually above the Montgomery Dam, in the vicinities of the Beaver Valley discharge 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 3-1 and are shown in Figure 3-3.

      Soil samples were collected at ten (10) locations during 2000. At each location, 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 3-1 and are shown in Figure 3-3.

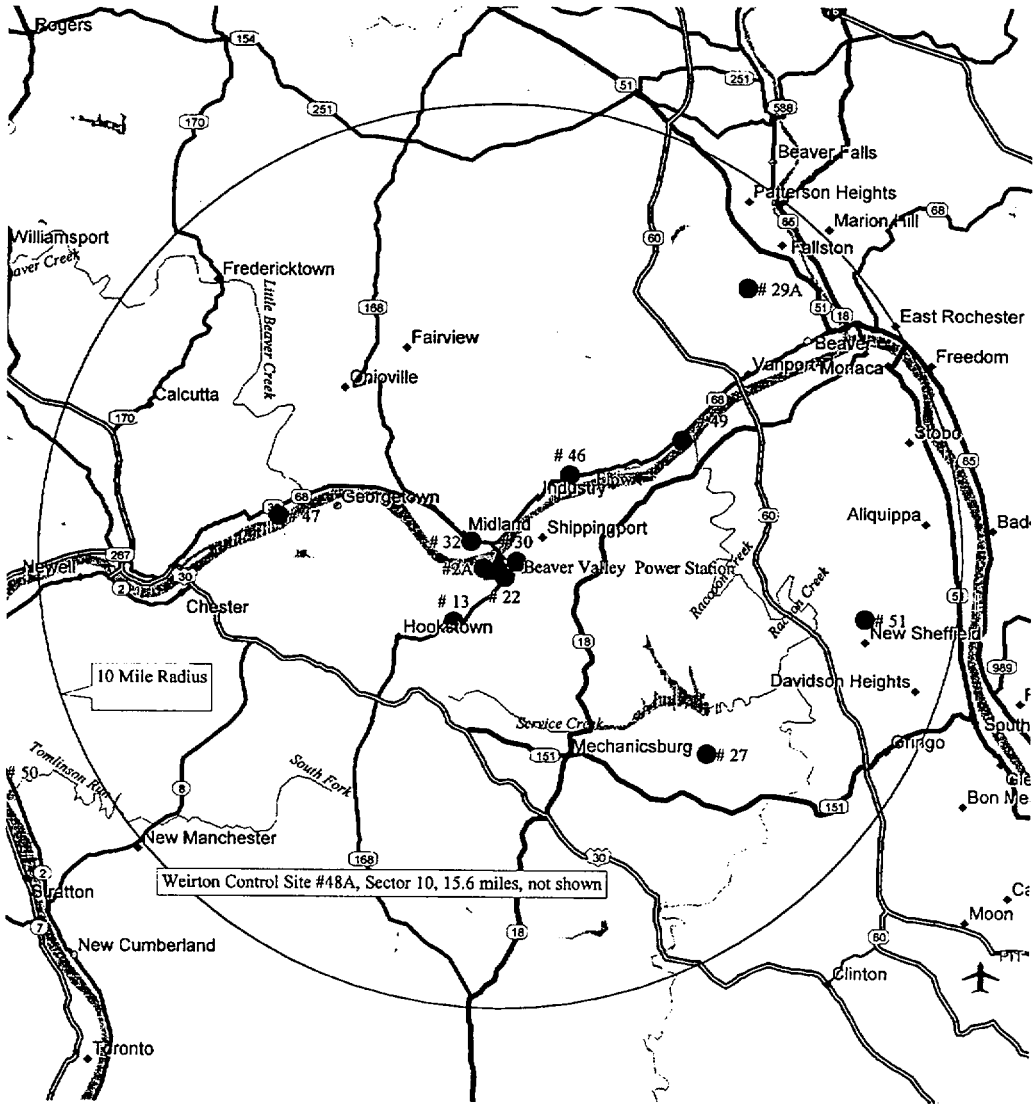
      Bottom sediments and soils are analyzed for gamma-emitting radionuclides.

   b. Analytical Procedures

      Gamma analysis of sediment or soil is performed in a 300 ml plastic bottle which is counted by a gamma spectrometer.

Figure 3-3

Environmental Monitoring Locations - Shoreline Sediments and Soil



SOIL SAMPLING LOCATIONS							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
13	11	1.4	Meyer's Farm	32	15	0.8	Midland (S.S.)
22	8	0.3	South of BVPS Transmission Line	46	3	2.5	Industry, Midway Dr.
27	7	6.1	Brunton's Farm	47	14	4.9	East Liverpool, Oh. - Water Treatment Plant
29A	3	8.3	Nicols Farm	48A	10	15.6	Weirton, W.Va. - Weirton Water Tower, E. Belleview Dr.
30	4	0.5	Shippingport (S.S.)	51	5	8.0	Aliquippa (S.S.)

SEDIMENT SAMPLING LOCATIONS							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
2A	13	0.2	BVPS Outfall Discharge	50	12	11.8	Upstream Side of New Cumberland Dam
49	3	5.0	Upstream Side of Montgomery Dam				

3. Results and Conclusions

A summary of sediment analysis is presented in Table 3-2.

a. Sediment

A total of six (6) samples were analyzed by gamma spectrometry. Naturally occurring K-40 and Th-228 were detected in every sample. Be-7 and Ra-226 were detected in two samples. Small amounts of Cs-137 from previous nuclear weapons tests were detected in all six river sediment samples, including two upstream above Montgomery Dam, which is unaffected by plant effluents. Small amounts of Co-58, Co-60, Cr-51, Mn-54, Nb-95, and Ag-110m were detected in the Beaver Valley Power Station discharge area and are attributable to station releases. The activity detected in the station discharge area is consistent with station data of authorized radioactive discharges which were within limits permitted by the NRC license.

The positive results detected are attributable to authorized releases from the Beaver Valley Power Station and are characteristic of the effluent. These results confirm that the station assessments, prior to authorizing radioactive discharges, are adequate and that the environmental monitoring program is sufficiently sensitive.

b. Soil

A total of ten (10) samples were analyzed by gamma spectrometry. Naturally occurring K-40 and Th-228 were detected in every sample. Naturally occurring Ra-226 was found in eight (8) of the ten (10) samples. Small amounts of Cs-137 from previous nuclear weapons tests were detected in nine of the ten samples including the control station (Weirton, WV). When compared against pre-operational values and previous samples, the Cs-137 is trending down.

D. Monitoring of Feedcrops and Food Products

1. Characterization of Farm Products

According to the latest data from the 1998-1999 Statistical Summary and Pennsylvania Department of Agriculture Annual Report, there were approximately 660 farms in Beaver County. The cash receipts from the sale of agricultural crops and livestock was $17,088,000. The principal source of revenue was in dairy products which was estimated at $6,623,000. Revenues from other farm products were estimated as follows:

Field Crops	$2,240,000
Fruits	$265,000
Horticulture and Mushrooms	$4,432,000
Vegetables and Potatoes	$463,000
Poultry and Meat Products	$3,065,000

2. Sampling Program and Analytical Techniques

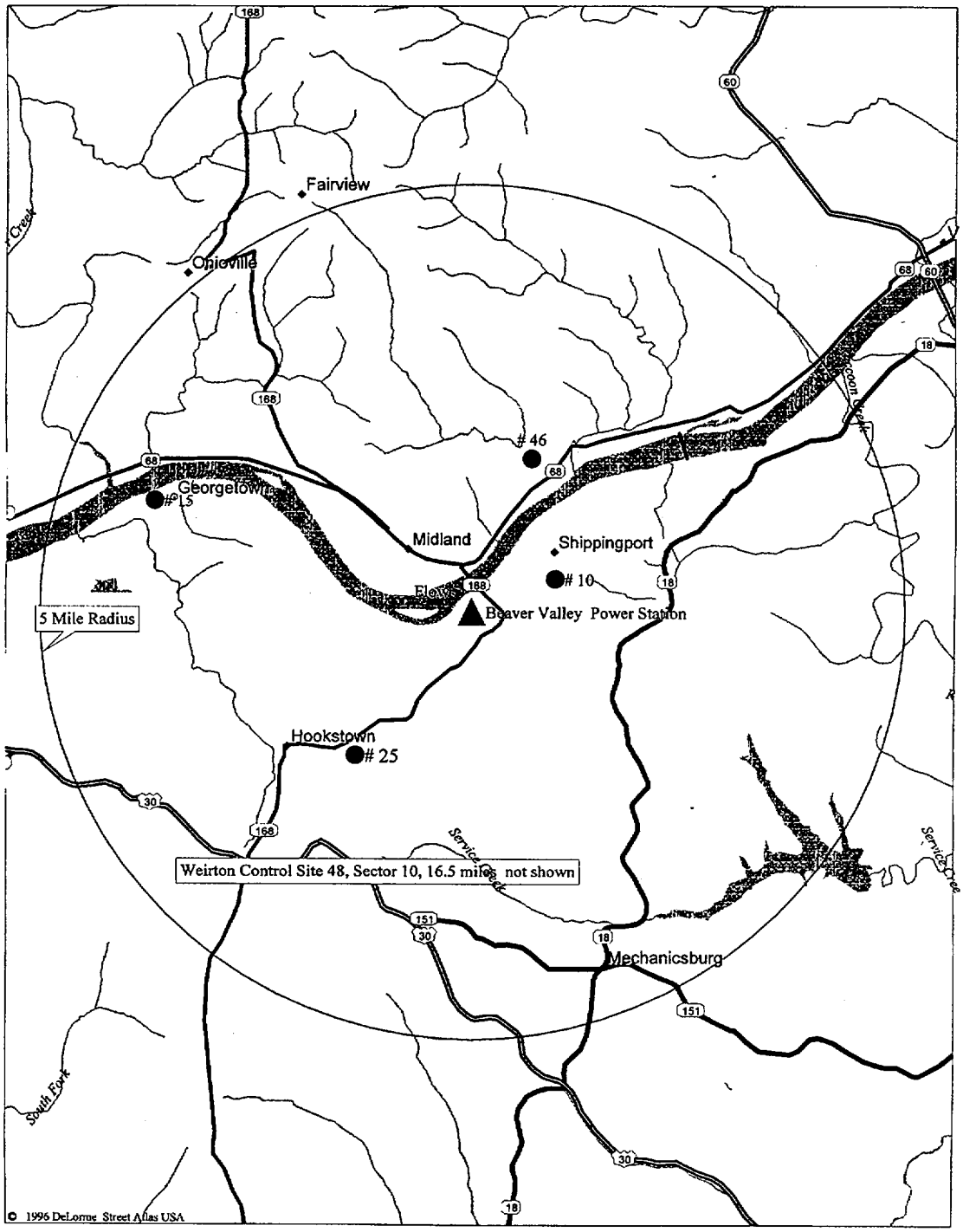
a. Program

Representative samples of cattle feed are collected monthly from the nearest dairy (Searight). See Figure 3-4. Each sample is analyzed by gamma spectrometry.

