

# Beaver Valley Power Station

## Unit 1/2

1/2-ODC-2.03

**ODCM: Radiological Environmental Monitoring Program**

Document Owner

**Manager, Nuclear Environmental and Chemistry**

Revision Number	4
Level Of Use	General Skill Reference
Safety Related Procedure	Yes
Effective Date	12/30/11

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**1.0     PURPOSE**

1.1     This procedure provides the Radiological Environmental Monitoring Program (REMP) requirements from the Radiological Branch Technical Position.<sup>(3.1.1)</sup>

1.1.1     Prior to issuance of this procedure, these items were located in Section 3 of the old ODCM.

**2.0     SCOPE**

2.1     This procedure is applicable to all station personnel that are qualified to perform activities as described and referenced in this procedure.

**3.0     REFERENCES AND COMMITMENTS**

**3.1     References**

3.1.1     Radiological Branch Technical Position, Revision 1, 1979.

3.1.2     Regulatory Guide 1.109, Calculation of Annual Dose to Man From Routine Releases of Reactor Effluents For the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, 1977.

3.1.3     NUREG-1301, Offsite Dose Calculation Manual Guidance; Standard Radiological Effluent Controls for Pressurized Water Reactors (Generic Letter 89-01, Supplement No. 1).

3.1.4     Regulatory Guide 1.111, Methods For Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases From Light-Water-Cooled Reactors, Revision 1, July 1977.

3.1.5     1/2-ADM-1640, Control of the Offsite Dose Calculation Manual

3.1.6     1/2-ADM-0100, Procedure Writers Guide

3.1.7     1/2-ADM-0101, Review and Approval of Documents

3.1.8     CR 04-00149, Radiation Protection Performance Committee Actions Items. CA-12 required obtaining GPS satellite data for use in the REMP.

3.1.9     CR 05-01169, Chemistry Action Plan for transition of RETS, REMP and ODCM. CA-17, revise procedure 1/2-ODC-2.03 to convert Radiation Protection responsibilities to Nuclear Environmental and Chemistry.

3.1.10     CR 05-01390, Include GPS data in 2004 REMP Report and related 1/2-ODC and 1/2-ENV procedures. CA-02, revise ODCM procedure 1/2-ODC-2.03 to include an update of REMP sample locations (using the GPS Satellite data).

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3.1.11 CR 10-77489, Fixed incorrect sample designations for TLD #94 and #95; changed sample point designation #49 to #49A; clarified garden sampling requirements.

3.1.12 CA G203-2011-97516-001, Retire TLD Station #88 and add Station #88A.

3.1.13 CR G203-2011-02332, Inability to meet ODCM requirements for REMP milk sampling in 2011 and CA G203-2011-02332-1, Make changes to the ODCM.

3.2 **Commitments**

3.2.1 10 CFR 50 Appendix I

4.0 **RECORDS AND FORMS**

4.1 **Records**

4.1.1 Any calculation supporting ODCM changes shall be documented, as appropriate, by a retrievable document (e.g., letter or calculation package) with an appropriate RTL number.

4.2 **Forms**

4.2.1 None.

5.0 **PRECAUTIONS AND LIMITATIONS**

5.1 The specified detection capabilities are state-of-the-art for routine environmental measurements in industrial laboratories.

6.0 **ACCEPTANCE CRITERIA**

6.1 Any change to this procedure shall contain sufficient justification that the change will maintain the level of radioactive effluent control required by 10 CFR 20.1302, 40 CFR Part 190, 10 CFR 50.36a and Appendix I to 10 CFR 50, and not adversely impact the accuracy or reliability of effluent dose or setpoint calculation.

6.1.1 All changes to this procedure shall be prepared in accordance with 1/2-ADM-0100<sup>(3.1.6)</sup> and 1/2-ADM-1640<sup>(3.1.5)</sup>.

6.1.2 All changes to this procedure shall be reviewed and approved in accordance with 1/2-ADM-0101<sup>(3.1.7)</sup> and 1/2-ADM-1640<sup>(3.1.5)</sup>.

7.0 **PREREQUISITES**

7.1 The user of this procedure shall be familiar with ODCM structure and format.

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**8.0    PROCEDURE**

**8.1    REMP Overview**

8.1.1    Attachment A, Table 3.0-1 contains the site number, sector, distance, sample point description, sampling and collection frequency, analysis, and analysis frequency for various exposure pathways in the vicinity of the Beaver Valley Power Station for the REMP. Attachment B, Figures 3.0-1 through 3.0-6 show the location of the various sampling points.

**8.2    Sampling and Analysis Program**

8.2.1    Environmental samples shall be collected and analyzed according to Attachment A, Table 3.0-1. Analytical techniques used shall be such that the detection capabilities in 1/2-ODC-3.03, Table 4.12-1 are achieved.

8.2.2    The results of the radiological environmental monitoring are intended to supplement the results of the radiological effluent monitoring by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways.

8.2.2.1    The specified environmental monitoring program provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the station operation.

8.2.2.2    The initial radiological environmental monitoring program should be conducted for the first 3 years of commercial operation (or other period corresponding to a maximum burnup in the initial core cycle). Following this period, program changes may be proposed based on operational experience.

8.2.3    Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons.

8.2.3.1    IF specimens are unobtainable due to sampling equipment malfunction, THEN every effort shall be made to complete corrective action prior to the end of the next sampling period.

