



FirstEnergy Nuclear Operating Company

Beaver Valley Power Station
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April 28, 2016

L-16-125

10 CFR 50.36a

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

SUBJECT:

Beaver Valley Power Station, Unit Nos. 1 and 2

Docket No. 50-334, License No. DPR-66

Docket No. 50-412, License No. NPF-73

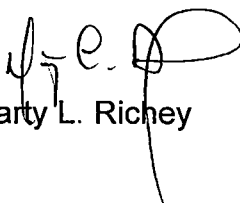
Submittal of 2015 Radioactive Effluent Release Report, 2015 Annual Radiological Environmental Operating Report, and 2015 Annual Environmental Operating Report (Non-Radiological)

In accordance with 10 CFR 50.36a and Beaver Valley Power Station (BVPS) Unit Nos. 1 and 2 Technical Specifications 5.5.1, 5.6.1, and 5.6.2, FirstEnergy Nuclear Operating Company (FENOC) hereby submits the BVPS *2015 Radioactive Effluent Release Report* and the *2015 Annual Radiological Environmental Operating Report*. These reports are provided in Enclosure A.

FENOC also submits the *2015 Annual Environmental Operating Report (Non-Radiological)* in accordance with the BVPS Unit No. 2 Operating License, Appendix B – Environmental Protection Plan. This report is provided in Enclosure B.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Donald J. Salera, Manager – Site Chemistry, at (724) 682-4141.

Sincerely,



Marty L. Richey

TE 48
NR R

Beaver Valley Power Station Unit Nos. 1 and 2
L-16-125
Page 2

Enclosures:

- A. *2015 Radioactive Effluent Release Report and 2015 Annual Radiological Environmental Operating Report*
- B. *2015 Annual Environmental Operating Report (Non-Radiological)*

cc: NRC Region I Administrator
NRC Resident Inspector
NRR Project Manager
Director BRP/DEP
Site BRP/DEP Representative
NRC Region I Health Physics Inspector

Enclosure A

L-16-125

2015 Radioactive Effluent Release Report
and
2015 Annual Radiological Environmental Operating Report
(Reports follow)

FIRSTENERGY NUCLEAR OPERATING COMPANY BEAVER VALLEY POWER STATION



2015 RADIOACTIVE EFFLUENT RELEASE REPORT AND **2015** ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT UNITS NO. 1 AND 2 LICENSES DPR-66 AND NPF-73

BEAVER VALLEY POWER STATION ENVIRONMENTAL & CHEMISTRY SECTION

Technical Report Approval:

2015 RADIOACTIVE EFFLUENT RELEASE REPORT

AND

2015 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

UNITS NO. 1 AND 2

LICENSES DPR-66 AND NPF-73

Prepared by: Patrick C. Seidel

Date: 6 APR 2016

Prepared by: Courtney F. Casto

Date: 4/6/16

Reviewed by: Robert R. Winters

Date: 4/6/16

Approved by: Donald J. Salera

Date: 4-6-16

Subject: **Beaver Valley Power Station, Unit Nos. 1 and 2**
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Radioactive Effluent Release Report for 2015, and
Annual Radiological Environmental Operating Report for 2015

Distribution for Enclosures 1 - 3:

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Page 2

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BVPS Document Control, RTL A9.690E

BVRC - *Keywords: Radioactive Effluent Release Report,
Annual Radiological Environmental Operating Report*

Form 1/2-ENV-01.05.F01 (page 1 of 39), Rev 3
Beaver Valley Power Station - Units 1 & 2

2015 Radioactive Effluent Release Report

FirstEnergy Nuclear Operating Company
FENOC

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

Radioactive Effluent Release Report

Calendar Year - 2015

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Attachment 2	Unit 1 and 2 Offsite Dose Calculation Manual (Complete Copy)	

Note: The Total Error values (%) listed in this report are documented in Calculation Package No. ERS-ATL-04-002

Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Report Submittal Requirements

Report Submittal and Requirements: The report was prepared and submitted in accordance with the requirements contained in the following documents:

BVPS Integrated Technical Specifications, Administrative Control 5.6.2

Offsite Dose Calculation Manual (ODCM) procedure 1/2-ODC-3.03, "Controls for RETS and REMP Programs", Attachment U, Control 6.9.3

BVPS procedure 1/2-ENV-01.05, "Compliance with Regulatory Guide 1.21 and Technical Specifications"

NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, Generic Letter 89-01, Supplement No.1, April 1991"

Regulatory Guide 1.21, "Measuring Evaluating and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Material in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants, Revision 1, June 1974"

BVPS Condition Report No. CR-2015-06087; RM-1GW-109 Process Vent Monitor will not be returned to service by required date

BVPS Condition Report No. CR-2015-06200; RM-1GW-109 fault due to defective Kurz flowmeter

BVPS Condition Report No. CR-2015-07757; 2HVL-RQ112, Condensate Polishing BLDG Particulate Monitor, not returned to service within 30 days

BVPS Condition Report No. CR-2015-09725; RM-1VS-101B Ventilation Vent Gas Monitor was not returned to service by required date

BVPS Condition Report No. CR-2015-09750; Order 200552303 for BV-RM-1VS-101B Exceeds Thirty Days OOS

BVPS Condition Report No. CR-2015-09731; RM-1MS-100B Invalid Hi Hi Alarm

BVPS Condition Report No. CR-2015-09851; 2HVS-RQ1109 removed from service due to Loss of Process Flow

BVPS Condition Report No. CR-2015-10933; RM-1MS-100B not returned to service within 30 days

BVPS Condition Report No. CR-2015-11078; RM-1MS-100B, ATMS Steam Dump and Main Steam Safety Valves Radiation Monitor, not returned to service within 30 days

BVPS Condition Report No. CR-2015-11081; 2HVS-RQ-109, SLCRS Effluent Radiation Monitor, not returned to service within 30 days

BVPS Condition Report No. CR-2015-12806; 2GWS-AOV108 Leakby causes gaseous waste storage tank pressure to lower

BVPS Condition Report No. CR-2015-14399; 2RMQ-RQ303B Sample Pump Failure

BVPS Condition Report No. CR-2015-15523; Improper restoration from corrective maintenance leads to potentially missed sample of ODCM compensatory action.

BVPS Condition Report No. CR-2015-15884; Documentation of discarded fire sump sample

BVPS SAP Notification No. 600952335, 2015 RETS/REMP Tracking

Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Liquid and Gaseous Effluent Control (Part 1 of 2)

Onsite Groundwater Monitoring: H-3 Summary: In 2015, twenty three (23) on-site monitoring wells were sampled in the spring and fall sampling periods in 2015. No new wells were installed, nor were any wells retired. MW-16 was sampled nine (9) times throughout 2015, two (2) of which were included in the yearly biannual sampling. These samples that were taking account for the highest concentrations.

No adverse effect to the offsite environment has been detected at this time, because all offsite groundwater, drinking water and surface water samples were <440 pCi/L. See Enclosure 2, Page xvii for additional details.

Onsite Spills: There were no onsite spills >100 gallons.

Decommissioning File Update: There were no updates to the decommissioning file.

Abnormal Liquid Releases: There were no abnormal liquid releases.

Abnormal Gaseous Releases: There was one abnormal gaseous release. See Page xv for details.

Liquid Radwaste Treatment System: The site operated via a shared Liquid Radwaste Treatment System, even though each Unit has its own ion-exchange vessels. Shared operation allowed either Unit to process liquid waste at the Unit of origin, or at the other Unit. Typically, when Unit 1 or 2 high level liquid waste was processed (e.g., coolant recovery waste) it was performed at Unit 1, because it has a carbon pre-conditioning filter.

Gaseous Radwaste Treatment System: The site operated via a shared Gaseous Radwaste Treatment System, even though each Unit has its own charcoal delay beds and storage/decay tanks. Shared operation allowed either Unit to process gaseous waste at the Unit of origin, or at the other Unit. Since Unit 2 has four additional storage tanks, gaseous waste was transferred from storage/decay at Unit 2 when either Unit went to a shutdown condition.

Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Liquid and Gaseous Effluent Control (Part 1 of 2)

Lower Limits of Detectability (LLD): All a-priori calculated LLD met the minimum requirements specified in the ODCM.

Effluent Monitoring Channels Inoperable >30 Days: There was five (5) Effluent Monitoring Instrumentation Channels not returned to Operable status within 30 days. See Enclosure 2, Page 18 for details.

ODCM Surveillance Deficiencies: There were two ODCM Surveillance Deficiency in the reporting period. See Page 20 for details.

ODCM Changes: There were one (1) changes made to the ODCM during the report period. See ODCM procedure 1/2-ODC-1.01, "ODCM: Index, Matrix and History ODCM Changes" for a complete description of the change and the change justification. All changes 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. Detailed descriptions of the ODCM changes are provided in Enclosure 2, Page 21 Table 9 and Attachment 2.

Meteorological Data Recovery: The Meteorological Data Recovery met the minimum requirement of at least 90%, as specified in Section 5 of Revision 1 to Regulatory Guide 1.23, Meteorological Monitoring Programs for Nuclear Power Plants.

Population Dose vs. Natural Background: The 0-50 mile total and average population doses were calculated using liquid and gaseous release quantities and real time meteorology. The average population dose is based on four (4) million people within 0-50 miles of the BVPS site. The following comparison to natural background radiation demonstrates that BVPS operations did not adversely affect the surrounding environment.

181 man-mrem = BVPS Total Population Dose for the year

0.0000454 mrem = BVPS Average Individual Dose for the year

296 mrem = Natural Background Individual Dose for the year. This dose value is documented as natural background radiation exposure for an individual in a year from the 1990 BEIR V Report.

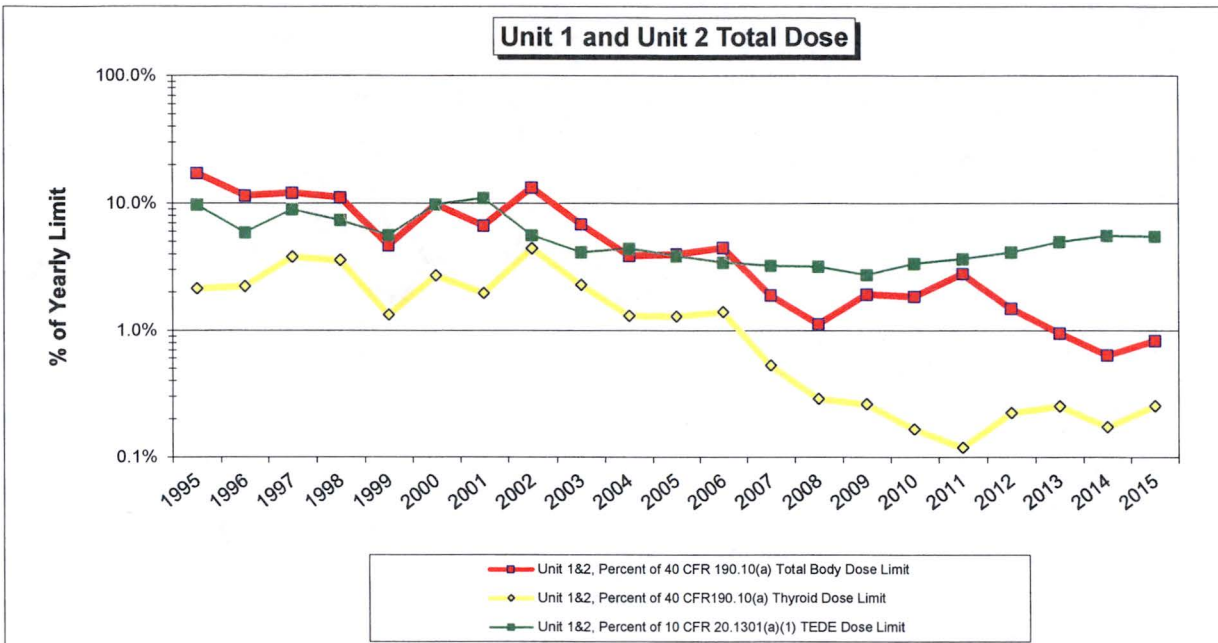
Carbon-14 Dose Assessment: Carbon-14 dose was calculated using actual sample measurements from gaseous release quantities and the default ODCM receptor. The highest organ doses were to the bone (child). Details of the dose assessment due to releases of Carbon-14 in gaseous effluents are provided in Attachment 3 of this report.

Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Total Dose

Trends of Total Dose: The following graph provides a comparison of the ODCM dose projections from all facility releases and direct radiation exposures to show compliance with Member of the Public dose limits from 10 CFR 20.1301 and 40 CFR Part 190. The graph reflects the results of the efforts to stabilize and reduce offsite dose.

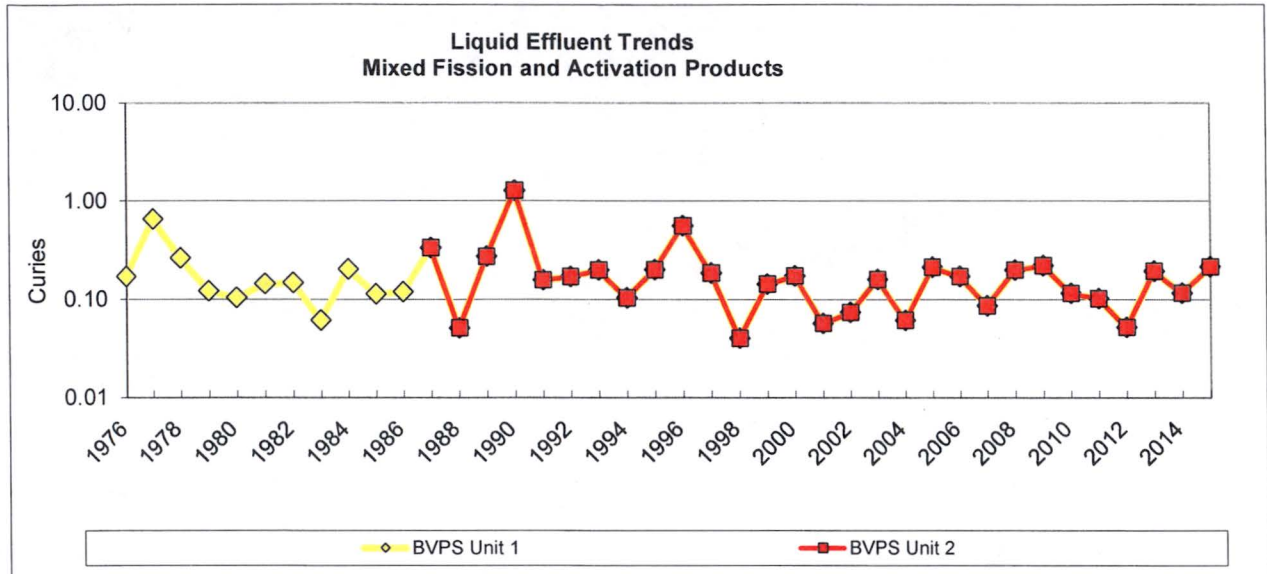


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Liquid Release Activity (Fission and Activation Products)

Liquid Release Activity (Fission and Activation Products): The following graph provides a comparison of total liquid mixed fission and activation product (particulate) radioactivity discharged from the site from 1976 to present.

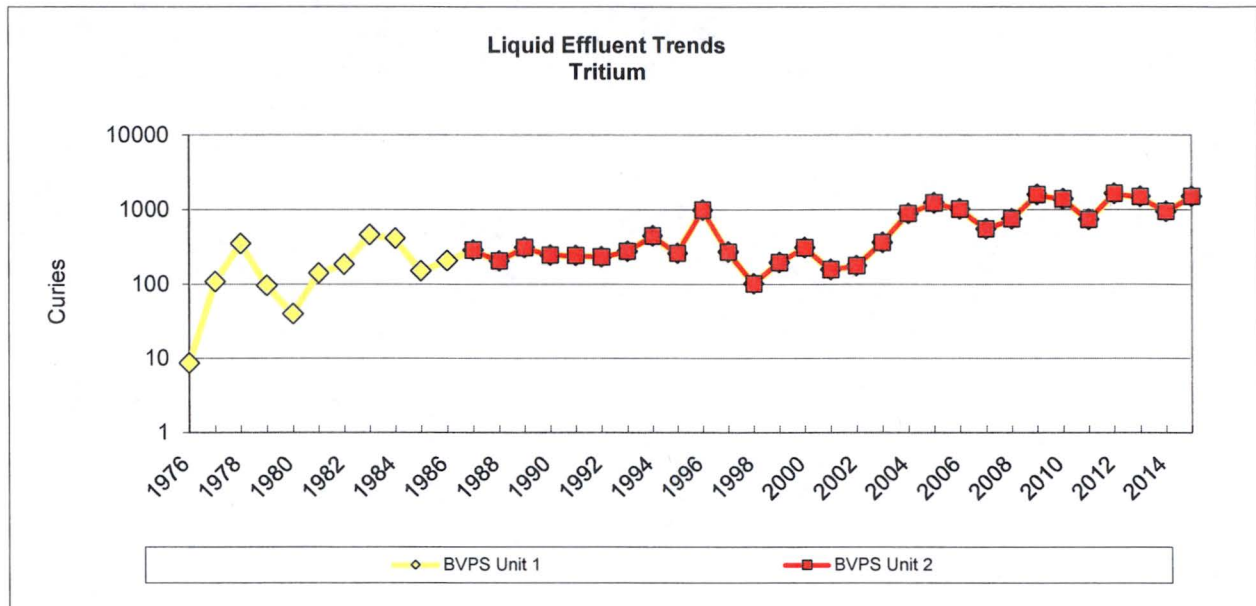


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Liquid Release Activity (Tritium)

Liquid Release Activity (Tritium): The following graph provides a comparison of total liquid tritium radioactivity discharged from the site from 1976 to present. The recent increases were due to efforts to reduce overall offsite dose. Specifically, discharging liquid radioactive inventory provided the benefit of reduced total offsite dose.