Food products (vegetables) were collected at garden locations during the summer of 2000. Leafy vegetables, i.e., cabbage, were obtained from Shippingport, Georgetown, and Industry, PA, and Weirton, W.Va. All samples were analyzed for gamma emitters by gamma spectroscopy. Samples were also analyzed by radiochemical analysis for I-131.

Figure 3-4

Environmental Monitoring Program - Feedcrop and Food Product Locations



Sample Type	Site No.	Location
Food	10	Shippingport
Food	15	Georgetown
Food	46	Industry
Food	48	Weirton, W.Va.
Feed	25	Searight's Dairy

b. Procedures

Gamma emitters in feed are determined by scanning a dried, homogenized sample with the gamma spectroscopy system. A high resolution germanium detector is utilized with this system. Food samples are loaded into tared 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.

Radioiodine (I-131) in food crops is determined by radiochemistry. Stable iodide carrier is first added to a chopped sample which is then leached with 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.

3. Results and Conclusions

A summary of data is presented in Table 3-2.

a. Feed

A total of eleven (11) samples were analyzed by gamma spectroscopy. Only naturally occurring nuclides were identified including: K-40 in all the samples, Th-228 in three (3), Be-7 in six (6), and Ra-226 in one (1).

Two feed samples that had reported MDA values that were higher than expected and indicated that the LLD was not met for I-131. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 0.06 pCi/g I-131. The increased time from sampling to counting caused the LLD value to increase. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. (Ref: CR 01-2009).

CR 01-2089 was written because the vendor analysis lab lost one monthly feed sample from Searight's Farm collected on 9/19/00 after it was received at the lab. During this time period, the vendor was in the process of moving to a new facility and was using a subcontractor for sample analysis. The vendor believes the sample was lost at the subcontractor's lab. The new facility became operational in January 2001 and the vendor is no longer subcontracting analysis work. The vendor Quality Control Manager has since reviewed the new lab sample receipt and storage area practices. His review concluded that the new facility would adequately prevent this from happening in the future. A milk sample was taken at this dairy on the same day and only naturally occurring K-40 was detected.

b. Food

A total of four (4) samples were analyzed for I-131. No detectable concentrations were present.

A total of four (4) samples were analyzed by gamma spectrometry. Naturally occurring K-40 was present in all samples. No other nuclides were identified.

One food sample had a reported MDA value that was higher than the LLD for Cs-134. The required LLD for Cs-134 is 0.06 pCi/g and the MDA result was 0.066 pCi/g. Since the exact counting conditions that are used to determine the LLD cannot always be duplicated, slight variations can occur. (Ref: CR 01-2009).

c. The data from food and feed analyses were consistent with previous data. Based on the analytical results, the operation of the Beaver Valley Power Station did not contribute any measurable increase in radioactivity in the foods and feeds in the vicinity of the site.

E. Monitoring of Local Cows Milk

1. Description - Milch Animal Locations

Samples of fresh milk are obtained from milch animals at locations and frequencies noted in Table 3-1. This milk is analyzed for its radioiodine content, gamma emitters, and strontuim-89 and strontuim-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 4, Land Use Census.

2. Sampling Program and Analytical Techniques

a. Program

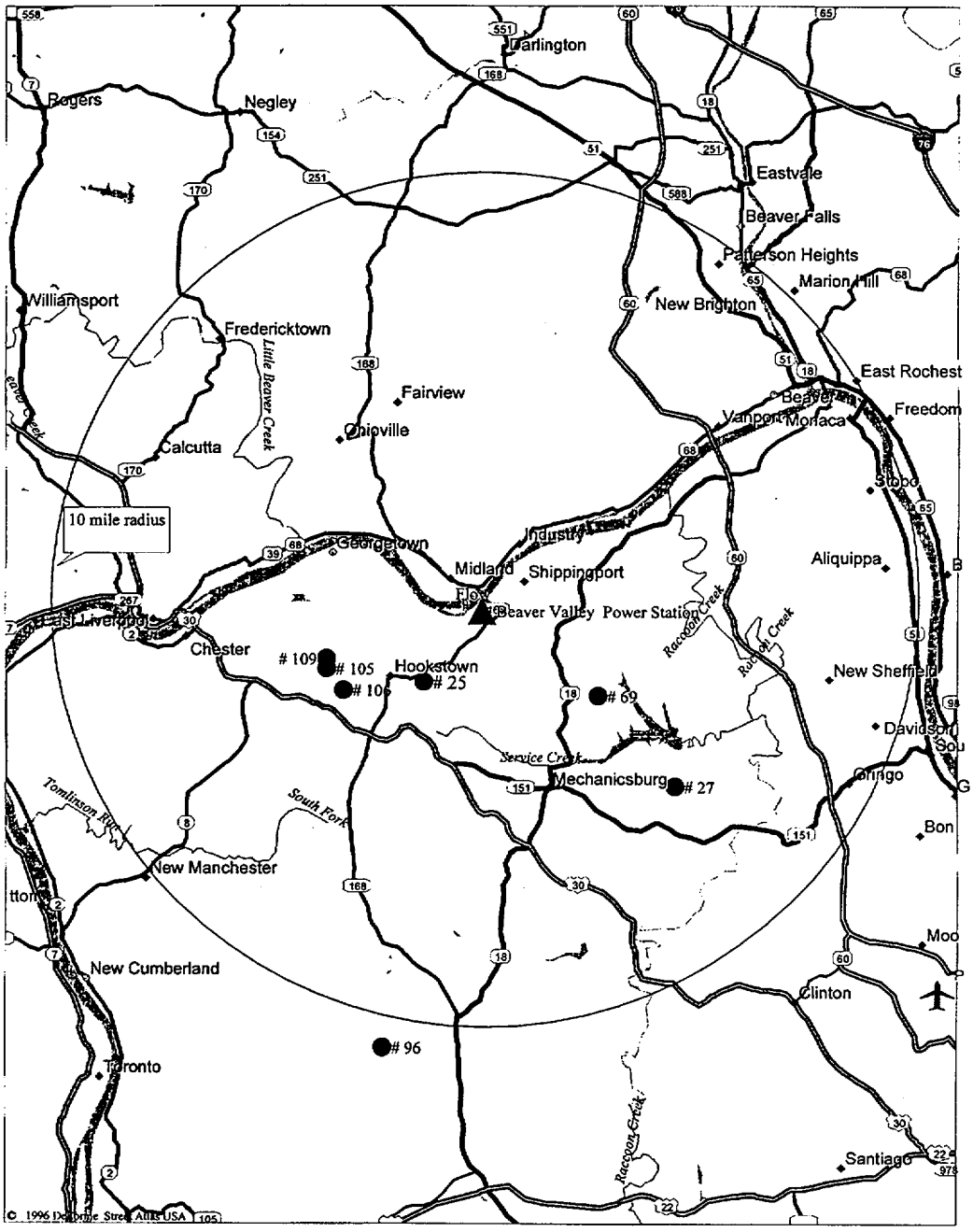
Milk was collected from two (2) reference dairy farms (Searight's and Brunton's) within a 10-mile radius of the site and from one (1) control location (Windsheimer's) outside of the 10-mile radius. Additional dairies, which represent the highest potential milk pathway for radioiodine based on milch animal surveys and meteorological data, were selected and sampled. These dairies are subject to change based upon availability of milk or when more recent data (milch animal census) indicate other locations are more appropriate. The location of each is shown in Figure 3-5 and described below.

Site	Dairy	Approximate Number of Animals being Milked	Direction and Distance from Midpoint of Unit 1 Reactor	Collection Period
25	Searight	46 Cows	2.1 miles SSW	Jan. - Dec.
27	Brunton	94 Cows	6.1 miles SE	Jan. - Dec.
69*	Collins	4 Goats	3.5 miles SE	Jan. - Nov.
96	Windsheimer	53 Cows	10.4 miles SSW	Jan. - Dec.
103*	Halstead	58 Cows	5.2 miles SSW	One sample in July and Dec.
105*	Ambrose	32 Cows	3.9 miles WSW	Jan. - Dec.
106*	Conkle	32 Cows	3.7 miles WSW	Jan. - Dec.
* Highest potential pathway dairies				

The sample from Searight Dairy is collected and analyzed weekly for radioiodine using a procedure with a high sensitivity. Samples from each of the other selected dairies are collected monthly when cows are indoors, and bi-weekly when cows are grazing. This monthly or bi-weekly sample is analyzed for Sr-89, Sr-90, gamma emitters including Cs-137 (by high resolution germanium gamma spectroscopy) and I-131 (high sensitivity analysis).

Figure 3-5

Environmental Monitoring Locations - Milk



Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
25	10	2.1	Searight's Farm	103*	10	5.2	Halstead Farm
27	7	6.1	Brunton's Farm	105*	12	3.8	Ambrose Farm
69*	7	3.4	Collins	106*	12	3.7	Conkle Farm
96	10	10.4	Windsheimer's Farm	109*	12	3.7	Soisson Farm

* Dairies selected based on highest deposition factors.

b. Procedure

Radioiodine (I-131) analysis in milk was performed using chemically prepared samples and analyzed with a low-level beta counting system.

Gamma emitters are determined by gamma spectroscopy of a 1 liter Marinelli container of milk.

Strontium milk samples are prepared by adding 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 ingrowth of Y-90. Yttrium is then precipitated as hydroxide, is 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 Sr-90 activity. Strontium-89 activity is determined by precipitating $SrCO_3$ 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 gravimetrically.

3. Results and Conclusions

A summary of data is presented in Table 3-2.

a. A total of one hundred fourteen (114) samples were analyzed for Sr-89 and Sr-90. No Sr-89 was detected. Sr-90 was detected in ninety-eight (98) samples at levels attributable to previous nuclear weapons tests and are within the normally expected range.

b. A total of one hundred fourteen (114) samples were analyzed by gamma spectroscopy. Naturally occurring K-40 was present in all samples. No other radionuclides were identified.

c. A total of one hundred and forty-nine (149) samples were analyzed for I-131 during 2000. All I-131 activities were below minimum detectable level.

d. Four Condition Reports were written concerning milk sample analysis.