8.2.3.2    All deviations from the sampling schedule shall be documented in the annual REMP report.

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8.3    **Crosscheck Program**

8.3.1    The laboratories of the licensee and licensee's contractors which perform analyses shall participate in the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparisons Studies (Crosscheck) Program or equivalent program.

8.3.1.1    This participation shall include all of the determinations (sample medium-radionuclide combination) that are offered by EPA and that also are included in the monitoring program.

8.3.1.2    The results of analysis of these crosscheck samples shall be included in the annual REMP report. The participants in the crosscheck program may provide their program code so that the NRC can review the participant data directly in lieu of submission in the annual REMP report.

8.3.1.3    IF the results of a determination in the crosscheck program are outside the specified control limits, THEN the laboratory shall investigate the cause of the problem and take steps to correct it. The results of this investigation and corrective action shall be included in the annual REMP report.

8.3.2    The requirement for the participation in the crosscheck program, is based on the need for independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices as part of the quality assurance program for environmental monitoring in order to demonstrate the results are reasonably valid.

8.4    **Land Use Census Program**

8.4.1    A census shall be conducted annually during the growing season to determine the location of the nearest milk animal, and nearest garden greater than 50 square meters (500 sq. ft.) producing broad leaf vegetation in each of the 16 meteorological sectors within a distance of 8 km (5 miles).

8.4.1.1    For elevated releases as defined in Regulatory Guide 1.111<sup>(3.1.4)</sup>, the census shall also identify the locations of all milk animals, and gardens greater than 50 square meters producing broad leaf vegetation out to a distance of 5 km (3 miles) for each radial sector.

8.4.1.2    IF it is learned from this census that the milk animals or gardens are present at a location which yields a calculated thyroid dose greater than those previously sampled, or if the census results in changes in the location used in ODCM dose calculations, THEN a written report shall be submitted to the Director of Operating Reactors, NRR (with a copy to the Director of the NRC Regional Office) within 30 days identifying the new location (distance and direction).

8.4.1.2.1    Milk animal or garden locations resulting in higher calculated doses shall be added to the surveillance program as soon as practicable.

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8.4.1.3

The sampling location (excluding the control sample location) having the lowest calculated dose may then be dropped from the surveillance program at the end of the grazing or growing season during which the census was conducted. Any location from which milk can no longer be obtained may be dropped from the surveillance program after notifying the NRC in writing that they are no longer obtainable at that location.

8.4.1.4

The results of the land-use census shall be reported in the annual REMP report.

8.4.1.5

The census of milk animals and gardens producing broad leaf vegetation is based on the requirement in Appendix I of 10 CFR Part 50 <sup>(3.2.1)</sup> to "Identify changes in the use of unrestricted areas (e.g., for agricultural purposes) to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure." The consumption of milk from animals grazing on contaminated pasture and of leafy vegetation contaminated by airborne radioiodine is a major potential source of exposure. Samples from milk animals are considered a better indicator of radioiodine in the environment than vegetation.

8.4.1.5.1

IF the census reveals milk animals are not present or are unavailable for sampling, THEN vegetation must be sampled.

8.4.1.6

The 50 square meter garden, considering 20% used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and a vegetation yield of 2 kg/m<sup>2</sup>, will produce the 26 kg/yr assumed in Regulatory Guide 1.109 <sup>(3.1.2)</sup>, for child consumption of leafy vegetation.

8.5

Direct Radiation Monitoring Program

8.5.1

The increase in the number of direct radiation stations is to better characterize the individual exposure (mrem) and population exposure (man-rem) in accordance with Criterion 64 - monitoring radioactivity releases, of 10 CFR Part 50, Appendix A. The NRC will place a similar amount of stations in the area between the two rings designated in 1/2-ODC-3.03, Table 3.12-1.

- END -

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## ATTACHMENT A

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## EXPOSURE PATHWAY AND SAMPLING REQUIREMENTS

TABLE 3.0-1  
PROGRAM DETAILS

<u>EXPOSURE</u> <u>PATHWAY AND/OR</u> <u>SAMPLE</u>	<u>SITE</u> <u>NO.</u>	<u>SECTOR</u> <u>1</u>	<u>MILES</u> <sup>2</sup>	<u>SAMPLE POINT DESCRIPTION</u> <sup>3</sup>	<u>SAMPLING AND</u> <u>COLLECTION</u> <u>FREQUENCY</u>	<u>TYPE AND</u> <u>FREQUENCY OF</u> <u>ANALYSES</u>
1. AIRBORNE	13	11	1.49	Old Meyer Farm	Continuous	Radioiodine Cartridge:
Radioiodine and	30	4	0.43	Shippingport (Cook's Ferry S.S.)	sampler operation	I-131 analysis weekly.
Particulates	32	15	0.75	Midland (North S.S.)	with collection at	Particulate Sampler:
	46.1	2/3	2.28	Industry, McKeel's Service - Rt. 68	least weekly	Gross beta analysis
	48	10	16.40	Weirton Water Tower, Collier Way		following filter
						change <sup>5</sup> ; Gamma
						isotopic analysis on
						composite (by location)
2. DIRECT	10	3/4	0.94	Shippingport Post Office	Continuous	Gamma dose quarterly.
RADIATION	13	11	1.49	Old Meyer Farm	measurement with	
	14	11	2.53	Hookstown Boro	quarterly	
	15	14	3.75	Georgetown Post Office	collection.	
	27	7	6.14	Brunton Farm		
	28	1	8.60	Sherman Farm		
	29B	3	7.97	Friendship Ridge		
	30	4	0.43	Shippingport (Cook's Ferry S.S.)		
	32	15	0.75	Midland (North S.S.)		
	45	5	2.19	Christian House Baptist Chapel - Rt. 18		
	45.1	6	1.92	Raccoon Twp., Kennedy's Corner		
	46	3	2.49	Industry, Midway Drive		
	46.1	2/3	2.28	Industry - McKeel's Service - Rt. 68		
	47	14	4.88	East Liverpool Water Dept.		
	48	10	16.40	Weirton Water Tower, Collier Way		
	51	5	8.00	Aliquippa (Sheffield S.S.)		
	59	6	0.99	236 Green Hill Rd.		
	60	13	2.51	444 Hill Rd.		
	70	1	3.36	236 Engle Rd.		
	71	2	6.01	Brighton Twp., First Western Bank		