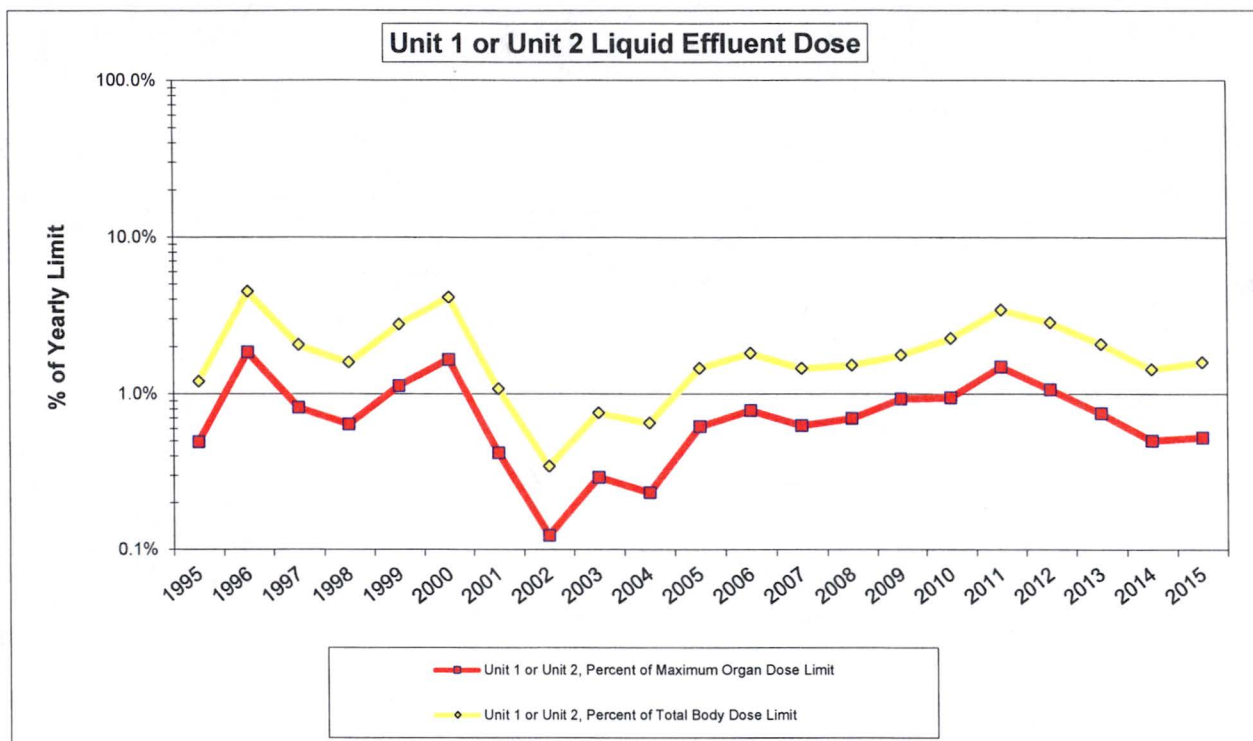


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Liquid Release Offsite Dose Projections

Liquid Release Offsite Dose Projections: The following graph provides a comparison of liquid offsite dose projections that were calculated to the maximum individual per 10 CFR 50, Appendix I and the ODCM. The projections use ODCM default flow rates for the receiving water (Ohio River), and were performed prior to release authorization.

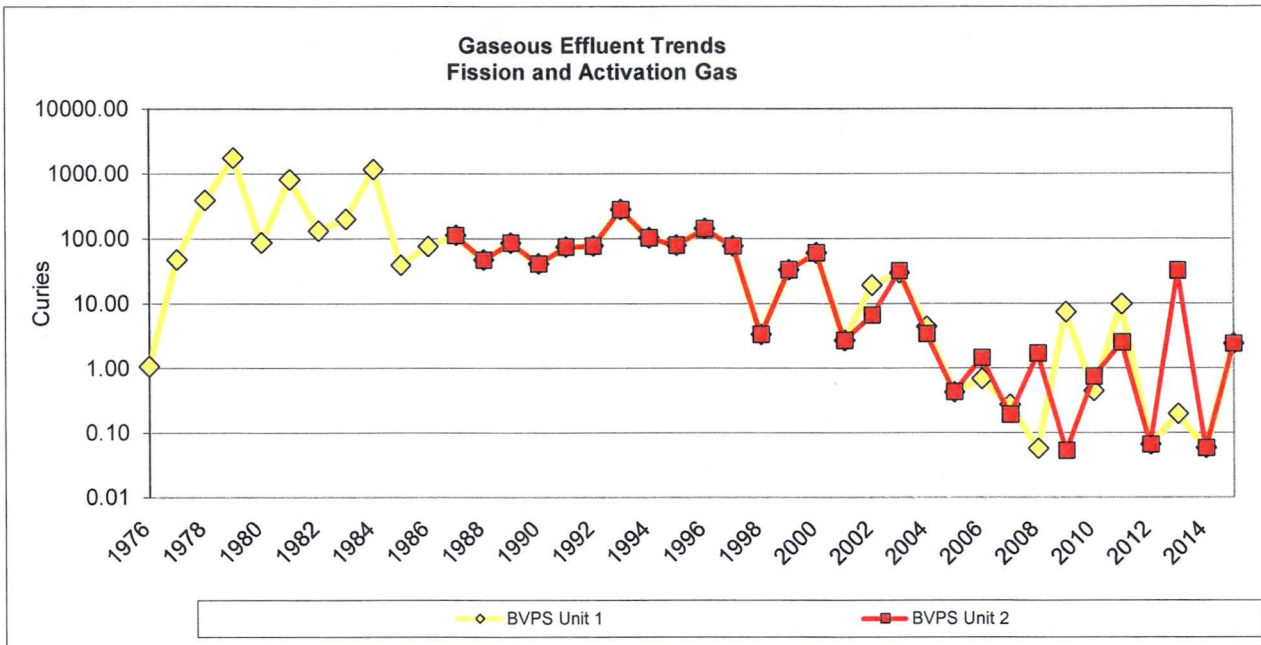


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Gaseous Release Activity (Fission and Activation Gas)

Gaseous Release Activity (Fission and Activation Gas): The following graph provides a comparison of total gaseous fission and activation gas discharged from the site from 1976 to present.

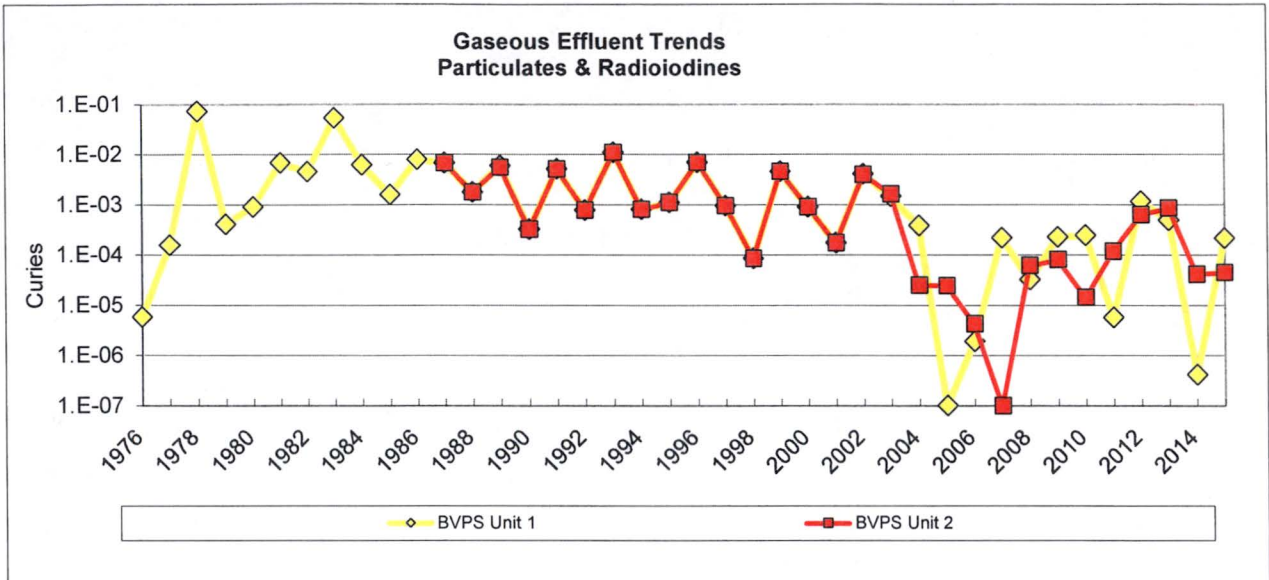


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Gaseous Release Activity (Particulates and Radioiodines)

Gaseous Release Activity (Particulates and Radioiodines): The following graph provides a comparison of total gaseous particulates and radioiodines discharged from the site from 1976 to present.

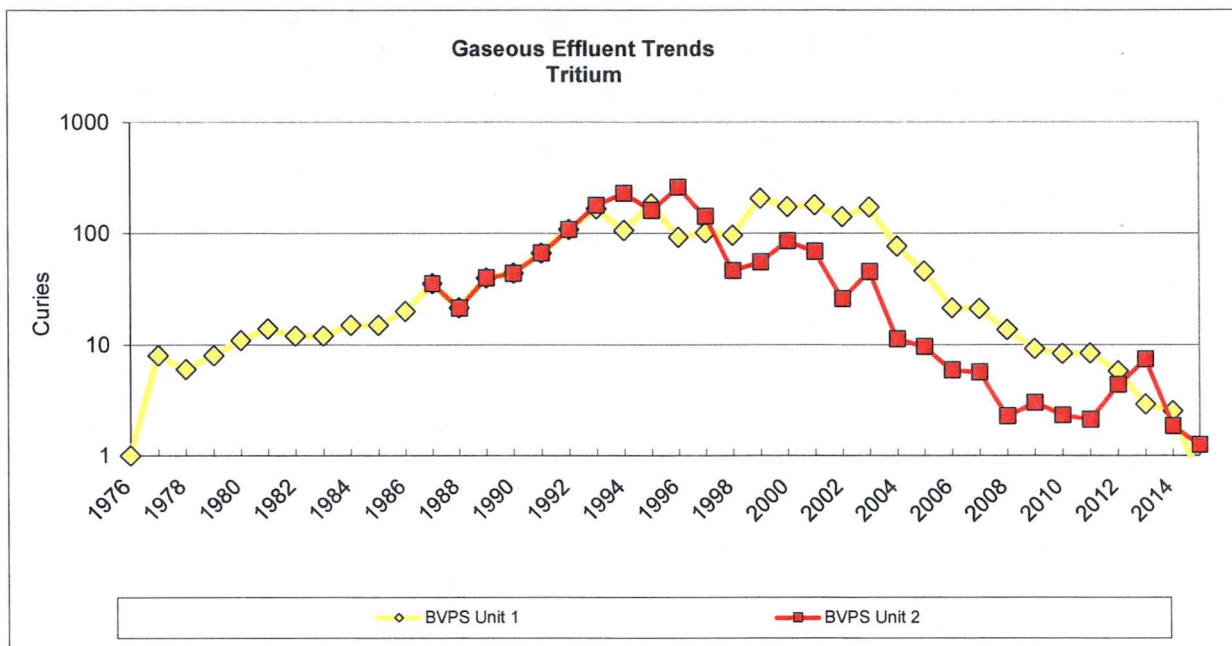


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Gaseous Release Activity (Tritium)

Gaseous Release Activity (Tritium): The following graph provides a comparison of total gaseous tritium discharged from the site from 1976 to present.

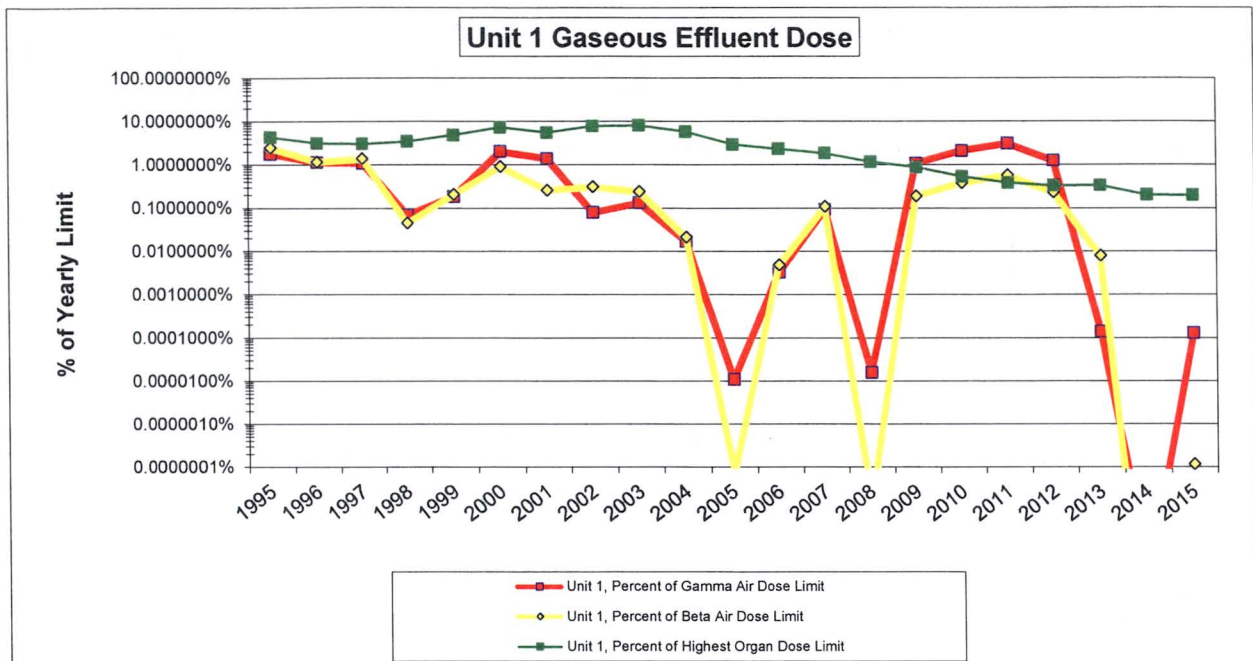


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Unit 1 Gaseous Release Offsite Dose Projections

Unit 1 Gaseous Release Offsite Dose Projections: The following graph provides a comparison of Unit 1 gaseous offsite dose projections that were calculated to the maximum individual per 10 CFR 50, Appendix I and the ODCM. The projections use ODCM default meteorological parameters for the atmospheric conditions surrounding the plant site, and were performed prior to release authorization. The steady decrease in highest organ dose were due to efforts to reduce overall offsite dose.