- CR 00-2425 was written because one of six milk samples taken in May had to be recounted because of equipment problems (malfunction of magnetic tape drive) at the vendor's lab and the second count failed to meet the required LLD for Ba-140. The increased time from sampling to the second count caused the LLD value to increase. All other Ba-140 results from that week were within the required LLD. The vendor has since replaced the magnetic tape drive system.
- CR 01-1515 and CR 01-2009 were written for thirty-four milk samples that had reported MDA values that were higher than expected and indicated that the LLD was not met either for Sr-89 (25) and/or Ba-140 (9). The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 15 pCi/liter for Ba-140 and 2 pCi/liter for Sr-89. The increased time from sampling to counting caused the LLD value to increase. These events were from some of the samples from July through December. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. Also, the vendor subcontracted out some of the analyses because of the delays during the move and this increased the time frame from sampling to counting. The new facility became operational in January 2001 and the vendor does not expect further delays. The state of Pennsylvania performs analyses (including Ba-140) on split samples from BVPS for two of the six dairies that BVPS samples. For the 3rd and 4th quarters, all Ba-140 results (12 total) from the state's analyses were less than the required LLD. The state does not analyze for Sr-89. A review of the BVPS effluent data showed that Sr-89 was not detected in any gaseous releases.
- CR 01-1515 and CR 01-2009 was also written for twenty-one milk samples that had reported MDA values that were higher than expected and indicated that the LLD was not met for Sr-90. These samples were subcontracted out by the vendor for analysis. The investigation performed by the vendor concludes that the subcontracted lab failed to count the samples for an adequate time to meet the required LLD. The new facility became operational in January 2001 and the vendor does not expect further delays. A review of the BVPS effluent data showed that Sr-90 was not detected in any gaseous releases.
- CR 01-0827 seven milk samples that had reported MDA values that were higher than expected and indicated that the LLD was not met for Sr-89. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 2 pCi/liter for Sr-89. The increased time from sampling to counting caused the LLD value to increase. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. A review of the BVPS effluent data showed that Sr-89 was not detected in any gaseous releases.

e. Based on all the analytical results and the above investigation, the operation of the Beaver Valley Power Station did not contribute any measurable increase in radioactivity in the milk in the vicinity of the site.

F. Environmental Radiation Monitoring

1. Description of Regional Background Radiation and Sources

The terrain in the vicinity of the Beaver Valley Power Station generally consists of rough hills with altitude variations of 300-400 feet. Most of the land is wooded.

The principal geologic features of the region are nearly flat-laying sedimentary beds of the Pennsylvania Age. 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.

Based on surveys reported in previous annual reports, exposure rates ranged from 6-12 μR/hr. Results for 2000 indicated that background radiation continued in this range.

2. Locations and Analytical Procedures

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

In 2000 there were a total of forty-four (44) offsite environmental TLD locations. The locations of the TLDs are shown in Figure 3-6. Thirteen (13) locations also have QC Laboratory TLDs.

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 in a special environmental holder.

3. Results and Conclusions

Data obtained with the contractor TLD during 2000 are summarized in Table 3-2.

The annual exposure rate of all offsite TLDs averaged 0.186 mR/day in 2000. As in previous years, there was some variation among locations and seasons as would be expected. In 2000, ionizing radiation dose determinations from TLDs averaged 68.1 mR for the year. This is comparable to previous years. There was no evidence of anomalies that could be attributed to the operation of the Beaver Valley Power Station. The TLDs confirm that changes from natural radiation levels, if any, are negligible.

In 2000, three TLD results were lost due to vandalism: [Ref: CR 00-2426]

- Site No. 46 - 2nd quarter
- Site No. 72 - 1st quarter
- Site No. 72 - 2nd quarter

Figure 3-6

TLD Locations

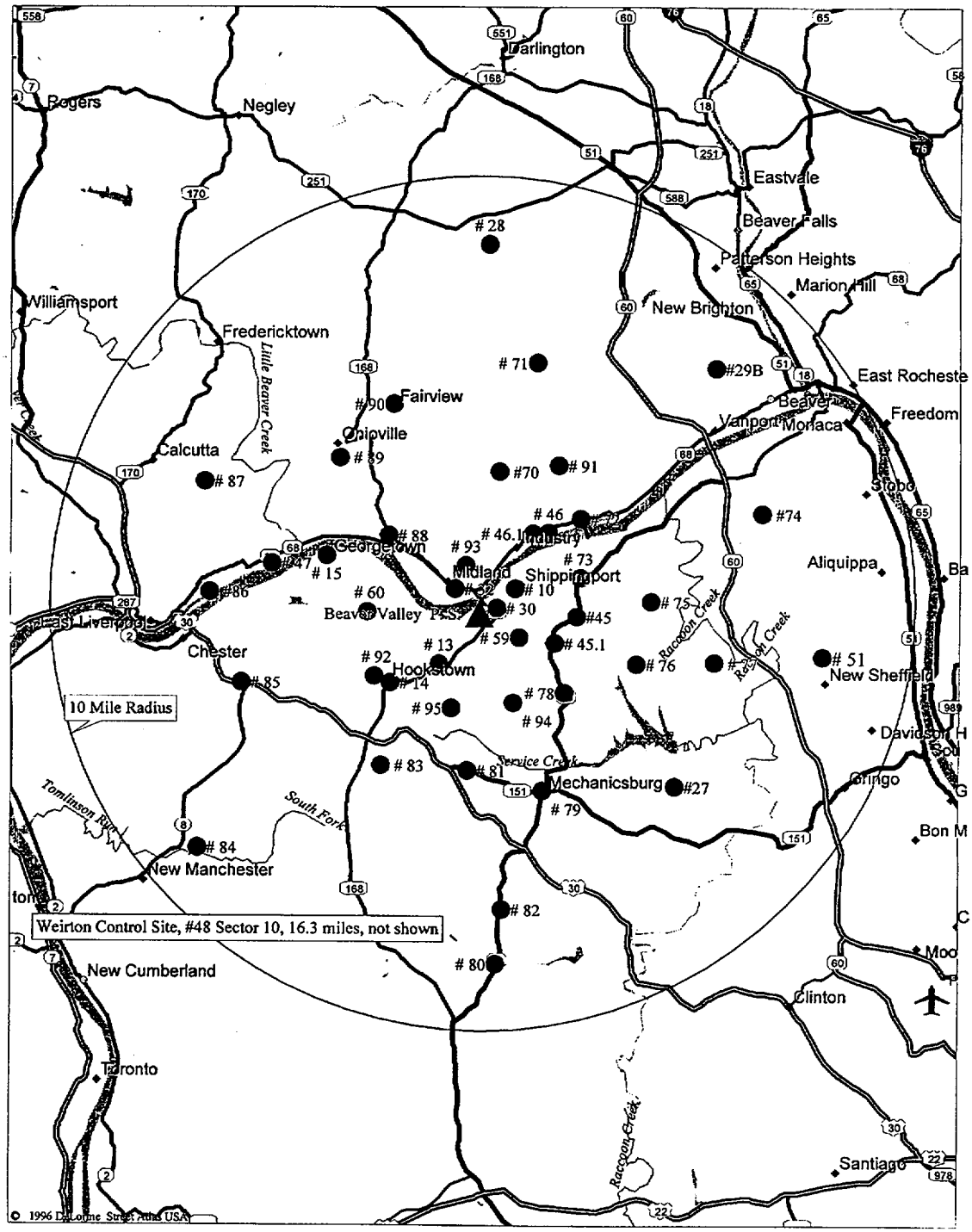


Figure 3-6 (Continued)

TLD Locations

SOUTHEAST

Site No.	Sector	Distance (miles)	Location
27	7	6.1	Brunton's Farm
45.1	6	1.9	Raccoon Twp., Kennedy's Corners
51	5	8.0	Aliquippa (S.S.)
59	6	1.0	236 Green Hill Rd.
76	6	3.8	Raccoon Elementary School
77	6	5.6	Raccoon Twp. (Green Garden Road)
78	7	2.7	Raccoon Municipal Bldg
79	8	4.4	Rt. 151 and Pross Ln.
80	9	8.2	Raccoon Park
82	9	6.9	Hanover Municipal Building
94	8	2.2	McCleary Road & Pole Cat Hollow Rd.

NORTHWEST

Site No.	Sector	Distance (miles)	Location
15	14	3.7	Georgetown Post Office
32	15	0.8	Midland (S.S.)
47	14	4.9	E. Liverpool, Oh. - Water Treatment Plant
60	13	2.5	444 Hill Rd.
86	13	6.2	E. Liverpool, Oh. - 1090 Ohio Ave.
87	14	7.0	Calcutta, Oh. – Calcutta Smiths Ferry Rd. & Valley Dr.
88	15	2.8	Midland Heights – 110 Summit Rd.
89	15	4.8	Ohioville, 488 Smith Ferry Rd.
90	16	5.2	Opposite Fairview School
93	16	1.1	Midland Sunrise Hills

NORTHEAST

Site No.	Sector	Distance (miles)	Location
10	3	1.0	Shippingport Boro
28	1	8.6	Sherman's Farm
29B	3	8.0	Beaver Valley Geriatric Center
30	4	0.5	Shippingport (S.S.)
45	5	2.2	Rt. 18 & Anderson St.
46	3	2.5	Industry Midway Dr.
46.1	3	2.3	Industry, Rt. 68 & Garage
70	1	3.4	North of Western Beaver School – Engle Rd.
71	2	6.0	Brighton Twp., First Western Bank
72	3	3.3	Industry, Logan Park
73	4	2.5	618 Squirrel Run Rd.
74	4	7.0	CCBC, 137 Poplar Ave.
75	5	4.1	117 Holt Road
91	2	3.9	Pine Grove Road & Doyle Road

SOUTHWEST

Site No.	Sector	Distance (miles)	Location
13	11	1.4	Meyer's Farm
14	11	2.5	Hookstown
48	10	16.3	Weirton, W.Va. - Weirton Water Tower, Collier Way
81	9	3.6	Millcreek United Pres. Church
83	10	4.2	735 Mill Creek Road
84	11	8.3	Hancock Co. Parks & Recreation Complex
85	12	5.7	Routes 8 & 30 Intersection
92	12	2.8	Georgetown Road (S.S.)
95	10	2.3	832 McCleary Road

G. Monitoring of Fish

1. Description

   During 2000, fish collected for the radiological monitoring program included carp, smallmouth bass, sauger, garr, quillback, and catfish.