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EXPOSURE PATHWAY AND SAMPLING REQUIREMENTS

TABLE 3.0-1

PROGRAM DETAILS

EXPOSURE PATHWAY AND/OR SAMPLE	SITE NO.	SECTOR <sup>1</sup>	MILES <sup>2</sup>	SAMPLE POINT DESCRIPTION <sup>3</sup>	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSES
2. DIRECT RADIATION (continued)	72	3	3.25	Ohioview Lutheran Church - Rear	Continuous measurement with quarterly collection.	Gamma dose quarterly.
	73	4	2.48	618 Squirrel Run Road		
	74	4	6.92	137 Poplar Ave. - CCBC		
	75	5	4.08	117 Holt Road		
	76	6	3.80	Raccoon Elementary School		
	77	6	5.52	3614 Green Garden Road		
	78	7	2.72	Raccoon Municipal Building		
	79	8	4.46	106 Rt. 151 - Ted McWilliams Auto Body		
	80	9	8.27	Raccoon Park Office, Rt. 18		
	81	9	3.69	Millcreek United Presby. Church		
	82	9	6.99	2697 Rt. 18		
	83	10	4.26	735 Mill Creek Road		
	84	11	8.35	Hancock Co. Senior Center		
	85	12	5.73	2048 Rt. 30		
	86	13	6.18	1090 Ohio Ave., E. Liverpool		
	87	14	7.04	50103 Calcutta Smith's Ferry Rd.		
	88A	15	2.8	Route 168, Midland Heights		
	89	15	4.72	488 Smith Ferry Rd., Ohioville		
	90	16	5.20	6286 Tuscarawas Rd.		
	91	2	3.89	Pine Grove & Doyle Roads		
	92	12	2.81	Georgetown Rd. (Georgetown S.S.)		
	93	16	1.10	104 Linden - Sunrise Hills		
	94	10	2.37	McCleary Road & Pole Cat Hollow Rd.		
	95	8	2.25	832 McCleary Road		

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TABLE 3.0-1 (continued)  
PROGRAM DETAILS

EXPOSURE PATHWAY AND/OR SAMPLE	SITE NO.	SECTOR <sup>1</sup>	MILES <sup>2</sup>	SAMPLE POINT DESCRIPTION <sup>3</sup>	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSES
3. WATERBORNE	49A	3	4.92	Upstream of Montgomery Dam <sup>4</sup>	Composite sample with sample collection at least monthly <sup>6</sup> .	Gamma isotopic analysis monthly; tritium analysis on composite (by location) quarterly.
a) Surface (River)	2.1	14	1.43	Midland – ATI Allegheny Ludlam		
b) Drinking Water	4	15	1.26	Midland Water Dept.	Composite sample with sample collection at least bi-weekly <sup>6</sup> .	I-131 analysis bi-weekly; gamma isotopic analysis on composite (by location) monthly; tritium analysis on composite (by location) quarterly.
	5	14	4.90	East Liverpool Water Dept.		
c) Ground Water				None required <sup>7</sup>		
d) Shoreline Sediment	2A	12	0.31	BVPS Outfall Vicinity	Semi-annually.	Gamma isotopic analysis semi-annually.
4. INGESTION	27	7	6.16	Brunton's (large local dairy)	At least bi-weekly when animals are on pasture; at least monthly at other times.	Gamma isotopic and I-131 analysis on each sample.
a) Milk <sup>11</sup>	25	10	2.10	Searight's Dairy (Historical continuity)		
	*8	--	--			
	*8	--	--			
	*8	--	--			
	96	10	10.48	Windsheimer Farm		
b) Fish	2A	12	0.31	BVPS Outfall Vicinity	Semi-annually one sample of available species.	Gamma isotopic analysis. On edible portion.
	49A	3	4.92	Upstream of Montgomery Dam		
c) Food Products (Leafy Vegetables) <sup>11</sup>	--	--	--	Three (3) locations within 5 miles of BVPS (Shippingport, Industry, and Georgetown) <sup>9</sup> .	Annually at harvest time. <sup>10, 11, 12</sup>	Gamma isotopic and I-131 analysis on edible portion.
	--	--	--	<sup>10, 11</sup> One (1) control location (Weirton, W. V. area) <sup>9, 10, 11</sup>		

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TABLE 3.0-1 (continued)

PROGRAM DETAILS

EXPOSURE PATHWAY AND/OR SAMPLE	SITE NO.	SECTOR <sup>1</sup>	MILES <sup>2</sup>	SAMPLE POINT DESCRIPTION <sup>3</sup>	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSES
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<sup>6</sup> Composite samples are obtained by collecting an aliquot at intervals not exceeding 2 hours. For the upstream surface water location site 49A, a weekly grab sample, composited each month is also acceptable.