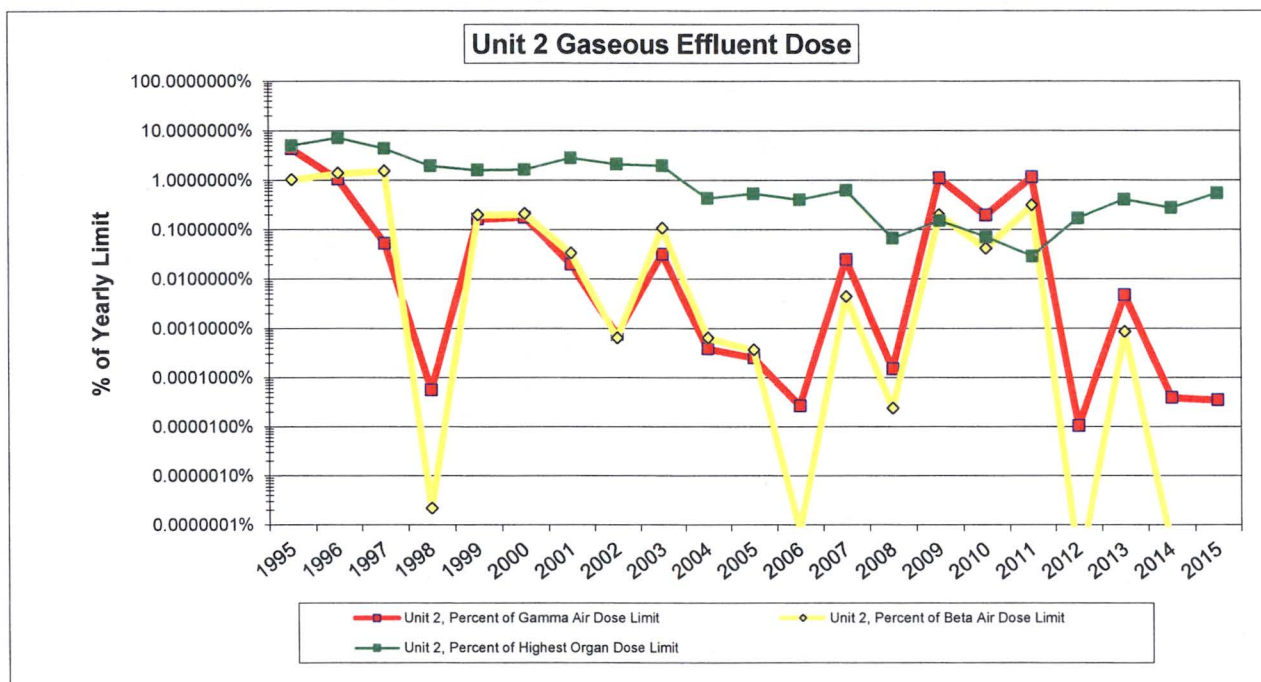


Radioactive Effluent Release Report

Calendar Year - 2015

Executive Summary - Trends of Unit 1 Gaseous Release Offsite Dose Projections

Unit 2 Gaseous Release Offsite Dose Projections: The following graph provides a comparison of Unit 2 gaseous offsite dose projections that were calculated to the maximum individual per 10 CFR 50, Appendix I and the ODCM. The projections use ODCM default meteorological parameters for the atmospheric conditions surrounding the plant site, and were performed prior to release authorization. The decrease in highest organ dose was due to efforts to reduce overall offsite dose.



Radioactive Effluent Release Report

Calendar Year - 2015

Results of Abnormal Releases

Abnormal Liquid Releases: None.

Abnormal Gas Releases: During 2R18 shutdown, there was a loss of 3.9 psig over 508 minutes (8.4667 hr) from the Unit 2 gaseous waste storage tanks. This discharge was not within the specifications of the degas permit and therefore was classified as an abnormal discharge. This is documented in CR-2015-12806. In order to be conservative in dose assessment, a calculation based on RCS stripped gas was completed and documented.

Radioactive Effluent Release Report

Calendar Year - 2015

Results of Onsite Spills and Items Added to Decommissioning Files per 10CFR50.75(g)

Summary of Onsite Spills (>100 gallons): None

Summary of Items added to Decommissioning Files per 10CFR50.75(g) Files: None

Radioactive Effluent Release Report

Calendar Year - 2015

Results of Onsite Groundwater Monitoring Program

Summary of Onsite Groundwater Samples

	2015 H-3 Maximum (pCi/L)	2015 H-3 Minimum (pCi/L)	2015 H-3 Average (pCi/L)	Typical H-3 LLD (pCi/L)	Required H-3 LLD (pCi/L)	Pre Operational Mean For H-3 (pCi/L)	Are Any H-3 Analyses Greater Than The Pre Operational Mean For H-3 ?	NEI and FENOC Communication Level For H-3 (pCi/L)	EPA Reporting Level For H-3 (pCi/L)
Spring (2nd Qtr)	9519	147	1078	<200	<2000	440	Yes	2000	30000
Fall (4th Qtr)	17406	143	1272	<200	<2000	440	Yes	2000	30000
MW-16	19058	3675	13580	<200	<2000	440	Yes	2000	30000

H-3 Summary: In 2015, twenty three (23) on-site monitoring wells were sampled in the spring and fall sampling periods in 2015. No new wells were installed, nor were any wells retired. MW-16 was sampled nine (9) times throughout 2015, two (2) of which were included in the yearly biannual sampling. These samples that were taking account for the highest concentrations.

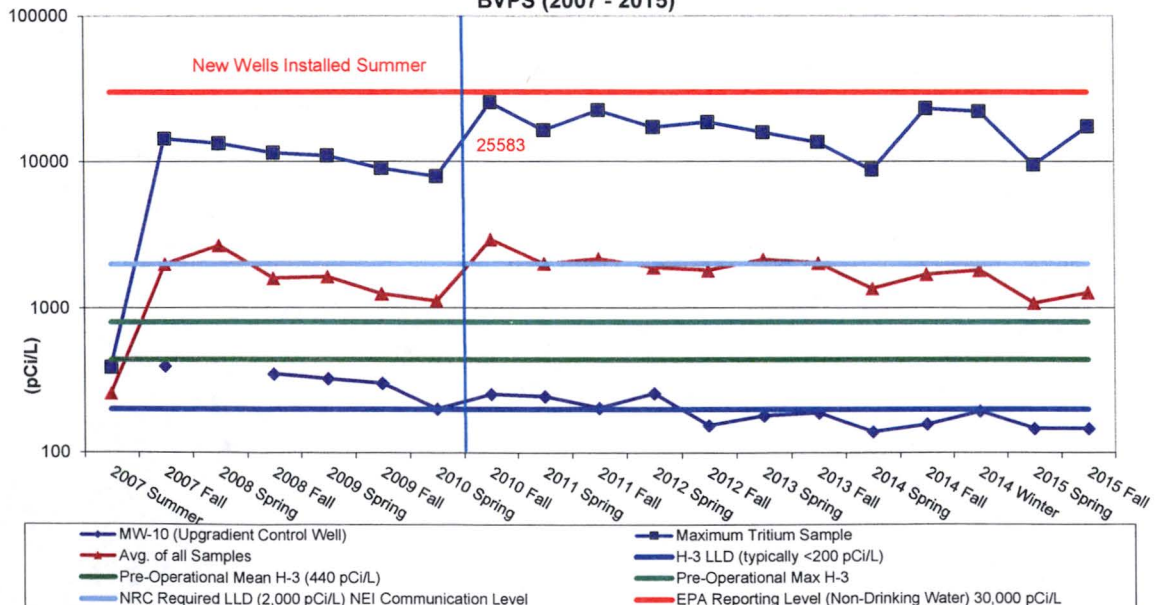
Sixteen (16) wells returned results of less than the pre-operational mean (440 pCi/L) during all sample periods in 2015. Three (3) wells returned results >440 pCi/L, but <2000 pCi/L. Four (4) wells returned results >2000 pCi/L. No wells exceeded 20,000 pCi/L with the highest concentration recorded as 19,058 pCi/L.

The NEI/FENOC communication level was reached for MW-12S & MW-12D during 2007. Notification to local, state & federal agencies was performed on 10/08/07. Additional communication for new well results was performed on 09/08/10 for those new wells that exceeded 2000 pCi/L. The newly installed well MW-20D exceeded 2,000 pCi/L on its first sample, but this was expected since the well was installed to monitor the previously identified plume intercepting MW-16. No adverse effect to the offsite environment has been detected at this time, because all offsite groundwater, drinking water and surface water samples were <440 pCi/L. Mitigation activities (catch basin sleeving) to prevent tritiated condensate water from reaching the groundwater were completed 12/17/11.

Remediation well, EW-1, was installed and began operation in October 2013. This equipment captures the tritium plume and it becomes a permitted discharge. Samples are taken monthly to provide the concentration of the discharge. Remediation will continue until the suspected plume is depleted and tritium levels stabilize.

Principal Gamma Emmitter Summary: Twenty three (23) onsite monitoring wells were sampled on at least two occasions during the year and analyzed for Principle Gamma Emitters. The results showed no positive indication of Licensed Radioactive Material (LRM) in any of the analyses.

**Onsite Groundwater Monitoring Well Program H-3 Trends
 BVPS (2007 - 2015)**



Radioactive Effluent Release Report

Calendar Year - 2015

Corrections to previous Radioactive Effluent Release Reports

Correction(s) to Previous Radioactive Effluent Release Reports:

There was no corrections made to previous reports.

Radioactive Effluent Release Report

Calendar Year - 2015

Supplemental Information Page

FACILITY: B.V.P.S. Units 1 and 2	LICENSEE: FENOC
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1. Regulatory Limits	
a. Fission and activation gases:	Annual Unit 1 or 2 Dose: 10 mrad from Gamma, & 20 mrad from Beta
b. Iodines & particulates, half-lives > 8 days:	Annual Unit 1 or 2 Dose: 15 mrem to Any Organ
c. Liquid effluents:	Annual Unit 1 or 2 Dose: 3 mrem to Total Body, & 10 mrem to Any Organ

2. Maximum Permissible Concentrations Used In Determining Allowable Release Rates Or Concentrations	
a. Fission and activation gases:	Site Release Rate: 500 mrem/yr to Total Body, & 3000 mrem/yr to the Skin
b. Iodines & particulates, half-lives > 8 days:	Site Release Rate: 1500 mrem/yr to Any Organ
c. Liquid effluents:	Site Release Concentration: 10 times 10 CFR 20 Appendix B, Table 2, EC's

3. Average Energy (Not Applicable To The BVPS ODCM)
--

4. Measurements and Approximations of Total Radioactivity	
The methods used to measure or approximate the total radioactivity in effluents, and the methods used to determine radionuclide composition are as follows:	
a. Fission and activation gases:	Ge Gamma Spectrometry, Liquid Scintillation Counter
b. Iodines:	Ge Gamma Spectrometry
c. Particulates, half-lives > 8 days:	Ge Gamma Spectrometry, Proportional Counter
d. Liquid effluents:	Ge Gamma Spectrometry, Proportional Counter, Liquid Scintillation

5. Batch & Abnormal Release Information	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
a. Liquid Batch Releases						
1. Number of batch releases		23	30	29	12	94
2. Total time period for batch releases	minutes	9274	17354	13410	12069	52107
3. Maximum time period for a batch release	minutes	253	4340	4044	3630	4340
4. Average time period for batch releases	minutes	403	578	462	1006	554
5. Minimum time period for a batch release	minutes	198	61	197	63	61
6. Average river flow during release periods	cuft/sec	55828	57123	22003	28232	40796
b. Gaseous Batch Releases						
1. Number of batch releases		10	21	16	13	60
2. Total time period for batch releases	minutes	872	17178	7635	4957	30643
3. Maximum time period for a batch release	minutes	500	5425	3480	2633	5425
4. Average time period for batch releases	minutes	87	818	477	381	511
5. Minimum time period for a batch release	minutes	79	0.37	0.25	51	0
c. Abnormal Liquid Releases						
1. Number of releases		NONE	NONE	NONE	NONE	NONE
2. Total activity released	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
d. Abnormal Gaseous Releases						
1. Number of releases		NONE	NONE	1	NONE	1
2. Total activity released	Curies	0.00E+00	0.00E+00	6.98E+03	0.00E+00	6.98E+03

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1A

Gaseous Effluents - Summation Of All Releases

	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year	Total Error, %
A. Fission & Activation Gases							
1. Site Total release	Ci	0.00E+00	4.18E+00	8.28E-02	6.63E-01	4.93E+00	26.5%
1a. Unit 1 Gases	Ci	0.00E+00	2.09E+00	4.14E-02	3.32E-01	2.47E+00	
1b. Unit 2 Gases	Ci	0.00E+00	2.09E+00	4.14E-02	3.32E-01	2.47E+00	
2. Average release rate for period	uCi/sec	0.00E+00	5.31E-01	1.05E-02	8.42E-02	1.56E-01	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	
B. Iodines							
1. Site Total Iodine - 131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	28.3%
1a. Unit 1 Iodine - 131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1b. Unit 2 Iodine - 131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	
C. Particulates							
1. Particulates with half-lives > 8 days	Ci	5.47E-05	3.43E-04	2.72E-05	2.44E-04	6.70E-04	30.0%
1a. Unit 1 Particulates	Ci	5.47E-05	3.43E-04	1.20E-05	4.54E-06	4.14E-04	
1b. Unit 2 Particulates	Ci	0.00E+00	2.23E-07	1.52E-05	2.40E-04	2.55E-04	
2. Average release rate for period	uCi/sec	6.94E-06	4.36E-05	3.46E-06	3.10E-05	2.12E-05	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	
D. Gross Alpha							
1. Site Gross alpha radioactivity	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	30.0%
1a. Unit 1 Gross alpha	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1b. Unit 2 Gross alpha	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
2. Average release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	
E. Tritium							
1. Site Total release	Ci	1.25E+00	9.44E-01	5.33E-01	2.20E-01	2.95E+00	32.9%
1a. Unit 1 Tritium	Ci	3.59E-01	4.39E-01	2.29E-01	1.27E-01	1.15E+00	
1b. Unit 2 Tritium	Ci	8.92E-01	5.04E-01	3.04E-01	9.34E-02	1.79E+00	
2. Average release rate for period	uCi/sec	1.59E-01	1.20E-01	6.76E-02	2.79E-02	9.35E-02	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	
F. Carbon-14							
1. Site Total release	Ci	3.43E+00	9.23E+00	1.55E+00	2.33E+00	1.65E+01	41.1%
1a. Unit 1 Carbon-14	Ci	1.98E+00	7.77E+00	4.12E-01	3.67E-01	1.05E+01	
1b. Unit 2 Carbon-14	Ci	1.45E+00	1.46E+00	1.14E+00	1.97E+00	6.01E+00	
2. Average release rate for period	uCi/sec	4.36E-01	1.17E+00	1.97E-01	2.96E-01	5.25E-01	
3. Percent of applicable limit	%	N/A	N/A	N/A	N/A	N/A	

N/A = Not Applicable

The amount of time (in seconds) used to calculate the release rates specified in A.2, B.2, C.2, D.2 and E.2 is the average amount of seconds per calendar quarter (7.88E+06 seconds).