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 3-7.

   b. Procedure

      A sample is prepared in a standard tared 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

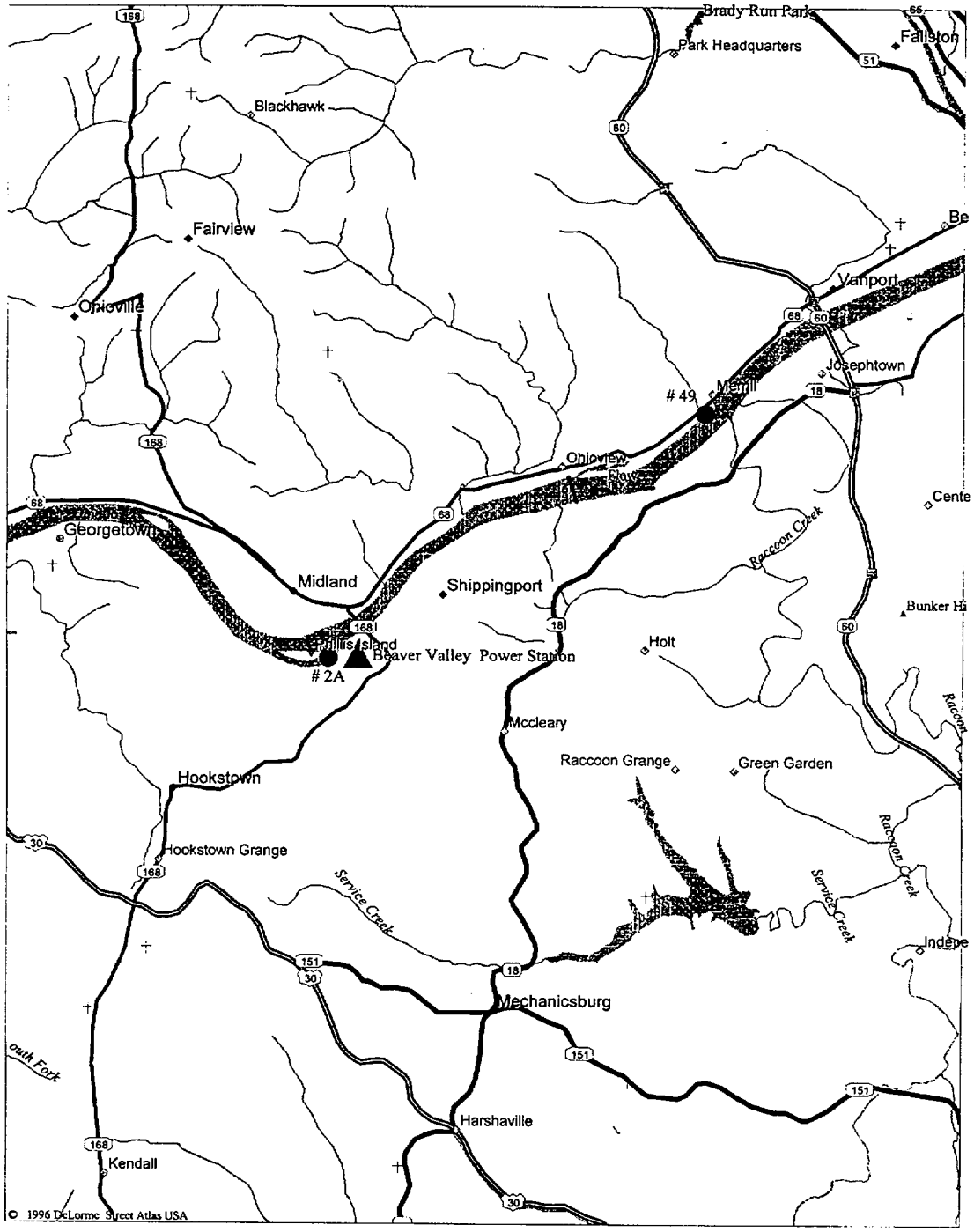
   A summary of the results of the fish monitoring data is provided in Table 3-2.

   A total of eight (8) samples were analyzed by gamma spectroscopy. Naturally occurring K-40 was detected in all samples. No other gamma emitting radionuclides were detected.

   Based on the analytical results, the operation of the Beaver Valley Power Station did not contribute any measurable increase in radioactivity in the Ohio River fish population.

Figure 3-7

Environmental Monitoring Program - Fish Sampling Locations



Site No.	Sector	Distance (miles)	Location
2A	13	0.2	BVPS Outfall Discharge
49	3	5.0	Upstream side of Montgomery Dam

H. Monitoring of Surface, Drinking, Ground Waters and Precipitation

1. Description of Water Sources

The Ohio River is the main body of water in the area. It is used by the Beaver Valley Power Station for plant make-up for the cooling tower and for receiving plant liquid effluents.

Ohio River water is a source of water for some towns both upstream and downstream of the Beaver Valley Power Station site. It is used by several municipalities and industries downstream of the 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 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 average annual precipitation for the area is 36.23 inches based on 1941 to 1970 data collected at the Pittsburgh International Airport.

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 normally collected at the East Liverpool (Ohio) Water Treatment Plant [River Mile 41.2] daily and composited into a weekly sample. One automatic river water sampler is located at J&L Steel's river water intake [River Mile 36.2]. The automatic sampler takes a 20-40 ml sample every 15 minutes and samples are collected on a weekly basis. A weekly grab sample is taken upstream of the Montgomery Dam [River Mile 29.6]. The weekly grab sample and automatic water sample are composited into monthly samples from each location. In addition, a quarterly composite sample is prepared for each sample point.

      The weekly grab samples upstream of the Montgomery Dam are analyzed for I-131.

      The monthly composites are analyzed for gamma emitters. The quarterly composites are analyzed for H-3.

      Locations of each sample point are shown in Figure 3-8.

   b. Drinking Water (Public Supplies)

      Drinking (treated) water is collected at both Midland (PA) and East Liverpool (OH) Water Treating Plants. An automatic sampler at each location collects 20-40 ml every 20 minutes which is composited into a weekly sample. The weekly sample from each location is analyzed for I-131.

      Monthly composites of the weekly samples are analyzed by gamma spectrometry. Quarterly composites are analyzed for H-3. Locations of each sample point are shown in Figure 3-8.

c. Groundwater

Semi-annual grab samples were collected from three (3) locations (see Figure 3-8) within four (4) miles of the site. 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 by gamma spectroscopy.

d. Precipitation

Precipitation is collected at Shippingport, Pa., East Liverpool, Oh. and Weirton, W.Va. Precipitation, when available, is collected each week and then composited into quarterly samples. The quarterly composites are analyzed for H-3 and gamma emitters. Locations of each sample point are shown in Figure 3-8.

e. Procedures

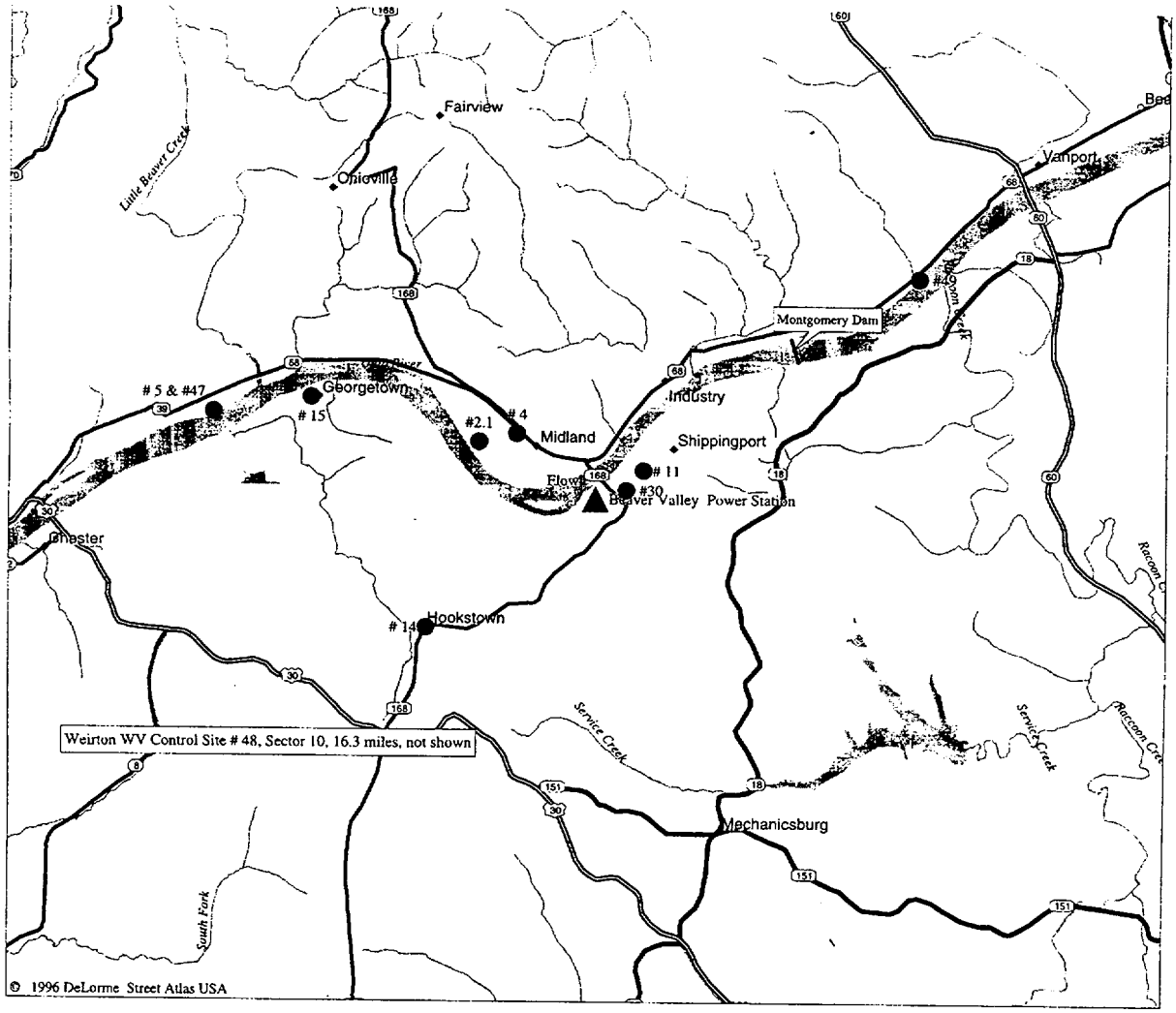
Gamma analysis is performed on water samples by placing one liter of the sample into a Marinelli container and counting the sample on a high resolution germanium gamma spectrometry system.

Tritium is determined in water samples by liquid scintillation counting.

Radioiodine (I-131) analysis in water was normally performed using chemically prepared samples and analyzed with a low-level beta counting system.

Figure 3-8

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



Sample Type	Site No.	Sector	Distance (miles)	Description
Surface	2.1	14	1.5	Downstream Midland - J&L
Surface	5	14	4.9	E. Liverpool, Oh. – Water Treatment Plant
Surface	49	3	5.0	Upstream side of Montgomery Dam
Drinking	4	15	1.3	Midland - Water Treatment Plant
Drinking	5	14	4.9	E. Liverpool, Oh. - Water Treatment Plant
Ground	11	3	0.8	Shippingport Boro

Sample Type	Site No.	Sector	Distance (miles)	Description
Ground	14	11	2.5	Hookstown
Ground	15	14	3.7	Georgetown
Precipitation	30	4	0.5	Shippingport (S.S.)
Precipitation	47	14	4.9	E. Liverpool, Oh., - Water Treatment Plant
Precipitation	48	10	16.3	Weirton, W.Va. – Weirton Water Tower, Collier Way

3. Results and Conclusions

A summary of results of all analyses of water samples (surface, drinking, ground and precipitation) are provided by sample type and analysis in Table 3-2. These are discussed below.

a. Surface Water

A total of twelve (12) samples were analyzed quarterly for H-3. One of the twelve was positive with a value of 380 pCi/liter. This level is well below the required LLD of 2000 pCi/liter.