<sup>7</sup> Collection of Ground Water samples is not required as the hydraulic gradient or recharge properties are directed toward the river because of the high terrain in the river valley at the BVPS; thus, station effluents do not affect local wells and ground water sources in the area.

<sup>8</sup> These Sample Points will vary and are chosen based upon calculated annual deposition factors (highest). Searight's Dairy may count as one of these.

<sup>9</sup> Exact location may vary due to availability of food products.

<sup>10</sup> When ODCM milk sample requirements are met, one type of broad leaf vegetation is to be sampled from the three (3) indicator locations and one (1) control location.

<sup>11</sup> When there are not enough milk sample locations available to meet the ODCM requirements, three (3) different types of broad leaf vegetation are to be sampled at each of two (2) indicator locations based on the highest predicted annual average ground D/Q (as determined from the previous year's Land Use Census results), in addition to those samples described in Note 10. Three (3) different types of broad leaf vegetation shall also be sampled at one (1) control location when in this condition.

<sup>12</sup> The primary sources of broad leaf vegetation are cabbage or lettuce. However, other acceptable substitutes are vegetables having leaves with large surface area, to be combined with the edible portion of the plant for analysis.

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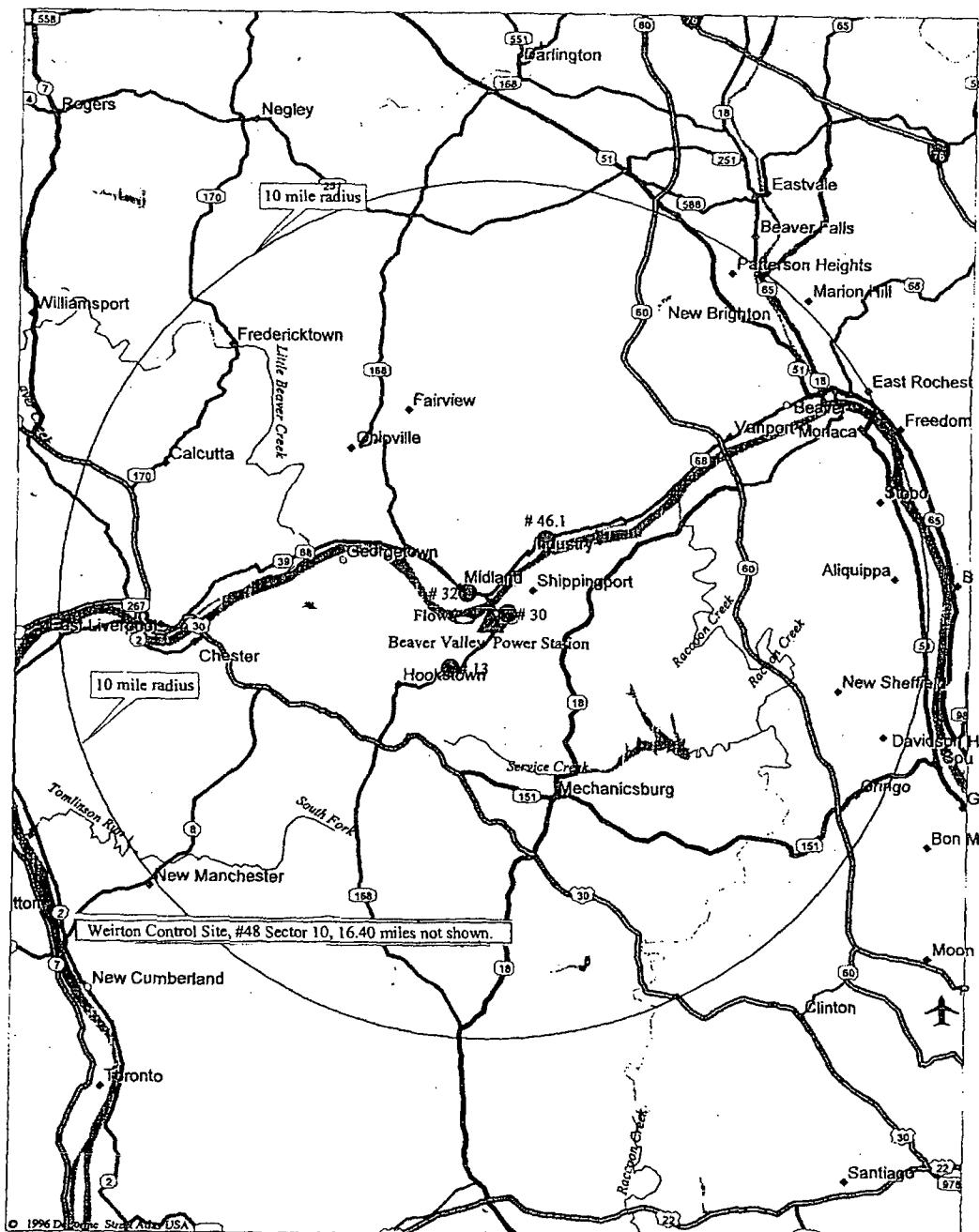
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### LOCATION OF SAMPLING SITES

**FIGURE 3.0-1**  
**AIR SAMPLING LOCATIONS**



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FIGURE 3.0-1 (Continued)  
AIR SAMPLING LOCATIONS