Radioactive Effluent Release Report

Calendar Year - 2015

Table 1B-EB

Gaseous Effluents - Elevated Batch Releases

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
1. Fission gases						
argon-41	Ci	LLD	3.91E+00	3.64E-02	6.48E-01	4.59E+00
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	3.24E-03	5.70E-04	LLD	3.81E-03
krypton-87	Ci	LLD	9.35E-03	LLD	LLD	9.35E-03
krypton-88	Ci	LLD	1.00E-02	LLD	LLD	1.00E-02
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	3.57E-02	1.91E-02	LLD	5.48E-02
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	3.44E-02	1.38E-02	4.17E-03	5.24E-02
xenon-135m	Ci	LLD	2.39E-04	2.73E-03	1.11E-02	1.41E-02
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	4.00E+00	7.26E-02	6.63E-01	4.74E+00
2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND
3. Particulates						
chromium-51	Ci	LLD	LLD	LLD	LLD	LLD
manganese-54	Ci	LLD	LLD	LLD	LLD	LLD
iron-59	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	LLD	LLD	2.21E-05	LLD	2.21E-05
cobalt-60	Ci	LLD	LLD	LLD	LLD	LLD
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
molybdenum-99	Ci	LLD	LLD	LLD	LLD	LLD
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	2.21E-05	ND	2.21E-05

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1B-EC

Gaseous Effluents - Elevated Continuous Releases

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
1. Fission gases						
argon-41	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	LLD	LLD	LLD	LLD
krypton-87	Ci	LLD	LLD	LLD	LLD	LLD
krypton-88	Ci	LLD	LLD	LLD	LLD	LLD
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	1.82E-01	1.02E-02	LLD	1.92E-01
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	1.82E-01	1.02E-02	ND	1.92E-01
2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND
3. Particulates						
chromium-51	Ci	LLD	LLD	LLD	LLD	LLD
manganese-54	Ci	LLD	LLD	LLD	LLD	LLD
iron-59	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	LLD	LLD	LLD	8.00E-06	8.00E-06
cobalt-60	Ci	LLD	LLD	LLD	LLD	LLD
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
zirconium/niobium-95	Ci	LLD	LLD	1.94E-06	LLD	1.94E-06
molybdenum-99	Ci	LLD	LLD	LLD	LLD	LLD
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
cerium-144	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	4.45E-07	LLD	1.08E-06	1.52E-06
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	4.45E-07	1.94E-06	9.08E-06	1.15E-05

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Unit 1

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1C-GB1

Gaseous Effluents - Ground Level Batch Releases (Unit 1)

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
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1. Fission gases						
argon-41	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	LLD	LLD	LLD	LLD
krypton-87	Ci	LLD	LLD	LLD	LLD	LLD
krypton-88	Ci	LLD	LLD	LLD	LLD	LLD
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND

2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND

3. Particulates						
chromium-51	Ci	LLD	LLD	LLD	LLD	LLD
manganese-54	Ci	LLD	LLD	LLD	LLD	LLD
iron-59	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-60	Ci	LLD	LLD	LLD	LLD	LLD
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
molybdenum-99	Ci	LLD	LLD	LLD	LLD	LLD
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
cerium-144	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Unit 1

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1C-GC1

Gaseous Effluents - Ground Level Continuous Releases (Unit 1)

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
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1. Fission gases						
argon-41	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	LLD	LLD	LLD	LLD
krypton-87	Ci	LLD	LLD	LLD	LLD	LLD
krypton-88	Ci	LLD	LLD	LLD	LLD	LLD
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND

2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND

3. Particulates						
chromium-51	Ci	LLD	LLD	LLD	LLD	LLD
manganese-54	Ci	LLD	LLD	LLD	LLD	LLD
iron-59	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	5.47E-05	2.16E-04	LLD	LLD	2.71E-04
cobalt-60	Ci	LLD	2.73E-05	LLD	LLD	2.73E-05
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
zirconium/niobium-95	Ci	LLD	9.96E-05	LLD	LLD	9.96E-05
molybdenum-99	Ci	LLD	LLD	LLD	LLD	LLD
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
cerium-144	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	5.47E-05	3.43E-04	ND	ND	3.98E-04

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Unit 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1C-GB2

Gaseous Effluents - Ground Level Batch Releases (Unit 2)

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
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1. Fission gases						
argon-41	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	LLD	LLD	LLD	LLD
krypton-87	Ci	LLD	LLD	LLD	LLD	LLD
krypton-88	Ci	LLD	LLD	LLD	LLD	LLD
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND

2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND

3. Particulates						
beryllium-7	Ci	LLD	LLD	LLD	LLD	LLD
chromium-51	Ci	LLD	LLD	LLD	LLD	LLD
manganese-54	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-60	Ci	LLD	LLD	LLD	LLD	LLD
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
zirconium/niobium-97	Ci	LLD	LLD	LLD	LLD	LLD
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
cerium-144	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Unit 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 1C-GC2

Gaseous Effluents - Ground Level Continuous Releases (Unit 2)

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
1. Fission gases						
argon-41	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85	Ci	LLD	LLD	LLD	LLD	LLD
krypton-85m	Ci	LLD	LLD	LLD	LLD	LLD
krypton-87	Ci	LLD	LLD	LLD	LLD	LLD
krypton-88	Ci	LLD	LLD	LLD	LLD	LLD
xenon-131m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133	Ci	LLD	LLD	LLD	LLD	LLD
xenon-133m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135	Ci	LLD	LLD	LLD	LLD	LLD
xenon-135m	Ci	LLD	LLD	LLD	LLD	LLD
xenon-138	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	ND	ND	ND
2. Iodines						
iodine-131	Ci	LLD	LLD	LLD	LLD	LLD
iodine-133	Ci	LLD	LLD	LLD	LLD	LLD
iodine-135	Ci	LLD	LLD	LLD	LLD	LLD
Total for period	Ci	ND	ND	ND	ND	ND
3. Particulates						
chromium-51	Ci	LLD	LLD	LLD	4.02E-05	4.02E-05
manganese-54	Ci	LLD	LLD	LLD	1.58E-06	1.58E-06
iron-59	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-57	Ci	LLD	LLD	LLD	LLD	LLD
cobalt-58	Ci	LLD	LLD	3.21E-06	1.78E-04	1.81E-04
cobalt-60	Ci	LLD	LLD	LLD	1.53E-05	1.53E-05
zinc-65	Ci	LLD	LLD	LLD	LLD	LLD
strontium-89	Ci	LLD	LLD	LLD	LLD	LLD
strontium-90	Ci	LLD	LLD	LLD	LLD	LLD
zirconium/niobium-95	Ci	LLD	LLD	LLD	LLD	3.52E-05
cesium-134	Ci	LLD	LLD	LLD	LLD	LLD
cesium-137	Ci	LLD	LLD	LLD	LLD	LLD
barium/lanthanum-140	Ci	LLD	LLD	LLD	LLD	LLD
cerium-141	Ci	LLD	LLD	LLD	LLD	LLD
cerium-144	Ci	LLD	LLD	LLD	LLD	LLD
selenium-75	Ci	LLD	LLD	LLD	LLD	LLD
unidentified	Ci	NONE	NONE	NONE	NONE	NONE
Total for period	Ci	ND	ND	3.21E-06	2.35E-04	2.38E-04

LLD = Below the Lower Limit of Detectability, in uCi/cc (Table 4).

ND = None Detected

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 2A

Liquid Effluents - Summation Of All Releases

	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year	Total Error, %
A. Fission & activation products							
1. Total release (excl. H-3, gas & alpha)	Ci	3.40E-02	1.02E-01	4.18E-02	5.73E-02	2.35E-01	26.1%
2. Average diluted concentration	uCi/ml	7.75E-09	2.14E-08	8.29E-09	1.25E-08	1.25E-08	
3. Percent of applicable limit	%	1.36E+00	4.09E+00	1.67E+00	2.29E+00	2.35E+00	
B. Tritium							
1. Total release	Ci	3.90E+02	6.95E+02	2.54E+02	1.73E+02	1.51E+03	25.0%
2. Average diluted concentration	uCi/ml	8.87E-05	1.45E-04	5.04E-05	3.77E-05	8.04E-05	
3. Percent of applicable limit	%	8.87E-01	1.45E+00	5.04E-01	3.77E-01	8.04E-01	
C. Dissolved and entrained gases							
1. Total release	Ci	ND	ND	ND	4.91E-05	4.91E-05	27.0%
2. Average diluted concentration	uCi/ml				1.07E-11	2.61E-12	
3. Percent of applicable limit	%				5.35E-06	1.31E-06	
D. Gross alpha radioactivity (total release)							
	Ci	LLD	LLD	LLD	LLD	LLD	28.9%
E. Volume of waste released (prior to dilution)							
	liters	1.29E+07	1.41E+07	1.38E+07	1.32E+07	5.40E+07	11.2%
F. Volume of dilution water used							
	liters	4.38E+09	4.78E+09	5.02E+09	4.58E+09	1.88E+10	22.9%

LLD = Below the Lower Limit of Detectability, in uCi/ml (Table 4)

A.3 is based on a historical PA-DEP guide of 10 Ci/yr

B.3 is based on a ODCM limit of 1.00E-2 uCi/ml

C.3 is based on a ODCM limit of 2.00E-04 uCi/ml

The values listed at F. are the volumes during actual liquid waste discharge periods. The total dilution volume for a continuous calendar quarter is approximately 1E+10 liters for BVPS-1 & 2 (ie.; ~ 22,800 gpm is the total dilution flowrate from the site)

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 2B-B

Liquid Effluents - Batch Releases

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
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1. Fission and activation products

beryllium-7	CI	LLD	LLD	LLD	LLD	LLD
sodium-24	CI	LLD	LLD	LLD	LLD	LLD
chromium-51	CI	1.07E-03	3.14E-03	1.11E-03	2.01E-03	7.33E-03
manganese-54	CI	4.18E-05	4.92E-04	2.84E-04	1.98E-04	1.02E-03
iron-55	CI	6.88E-03	LLD	1.85E-03	7.47E-03	1.62E-02
iron-59	CI	LLD	LLD	LLD	6.98E-05	6.98E-05
cobalt-57	CI	1.15E-05	2.35E-05	1.26E-05	3.10E-05	7.86E-05
cobalt-58	CI	8.60E-04	1.38E-02	2.69E-03	1.42E-02	3.16E-02
cobalt-60	CI	1.07E-03	7.84E-03	5.99E-03	3.67E-03	1.86E-02
nickel-63	CI	8.44E-04	LLD	LLD	LLD	8.44E-04
zinc-65	CI	LLD	1.95E-02	LLD	LLD	1.95E-02
strontium-89	CI	2.97E-04	LLD	LLD	LLD	2.97E-04
strontium-90	CI	LLD	LLD	LLD	LLD	LLD
zirconium/niobium-95	CI	LLD	2.24E-03	1.27E-04	6.75E-04	3.04E-03
zirconium/niobium-97	CI	LLD	LLD	LLD	LLD	LLD
molybdenum-99/technetium-99m	CI	LLD	LLD	LLD	LLD	LLD
rhodium-105	CI	LLD	LLD	LLD	LLD	LLD
ruthenium-106	CI	LLD	LLD	3.32E-05	LLD	3.32E-05
tin-113	CI	LLD	LLD	LLD	3.83E-05	3.83E-05
tin-117m	CI	LLD	LLD	LLD	5.68E-05	5.68E-05
tin-125	CI	LLD	LLD	LLD	LLD	LLD
silver-110m	CI	LLD	1.20E-03	2.19E-03	9.03E-04	4.29E-03
antimony-122	CI	LLD	LLD	LLD	5.49E-05	5.49E-05
antimony-124	CI	2.26E-02	2.48E-03	9.59E-04	5.79E-04	2.66E-02
antimony-125	CI	1.77E-04	5.13E-02	2.64E-02	2.71E-02	1.05E-01
antimony-126	CI	LLD	LLD	LLD	LLD	LLD
iodine-131	CI	LLD	LLD	LLD	LLD	LLD
iodine-133	CI	LLD	LLD	LLD	LLD	LLD
cesium-134	CI	LLD	LLD	LLD	LLD	LLD
cesium-137	CI	1.87E-04	3.09E-04	1.16E-04	2.10E-04	8.22E-04
barium/lanthanum-141	CI	LLD	LLD	LLD	LLD	LLD
cerium-141	CI	LLD	LLD	LLD	LLD	LLD
cerium-144	CI	LLD	LLD	LLD	LLD	LLD
unidentified	CI	NONE	NONE	NONE	NONE	NONE
Total for period	CI	3.40E-02	1.02E-01	4.18E-02	5.73E-02	2.35E-01

2. Dissolved and entrained gases

Argon-41	CI	LLD	LLD	LLD	LLD	LLD
krypton-85	CI	LLD	LLD	LLD	LLD	LLD
xenon-133	CI	LLD	LLD	LLD	4.91E-05	4.91E-05
xenon-133m	CI	LLD	LLD	LLD	LLD	LLD
xenon-135	CI	LLD	LLD	LLD	LLD	LLD
carbon-14	CI	N/A	N/A	N/A	N/A	LLD
unidentified	CI	NONE	NONE	NONE	NONE	NONE
Total for period	CI	ND	ND	ND	4.91E-05	4.91E-05

LLD = Below the Lower Limit of Detectability, in uCi/ml (Table 4)

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 2B-C

Liquid Effluents - Continuous Releases

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Calendar Year
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1. Fission and activation products

beryllium-7	CI	N/A	N/A	N/A	N/A	N/A
sodium-24	CI	N/A	N/A	N/A	N/A	N/A
chromium-51	CI	N/A	N/A	N/A	N/A	N/A
manganese-54	CI	N/A	N/A	N/A	N/A	N/A
iron-55	CI	N/A	N/A	N/A	N/A	N/A
iron-59	CI	N/A	N/A	N/A	N/A	N/A
cobalt-57	CI	N/A	N/A	N/A	N/A	N/A
cobalt-58	CI	N/A	N/A	N/A	N/A	N/A
cobalt-60	CI	N/A	N/A	N/A	N/A	N/A
zinc-65	CI	N/A	N/A	N/A	N/A	N/A
strontium-89	CI	N/A	N/A	N/A	N/A	N/A
strontium-90	CI	N/A	N/A	N/A	N/A	N/A
zirconium/niobium-95	CI	N/A	N/A	N/A	N/A	N/A
zirconium/niobium-97	CI	N/A	N/A	N/A	N/A	N/A
molybdenum-99	CI	N/A	N/A	N/A	N/A	N/A
technetium-99m	CI	N/A	N/A	N/A	N/A	N/A
ruthenium-103	CI	N/A	N/A	N/A	N/A	N/A
silver-110m	CI	N/A	N/A	N/A	N/A	N/A
antimony-124	CI	N/A	N/A	N/A	N/A	N/A
antimony-125	CI	N/A	N/A	N/A	N/A	N/A
iodine-131	CI	N/A	N/A	N/A	N/A	N/A
iodine-133	CI	N/A	N/A	N/A	N/A	N/A
cesium-134	CI	N/A	N/A	N/A	N/A	N/A
cesium-137	CI	N/A	N/A	N/A	N/A	N/A
barium/lanthanum-140	CI	N/A	N/A	N/A	N/A	N/A
cerium-141	CI	N/A	N/A	N/A	N/A	N/A
cerium-144	CI	N/A	N/A	N/A	N/A	N/A
unidentified	CI	N/A	N/A	N/A	N/A	N/A
Total for period	CI	N/A	N/A	N/A	N/A	N/A

2. Dissolved and entrained gases

argon-41	CI	N/A	N/A	N/A	N/A	N/A
xenon-133	CI	N/A	N/A	N/A	N/A	N/A
xenon-133m	CI	N/A	N/A	N/A	N/A	N/A
xenon-135	CI	N/A	N/A	N/A	N/A	N/A
carbon-14	CI	N/A	N/A	N/A	N/A	N/A
unidentified	CI	N/A	N/A	N/A	N/A	N/A
Total for period	CI	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable (liquids not discharged in a continuous mode during this period)

Radioactive Effluent Release Report

Calendar Year - 2015

Table 3A

Solid Waste And Irradiated Fuel Shipments (Part 1 of 3)

A. Solid Waste Shipped Offsite For Burial Or Disposal (Not Irradiated fuel)			
1. Type of Waste (Spent resins, Filter Sludges, Evaporator Bottoms, Oil)		1st Half	2nd Half
a. Volume Shipped		9.88E+00 m ³	1.84E+00 m ³
b. Volume Buried		2.08E+00 m ³	2.75E+00 m ³
c. Total Activity		3.41E+02 Ci	9.50E+01 Ci
2. Estimate of Major Nuclide Composition by Type of Waste On This Table (2)		Percent (%)	Percent (%)
H-3		0.04 %	1.10 %
C-14		0.18 %	0.24 %
Mn-54		0.38 %	0.21 %
Fe-55		5.29 %	14.10 %
Co-58		0.01 %	4.24 %
Co-60		16.20 %	11.10 %
Ni-59		0.51 %	0.00 %
Ni-63		75.10 %	59.30 %
Zn-65		0.08 %	0.54 %
Cs-134		0.02 %	0.19 %
Cs-137		0.69 %	6.75 %
Sb-125		1.47 %	1.73 %
Pu-241		0.00 %	0.13 %
3. Number of Shipments		5	1
a. Type of Container Used	LSA	4	1
	Type A	0	0
	Type B	1	0
	Large Quantity	0	0
b. Solidification Agent Used	Cement	0	0
	Urea Formaldehyde	0	0
	None	5	1
c. Mode of Transport	Truck	5	1
	Rail	0	0
d. Final Destination	Erwin, TN	2	1
	Barnwell, SC	1	0
	Oak Ridge, TN	2	0
e. Waste Class per 10 CFR Part 61	Class A	1	0
	Class B	1	1
	Class C	3	0
	> Class C	0	0

(1) Since container volumes are provided by the burial site, a calculational error of zero is assumed.

(2) Percent values for any nuclide that are <0.01 % are not shown on this table. Data is available upon request.