A total of thirty-six (36) samples were analyzed by gamma spectrometry. One of thirty-six indicated naturally occurring K-40. No other gamma-emitting radionuclides were detected.

A total of fifty-two (52) samples were analyzed for I-131 using a radiochemical method. Positive levels of I-131 were measured in twenty-eight (28) of the weekly samples. The positive results ranged in values from 0.29 to 2.80 pCi/liter. This is similar to previous years. These positive results were detected at a Control location five miles upstream of BVPS and is considered outside the influence of BVPS operation.

b. Drinking Water

A total of eight (8) samples were analyzed for H-3. All results were below the LLD.

A total of twenty-four (24) samples were analyzed by gamma spectrometry. No gamma-emitting radionuclides were detected.

A total of one hundred four (104) samples were analyzed for I-131 using a radiochemical method. Positive levels of I-131 were measured in fifty-two (52) of the weekly samples. All the positive results except four were below the required LLD. The four above the required LLD were below reportable levels. The positive results were detected at both the Midland and East Liverpool plants as similar concentrations. Also, calculations were performed to predict the I-131 concentrations at the Midland Water Treatment Plant from liquid effluent releases at the Beaver Valley Power Station during 2000. These calculations show that the predicted concentrations (less than detectable level) at the Midland Water Treatment Plant are well below the values being detected. This calculation and the fact that I-131 is also being detected at the upstream surface water Control station at similar concentrations indicates that the positive results detected at the Midland Water Treatment Plant are not a result of plant releases.

c. Groundwater

A total of six (6) samples were each analyzed for H-3 and by gamma spectrometry. No gamma-emitting radionuclides were detected. All six tritium results were less than LLD. Three samples were less than the normal LLD of 200 pCi/liter. The other three were counted at a subcontracted lab and were all < 1300 pCi/liter, which is less than the required LLD of 2000 pCi/liter.

d. Precipitation

A total of twelve (12) samples were analyzed for H-3 and by gamma spectrometry. Six (6) positive tritium results detected were within normal levels. One sample had the tritium analysis performed at a subcontracted lab and reported results were less than 1200 pCi/l, which is below the required LLD of 2000 pCi/l. Naturally occurring Be-7 was detected in six (6) samples and K-40 was detected in one (1) sample. No other gamma emitting radionuclides were detected.

e. Deviations from required sampling schedule and analysis

- CR 01-1515 and CR 01-2009 were written for nineteen water samples (surface, drinking and precipitation) that had reported MDA values that were higher than expected and indicated that the LLD was not met for Ba-140. The vendor failed to count the samples in a time period (delta T) that would meet the required LLD of 15 pCi/liter for Ba-140. The increased time from sampling to counting caused the LLD value to increase. The reason given by the vendor for the delay was the vendor moved its lab from New Jersey to Knoxville, TN and experienced a longer than anticipated interruption in production. The new facility became operational in January 2001 and the vendor does not expect further delays. The state of Pennsylvania gets monthly split samples from BVPS for the three surface water stations. For the 3rd and 4th quarters, all Ba-140 results (18 total) from the state's analyses were less than the required LLD. Also, a review of the liquid discharges indicated that no Ba-140 was released from BVPS during 2000.

- CR 01-2089 was written because the vendor analysis lab lost one weekly surface water sample after it was received at the lab. The sample was from Site 49 (Control location), which is upstream of the BVPS and it was collected on 10/17/00. During this time period, the vendor was in the process of moving to a new facility and was using a subcontractor for sample analysis. The vendor believes the sample was lost at the subcontractor's lab. The new facility became operational in January 2001 and the vendor is no longer subcontracting analysis work. The vendor Quality Control Manager has since reviewed the new lab sample receipt and storage area practices. His review concluded that the new facility would adequately prevent this from happening in the future. This sample is from a Control location and is considered outside the influence of plant operations.

f. Summary

The data from water analyses demonstrates that the Beaver Valley Power Station did not contribute a significant increase of radioactivity in local river, drinking, well waters or 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.

I. Estimates of Radiation Dose to Man

1. Pathways to Man - Calculational Models

The radiation doses to man as a result of Beaver Valley operations were calculated for both gaseous and liquid effluent pathways using codes for the ARERAS/MIDAS computer system equivalent to NRC computer codes XOQDOQ2, GASPAR, and LADTAP. Dose factors listed in the ODCM were used to calculate doses to maximum individuals from radioactive noble gases in discharge plumes. Beaver Valley effluent data, based on sample analysis in accordance with Tables 2-1 and 2-3, were used as the radionuclide activity input.

Radionuclides contained in the Annual Radioactive Effluent Release Report (noble gases, particulates, radioiodines and tritium) were included as source terms when they were detected above the LLD values. All LLD values reported by Beaver Valley Power Station are equal to or lower than those required by the ODCM.

All gaseous effluent releases, including Auxiliary Building Ventilation, were included in dose assessments. The release activities are based on laboratory analysis. Meteorological data collected by the Beaver Valley Power Station Meteorology System was used as input to code equivalent to XOQDOQ2 which in turn provided input for the GASPAR equivalent. Except when more recent or specific data was available, all inputs were the same as used in the Beaver Valley Power Station Environmental Statements or in Regulatory Guide 1.109. The airborne pathways evaluated were beta and gamma doses from noble gas plumes inhalation, the "cow-milk-child", and other ingestion pathways.

All potentially radioactive liquid effluents, including steam generator blowdown, are released by batch mode after analysis by gamma spectrometry using intrinsic germanium detectors. Each batch is diluted by cooling tower blowdown water prior to discharge into the Ohio River at the Beaver Valley Power Station outfall (River Mile 35.0). The actual data from these analyses are tabulated and used as the radionuclide activity input term in code equivalent to LADTAP. A hypothetical real individual for liquid pathways is located at Midland. Except when more recent or specific data for the period is available, all other input are obtained from the Beaver Valley Power Station Environmental Statement or Regulatory Guide 1.109. Pathways, which were evaluated, are drinking water, fish consumption, and shoreline recreation.

2. Results of Calculated Radiation Dose to Man - Liquid Releases

   a. Individual Dose

      The doses which are calculated by the model described above are to the likely most exposed real individual located at Midland since this is the nearest location where significant exposure of a member of the general population could potentially occur. A breakdown of doses by total body by age group and highest organ by age group is provided in Table 3-5 for the likely most exposed individual. Included in this table is a breakdown of a typical dose to individuals from natural radiation exposure.

   b. Population Dose

      The 2000 calculated dose to the entire population of almost 4 million people within 50 miles of the plant is presented in Table 3-5.

Table 3-5

Results of Calculated Individual and Population Radiation Dose to Man - Liquid Releases

Organ	Individual Exposure (a) mrem
TOTAL BODY	
Adult	0.0026
Teen	0.0017
Child	0.0023
Infant	0.0019
ANY ORGAN	
Adult	0.0030 (Liver)
Teen	0.0027 (Liver)
Child	0.0034 (Liver)
Infant	0.0020 (Thyroid, Liver, GI)

TYPICAL DOSE TO INDIVIDUALS FROM NATURAL RADIATION EXPOSURE(b)		
Ambient Gamma Radiation	:	58
Radionuclides in Body	:	40
Global Fallout	:	< 1
Radon	:	198
TOTAL mRem/year	:	296

(a) Likely most exposed member of general population - located at Midland drinking water intake.

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

Population		
Organ	**Man-Millirems**	**Largest Isotope Contributor**
Total Body	145	H-3 140 Man-Millirems
GI-LLI	151	H-3 140 Man-Millirems

3. Results of Calculated Radiation Dose to Man - Atmospheric Releases

The results of calculated radiation dose to the maximum exposed individuals for BVPS airborne radioactive effluents during 2000 are provided in Table 3-6. The doses include the contribution of all pathways. A 50-mile population dose was also calculated and is provided.

Table 3-6

Results of Calculated Radiation Dose to Man - Atmospheric Releases

Organ	Maximum Exposed Individual mrem
TOTAL BODY	0.317
SKIN	0.317
LUNG	0.317
THYROID	0.331

Organ	50-Mile Population Dose man-rem
TOTAL BODY	0.760
THYROID	0.800

4. Conclusions

Based upon the estimated dose to individuals from the natural background radiation exposure in Table 3-5, the incremental increase in total body dose to the 50-mile population (approximately 4 million people), from the operation of Beaver Valley Power Station - Unit 1 and 2, is less than 0.0001% of the annual background dose.

The calculated doses to the public from the operation of Beaver Valley Power Station - Unit 1 and 2, are below BVPS 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 4 - LAND USE CENSUS

A land use census was conducted July 30 through August 4, 2000 to comply with BV-1 and BV-2 Technical Specification 6.8.6b Item 2 and the ODCM Appendix C CONTROL 3.12.2. The census results are summarized in Table 4-1. The locations of the milch animals are shown on Figure 4-1.