Sector	Site #	Distance (miles)	Location
11	13	1.49	Old Meyer Farm
4	30	0.43	Shippingport (Cook's Ferry S.S.)
15	32	0.75	Midland (North S.S.)
2/3	46.1	2.28	Industry - McKeel's Service - Rt. 68
10	48	16.40	Weirton Water Tower, Collier Way

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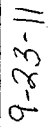
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## LOCATION OF SAMPLING SITES

## TLD LOCATIONS



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FIGURE 3.0-2 (continued)

TLD LOCATIONS

**Southeast**

Sector	Site #	Distance (miles)	Location	Sector	Site #	Distance (miles)	Location
7	27	6.14	Brunton Farm	7	78	2.72	Raccoon Municipal Bldg.
6	45.1	1.92	Raccoon Twp., Kennedy Corners	8	79	4.46	106 Rt. 151- Ted McWilliams Auto Body
5	51	8.00	Aliquippa (Sheffield S.S.)	9	80	8.27	Raccoon Park Office, Rt. 18
6	59	0.99	236 Green Hill Road	9	82	6.99	2697 Rt. 18
6	76	3.80	Raccoon Elementary School	8	94	2.25	McCleary & Pole Cat Hollow Roads
6	77	5.52	3614 Green Garden Road				

**Northwest**

Sector	Site #	Distance (miles)	Location	Sector	Site #	Distance (miles)	Location
14	15	3.75	Georgetown Post Office	14	87	7.04	50103 Calcutta Smith's Ferry Rd.
15	32	0.75	Midland (North S.S.)	15	88A	2.8	Route 168; Midland Heights
14	47	4.88	E. Liverpool Water Dept.	15	89	4.72	488 Smith Ferry Rd., Ohioville
13	60	2.51	444 Hill Road	16	90	5.20	6286 Tuscarawas Rd.
13	86	6.18	1090 Ohio Avenue, E. Liverpool	16	93	1.10	104 Linden - Sunrise Hills

**Northeast**

Sector	Site #	Distance (miles)	Location	Sector	Site #	Distance (miles)	Location
3/4	10	0.94	Shippingport Post Office	1	70	3.36	236 Engle Rd.
1	28	8.60	Sherman Farm	2	71	6.01	Brighton Twp., First Western Bank
3	29B	7.97	Friendship Ridge	3	72	3.25	Ohioview Lutheran Church - Rear
4	30	0.43	Shippingport (Cook's Ferry S.S.)	4	73	2.48	618 Squirrel Run Rd.
5	45	2.19	Christian House Baptist Chapel - Rt 18	4	74	6.92	137 Poplar Ave. - CCBC
3	46	2.49	Industry, Midway Dr.	5	75	4.08	117 Holt Rd.
2/3	46.1	2.28	Industry - McKeel's Service - Rt 68	2	91	3.89	Pine Grove Rd. & Doyle Rd.

**Southwest**

Sector	Site #	Distance (miles)	Location	Sector	Site #	Distance (miles)	Location
11	13	1.49	Old Meyer Farm	11	84	8.35	Hancock Co. Senior Center
11	14	2.53	Hookstown Boro	12	85	5.73	2048 Rt. 30
10	48	16.40	Weirton Water Tower, Collier Way	12	92	2.81	Georgetown Rd. (Georgetown S.S.)
9	81	3.69	Millcreek United Presby. Church	10	95	2.37	832 McCleary Rd.
10	83	4.26	735 Mill Creek Rd.				

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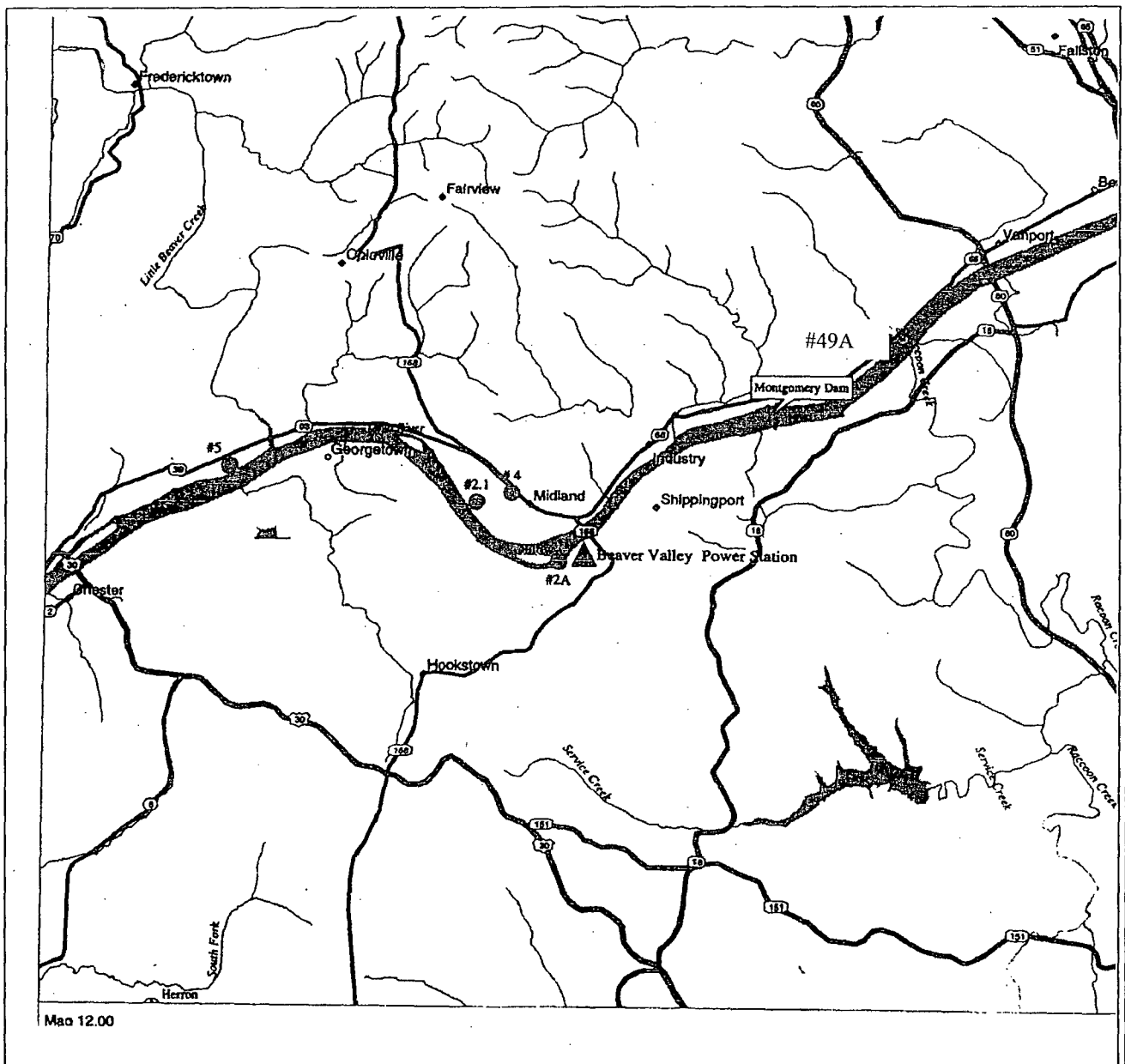
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### LOCATION OF SAMPLING SITES