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 3B

Solid Waste And Irradiated Fuel Shipments (Part 2 of 3)

A. Solid Waste Shipped Offsite For Burial Or Disposal (Not irradiated fuel)			
1. Type of Waste (Dry Compressible Waste, Contaminated Equipment, etc.)	1st Half	2nd Half	Estimated Total Error
a. Volume Shipped	3.06E+02 m ³	5.81E+02 m ³	0.0% (1)
b. Volume Buried	1.97E+00 m ³	7.35E+01 m ³	0.0% (1)
c. Total Activity	1.50E-01 Ci	4.10E-01 Ci	30.0%
2. Estimate of Major Nuclide Composition by Type of Waste On This Table (2)	Percent (%)	Percent (%)	
H-3	21.20 %	1.10 %	
C-14	0.02 %	0.24 %	
Cr-51	0.26 %	0.18 %	
Mn-54	1.20 %	0.21 %	
Fe-55	1.13 %	14.10 %	
Co-58	28.90 %	4.24 %	
Co-60	13.60 %	11.10 %	
Ni-59	0.03 %	0.00 %	
Ni-63	16.20 %	59.30 %	
Nb-95	0.56 %	0.51 %	
Zn-65	0.73 %	0.05 %	
Zr-95	0.31 %	0.13 %	
Ag-110m	0.16 %	0.01 %	
Sb-124	0.03 %	0.00 %	
Sb-125	1.10 %	1.75 %	
Sn-113	0.01 %	0.01 %	
Cs-134	0.00 %	0.19 %	
Cs-137	14.20 %	6.75 %	
Ce-144/Pr-144	0.00 %	0.01 %	
3. Number of Shipments	5	10	
a. Type of Container Used	LSA	5	10
	Type A	0	0
	Type B	0	0
	Large Quantity	0	0
b. Solidification Agent Used	Cement	0	0
	Urea Formaldehyde	0	0
	None	5	10
c. Mode of Transport	Truck	5	10
	Rail	0	0
	Other	0	0
d. Final Destination	Oak Ridge, TN	5	10
	Wampum, PA	0	0
e. Waste Class per 10 CFR Part 61	Class A	5	10
	Class B	0	0
	Class C	0	0
	> Class C	0	0

(1) Since container volumes are provided by the burial site, a calculational error of zero is assumed.

(2) Percent values for any nuclide that are <0.01 % are not shown on this table. Data is available upon request.

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 3C

Solid Waste And Irradiated Fuel Shipments (Part 3 of 3)

A. Solid Waste Shipped Offsite For Burial Or Disposal (Not irradiated fuel)				
1. Type of Waste (Irradiated components, Control Rods, etc)		1st Half	2nd Half	Estimated Total Error
a. Volume Shipped		0.00E+00 m3	0.00E+00 m3	0.0% (1)
b. Volume Buried		0.00E+00 m3	0.00E+00 m3	0.0% (1)
c. Total Activity		0.00E+00 Ci	0.00E+00 Ci	0.0%
2. Estimate of Major Nuclide Composition by Type of Waste On This Table (2)		Percent (%)	Percent (%)	
3. Number of Shipments		0	0	
a. Type of Container Used	LSA	0	0	
	Type A	0	0	
	Type B	0	0	
	Large Quantity	0	0	
b. Solidification Agent Used	Cement	0	0	
	Urea Formaldehyde	0	0	
	None	0	0	
c. Mode of Transport	Truck	0	0	
	Rail	0	0	
	Other	0	0	
d. Final Destination	Barnwell, SC	0	0	
	Oak Ridge, TN	0	0	
e. Waste Class per 10 CFR Part 61	Class A	0	0	
	Class B	0	0	
	Class C	0	0	
	> Class C	0	0	
B. No Irradiated Fuel Shipments				

(1) Since container volumes are provided by the burial site, a calculational error of zero is assumed.

(2) Percent values for any nuclide that are <0.01 % are not shown on this table. Data is available upon request.

Radioactive Effluent Release Report

Calendar Year - 2015

Table 4

Lower Limits Of Detectability (LLD)

Nuclide	RWDA-G 1000 cc Gas Grab Sample		RWDA-L 1000 ml Liquid Grab Sample		Filter Paper / Charcoal Continuous Effluent Sample	
	(3) Calculated LLD (uCi/cc)	ODCM Required LLD (uCi/cc)	(3) Calculated LLD (uCi/ml)	ODCM Required LLD (uCi/ml)	(3) Calculated (2) LLD (uCi/cc)	ODCM Required LLD (uCi/cc)
H-3	(4) 1.00E-06	1E-06	1.00E-06	1E-06	-----	-----
Na-24	7.81E-08	1E-04	1.71E-08	5E-07	2.00E-13	1E-11
Ar-41	9.71E-08	1E-04	2.14E-08	5E-07	-----	-----
Cr-51	5.42E-07	1E-04	1.25E-07	5E-07	1.08E-12	1E-11
Mn-54	4.87E-08	1E-04	1.08E-08	5E-07	1.67E-13	1E-11
Fe-55	-----	-----	(1) 1.00E-06	1E-06	-----	-----
Fe-59	1.57E-07	1E-04	3.47E-08	5E-07	5.14E-13	1E-11
Co-57	5.09E-08	1E-04	1.27E-08	5E-07	8.57E-14	1E-11
Co-58	4.16E-08	1E-04	9.26E-09	5E-07	1.64E-13	1E-11
Co-60	5.35E-08	1E-04	1.18E-08	5E-07	2.03E-13	1E-11
Zn-65	1.02E-07	1E-04	2.25E-08	5E-07	3.34E-13	1E-11
Se-75	-----	-----	-----	-----	1.26E-13	1E-11
Kr-85	9.73E-06	1E-04	2.20E-06	1E-05	-----	-----
Kr-85m	5.45E-08	1E-04	1.32E-08	1E-05	-----	-----
Kr-87	9.28E-08	1E-04	2.12E-08	1E-05	-----	-----
Kr-88	1.64E-07	1E-04	3.89E-08	1E-05	-----	-----
Sr-89	-----	-----	(1) 5.00E-08	5E-08	(1) 1.00E-13	1E-11
Sr-90	-----	-----	(1) 5.00E-08	5E-08	(1) 1.00E-14	1E-11
Sr-92	7.13E-08	1E-04	1.56E-08	5E-07	2.82E-13	1E-11
Nb-95	5.62E-08	1E-04	1.25E-08	5E-07	1.27E-13	1E-11
Nb-97	5.10E-08	1E-04	1.15E-08	5E-07	2.14E-13	1E-11
Zr-95	8.70E-08	1E-04	1.95E-08	5E-07	2.79E-13	1E-11
Mo-99	4.63E-08	1E-04	1.14E-08	5E-07	8.66E-14	1E-11
Tc-99m	4.54E-08	1E-04	1.11E-08	5E-07	8.49E-14	1E-11
Ag-110m	4.61E-08	1E-04	1.04E-08	5E-07	2.07E-13	1E-11
Sb-124	4.39E-08	1E-04	9.90E-09	5E-07	1.24E-13	1E-11
Sb-125	1.60E-07	1E-04	3.66E-08	5E-07	2.69E-13	1E-11
I-131	3.98E-08	1E-04	9.14E-09	1E-06	1.08E-13	1E-12
I-133	4.08E-08	1E-04	9.24E-09	5E-07	1.38E-13	1E-10
I-135	2.34E-07	1E-04	5.14E-08	5E-07	8.23E-13	1E-11
Xe-131m	2.25E-06	1E-04	5.41E-07	1E-05	-----	-----
Xe-133	1.19E-07	1E-04	3.36E-08	1E-05	-----	-----
Xe-133m	4.39E-07	1E-04	1.03E-07	1E-05	-----	-----
Xe-135	4.83E-08	1E-04	1.13E-08	1E-05	-----	-----
Xe-135m	1.24E-07	1E-04	2.81E-08	1E-05	-----	-----
Xe-137	6.15E-07	1E-04	1.40E-07	1E-05	-----	-----
Xe-138	2.71E-07	1E-04	6.34E-08	1E-05	-----	-----
Cs-134	4.83E-08	1E-04	1.09E-08	5E-07	1.32E-13	1E-11
Cs-137	5.41E-08	1E-04	1.22E-08	5E-07	2.30E-13	1E-11
Ba-139	2.57E-07	1E-04	6.18E-08	5E-07	5.73E-13	1E-11
Ba-140	1.58E-07	1E-04	3.57E-08	5E-07	3.82E-13	1E-11
La-140	1.21E-07	1E-04	2.64E-08	5E-07	4.05E-13	1E-11
Ce-141	7.60E-08	1E-04	1.85E-08	5E-07	1.31E-13	1E-11
Ce-144	4.24E-07	1E-04	1.05E-07	5E-07	7.17E-13	1E-11
Gross Alpha	-----	-----	(1) 1.00E-07	1E-07	(1) 3.51E-15	1E-11

(1) Sample analyses performed by a contractor laboratory.

(2) These LLD calculations contain a default weekly continuous sample volume of 2.85E+8 cc. Therefore, grab sample LLD values reflect a different volume (ie; 10 cuft or 2.83E+5 cc).

(3) The calculated LLD's, except those denoted by (1), are from a counter/detector calibration on 09/23/15. These values are typical for other counter/detectors used for effluent counting at BVPS.

(4) Based on counting 50 ml of the water that was bubbled through a 20 liter air sample.

Beaver Valley Power Station - Unit 1

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 5A

Assessment Of Radiation Doses

Unit 1 Liquid Effluents											
		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Calendar Year	
Batch Releases		Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit
O R G A N	Bone	7.84E-03	0.1568	3.77E-03	0.0753	1.38E-03	0.0276	2.69E-03	0.0538	1.57E-02	0.1567
	Liver	1.22E-02	0.2431	1.74E-02	0.3486	1.11E-02	0.2227	1.21E-02	0.2419	5.28E-02	0.5281
	Total Body	1.08E-02	0.7202	1.55E-02	1.0356	1.06E-02	0.7057	1.10E-02	0.7320	4.79E-02	1.5967
	Thyroid	8.39E-03	0.1679	1.19E-02	0.2375	9.72E-03	0.1944	8.38E-03	0.1675	3.84E-02	0.3836
	Kidney	9.53E-03	0.1906	1.39E-02	0.2775	1.00E-02	0.2000	9.59E-03	0.1919	4.30E-02	0.4300
	Lung	8.79E-03	0.1758	1.24E-02	0.2489	9.69E-03	0.1938	8.78E-03	0.1757	3.97E-02	0.3971
(1)	GI-LLI	8.98E-03	0.1797	1.53E-02	0.3064	1.07E-02	0.2147	1.16E-02	0.2328	4.67E-02	0.4668

Unit 1 Gaseous Effluents											
		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Calendar Year	
Batch & Continuous Releases		Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit
(2)	Gamma Air	0.00E+00	0.0000	1.04E-05	0.0002	1.99E-06	0.0000	8.31E-07	0.0000	1.32E-05	0.0001
(2)	Beta Air	0.00E+00	0.0000	1.80E-08	0.0000	3.93E-09	0.0000	1.37E-09	0.0000	2.33E-08	0.0000
O R G A N	Bone	0.00E+00	0.0000	4.92E-04	0.0066	1.35E-07	0.0000	3.42E-09	0.0000	4.93E-04	0.0033
	Liver	6.23E-03	0.0831	1.19E-02	0.1586	8.78E-03	0.1171	2.45E-03	0.0327	2.93E-02	0.1957
	Total Body	6.23E-03	0.0831	1.19E-02	0.1592	8.78E-03	0.1171	2.45E-03	0.0327	2.94E-02	0.1960
	Thyroid	6.23E-03	0.0831	1.19E-02	0.1583	8.78E-03	0.1171	2.45E-03	0.0327	2.93E-02	0.1955
	Kidney	6.23E-03	0.0831	1.19E-02	0.1583	8.78E-03	0.1171	2.45E-03	0.0327	2.93E-02	0.1955
	Lung	6.23E-03	0.0831	1.25E-02	0.1672	8.78E-03	0.1171	2.45E-03	0.0327	3.00E-02	0.2000
(3)	GI-LLI	6.23E-03	0.0831	1.23E-02	0.1634	8.78E-03	0.1171	2.45E-03	0.0327	2.97E-02	0.1981

(1) These doses are listed in mrem; they are calculated for the maximum individual for all batch liquid effluents

(2) These doses are listed in mrad; they are calculated at the site boundary for batch & continuous gaseous effluents (0.4 miles NW)

(3) These doses are listed in mrem; they are calculated for the most likely exposed real individual (child) via all real pathways at 0.89 miles NW.

Limits used for calculation of percent (%) are from ODCM procedure 1/2-ODC-3.03, Attachment H Control 3.11.1.2, Attachment L Control 3.11.2.2, and Attachment M Control 3.11.2.3 (considered to be the design objectives).

Beaver Valley Power Station - Unit 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 5B

Assessment Of Radiation Doses

		Unit 2 Liquid Effluents									
		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Calendar Year	
Batch Releases		Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit
O R G A N (1)	Bone	7.84E-03	0.1568	3.77E-03	0.0753	1.38E-03	0.0276	2.69E-03	0.0538	1.57E-02	0.1567
	Liver	1.22E-02	0.2431	1.74E-02	0.3486	1.11E-02	0.2227	1.21E-02	0.2419	5.28E-02	0.5281
	Total Body	1.08E-02	0.7202	1.55E-02	1.0356	1.06E-02	0.7057	1.10E-02	0.7320	4.79E-02	1.5967
	Thyroid	8.39E-03	0.1679	1.19E-02	0.2375	9.72E-03	0.1944	8.38E-03	0.1675	3.84E-02	0.3836
	Kidney	9.53E-03	0.1906	1.39E-02	0.2775	1.00E-02	0.2000	9.59E-03	0.1919	4.30E-02	0.4300
	Lung	8.79E-03	0.1758	1.24E-02	0.2489	9.69E-03	0.1938	8.78E-03	0.1757	3.97E-02	0.3971
	GI-LLI	8.98E-03	0.1797	1.53E-02	0.3064	1.07E-02	0.2147	1.16E-02	0.2328	4.67E-02	0.4668

		Unit 2 Gaseous Effluents									
		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Calendar Year	
Batch & Continuous Releases		Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit	Dose	% of ODCM Limit
(2)	Gamma Air	0.00E+00	0.0000	7.32E-07	0.0000	1.99E-06	0.0000	8.31E-07	0.0000	3.55E-06	0.0000
(2)	Beta Air	0.00E+00	0.0000	3.38E-09	0.0000	3.93E-09	0.0000	1.37E-09	0.0000	8.68E-09	0.0000
O R G A N (3)	Bone	0.00E+00	0.0000	0.00E+00	0.0000	1.35E-07	0.0000	8.19E-07	0.0000	9.54E-07	0.0000
	Liver	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576
	Total Body	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576
	Thyroid	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576
	Kidney	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576
	Lung	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576
	GI-LLI	1.14E-02	0.1526	6.92E-03	0.0922	1.01E-02	0.1347	5.52E-02	0.7357	8.36E-02	0.5576

(1) These doses are listed in mrem; they are calculated for the maximum individual for all batch liquid effluents

(2) These doses are listed in mrad; they are calculated at the site boundary for batch & continuous gaseous effluents (0.4 miles NW)

(3) These doses are listed in mrem; they are calculated for the most likely exposed real individual (child) via all real pathways at 0.89 miles NW.

Limits used for calculation of percent (%) are from ODCM procedure 1/2-ODC-3.03, Attachment H Control 3.11.1.2, Attachment L Control 3.11.2.2, and Attachment M Control 3.11.2.3 (considered to be the design objectives).

Beaver Valley Power Station - Units 1 & 2**Enclosure 2, Page 18 of 21****Radioactive Effluent Release Report****Calendar Year - 2015****Table 6****Effluent Monitoring Instrumentation Channels Not Returned To Operable Status Within 30 Days**

There were several Effluent Monitoring Instrumentation Channels that were not returned to operable status within 30 days.

1) Unit 1 Process Vent Monitor, RM-GW-109 - On 04/01/2015 RM-1GW-109 was removed from service due to monitor failing to give proper indications for HI-HI alarms in the control room. The thirty (30) day return to service criteria was exceeded due to a defective Kurtz flowmeter and reordering the part. The monitor was returned to service on 5/13/2015 (reference CR-2015-06087 & CR-2015-06200).

2) Unit 1 Main Steam Relief Effluent Monitor, RM-1MS-100B - On 07/17/2015 RM-1MS-100B was removed from service due to invalid High-High alarms. The thirty (30) day return to service criteria was exceeded due to unexpected spiking. The monitor was returned to service on 11/17/2015 (reference CR-2015-09731, CR-2015-10933, & CR-2015-11078).

3) Unit 1 Ventilation Vent, RM-1VS-101B - On 06/17/2015 RM-1VS-101B was removed from service due to repeated loss of process flow alarms. The thirty (30) day return to service criteria was exceeded due to extended wait time for parts. The monitor was returned to service on 11/23/2015 (reference CR-2015-09725 & CR-2015-09750).