Table 4-1

Location of Nearest Residence, Garden, and Milch Animal

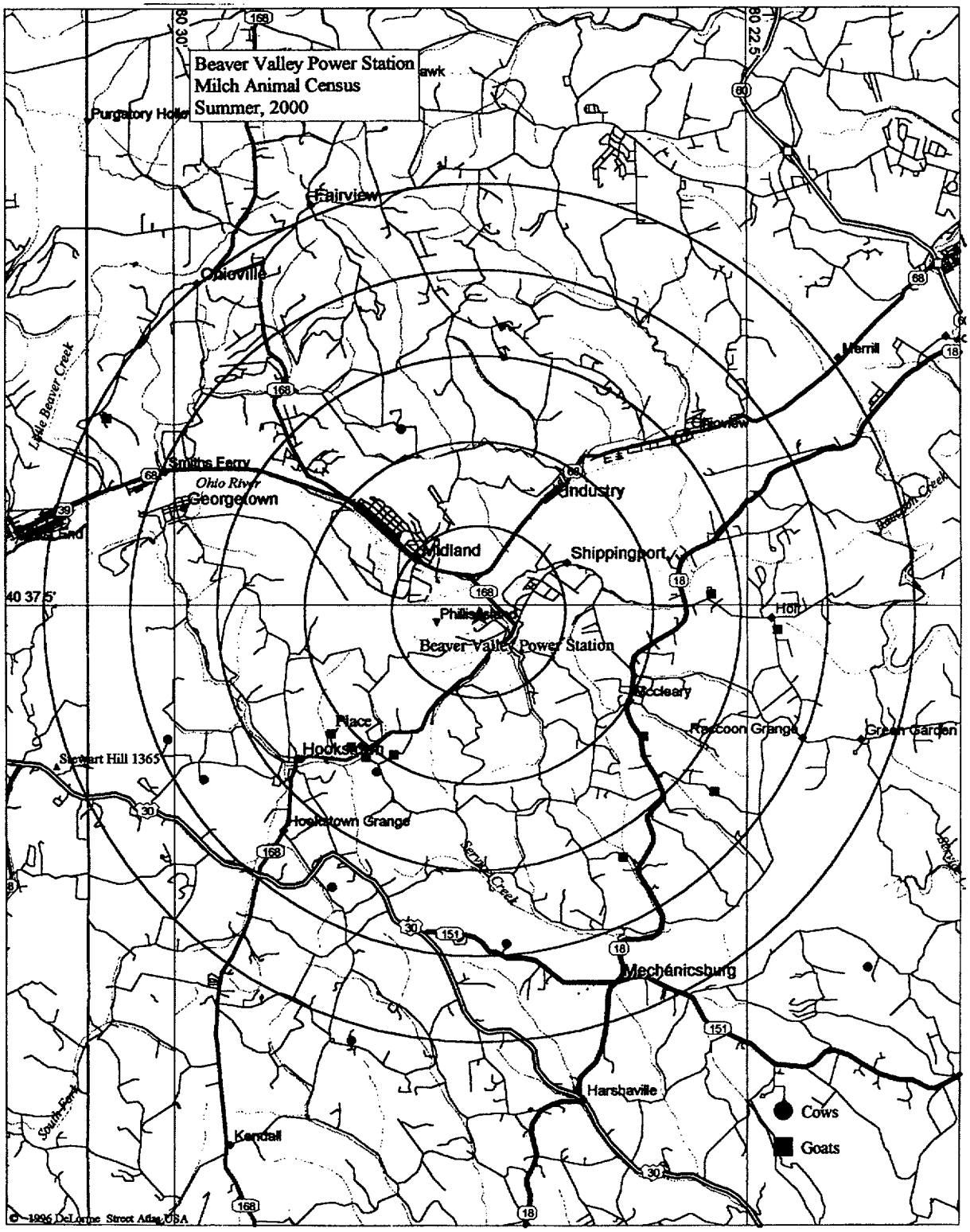
SECTOR	RESIDENCE (miles)	GARDEN (miles) [1]	MILCH ANIMALS (miles) [2]
N	1.58	2.00	None
NNE	1.62	1.62	None
NE	0.37	2.66	None
ENE	0.54	0.98	None
E	0.40	1.93	2.62
ESE	0.89	1.71	None
SE	1.10	1.74	2.31
SSE	1.12	2.16	3.16
S	1.42	2.23	3.83
SSW	0.81	2.10	1.93
SW	1.50	1.72	2.12
WSW	1.44	2.56	3.72
W	2.25	2.25	None
WNW	2.75	3.02	4.83
NW	0.89	4.32	None
NNW	0.91	1.19	2.38

(1) Gardens greater than 500 square feet producing fresh leafy vegetables

(2) Within five miles

Figure 4-1

Milch Animal Census



SECTION 5 - QUALITY CONTROL PROGRAM / INTERLABORATORY COMPARISON PROGRAM

A. Quality Control Program

The Quality Control (QC) Program for the Beaver Valley Radiological Environmental Monitoring Program involves the analysis of split and duplicate samples at a QC laboratory and the analysis of high quality (NIST traceable) spiked samples (results are discussed in the Interlaboratory Comparison Program section). This testing provides a means to ensure independent checks are performed on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices. It should be noted that the comparisons for split and duplicate samples were at very low levels of radioactivity and consequently, the activities at these levels are difficult to measure.

The NRC criteria listed in NRC Inspection Procedure 84750, 12/4/90, Inspection Guidance 84750-03 is used as the acceptance criteria for comparisons of results of split and spike samples between the Contractor Lab and the QC Lab/Independent Lab. These comparisons are performed by dividing the comparison standard (the QC Lab or 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. Note that in the case where the counting precision of the standard yields a resolution of less than 4, a valid comparison cannot be made. Values identified with an '*' in Tables 5-1 through 5-10 do not meet acceptance criteria.

Resolution	Ratio
< 4	--
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.8 - 1.25
> 200	0.85 - 1.18

1. Split Sample Program (Contractor Laboratory - QC Laboratory)

   Routine environmental samples of surface (river) water, drinking water, milk, sediment, food crops, and feed crops were routinely split and analyzed by the Contractor Laboratory and the QC Laboratory.

   A summary of results of split water samples is provided in Table 5-1 and Table 5-2. There were no non-comparisons in all the surface water and drinking water analysis for gamma spec, I-131 and tritium analysis.

   Summaries of milk, sediment, and feed/food crop split samples are provided in Table 5-3 and Table 5-4. Good overall agreement was obtained in all samples.

2. Duplicate Sample Program (Contractor Laboratory - QC Laboratory)

   Duplicate (co-located) air particulate and charcoal filters samples were collected at Location #30 and compared (gross beta for particulate filters and radioiodine for charcoal filters) during the year on a weekly basis. Comparison of particulate and charcoal samples alternated from week to week. For each quarter the particulate filters were composited and analyzed for gamma activity. Results are presented in Table 5-5 and Table 5-6. There was good agreement of both the air particulate (beta) and charcoal cartridge filters with only one air particulate gross beta showing non-comparison. Quarterly composites of the air particulate filters (gamma) showed good comparisons except for one Be-7 result in the fourth quarter.

   Thirteen (13) duplicate (co-located) TLDs from the Contractor Laboratory and QC Laboratory are replaced quarterly, and the results are compared. The average of the Contractor Laboratory and the average of the QC Laboratory agree within ± 4.6% of the mean of all results. This is well within the precision of typical TLD systems. Summary data of the TLD monitoring program is provided in Table 5-7.

3. Blind Split Program (Contractor)

   The blind split program consisted of unscheduled unannounced split samples of water, sediment and milk from normal environmental locations. The 'normal' and blind split samples were sent to the Contractor Lab along with other samples of the same media. The lab had no knowledge of the location of the blind split sample or that it was even a split.

   A summary of the results are provided on Table 5-8. The sediment, milk, and water samples showed good agreement with no non-comparisons.

B. Interlaboratory Comparison Program

Participation in an Interlaboratory Comparison Program is required by BV-1 and BV-2 Technical Specification 6.8.6b, Item 3. In 2000 this requirement was fulfilled by the Contractor Lab (Teledyne Brown Engineering Environmental Services - Westwood N.J.) analyzing high quality (NIST traceable) spiked samples supplied by two Beaver Valley Power Station contracted vendors.

1. Contractor Lab

   The high quality (NIST traceable) spiked samples include air particulate and charcoal filters (prepared by the QC Laboratory) and water and milk (prepared by the Independent Laboratory). The samples were submitted to the Contractor Lab for analysis. The "spiked to" values are used for calculating comparison acceptance criteria. Values identified with an '*' do not meet acceptance criteria explained above.

   - Comparison of results of the spiked milk and water samples showed good results. Two milk samples had one radionuclide each that showed a non-comparison. In one of the milk samples, Sr-90 fell out of the comparison range. This was a single incident and all other milk and water samples analyzed for Sr-90 showed good comparison. One milk sample result was slightly above the upper limits of acceptance for Fe-59. One water sample had two radionuclides that showed a non-comparison. Fe-59 was slightly above the upper limits of acceptance as was the milk sample reported above. Also, Cr-51 was originally reported as < 50 pCi/l (CR #01-1552). The actual value was 230 pCi/l as reported by the Independent Lab. The vendor was contacted and stated that the count failed to quantify Cr-51 due to an energy calibration that did no encompass the photon energy from Cr-51 @ 320.08 kev. The actual photon peak for the sample in question occurred at 317.78 kev for Cr-51, which was outside the 2 kev energy tolerance. The value for Cr-51 was recalculated with a result of 259.9 pCi/l, which is within the comparison range. Actual water and milk samples were specifically rechecked for any incidence of Cr-51 not being identified. No occurrences were found.

     The following is a follow-up on last year's report. The investigation of a higher than expected Fe-59 results in water from 1999 was completed. The vendor concluded that random coincidental summing of photon energies from other radionuclides caused the over estimation. The vendor has changed their library to use peak 1292 kev instead of 1099 kev to prevent this from occurring in the future. A new vendor is now being used by BVPS (as of 4/1/01) and their analyses of spiked samples will be tracked for similar problems.

   - Comparison of results of the spiked air particulate filters and charcoal cartridge filters showed good results. Both results are reported in Table 5-11.

C. Conclusions

Based on all available Quality Control data and Interlaboratory Comparison data the Environmental Monitoring Program for 2000 is acceptable with respect to both accuracy and measurement.

Table 5-1

Quality Control Data
Contractor/Quality Control Laboratory
Comparison Split Surface Water Samples

Site 2.1

Media	Analysis	Sampling Period	Contractor Lab (1)	QC Lab (1)	Units
Surface Water (Monthly Composite)	Co-60	January	< 3	< 2.6	pCi/l
		April	< 1	< 1.4	pCi/l
		July	< 1	< 5.6	pCi/l
		October	< 3	< 4.6	pCi/l
Surface Water (Monthly Composite)	Cs-134	January	< 3	< 3.2	pCi/l
		April	< 1	< 2.7	pCi/l
		July	< 1	< 7.2	pCi/l
		October	< 3	< 5.4	pCi/l
Surface Water (Monthly Composite)	Cs-137	January	< 3	< 3.8	pCi/l
		April	< 2	< 3.6	pCi/l
		July	< 1	< 5.8	pCi/l
		October	< 3	< 4.0	pCi/l
Surface Water (Quarterly Composite	Tritium	1st Quarter	< 100	< 183	pCi/l
		3rd Quarter	380 ± 100	< 176	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

Table 5-2

Quality Control Data
Contractor/Quality Control Laboratory
Comparison Split Drinking Water Samples