FIGURE 3.0-3

SHORELINE SEDIMENT, SURFACE WATER, AND DRINKING WATER SAMPLING LOCATIONS





<b>Beaver Valley Power Station</b>		Procedure Number: <b>1/2-ODC-2.03</b>	
Title: ODCM: Radiological Environmental Monitoring Program		Unit: <b>1/2</b>	Level Of Use: <b>General Skill Reference</b>
		Revision: <b>4</b>	Page Number: <b>17 of 23</b>

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LOCATION OF SAMPLING SITES

FIGURE 3.0-3 (Continued)

SHORELINE SEDIMENT, SURFACE WATER, AND DRINKING WATER SAMPLING LOCATIONS

Sample Type	Sector	Site #	Distance (miles)	Location
Surface Water	14	2.1	1.43	Midland - ATI Allegheny Ludlam
Surface Water	3	49A	4.92	Upstream of Montgomery Dam
Sediment	12	2A	0.31	BVPS Outfall Vicinity
Sediment*	3	49A	4.93	Upstream of Montgomery Dam
Drinking Water	15	4	1.26	Midland Water Dept.
Drinking Water	14	5	4.90	East Liverpool Water Dept.

\* Site #49A added – control site.

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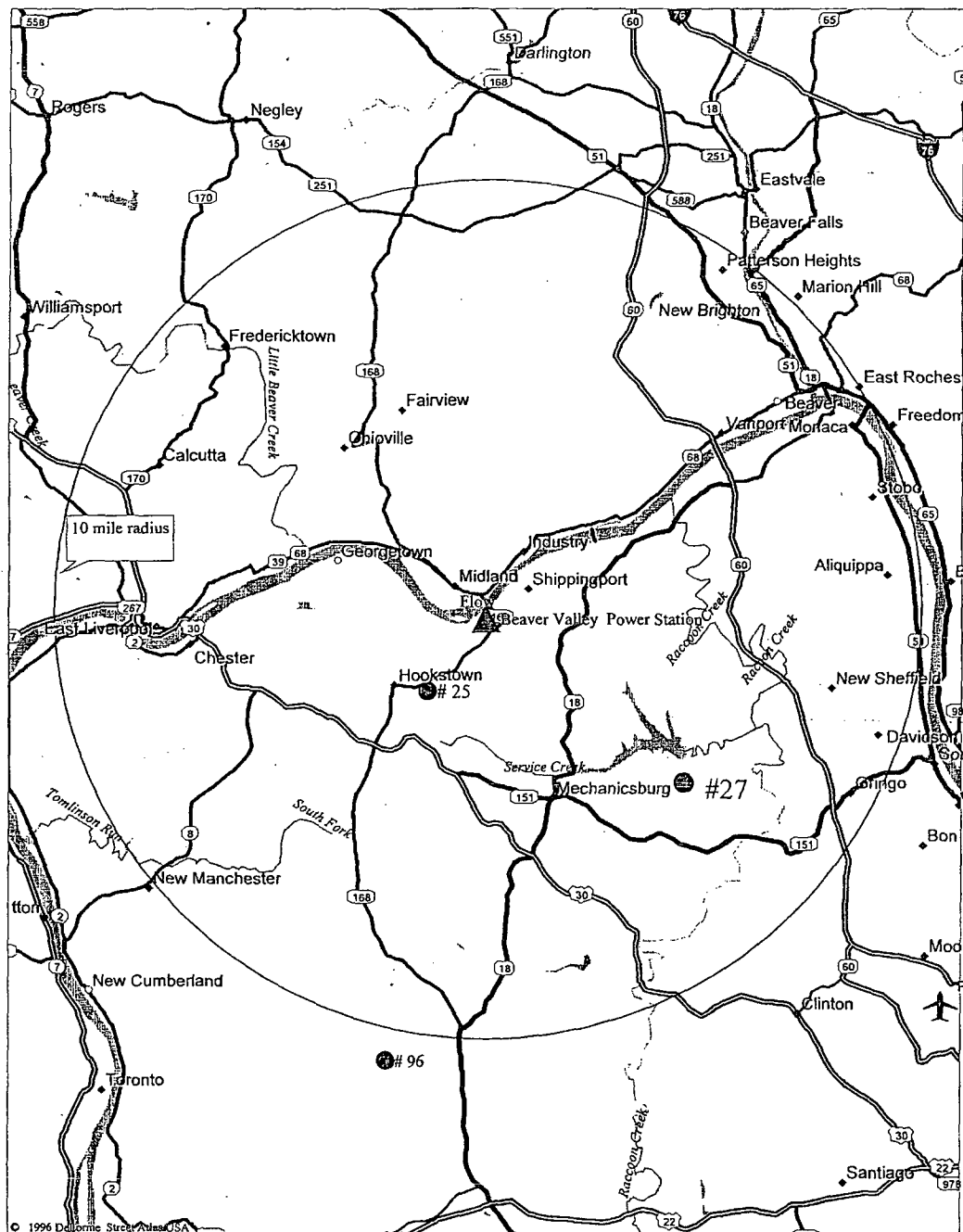
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### LOCATION OF SAMPLING SITES