4) Unit 2 Condensate Polishing Building Vent Monitor, 2HVL-RQ112 - On 04/22/2015 2HVL-RQ112 was removed from service due to sample pumps not rotating. The thirty (30) day return to service criteria was exceeded due to radiation monitor not being listed on the daily status report and not deeming it a priority. The monitor was returned to service on 06/03/2015 (reference CR-2015-07757 & CR-2015-07790).

5) Unit 2 SLCRS Effluent Vent Monitor, 2HVS-RQ109 - On 07/21/2015 2HVS-RQ109 was removed from service due to repeated loss of process flow alarms. The thirty (30) day return to service criteria was exceeded due to sample pump failure and replacement was obsolete. The monitor was returned to service on 09/23/2015 (reference CR-2015-09851 & CR-2015-11081).

Radioactive Effluent Release Report

Calendar Year - 2015

Table 7

Total Dose Commitments, Total Effective Dose Equivalents and Population Doses

Total Dose Commitment From All Facility Releases To Members of the Public 40 CFR 190.10(a) Environmental Doses				
Organ	(1) Effluent Dose (mrem)	(2) Direct Radiation Dose (mrem)	Total Dose (mrem)	% of ODCM or 40 CFR 190 Limit
Bone	3.18E-02	0.00E+00	3.18E-02	0.13%
Liver	2.19E-01	0.00E+00	2.19E-01	0.87%
Total Body	2.09E-01	0.00E+00	2.09E-01	0.84%
Thyroid	1.90E-01	0.00E+00	1.90E-01	0.25%
Kidney	1.99E-01	0.00E+00	1.99E-01	0.80%
Lung	1.93E-01	0.00E+00	1.93E-01	0.77%
GI-LLI	2.07E-01	0.00E+00	2.07E-01	0.83%
<p>(1) The cumulative dose contributions from liquid and gaseous effluents were determined in accordance with the applicable CONTROLS & SURVEILLANCE REQUIREMENTS listed in ODCM procedure 1/2-ODC-3.03. The dose commitment limits for 40 CFR 190 MEMBERS OF THE PUBLIC (ODCM 1/2-ODC-3.03 Control 3.11.4.1) are as follows:</p> <p>a) ≤ 25 mrem / calendar year (for the total body, or any organ except the thyroid)</p> <p>b) ≤ 75 mrem / calendar year (for the thyroid)</p>				
<p>(2) The dose contribution listed for the total body is for Direct Radiation. This was calculated by comparing offsite TLD exposure at the ODCM controlling location (0.8 miles NW; Midland, PA) to TLD exposure at the REMP control location (16.5 miles SSW; Weirton, WV).</p>				

Compliance to 100 mrem Limit of 10 CFR 20.1301 For Total Effective Dose Equivalent

Pursuant to 10 CFR 20.1301(a)(1), the Total Effective Dose Equivalent from licensed operation to the maximum individual during the report period, is **5.38 mrem**. This is a summation of Direct Radiation Exposure (calculated by comparing the maximum of all perimeter TLD exposures to TLD exposure at the REMP control location) plus Effluent Doses (calculated per the ODCM).

Members of the Public Doses Due To Their Activities Inside The Site Boundary

The radiation doses for MEMBER(S) OF THE PUBLIC due to their activities inside the site boundary are not greater than the doses listed in this table to show compliance with 40 CFR Part 190 or 10 CFR 20.1301. Evaluations have shown that exposure time for individuals not occupationally associated with the plant site is minimal in comparison to the exposure time considered for the dose calculation at or beyond the site boundary. Therefore, a separate assessment of radiation doses from radioactive effluents to MEMBER(S) OF THE PUBLIC, due to their activities inside the site boundary, is not necessary for this report period.

0-50 Mile Population Doses From Liquid and Gaseous Effluents

0-50 mile Total Population Dose from liquid and gaseous effluents = **182 man-mrem (Total Body)**
 0-50 mile Average Population Dose from liquid and gaseous effluents = **0.0000454 man-mrem (Total Body)**

Beaver Valley Power Station - Units 1 & 2

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Radioactive Effluent Release Report

Calendar Year - 2015

Table 8

Offsite Dose Calculation Manual Surveillance Deficiencies

There were two (2) Offsite Dose Calculation Manual Surveillance Deficiencies during the reporting period 2015.

1) In October, cable vault sump, or fire sump, was discharged. Two independent samples were obtained by Radiation Protection and no isotopes were identified. However, the samples were discarded before Chemistry could analyze them for tritium. The discharge was documented and based on the tritium from the most recent fire sump discharge in September (reference CR-2015-15884).

2) In November, 2RMQ-RQ303 went OOS as a result of a sample pump seizing. During this period, one of the two grab samples of the day were missed, due to miscommunication within Radiation Protection. This missed sample was documented (reference CR-2015-14399 & CR-2015-15523)

Radioactive Effluent Release Report

Calendar Year - 2015

Table 9

Unit 1 and 2 Offsite Dose Calculation Manual Changes (Description)

There was one change made to the ODCM during the report period. See ODCM procedure 1/2-ODC-1.01, "ODCM: Index, Matrix and History ODCM Changes" for a complete description of the change and the change justification. A brief description of the change is as follows:

Change (38) to the ODCM (Effective January 2015)

1) Procedure 1/2-ODC-1.01, "ODCM: Index, Matrix and History of ODCM Changes" (Rev 20)

Updated the History of ODCM changes to include this change.

2) Procedure 1/2-ODC-2.01, "ODCM: Liquid Effluents" (Rev 15)

Added clarification for mixing factors and corrected values for barium-137m (Ba-137m).

3) Procedure 1/2-ODC-2.02, "ODCM: Gaseous Effluents" (Rev 6)

Reference, efficiencies, and setpoints for Eberline SPING radiation monitors were removed and replaced by for new Mirion monitors

4) Procedure 1/2-ODC-3.02, "ODCM: Bases for ODCM Controls" (Rev 3)

Updated the reference for 10 CFR Part 20

5) Procedure 1/2-ODC-3.03, "ODCM: Controls for RETS and REMP programs" (Rev 13)

Reference, efficiencies, and setpoints for Eberline SPING radiation monitors were removed and replaced by for new Mirion monitors

ENCLOSURE 2, ATTACHMENT 1

Beaver Valley Power Station - Units 1 & 2

Radioactive Effluent Release Report

Calendar Year - 2015

Attachment 1

Joint Frequency Distribution Tables

Attachment 1
As specified in the ODCM, an annual summary of hourly meteorological data (in the form of joint frequency distribution) is provided for the calendar year. In summary, the joint frequency distribution data is similar to previous years and close to long-term normals.

Meteorological Data Recovery
The Meteorological Data Recovery for the calendar year met the minimum requirement of at least 90% (as specified in Section 5 of Revision 1 to Regulatory Guide 1.23, Meteorological Monitoring Programs for Nuclear Power Plants). The actual Meteorological Data Recovery is shown in the following table:
PERCENT RECOVERY OF INDIVIDUAL METEOROLOGICAL PARAMETERS
99.7% = Wind Speed 35'
99.3% = Wind Speed 150'
99.7% = Wind Speed 500'
99.7% = Wind Direction 35'
99.7% = Wind Direction 150'
93.9% = Wind Direction 500'
97.9% = Delta Temperature (150' - 35') 1P
99.1% = Delta Temperature (500' - 35') 2P
99.2% = Temperature 35'
99.7% = Precipitation
98.8% = Average Recovery of Individual Meteorological Parameters
PERCENT RECOVERY OF COMPOSITE VARIABLES
97.8% = Wind Speed 35', Wind Direction 35', Delta Temperature 1P
97.4% = Wind Speed 150', Wind Direction 150', Delta Temperature 1P
93.4% = Wind Speed 500', Wind Direction 500', Delta Temperature 2P
97.9% = Average Recovery of Composite Variables

Attachment 1 Clarification
Hourly meteorological data is not provided for specific periods of Abnormal Gaseous Release during the calendar quarters (as indicated in Regulatory Guide 1.21), for the following reasons:
1) All routine Gaseous Releases for the calendar year were determined to be within design objectives, in which, the ODCM Dose Limits and the ODCM Dose Rate Limits are considered to be the design objectives.
2) There was Abnormal Gaseous Releases during the calendar year, but it did not exceed design objective
For a copy of the hourly meteorological data during the calendar quarters, contact Patrick Seidel at 724-682-4255.

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

Page 1 of 8

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P

Direction: DI35P

Lapse: DT150-35

Stability Class A

Delta Temperature Extremely Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	27	35	2	0	0	0	64
NNE	20	13	1	0	0	0	34
NE	36	17	0	0	0	0	53
ENE	50	25	1	0	0	0	76
E	33	18	0	0	0	0	51
ESE	21	9	0	0	0	0	30
SE	22	6	0	0	0	0	28
SSE	12	8	0	0	0	0	20
S	7	18	0	0	0	0	25
SSW	4	51	5	0	0	0	60
SW	9	75	41	1	0	0	126
WSW	17	109	38	0	0	0	164
W	28	144	26	0	0	0	198
WNW	27	78	7	0	0	0	112
NW	24	45	4	0	0	0	73
NNW	20	28	7	0	0	0	55
Total	357	679	132	1	0	0	1169

Calm Hours not Included above for :

Total Period

106

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

193

Valid Hours for this Stability Class for:

Total Period

1169

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

Page 2 of 8

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2015 00:00 - 12/31/2015 23:00
Elevation: SP35P **Speed:** SP35P **Direction:** DI35P **Lapse:** DT150-35
Stability Class B **Delta Temperature** Moderately Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	6	6	0	0	0	0	12
NNE	6	2	0	0	0	0	8
NE	5	1	0	0	0	0	6
ENE	2	2	0	0	0	0	4
E	5	1	0	0	0	0	6
ESE	1	0	0	0	0	0	1
SE	3	0	0	0	0	0	3
SSE	1	1	0	0	0	0	2
S	4	1	0	0	0	0	5
SSW	2	6	0	0	0	0	8
SW	3	16	14	0	0	0	33
WSW	3	22	7	0	0	0	32
W	11	17	7	0	0	0	35
WNW	4	13	2	0	0	0	19
NW	7	9	2	0	0	0	18
NNW	9	10	1	0	0	0	20
Total	72	107	33	0	0	0	212

Calm Hours not Included above for :

Total Period

106

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

193

Valid Hours for this Stability Class for:

Total Period

212

Total Hours for Period

8760

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P

Direction: DI35P

Lapse: DT150-35

Stability Class C

Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	8	8	0	0	0	0	16
NNE	3	3	0	0	0	0	6
NE	6	2	0	0	0	0	8
ENE	7	3	0	0	0	0	10
E	5	1	0	0	0	0	6
ESE	3	1	0	0	0	0	4
SE	3	0	0	0	0	0	3
SSE	3	0	0	0	0	0	3
S	2	4	0	0	0	0	6
SSW	3	10	1	0	0	0	14
SW	5	16	4	2	0	0	27
WSW	4	17	7	2	0	0	30
W	10	30	4	0	0	0	44
WNW	3	14	2	0	0	0	19
NW	6	18	2	0	0	0	26
NNW	2	11	1	0	0	0	14
Total	73	138	21	4	0	0	236

Calm Hours not Included above for :

Total Period

106

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

193

Valid Hours for this Stability Class for:

Total Period

236

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P

Direction: DI35P

Lapse: DT150-35

Stability Class D

Delta Temperature Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	86	66	4	0	0	0	156
NNE	58	19	1	0	0	0	78
NE	98	10	1	0	0	0	109
ENE	86	17	0	0	0	0	103
E	54	13	0	0	0	0	67
ESE	27	3	0	0	0	0	30
SE	22	3	0	0	0	0	25
SSE	16	10	2	0	0	0	28
S	27	32	0	0	0	0	59
SSW	61	69	8	0	0	0	138
SW	67	159	92	3	0	0	321
WSW	87	205	66	5	0	0	363
W	84	245	55	0	0	0	384
WNW	72	105	8	0	0	0	185
NW	108	135	20	1	0	0	264
NNW	85	95	8	0	0	0	188
Total	1038	1186	265	9	0	0	2498

Calm Hours not Included above for :

Total Period

106

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

193

Valid Hours for this Stability Class for:

Total Period

2498

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P**Direction: DI35P****Lapse: DT150-35****Stability Class E****Delta Temperature Slightly Stable****Wind Speed (mph)**

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	101	12	2	0	0	0	115
NNE	122	11	0	0	0	0	133
NE	160	11	2	0	0	0	173
ENE	193	32	0	0	0	0	225
E	136	22	0	0	0	0	158
ESE	111	3	0	0	0	0	114
SE	99	4	0	0	0	0	103
SSE	113	4	0	0	0	0	117
S	171	31	0	0	0	0	202
SSW	168	73	5	0	0	0	246
SW	133	123	13	0	0	0	269
WSW	78	116	26	2	0	0	222
W	78	74	16	0	0	0	168
WNW	66	23	1	0	0	0	90
NW	97	13	1	0	0	0	111
NNW	85	17	0	0	0	0	102
Total	1911	569	66	2	0	0	2548

Calm Hours not Included above for:**Total Period**

106

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

193

Valid Hours for this Stability Class for:**Total Period**

2548

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P**Direction: DI35P****Lapse: DT150-35****Stability Class F****Delta Temperature Moderately Stable****Wind Speed (mph)**

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	10	1	0	0	0	0	11
NNE	19	0	0	0	0	0	19
NE	33	1	0	0	0	0	34
ENE	67	1	0	0	0	0	68
E	165	1	0	0	0	0	166
ESE	175	3	1	0	0	0	179
SE	158	0	0	0	0	0	158
SSE	155	0	0	0	0	0	155
S	126	5	0	0	0	0	131
SSW	82	8	0	0	0	0	90
SW	46	10	2	0	0	0	58
WSW	13	5	0	0	0	0	18
W	10	1	0	0	0	0	11
WNW	8	0	0	0	0	0	8
NW	11	0	0	0	0	0	11
NNW	16	0	1	0	0	0	17
Total	1094	36	4	0	0	0	1134

Calm Hours not Included above for :**Total Period**

106

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

193

Valid Hours for this Stability Class for:**Total Period**

1134

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P**Direction: DI35P****Lapse: DT150-35****Stability Class G****Delta Temperature Extremely Stable****Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	4	0	0	0	0	0	4
NNE	19	2	0	0	0	0	21
NE	22	0	0	0	0	0	22
ENE	27	0	0	0	0	0	27
E	66	1	0	0	0	0	67
ESE	136	1	0	0	0	0	137
SE	146	0	0	0	0	0	146
SSE	83	0	0	0	0	0	83
S	56	1	0	0	0	0	57
SSW	34	2	0	0	0	0	36
SW	27	0	0	0	0	0	27
WSW	11	0	0	0	0	0	11
W	5	0	0	0	0	0	5
WNW	3	0	0	0	0	0	3
NW	8	1	0	0	0	0	9
NNW	9	0	0	0	0	0	9
Total	656	8	0	0	0	0	664

Calm Hours not Included above for :**Total Period**

106

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

193

Valid Hours for this Stability Class for:**Total Period**

664

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 1 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

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Part 1: Joint Frequency Distribution Tables (35ft)

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Hours at Each Wind Speed and Direction

Summary of All Stability Classes**Total Period**

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP35P

Direction: DI35P

Lapse: DT150-35

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	242	128	8	0	0	0	378
NNE	247	50	2	0	0	0	299
NE	360	42	3	0	0	0	405
ENE	432	80	1	0	0	0	513
E	464	57	0	0	0	0	521
ESE	474	20	1	0	0	0	495
SE	453	13	0	0	0	0	466
SSE	383	23	2	0	0	0	408
S	393	92	0	0	0	0	485
SSW	354	219	19	0	0	0	592
SW	290	399	166	6	0	0	861
WSW	213	474	144	9	0	0	840
W	226	511	108	0	0	0	845
WNW	183	233	20	0	0	0	436
NW	261	221	29	1	0	0	512
NNW	226	161	18	0	0	0	405
Total	5201	2723	521	16	0	0	8461

Calm Hours not Included above for :

Total Period

106

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

193

Valid Hours for this Stability Class for:

Total Period

8461

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

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Part 2: Joint Frequency Distribution Tables (150ft)

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Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P

Direction: DI150P

Lapse: DT150-35

Stability Class A

Delta Temperature Extremely Unstable

Wind Speed (mph)