Site 4

Media	Analysis	Sampling Period	Contractor Lab (1)	QC Lab (1)	Units
Drinking Water (Monthly Composite)	Cs-137	February	< 4	< 4.9	pCi/l
		May	< 3	< 3.3	pCi/l
		August	< 3	< 3.7	pCi/l
		November	< 2	< 4.5	pCi/l
Drinking Water (Monthly Composite)	Cs-134	February	< 4	< 3.6	pCi/l
		May	< 3	< 3.5	pCi/l
		August	< 3	< 4.9	pCi/l
		November	< 2	< 4.4	pCi/l
Drinking Water (Monthly Composite)	Co-60	February	< 4	< 4.2	pCi/l
		May	< 3	< 2.8	pCi/l
		August	< 3	< 1.4	pCi/l
		November	< 2	< 4.5	pCi/l
Drinking Water (Weekly Split)	I-131	3/7 to 3/14	1.0 ± 0.2	0.8 ± 0.3**	pCi/l
		6/13 to 6/20	0.54 ± 0.23	< 0.4	pCi/l
		8/8 to 8/15	< 0.29	< 0.3	pCi/l
		11/7 to 11/14	< 1.0	0.4 ± 0.2	pCi/l
Drinking Water (Quarterly Composite	Tritium	2nd Quarter	< 100	< 179	pCi/l
		4th Quarter	< 120	< 152	pCi/l

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

** Resolution < 4, see Section 5A.

Table 5-3

Quality Control Data
Contractor/Quality Control Laboratory
Comparison Split Milk Samples

Site 25

Media	Sampling Period	Analysis	Contractor Lab (1)	QC Lab (1)	Units
Milk (Weekly Split)	3/13/00	Sr-89	< 1.2	< 0.5	pCi/l
		Sr-90	2.2 ± 0.2	1.8 ± 0.4	pCi/l
		I-131	< 0.24	< 0.4	pCi/l
		Co-60	< 4	< 5.3	pCi/l
		Cs-134	< 4	< 5.5	pCi/l
		Cs-137	< 4	< 6.9	pCi/l
		K-40	1230 ± 120	1336 ± 170	pCi/l
Milk (Weekly Split)	6/12/00	Co-60	< 5	< 3.8	pCi/l
		I-131	< 0.22	< 0.3	pCi/l
		Cs-134	< 4	< 6.1	pCi/l
		Cs-137	< 4	< 4.2	pCi/l
		K-40	1160 ± 120	1374 ± 167	pCi/l
Milk (Weekly Split)	9/19/00	Sr-89	(2)	< 0.7	pCi/l
		Sr-90	(2)	2.0 ± 0.5	pCi/l
		I-131	< 0.31	< 0.3	pCi/l
		Co-60	< 5	< 3.3	pCi/l
		Cs-134	< 4	< 3.6	pCi/l
		Cs-137	< 3	< 2.6	pCi/l
		K-40	1370 ± 140	1252 ± 108	pCi/l
Milk (Weekly Split)	12/12/00	Co-60	< 4	< 3.6	pCi/l
		I-131	< 0.82	< 0.3	pCi/l
		Cs-134	< 3	< 3.0	pCi/l
		Cs-137	< 4	< 3.7	pCi/l
		K-40	1406 ± 47	1267 ± 93	pCi/l

(1) Uncertainties are based on counting statistics and are at the 95% confidence level.

(2) Comparison results are not available (CR 01-1515).

Table 5-4

Quality Control Data
Contractor/Quality Control Laboratory
Comparison Split Feed, Food, Sediment and Soil Samples

Media	Sampling Period	Analysis	Contractor Lab (1)	QC Lab (1)	Units
Feed Site 25	6/13/00	Be-7	1.97 ± 0.24	2.05 ± 0.30	pCi/gm (dry)
		K-40	14.6 ± 1.5	14.04 ± 0.73	pCi/gm (dry)
		Co-60	< 0.03	< 0.012	pCi/gm (dry)
		I-131	< 0.06	< 0.030	pCi/gm (dry)
		Cs-134	< 0.03	< 0.025	pCi/gm (dry)
		Cs-137	< 0.03	< 0.020	pCi/gm (dry)
Food Site 10	8/8/00	K-40	1.35 ± 0.13	1.80 ± 0.23	pCi/gm (wet)
		Co-60	< 0.009	< 0.004	pCi/gm (wet)
		I-131	< 0.046	< 0.016	pCi/gm (wet)
		Cs-134	< 0.010	< 0.015	pCi/gm (wet)
		Cs-137	< 0.010	< 0.011	pCi/gm (wet)
Sediment Site 2A	10/27/00	Co-58	0.70 ± 0.01	0.63 ± 0.08	pCi/gm (dry)
		Co-60	0.81 ± 0.001	0.83 ± 0.06	pCi/gm (dry)
		Cs-134	0.10 ± 0.004	0.08 ± 0.04**	pCi/gm (dry)
		Cs-137	0.17 ± 0.005	0.16 ± 0.04	pCi/gm (dry)
		Th-228	0.84 ± 0.01	1.03 ± 0.16	pCi/gm (dry)
		K-40	8.34 ± 0.09	9.53 ± 0.83	pCi/gm (dry)
Soil Site 30	5/4/00	K-40	10.2 ± 1.0	9.25 ± 0.55	pCi/gm (dry)
		Co-60	< 0.03	< 0.010	pCi/gm (dry)
		Cs-134	< 0.04	< 0.014	pCi/gm (dry)
		Cs-137	0.21 ± 0.04	0.22 ± 0.03	pCi/gm (dry)
		Ra-226	< 0.90	1.66 ± 0.33	pCi/gm (dry)

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

** Resolution < 4, see Section 5A.

Table 5-5
Quality Control Data
Contractor/Quality Control Laboratory Comparison
Duplicate (Co-located) Air Particulate and Charcoal Filter Samples

Sites 30 and 30A

Air Particulates pCi/Cu Meter (Beta)			Air Iodine pCi/Cu Meter		
Sample Date	Contractor Lab 1)	QC Lab (1)	Sample Date	Contractor Lab	QC Lab
1/10 - 1/17	0.017 ± 0.003	0.018 ± 0.003	1/3 – 1/10	< 0.01	< 0.005
1/24 – 1/31	0.025 ± 0.003	0.029 ± 0.004	1/17 - 1/24	< 0.01	< 0.011
2/7 - 2/14	0.021 ± 0.003	0.028 ± 0.003	1/31 - 2/7	< 0.01	< 0.006
2/22 – 2/28	0.021 ± 0.004	0.028 ± 0.004	2/14 - 2/22	< 0.01	< 0.005
3/6 - 3/13	0.013 ± 0.003	0.022 ± 0.003	2/28 - 3/6	< 0.01	< 0.008
3/20 - 3/27	0.010 ± 0.003	0.016 ± 0.003	3/13 - 3/20	< 0.01	< 0.005
4/3 - 4/10	0.007 ± 0.003*	0.015 ± 0.003	3/27 - 4/3	< 0.01	< 0.007
4/17 - 4/24	0.006 ± 0.002	0.009 ± 0.003	4/10 - 4/17	< 0.01	< 0.006
5/1 - 5/8	0.022 ± 0.003	0.025 ± 0.003	4/24 - 5/1	< 0.01	< 0.004
5/15 - 5/22	0.012 ± 0.003	0.017 ± 0.003	5/8 - 5/15	< 0.02	< 0.027
5/30 - 6/5	0.011 ± 0.003	0.017 ± 0.003	5/22 – 5/30	< 0.01	< 0.006
6/12 - 6/19	0.012 ± 0.003	0.015 ± 0.003	6/5 - 6/12	< 0.01	< 0.008
6/26 - 7/3	0.011 ± 0.003	0.015 ± 0.004	6/19 - 6/26	< 0.01	< 0.016
7/10 - 7/17	0.009 ± 0.002	0.036 ± 0.004	7/3 - 7/10	< 0.01	< 0.006
7/24 – 7/31	0.017 ± 0.003	0.022 ± 0.003	7/17 - 7/24	< 0.01	< 0.011
8/7 - 8/14	0.013 ± 0.003	0.018 ± 0.003	7/31 - 8/7	< 0.01	< 0.010
8/21 – 8/28	0.018 ± 0.003	0.028 ± 0.002	8/14 - 8/21	< 0.01	< 0.009
9/5 - 9/11	0.014 ± 0.004	0.017 ± 0.003	8/28 - 9/5	< 0.02	< 0.010
9/18 - 9/25	0.017 ± 0.003	0.021 ± 0.003	9/14 - 9/18	< 0.03	< 0.033
10/2 - 10/9	0.017 ± 0.003	0.020 ± 0.003	9/25 - 10/2	< 0.01	< 0.011
10/16 - 10/23	0.043 ± 0.004	0.046 ± 0.004	10/9 - 10/16	< 0.01	< 0.007
10/30 – 11/6	0.033 ± 0.005	0.023 ± 0.003	10/23 – 10/30	< 0.01	< 0.014
11/13 - 11/20	0.039 ± 0.004	0.033 ± 0.004	11/6 - 11/13	< 0.01	< 0.010
11/27 - 12/4	0.039 ± 0.005	0.023 ± 0.003	11/20 - 11/27	< 0.01	< 0.005
12/11 - 12/18	0.034 ± 0.004	0.028 ± 0.003	12/4 - 12/11	< 0.30	< 0.005
			12/18 - 12/26	< 0.07	< 0.006

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 5-A.

Table 5-6

Quality Control Data
Contractor/Quality Control Laboratory
Comparison Duplicate (Co-located) Air Particulate Samples (Gamma) (pCi/Cu Meter)

Sample Period	Nuclide	Contractor Lab (1) – Site 30	QC Lab (1) – Site 30A
1st Quarter Composite	Be-7	0.111 ± 0.011	0.074 ± 0.010
	Co-60	< 0.0003	< 0.0006
	Cs-134	< 0.0003	< 0.0006
	Cs-137	< 0.0002	< 0.0005
	Ba-La-140	< 0.010	< 0.0005
	K-40	< 0.004	< 0.020
2nd Quarter Composite	Be-7	0.109 ± 0.011	0.070 ± 0.010
	Co-60	< 0.0003	< 0.0005
	Cs-134	< 0.0003	< 0.0006
	Cs-137	< 0.0003	< 0.0006
	Ba-La-140	< 0.010	< 0.0011
	K-40	< 0.009	< 0.017
3rd Quarter Composite	Be-7	0.114 ± 0.03	0.064 ± 0.011
	Co-60	< 0.0008	< 0.0007
	Cs-134	< 0.0008	< 0.0004
	Cs-137	< 0.0007	< 0.0005
	Ba-La-140	(2)	< 0.0022
	K-40	< 0.006	< 0.020
4th Quarter Composite	Be-7	0.090 ± 0.01*	0.044 ± 0.009
	Co-60	< 0.0003	< 0.0004
	Cs-134	< 0.0003	< 0.0005
	Cs-137	< 0.0004	< 0.0005
	Ba-La-140	(3)	< 0.0012
	K-40	< 0.007	< 0.0194

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

(2) Comparison results are not available (CR 01-2009).

(3) Comparison results are not available (CR 01-2380).

* See Section 5-A.