FIGURE 3.0-4  
MILK SAMPLING LOCATIONS



12-30-11

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LOCATION OF SAMPLING SITES

FIGURE 3.0-4 (Continued)  
MILK SAMPLING LOCATIONS

Sector	Site #	Distance (miles)	Location
10	25	2.10	Searight's Dairy
7	27	6.16	Brunton's Dairy
10**	96	10.48	Windsheimer Farm
	*		
	*		
	*		

\*Three dairies based on highest deposition factors; Searight's may count as one of these.

\*\* Control Location.

12-30-11

# Beaver Valley Power Station

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Title:  
ODCM: Radiological Environmental Monitoring Program

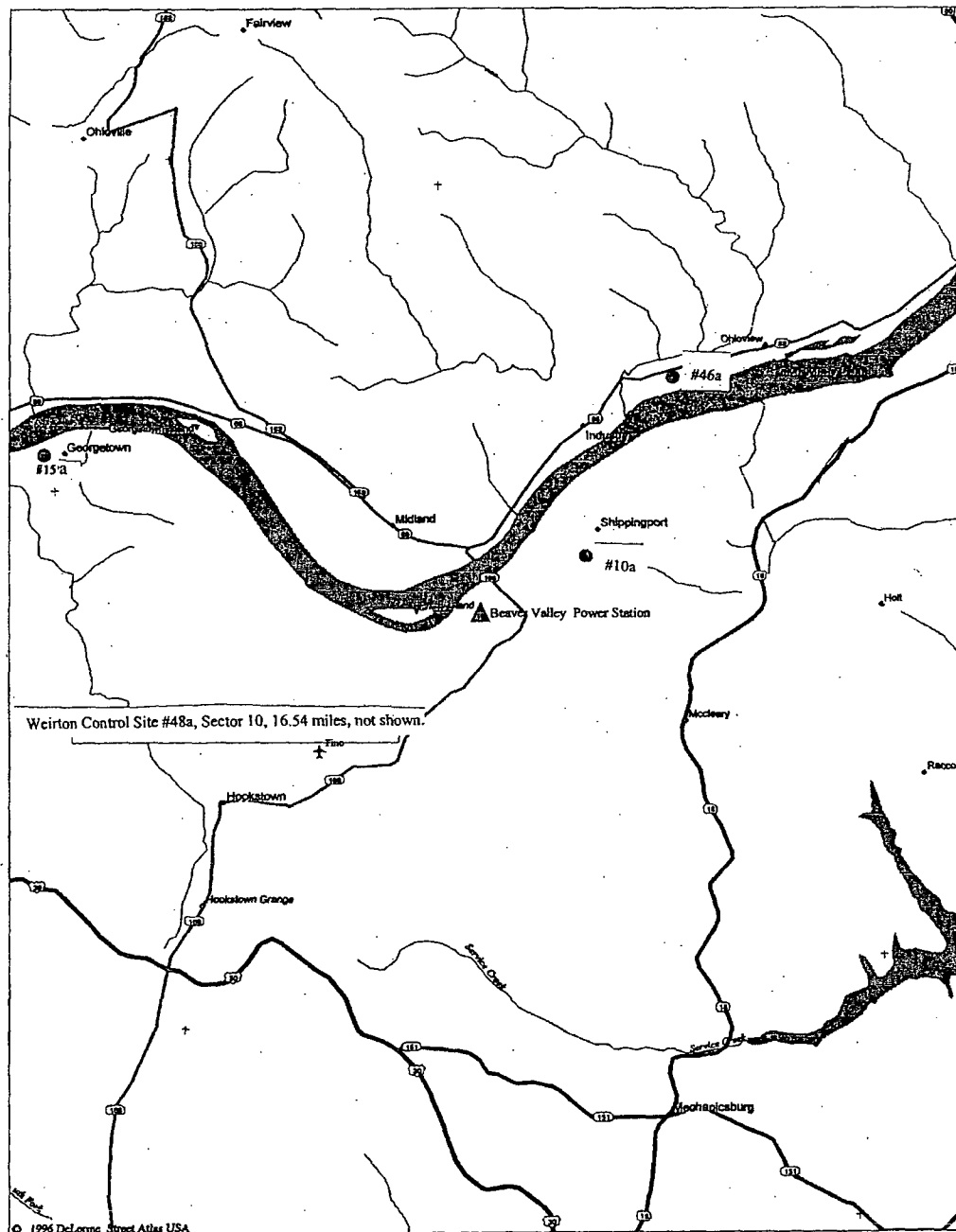
Unit: 1/2	Level Of Use: General Skill Reference
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### LOCATION OF SAMPLING SITES