Wind Direction	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	6	26	17	1	0	0	50
NNE	3	24	8	0	0	0	35
NE	7	26	10	0	0	0	43
ENE	2	45	38	4	0	0	89
E	1	34	21	1	0	0	57
ESE	0	20	5	5	0	0	30
SE	2	20	11	1	0	0	34
SSE	2	12	15	1	0	0	30
S	0	15	30	0	0	0	45
SSW	0	20	38	4	0	0	62
SW	1	26	50	14	1	0	92
WSW	6	33	55	13	0	0	107
W	3	70	73	37	3	0	186
WNW	7	67	57	28	1	0	160
NW	10	24	25	7	0	0	66
NNW	4	30	21	2	0	0	57
Total	54	492	474	118	5	0	1143

Calm Hours not Included above for :

Total Period

1

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

304

Valid Hours for this Stability Class for:

Total Period

1143

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P**Direction: DI150P****Lapse: DT150-35****Stability Class B****Delta Temperature****Moderately Unstable****Wind Speed (mph)**

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	2	4	6	0	0	0	12
NNE	2	4	0	0	0	0	6
NE	0	5	1	0	0	0	6
ENE	0	3	6	1	0	0	10
E	0	4	1	0	0	0	5
ESE	0	1	0	0	0	0	1
SE	2	1	1	0	0	0	4
SSE	0	5	1	0	0	0	6
S	0	1	5	0	0	0	6
SSW	0	4	2	0	0	0	6
SW	0	4	15	3	0	0	22
WSW	1	8	13	6	0	0	28
W	2	11	10	11	0	0	34
WNW	2	8	11	7	0	0	28
NW	0	3	5	1	0	0	9
NNW	7	10	7	0	0	0	24
Total	18	76	84	29	0	0	207

Calm Hours not Included above for :**Total Period**

1

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

304

Valid Hours for this Stability Class for:**Total Period**

207

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P

Direction: DI150P

Lapse: DT150-35

Stability Class C

Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	5	6	0	0	0	12
NNE	0	3	3	1	0	0	7
NE	0	4	2	0	0	0	6
ENE	0	6	5	0	0	0	11
E	0	4	0	0	0	0	4
ESE	0	3	1	1	0	0	5
SE	1	4	1	0	0	0	6
SSE	0	4	1	0	0	0	5
S	1	3	5	0	0	0	9
SSW	1	6	5	0	0	0	12
SW	0	7	7	2	0	0	16
WSW	1	5	8	5	2	1	22
W	5	11	16	7	1	0	40
WNW	3	9	21	8	0	0	41
NW	3	6	14	0	0	0	23
NNW	2	5	5	1	0	0	13
Total	18	85	100	25	3	1	232
Calm Hours not Included above for :							Total Period
Variable Direction Hours for:							Total Period
Invalid Hours for:							Total Period
Valid Hours for this Stability Class for:							Total Period
Total Hours for Period							8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P**Direction: DI150P****Lapse: DT150-35****Stability Class D****Delta Temperature Neutral****Wind Speed (mph)**

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	34	74	61	3	0	0	172
NNE	22	63	16	0	0	0	101
NE	25	33	3	0	0	0	61
ENE	20	76	31	9	0	0	136
E	11	36	12	0	0	0	59
ESE	4	21	6	2	0	0	33
SE	9	17	7	0	0	0	33
SSE	8	19	6	0	1	0	34
S	11	38	36	1	0	0	86
SSW	13	49	53	8	0	0	123
SW	16	44	103	41	0	0	204
WSW	28	65	120	31	8	0	252
W	36	103	216	123	16	2	496
WNW	28	111	157	50	3	0	349
NW	18	87	86	16	0	0	207
NNW	27	58	49	3	0	0	137
Total	310	894	962	287	28	2	2483

Calm Hours not Included above for :**Total Period**

1

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

304

Valid Hours for this Stability Class for:**Total Period**

2483

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P

Direction: DI150P

Lapse: DT150-35

Stability Class E

Delta Temperature Slightly Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	64	32	14	0	0	0	110
NNE	75	54	17	0	0	0	146
NE	111	94	6	1	0	0	212
ENE	85	117	63	11	0	0	276
E	53	50	19	0	0	0	122
ESE	16	28	17	3	0	0	64
SE	19	31	11	3	0	0	64
SSE	22	32	6	0	0	0	60
S	47	62	48	1	0	0	158
SSW	68	82	43	2	0	0	195
SW	85	84	102	0	0	0	271
WSW	75	94	48	9	2	1	229
W	54	95	106	49	7	0	311
WNW	26	101	28	2	0	0	157
NW	46	49	9	0	0	0	104
NNW	35	34	4	0	0	0	73
Total	881	1039	541	81	9	1	2552

Calm Hours not Included above for :

Total Period

1

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

304

Valid Hours for this Stability Class for:

Total Period

2552

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P**Direction: DI150P****Lapse: DT150-35****Stability Class F**

Delta Temperature Moderately Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	57	7	0	0	0	0	64
NNE	106	24	1	0	0	0	131
NE	122	60	2	0	0	0	184
ENE	58	74	5	0	0	0	137
E	27	20	0	0	0	0	47
ESE	15	7	0	0	0	0	22
SE	14	6	0	0	0	0	20
SSE	8	8	1	0	0	0	17
S	31	21	0	0	0	0	52
SSW	81	51	4	0	0	0	136
SW	94	54	10	0	0	0	158
WSW	50	26	4	0	0	0	80
W	28	15	5	1	0	0	49
WNW	10	10	0	0	0	0	20
NW	15	7	0	0	0	0	22
NNW	23	4	0	0	0	0	27
Total	739	394	32	1	0	0	1166

Calm Hours not Included above for :

Total Period

1

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

304

Valid Hours for this Stability Class for:

Total Period

1166

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P**Direction:** DI150P**Lapse:** DT150-35**Stability Class** G**Delta Temperature** Extremely Stable**Wind Speed (mph)**

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	30	2	0	1	0	0	33
NNE	70	15	0	0	0	0	85
NE	78	36	1	0	0	0	115
ENE	23	35	3	0	0	0	61
E	9	10	0	0	0	0	19
ESE	10	2	0	0	0	0	12
SE	10	6	0	0	0	0	16
SSE	7	13	0	0	0	0	20
S	27	26	3	0	0	0	56
SSW	37	36	1	0	0	0	74
SW	37	20	7	0	0	0	64
WSW	34	14	2	0	0	0	50
W	11	8	1	0	0	0	20
WNW	7	9	0	0	0	0	16
NW	11	3	0	0	0	0	14
NNW	14	3	0	0	0	0	17
Total	415	238	18	1	0	0	672
Calm Hours not Included above for :							Total Period 1
Variable Direction Hours for:							Total Period 0
Invalid Hours for:							Total Period 304
Valid Hours for this Stability Class for:							Total Period 672
Total Hours for Period							8760

Enclosure 2, Attachment 1 (Part 2 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

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Part 2: Joint Frequency Distribution Tables (150ft)

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Hours at Each Wind Speed and Direction

Summary of All Stability Classes**Total Period****Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP150P**Direction: DI150P****Lapse: DT150-35**

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	194	150	104	5	0	0	453
NNE	278	187	45	1	0	0	511
NE	343	258	25	1	0	0	627
ENE	188	356	151	25	0	0	720
E	101	158	53	1	0	0	313
ESE	45	82	29	11	0	0	167
SE	57	85	31	4	0	0	177
SSE	47	93	30	1	1	0	172
S	117	166	127	2	0	0	412
SSW	200	248	146	14	0	0	608
SW	233	239	294	60	1	0	827
WSW	195	245	250	64	12	2	768
W	139	313	427	228	27	2	1136
WNW	83	315	274	95	4	0	771
NW	103	179	139	24	0	0	445
NNW	112	144	86	6	0	0	348
Total	2435	3218	2211	542	45	4	8455

Calm Hours not Included above for :**Total Period**

1

Variable Direction Hours for:**Total Period**

0

Invalid Hours for:**Total Period**

304

Valid Hours for this Stability Class for:**Total Period**

8455

Total Hours for Period

8760

Attachment 1

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Period of Record = 1/1/2015 00:00 - 12/31/2015 23:00
Elevation: Speed: SP500P **Direction:** DI500P **Lapse:** DT500-35
Stability Class A Delta Temperature Extremely Unstable

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	1	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	1	1	0	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	1	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	1	0	0	1
Total	0	1	3	1	0	0	5

Calm Hours not Included above for :	Total Period	12
Variable Direction Hours for:	Total Period	0
Invalid Hours for:	Total Period	664
Valid Hours for this Stability Class for:	Total Period	5
Total Hours for Period		8760

Enclosure 2, Attachment 1 (Part 3 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 3: Joint Frequency Distribution Tables (500ft)

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Hours at Each Wind Speed and Direction

Total Period**Period of Record =**

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP500P**Direction: DI500P****Lapse: DT500-35****Stability Class B**

Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	2	1	0	0	3
E	0	1	1	0	0	0	2
ESE	0	1	0	0	0	0	1
SE	0	1	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	1	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	0	3	3	2	0	0	8

Calm Hours not Included above for :

Total Period

12

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

664

Valid Hours for this Stability Class for:

Total Period

8

Total Hours for Period

8760

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Part 3: Joint Frequency Distribution Tables (500ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP500P

Direction: DI500P

Lapse: DT500-35

Stability Class C

Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	0	0	0	0	0	0	0
NNE	0	1	0	0	0	0	1
NE	0	0	2	1	0	0	3
ENE	0	1	5	0	0	0	6
E	0	1	3	0	0	0	4
ESE	0	0	5	0	0	0	5
SE	0	3	3	0	0	0	6
SSE	0	1	2	0	0	0	3
S	0	2	4	0	0	0	6
SSW	0	0	4	0	1	0	5
SW	0	0	1	0	0	0	1
WSW	0	0	3	1	0	0	4
W	0	1	0	3	1	0	5
WNW	0	1	1	6	3	0	11
NW	0	0	0	0	2	0	2
NNW	0	0	0	1	0	0	1
Total	0	11	33	12	7	0	63

Calm Hours not Included above for :

Total Period

12

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

664

Valid Hours for this Stability Class for:

Total Period

63

Total Hours for Period

8760

Beaver Valley Power Station – Units 1 & 2

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Part 3: Joint Frequency Distribution Tables (500ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2015 00:00 - 12/31/2015 23:00
Elevation: Speed: SP500P Direction: DI500P Lapse: DT500-35
Stability Class D Delta Temperature Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	18	60	142	42	0	0	262
NNE	10	42	33	16	3	0	104
NE	19	33	45	28	11	0	136
ENE	17	72	53	24	6	0	172
E	15	79	75	24	2	0	195
ESE	11	69	50	25	3	0	158
SE	9	54	56	25	9	1	154
SSE	7	36	36	26	3	2	110
S	15	31	81	77	4	0	208
SSW	10	40	122	105	15	1	293
SW	10	40	138	223	71	2	484
WSW	9	62	165	187	38	10	471
W	8	73	234	297	129	30	771
WNW	17	79	228	197	52	7	580
NW	19	50	160	87	11	3	330
NNW	14	64	160	72	8	0	318
Total	208	884	1778	1455	365	56	4746
Calm Hours not Included above for :							Total Period 12
Variable Direction Hours for:							Total Period 0
Invalid Hours for:							Total Period 664
Valid Hours for this Stability Class for:							Total Period 4746
Total Hours for Period							8760

Enclosure 2, Attachment 1 (Part 3 of 3)

Beaver Valley Power Station – Units 1 & 2

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Part 3: Joint Frequency Distribution Tables (500ft)

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Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2015 00:00 - 12/31/2015 23:00
Elevation: **Speed:** SP500P **Direction:** DI500P **Lapse:** DT500-35
Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	29	20	21	8	0	0	78
NNE	28	20	6	4	0	0	58
NE	40	27	9	2	0	0	78
ENE	51	76	46	5	0	0	178
E	54	92	48	4	0	0	198
ESE	37	55	43	4	0	0	139
SE	23	41	24	14	2	0	104
SSE	28	34	26	17	0	0	105
S	23	40	45	37	4	0	149
SSW	30	30	27	46	17	0	150
SW	42	38	48	101	40	1	270
WSW	52	92	49	21	2	0	216
W	49	104	132	26	8	0	319
WNW	20	62	54	8	0	0	144
NW	29	30	15	1	0	0	75
NNW	21	22	25	2	0	0	70
Total	556	783	618	300	73	1	2331

Calm Hours not Included above for :

Total Period 12

Variable Direction Hours for:

Total Period 0

Invalid Hours for:

Total Period 664

Valid Hours for this Stability Class for:

Total Period 2331

Total Hours for Period

8760

Enclosure 2, Attachment 1 (Part 3 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 3: Joint Frequency Distribution Tables (500ft)

Page 6 of 8

Hours at Each Wind Speed and Direction

Total Period

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP500P

Direction: DI500P

Lapse: DT500-35

Stability Class F

Delta Temperature Moderately Stable

Wind Speed (mph)

Wind Direction	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	11	5	4	0	0	0	20
NNE	9	6	0	0	0	0	15
NE	17	10	0	1	0	0	28
ENE	19	32	4	1	0	0	56
E	39	54	9	0	0	0	102
ESE	20	30	24	1	0	0	75
SE	15	24	16	0	0	0	55
SSE	12	23	18	2	0	0	55
S	16	24	33	15	0	0	88
SSW	19	21	22	16	1	0	79
SW	12	17	18	22	5	0	74
WSW	18	33	9	4	0	0	64
W	20	19	18	5	0	0	62
WNW	5	19	10	0	0	0	34
NW	8	7	1	0	0	0	16
NNW	10	2	7	0	0	0	19
Total	250	326	193	67	6	0	842

Calm Hours not Included above for :

Total Period

12

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

664

Valid Hours for this Stability Class for:

Total Period

842

Total Hours for Period

8760

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 3: Joint Frequency Distribution Tables (500ft)

Page 7 of 8

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2015 00:00 - 12/31/2015 23:00
Elevation: Speed: SP500P Direction: DI500P Lapse: DT500-35
Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	1	1	0	0	0	0	2
E	6	3	0	0	0	0	9
ESE	2	8	2	0	0	0	12
SE	2	3	0	0	0	0	5
SSE	2	9	2	0	0	0	13
S	3	5	6	3	1	0	18
SSW	2	5	5	4	0	0	16
SW	3	2	0	2	2	0	9
WSW	1	3	0	0	0	0	4
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	23	39	15	9	3	0	89

Calm Hours not Included above for :	Total Period	12
Variable Direction Hours for:	Total Period	0
Invalid Hours for:	Total Period	664
Valid Hours for this Stability Class for:	Total Period	89
Total Hours for Period		8760

Enclosure 2, Attachment 1 (Part 3 of 3)

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015

Attachment 1

Part 3: Joint Frequency Distribution Tables (500ft)

Page 8 of 8

Hours at Each Wind Speed and Direction

Summary of All Stability Classes**Total Period**

Period of Record =

1/1/2015 00:00 - 12/31/2015 23:00

Elevation: Speed: SP500P

Direction: DI500P

Lapse: DT500-35

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	58	85	167	50	0	0	360
NNE	47	69	39	20	3	0	178
NE	77	70	56	32	11	0	246
ENE	88	182	110	31	6	0	417
E	114	230	137	28	2	0	511
ESE	70	163	124	30	3	0	390
SE	49	127	100	39	11	1	327
SSE	49	103	84	45	3	2	286
S	57	102	169	132	9	0	469
SSW	61	96	180	171	34	1	543
SW	67	97	206	348	118	3	839
WSW	80	190	226	213	40	10	759
W	77	197	384	331	138	30	1157
WNW	42	161	293	212	55	7	770
NW	56	87	176	88	13	3	423
NNW	45	88	192	76	8	0	409
Total	1037	2047	2643	1846	454	57	8084

Calm Hours not Included above for :

Total Period

12

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

664

Valid Hours for this Stability Class for:

Total Period

8084

Total Hours for Period

8760

ENCLOSURE 2, ATTACHMENT 2

Beaver Valley Power Station - Units 1 & 2

Radioactive Effluent Release Report

**Calendar Year - 2015
Attachment 2
Unit 1 and 2 Offsite Dose Calculation Manual Changes**

Attachment 2
Enclosed is a complete copy of the ODCM that includes: Change (38) of the ODCM (Effective: January 2015)

Attachment 2 Clarification
A complete copy of the ODCM has been provided to the following offices: United States Nuclear Regulatory Commission Attention: Document Control Desk Washington, DC 20555-0001 United States Nuclear Regulatory Commission Regional Administrator 2100 Renaissance Blvd., Suite 100 King of Prussia, PA 19406-2713
For a complete copy of the ODCM, contact Patrick Seidel at 724-682-4255.