Table 5-7

Quality Control Data
Contractor/Quality Control Laboratory Comparison
Thermoluminescent Dosimeters - mR/day

1ST QUARTER		
Location No.	Contractor	QC Lab
10	0.165	0.147
13	0.153	0.166
14	0.154	0.162
15	0.158	0.170
27	0.158	0.147
28	0.158	0.157
29B	0.180	0.169
32	0.173	0.175
45	0.169	0.170
46	0.151	0.152
47	0.182	0.189
48	0.180	0.175
51	0.175	0.166

2ND QUARTER		
Location No.	Contractor	QC Lab
10	0.164	0.152
13	0.157	0.159
14	0.164	0.160
15	0.157	0.169
27	0.153	0.160
28	0.160	0.170
29B	0.183	0.180
32	0.177	0.162
45	0.165	0.170
46	Lost	Lost
47	0.185	0.189
48	0.182	0.162
51	0.175	0.159

3RD QUARTER		
Location No.	Contractor	QC Lab
10	0.198	0.140
13	0.192	0.154
14	0.192	0.154
15	0.187	0.186
27	0.191	0.149
28	0.201	0.154
29B	0.216	0.170
32	0.217	0.159
45	0.199	0.173
46	0.184	0.168
47	0.216	0.185
48	0.209	0.171
51	0.206	0.158

4TH QUARTER		
Location No.	Contractor	QC Lab
10	0.192	0.180
13	0.195	0.186
14	0.215	0.168
15	0.237	0.190
27	0.200	0.169
28	0.228	0.185
29B	0.236	0.200
32	0.190	0.171
45	0.210	0.179
46	0.183	0.179
47	0.216	0.193
48	0.201	0.186
51	0.205	0.177

Table 5-8

Quality Control Data
Contractor Comparison of Blind Split Samples

Media	Site	Sampling Period	Analysis	Contractor Lab Routine Result*	Contractor Lab Split Result	Units
Drinking Water	4	6/13 – 6/20	I-131	0.54 ± 0.23	0.58 ± 0.25**	pCi/liter
Sediment	2A	10/27/00	Co-58	0.70 ± 0.01	0.62 ± 0.007	pCi/g (dry)
			Co-60	0.81 ± 0.01	0.91 ± 0.004	pCi/g (dry)
			Cs-134	0.10 ± 0.004	0.09 ± 0.003	pCi/g (dry)
			Cs-137	0.17 ± 0.005	0.17 ± 0.003	pCi/g (dry)
			Ag-110m	0.17 ± 0.004	0.16 ± 0.003	pCi/g (dry)
			Th-228	0.84 ± 0.013	0.86 ± 0.008	pCi/g (dry)
			K-40	8.34 ± 0.09	8.63 ± 0.06	pCi/g (dry)
Milk	96	6/12/00	Sr-89	< 0.97	< 0.99	pCi/liter
			Sr-90	1.1 ± 0.2	1.2 ± 0.2	pCi/liter
			Co-60	< 3	< 4	pCi/liter
			I-131	< 0.32	< 0.27	pCi/liter
			Cs-134	< 4	< 4	pCi/liter
			Cs-137	< 4	< 4	pCi/liter
			K-40	1500 ± 150	1600 ± 160	pCi/liter

* Indicates non-comparison

** Resolution < 4, see Section 5A.

Table 5-9

Interlaboratory Comparison Program
Independent Laboratory/Contractor Laboratory
Comparison Spiked Water Samples (pCi/l)

Sample Date	Sample Type and Identification No.	Sample Analyses	Independent Lab (1)	Contractor Lab (1)
3/23/00	Water 53-382	Sr-89	94 ± 5	85 ± 2
		Sr-90	51 ± 3	47 ± 1
		I-131	74 ± 4	70 ± 1
		Ce-141	427 ± 21	434 ± 43
		Cr-51	238 ± 12	234 ± 34
		Cs-134	139 ± 7	131 ± 13
		Cs-137	128 ± 6	140 ± 14
		Co-58	44 ± 2	50 ± 5
		Mn-54	159 ± 8	173 ± 17
		Fe-59	92 ± 5	98 ± 10
		Zn-65	196 ± 10	209 ± 21
		Co-60	116 ± 6	129 ± 13
3/23/00	Water 53-383	H-3	4170 ± 210	4100 ± 200
6/22/00	Water 53-384	Sr-89	67 ± 3	53 ± 4
		Sr-90	80 ± 4	85 ± 2
		I-131	84 ± 4	82 ± 1
		Ce-141	74 ± 4	73 ± 8
		Cr-51	226 ± 11	215 ± 48
		Cs-134	98 ± 5	95 ± 10
		Cs-137	204 ± 10	208 ± 21
		Co-58	111 ± 6	114 ± 11
		Mn-54	127 ± 6	132 ± 13
		Fe-59	54 ± 3	58 ± 10
		Zn-65	158 ± 8	162 ± 16
		Co-60	152 ± 8	162 ± 16
6/22/00	Water 53-385	H-3	11400 ± 570	10000 ± 3000

(Table 5-9 continued on next page)

Table 5-9 (Continued)

Interlaboratory Comparison Program
Independent Laboratory/Contractor Laboratory
Comparison Spiked Water Samples (pCi/l)

Sample Date	Sample Type and Identification No.	Sample Analyses	Independent Lab (1)	Contractor Lab (1)
9/21/00	Water 53-386	Sr-89	85 ± 4	77 ± 2
		Sr-90	54 ± 3	52 ± 1
		I-131	75 ± 4	72 ± 2
		Ce-141	191 ± 10	194 ± 19
		Cr-51	230 ± 12	< 50* 257 ± 47**
		Cs-134	128 ± 6	136 ± 14
		Cs-137	218 ± 11	241 ± 24
		Co-58	60 ± 3	66 ± 7
		Mn-54	89 ± 4	107 ± 11
		Fe-59	54 ± 3	74 ± 9*
		Zn-65	134 ± 7	157 ± 16
		Co-60	246 ± 12	275 ± 27
9/21/00	Water 53-387	H-3	8947 ± 447	7500 ± 200
12/7/00	Water 53-388	Sr-89	87 ± 4	82 ± 5
		Sr-90	46 ± 2	39 ± 2
		I-131	60 ± 3	61 ± 5
		Ce-141	376 ± 19	373 ± 10
		Cr-51	532 ± 27	540 ± 70
		Cs-134	90 ± 5	83 ± 4
		Cs-137	210 ± 11	213 ± 10
		Co-58	81 ± 4	82 ± 6
		Mn-54	161 ± 8	163 ± 10
		Fe-59	86 ± 4	92 ± 10
		Zn-65	156 ± 8	170 ± 10
		Co-60	194 ± 10	195 ± 10
12/7/00	Water 53-389	H-3	10082 ± 504	10000 ± 100

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 5-A.

** Re-evaluated

Table 5-10

Interlaboratory Comparison Program
Independent Laboratory/Contractor Laboratory
Comparison Spiked Milk Samples (pCi/l)

Sample Date	Sample Type and Identification No.	Sample Analyses	Independent Lab (1)	Contractor Lab (1)
3/23/00	Milk 52-294	Sr-89	59 ± 3	71 ± 3
		Sr-90	90 ± 5	57 ± 1*
		I-131	84 ± 4	82 ± 1
		Ce-141	460 ± 23	471 ± 47
		Cr-51	256 ± 13	263 ± 41
		Cs-134	150 ± 8	152 ± 15
		Cs-137	138 ± 7	158 ± 16
		Co-58	47 ± 2	48 ± 5
		Mn-54	171 ± 9	182 ± 18
		Fe-59	99 ± 5	109 ± 11
		Zn-65	208 ± 10	242 ± 24
		Co-60	125 ± 6	133 ± 13
6/22/00	Milk 52-295	Sr-89	71 ± 4	72 ± 3
		Sr-90	52 ± 3	48 ± 1
		I-131	81 ± 4	85 ± 4
		Ce-141	69 ± 3	75 ± 8
		Cr-51	211 ± 11	225 ± 44
		Cs-134	91 ± 5	92 ± 9
		Cs-137	190 ± 10	213 ± 21
		Co-58	104 ± 5	111 ± 11
		Mn-54	118 ± 6	130 ± 13
		Fe-59	50 ± 3	60 ± 11
		Zn-65	148 ± 7	173 ± 17
		Co-60	142 ± 7	155 ± 16

(Table 5-10 continued on next page)

Table 5-10 (Continued)

Interlaboratory Comparison Program
Independent Laboratory/Contractor Laboratory
Comparison Spiked Milk Samples (pCi/l)

Sample Date	Sample Type and Identification No.	Sample Analyses	Independent Lab (1)	Contractor Lab (1)
9/21/00	Milk 52-296	Sr-89	74 ± 4	65 ± 10
		Sr-90	39 ± 2	39 ± 1
		I-131	58 ± 3	58 ± 1
		Ce-141	164 ± 8	156 ± 16
		Cr-51	198 ± 10	171 ± 36
		Cs-134	110 ± 6	111 ± 11
		Cs-137	188 ± 9	195 ± 20
		Co-58	51 ± 3	54.2 ± 5
		Mn-54	77 ± 4	81 ± 8
		Fe-59	47 ± 2	64 ± 11*
		Zn-65	115 ± 6	123 ± 12
		Co-60	212 ± 11	215 ± 22
12/7/00	Milk 52-297	Sr-89	85 ± 4	77 ± 6
		Sr-90	57 ± 3	56 ± 3
		I-131	85 ± 4	90 ± 6
		Ce-141	356 ± 18	340 ± 10
		Cr-51	503 ± 25	440 ± 60
		Cs-134	85 ± 4	76 ± 3
		Cs-137	199 ± 10	190 ± 10
		Co-58	76 ± 4	76 ± 5
		Mn-54	152 ± 8	150 ± 10
		Fe-59	82 ± 4	92 ± 9
		Zn-65	148 ± 7	140 ± 10
		Co-60	184 ± 9	180 ± 2

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.

* See Section 5-A.

Table 5-11

Interlaboratory Comparison Program
Contractor/Quality Control Laboratory
Comparison Spiked Air Particulate/Charcoal Filters

Sample Date	Sample Type and Identification No.	Sample Analyses	Contractor Lab (1)	QC Lab (1)	Units
6/8/00	Air Particulate Filter DQQC AP-11	Gross Beta	4.20 ± 0.10	5.35 ± 0.54	pCi/m^3
12/26/00	Air Particulate Filter DQQC AP-10	Gross Beta	5.00 ± 0.31	5.91 ± 0.59	pCi/m^3
3/9/00	Air Charcoal Filter DQQC CH-12	I-131	0.76 ± 0.16	0.53 ± 0.05	pCi/m^3
12/26/00	Air Charcoal Filter DQQC CH-13	I-131	1.49 ± 0.04	2.11 ± 0.2	pCi/m^3

(1) Uncertainties are based on counting statistics and are specified at the 95% confidence coefficient.