FIGURE 3.0-5  
FOODCROP SAMPLING LOCATIONS



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LOCATION OF SAMPLING SITES

FIGURE 3.0-5 (Continued)  
FOODCROP SAMPLING LOCATIONS

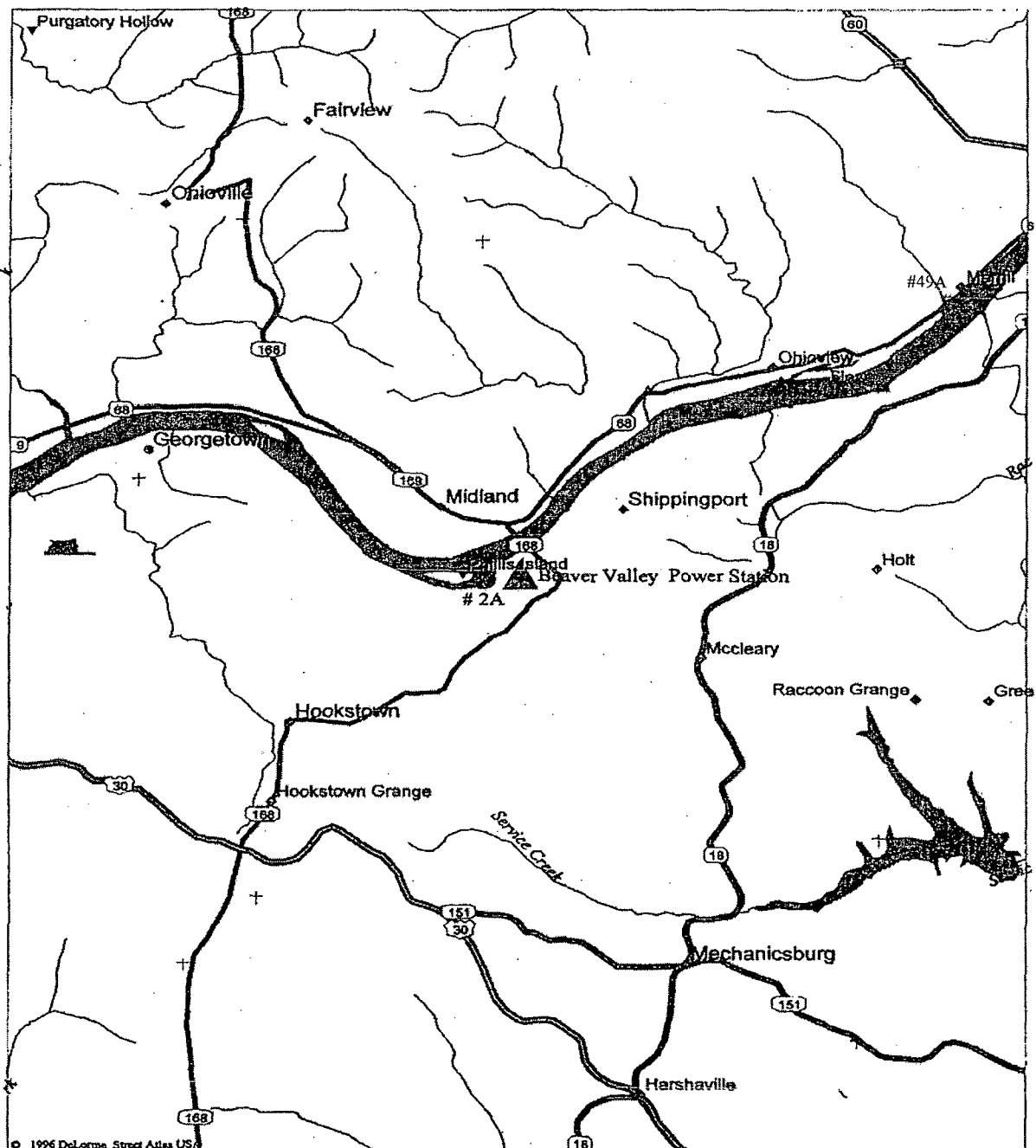
Site #	Description
10*	Shippingport Boro
15*	Georgetown Boro
46*	Industry Boro
48*	Weirton Area

*\* Individual garden locations may change based upon availability. The requirements are met as long as one garden is sampled from each of these communities.*

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FIGURE 3.0-6  
FISH SAMPLING LOCATIONS



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LOCATION OF SAMPLING SITES

FIGURE 3.0-6 (Continued)  
FISH SAMPLING LOCATIONS

Sector	Site #	Distance (miles)	Location
12	2A	0.31	BVPS Outfall Vicinity
3	49A	4.93	Upstream of Montgomery Dam