ENCLOSURE 2, ATTACHMENT 3

Beaver Valley Power Station – Units 1 & 2

Radioactive Effluent Release Report

Calendar Year – 2015
Attachment 3

Unit 1 and 2 Carbon-14 (C-14) Dose Estimates

Carbon-14 Methodology								
<p>Gaseous doses from carbon-14 were calculated according to Regulatory Guide 1.109 methodology. However, only daylight growing season hours were utilized for batch releases, which accounted for minimal dose consequence compared to continuous releases. Liquid effluent release doses are considered to be insignificant and are not included in this report. This report does not address the amount of carbon-14 disposed of in shipments of solid waste and irradiated fuel. The term "other" discussed below refers to liver, total body, thyroid, kidney, lung and GI. Doses for these organs are assumed to be equal.</p> <p>The receptor chosen was selected based upon the default ODCM receptor - NW 1432 meters (0.89 miles). It is assumed that only vegetation and inhalation exposure pathways are available.</p> <p>The year of 2015 was the four year of carbon-14 sampling (in the form of CO₂) at BVPS for gaseous effluent releases. The large disparity between data from Unit 1 and Unit 2 is believed to be caused by the difference in dilution flow in the ventilations between the units. With only four years of information, it is still difficult to trend data for to determine where our carbon-14 dose stand.</p>								

Dose Calculations for Unit 1								
Exposure Pathway	Infant		Child		Teen		Adult	
	Bone	Other*	Bone	Other*	Bone	Other*	Bone	Other*
Inhalation	0.32	0.064	0.43	0.081	0.31	0.058	0.22	0.041
Vegetation	-	-	9.60	1.90	4.00	0.79	2.50	0.49
Ingestion								
TOTAL	3.2E-01	6.4E-02	1.0E+01	2.0E+00	4.3E+00	8.5E-01	2.7E+00	5.3E-01

Dose Calculations for Unit 2								
Exposure Pathway	Infant		Child		Teen		Adult	
	Bone	Other*	Bone	Other*	Bone	Other*	Bone	Other*
Inhalation	0.27	0.054	0.37	0.069	0.27	0.050	0.19	0.035
Vegetation	-	-	5.00	1.00	2.10	0.42	1.30	0.26
Ingestion								
TOTAL	2.7E-01	5.4E-02	5.4E+00	1.1E+00	2.4E+00	4.7E-01	1.5E+00	3.0E-01

Dose Calculations for Total Site								
	Infant		Child		Teen		Adult	
	Bone	Other*	Bone	Other*	Bone	Other*	Bone	Other*
TOTAL	5.9E-01	1.2E-01	1.5E+01	3.1E+00	6.7E+00	1.3E+00	4.2E+00	8.3E-01

Beaver Valley Power Station - Units 1 & 2

2015 Annual Radiological Environmental Operating Report

FirstEnergy Nuclear Operating Company
FENOC

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

EXECUTIVE SUMMARY and INDEX

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

- BVPS Integrated Technical Specifications, Administrative Control 5.6.1
- Offsite Dose Calculation Manual (ODCM) procedure 1/2-ODC-3.03, Attachment T, Control 6.9.2, “Controls for RETS and REMP Programs”
- BVPS procedure 1/2-ENV-01.05, “Compliance with Regulatory Guide 1.21 and Technical Specifications”
- BVPS procedure 1/2-ENV-02.01, “Radiological Environmental Monitoring Program”
- NUREG-1301, “Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, Generic Letter 89-01, Supplement No.1, April 1991”
- BVPS Condition Report No. 2015-06857: Vendor Lab Failed Cross Check for 1st Quarter 2015
- BVPS Condition Report No. 2015-15097: REMP: Changes in Soil Sample Availability
- BVPS Condition Report No. 2015-05181: REMP Air Station Found Out of Service
- BVPS Condition Report No. 2015-11091: REMP Air Station (Site No. 27) Found Out of Service
- BVPS Condition Report No. 2015-1561: REMP Assessment: Fleet Peer Recommendations
- BVPS Condition Report No. 2015-16936: 2015 NRC REMP Inspection: Observations
- BVPS Condition Report No. 2015-02499: REMP Surface Water Sample (49A) Not Able to be Obtained – Cold Weather Issue
- BVPS Condition Report No. 2016-04028: REMP Milk Samples (Site No. 96) Discarded
- SAP Notification 600952335: 2015 RETS and REMP Report

EXECUTIVE SUMMARY and INDEX

Report Overview:

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

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

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

Description of Operational REMP (1976 – Present):

The operational REMP program was initiated during calendar year 1976 and continued through the report period. During the past **thirty nine (39)** years, radiation and radioactivity in the environment was monitored within a 10-mile radius of the site. A description of the operational REMP program is outlined in Table 2-1 of this report. In general, two (2) types of samples were collected and compared during the report period, and are described as follows:

- **Control Samples:** These samples are collected from areas that are beyond measurable influence of BVPS operation, and are used as reference data. Normal background radiation levels, or radiation present due to causes other than BVPS operation, can thus be compared to the environment surrounding the BVPS site. During the report period, **four hundred one (401)** analyses were performed on samples from the control locations. In addition, **eight (8)** analyses were completed for Thermo Luminescent Dosimeters (TLDs) at the control locations. Results of the analyses from the control locations are summarized in Table 2-2 of this report.
- **Indicator Samples:** Indicator samples are collected to determine the radiological impact of BVPS operation in the environment. These samples are collected from various locations near the BVPS site. At a minimum, the samples are collected from areas where the BVPS contribution would indicate the most significant radiological impact. During the report period, **one thousand eight hundred eighty five (1,885)** analyses were performed on samples collected from **eighty four (84)** indicator locations. In addition, **five hundred twenty (520)** analyses were completed for TLDs at the indicator locations. Results of the analyses from the indicator locations are also summarized in Table 2-2 of this report.

EXECUTIVE SUMMARY and INDEX

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

Determination of Environmental Impact

- **2015 Sample Media and Analyses:** Results for drinking water, surface water, precipitation, groundwater, shoreline stream sediment, fish, cow milk, goat milk, feedstuff, foodcrops, air particulate and air radioiodine media remained consistent with previous data. Minor increases and decreases were noted in most sample media, and any positive results attributable to the BVPS operation were consistent with station data of authorized radioactive discharges, and were within limits permitted by the operating license and the ODCM. Other radioactivity detected was attributable to naturally occurring radionuclides, previous nuclear weapons tests, other man-made sources, and to the normal statistical fluctuation for activities near the Lower Limit of Detection (LLD).
- **Airborne Exposure Pathway:** This ODCM required pathway was evaluated via sampling of airborne radioiodine and airborne particulates. The results during this report period were similar to previous years. There was no notable increase in natural products and no detectable fission products or other radionuclides in the airborne particulate media during the year attributed to effluent releases from BVPS.
- **Direct Exposure Pathway:** This ODCM required pathway was evaluated via measurement of environmental radiation doses by use of Thermo Luminescent Dosimeters (TLDs). The results of TLD processing have indicated a stable trend and compare well with previous years.
- **Ingestion Exposure Pathway:** This ODCM required pathway was evaluated via sampling of milk, fish, and foodcrops (leafy vegetables).

For milk samples, strontium-90 (attributable to past atmospheric weapons testing), was detected at levels similar to those of previous years. The gamma spectrometry analyses indicated positive results for naturally occurring potassium-40 at average environmental levels.

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

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

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

Water samples were analyzed for tritium and gamma-emitting radionuclides. Tritium was not identified in any of these water samples. Iodine-131 analysis of drinking water indicated

EXECUTIVE SUMMARY and INDEX

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

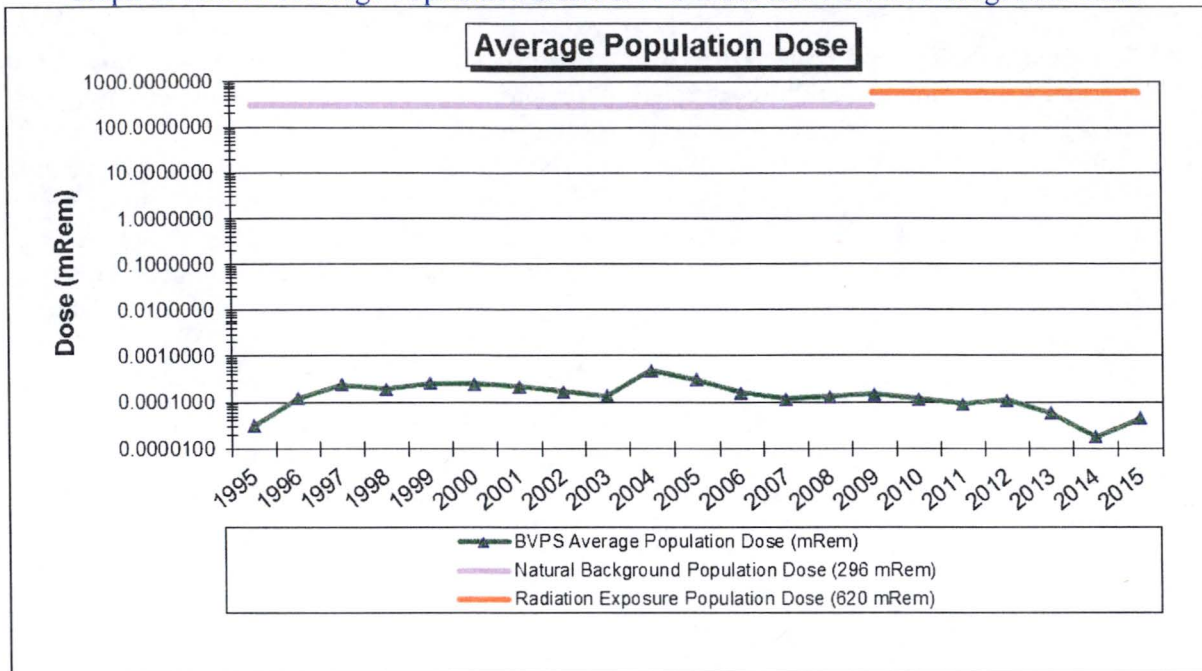
Sediment samples were collected from upstream of the site, at the discharge point of BVPS liquid effluent releases, and downstream of the site. Analysis of samples indicated naturally occurring radionuclides potassium-40, thallium-208, bismuth-214, lead-212, lead-214, radium-226, and actinium-228 in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

- **Other Exposure Pathways:** In addition to the samples collected from the exposure pathways described above, other media (i.e., precipitation and feedstuff) were also collected. Results were consistent with previous years, with no degrading trends.
- **Offsite Groundwater Monitoring:** A total of four (4) offsite groundwater samples were collected and analyzed for Tritium and by gamma spectrometry during the report period. The samples were collected on a semi-annual basis from two (2) locations within four (4) miles of the site. The locations included one (1) well in Hookstown, PA; and one (1) well in Georgetown, PA. No gamma-emitting radionuclides were detected in the analyses. All tritium results were less than the pre-operational value.
- **Supplemental Sample Sites:** The REMP program includes supplemental sampling sites in addition to the required sites set forth in the ODCM. The supplemental sites include five (5) air sampling sites, one (1) surface water site, two (2) groundwater sites, three (3) precipitation sites, two (2) sediment sites, and one (1) milk animal feedstuff site.
- **Population Dose vs. Natural Background:** During the report period, the total calculated 0-50 mile population dose was 141 man-mrem (liquid releases), and 41 man-mrem (gaseous releases). The average individual population dose from BVPS operation was much less than <1 mrem. Accordingly, the typical dose to an individual from background (natural radiation exposure including radon) was estimated as an average of 296 mrem per year according to the National Academy of Sciences 1990 BEIR Report. In 2009, the NCRP Report No. 160: "Ionizing Radiation Exposure of the Population of the United States," defined the radiation exposure population dose to be 620 mrem per year. The following graph in Figure i-1 illustrates that the average individual population dose was not affected from BVPS operation.

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Figure i-1

Graph of Annual Average Population Dose: BVPS Dose and Natural Background Dose



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

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Inter-laboratory Comparison Programs:

- **Split Sample Program:** BVPS shared split samples with the Pennsylvania Department of Environmental Protection (PADEP) in support of their nuclear power plant monitoring program. The shared media and number of locations were typically comprised of milk (2), surface water (3), river sediment (1), fish (1), foodcrops (2), co-located air particulate/air iodine (4), and TLD (24). The split sample program was coordinated by the state, and the results are not provided with this report.
- **Spike Sample Program:** Spiked samples were provided by an independent laboratory and then analyzed by the REMP contractor laboratory. The samples were provided throughout the report period and included water samples, milk samples, filter paper samples and charcoal cartridge samples. All one hundred eight (108) analyses performed by the contractor laboratory on the spiked samples met the NRC comparison criteria.

Special Reports:

- **SINCE** no reporting levels were exceeded during 2015, **THEN** no Special Reports were required. For information, a Special Report shall be submitted to the NRC when (1) levels of radioactivity in an environmental sampling medium exceeds the limits specified in ODCM procedure 1/2-ODC-3.03, Attachment Q Table 3.12-2, and when (2) the results of the following calculation are ≥ 1.0 (for calculations performed when more than one radionuclide is detected in the sampling medium):

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

Land Use Census Results:

Highlights from the most recent Land Use Census are documented in letter NPD3NRE:1125, dated December 23, 2015 and are summarized as follows:

- **Nearest Residence (0 to 5 mile radius):** The location has not changed since the previous census. The nearest inhabited residence is at **209 Ferry Hill Road**, Shippingport, PA (0.4 miles, E).
- **Nearest Garden >500 sqft:** The location has not changed since the previous census. The closest garden location is at the **Pringle Residence**, 1221 Virginia Avenue, Midland, PA (1.0 miles, in the NW Sector). The previous sampling location at the **Cox Residence**, 238 State Route 168, Hookstown, PA (0.760 miles, in the SSW Sector) was available for sampling cabbage this year but does not meet all the requirements of NUREG-1301.
- **Nearest Dairy Cow (0 to 5 mile radius):** The location has changed since the previous census. **Searight Dairy**, 948 McCleary Road, Hookstown, PA (2.097 miles, SSW) closed in 2014. Therefore, the closest milking cow location is **Brunton Dairy**, 3681 Ridge Road, Aliquippa, PA (6.158 miles, SE).

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- **Nearest Doe Goat (0 to 5 mile radius):** The location has not changed since the previous census. The closest location is the **Covert Residence**, 930 Pine Street, Hookstown, PA (1.900 miles, SW).
- **Prevailing Winds:** The prevailing wind direction for Ground Releases was identified by showing the highest D/Q in the East Sector. The prevailing wind direction for Elevated Releases was identified by showing the highest D/Q in the ESE Sector. The REMP properly monitors the environment with air particulate sampling stations in some Sectors and direct radiation TLDs in all Sectors.
- **2015 Dairy Cow & Doe Goat Sampling Locations:** The dairy cow sampling location changed in 2015. Since **Searight Dairy** closed in 2014, the dairy cow sampling will be performed at **Brunton Dairy**, 3681 Ridge Road, Aliquippa, PA (6.158 miles, SE), and **Windsheimer Dairy**, 20 Windsheimer Lane, Burgettstown, PA (10.476 miles, SSW). The Doe Goat sampling location will be at **Covert Residence**, 930 Pine Street, Hookstown, PA (1.900 miles, SW). **Searight Dairy**, 948 McCleary Road, Hookstown, PA (2.097 miles, SSW) and the **Ferry Residence**, 227 Calhoun Road, Aliquippa, PA (3.320 miles, SE) no longer have doe goats.
- **Deposition (D/Q) for Milch Animal Locations:** None of the 2015 milch animal sampling locations experienced a >20% increase in D/Q. Therefore, a Special Report per ODCM Control 3.12.2 Action "a" and/or Action "b" is not required.
- **D/Q for Offsite Dose Determination:** There is no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, the analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% of the offsite dose previously calculated using current ODCM methodology. Therefore, a Special Report per ODCM Control 3.12.2 Action "a" and/or Action "b" is not required.
- **D/Q Historical Trend Comparison:** There is no adverse trend in D/Q when comparing 2000 to 2015 data to the ODCM default D/Q values. This validates that there is no adverse effect on the current ODCM methodology used for offsite dose determination from effluent releases. Specifically, the analysis of D/Q did not yield any valid locations where the offsite dose could have increased >20% of the offsite dose previously calculated using current ODCM methodology. Therefore, a change in ODCM Receptor location and/or a change to meteorology at the current ODCM Receptor location is not required.

The 2015 Land Use Census results indicate that no significant changes are required in the current Radiological Environmental Monitoring Program or to its methodology.

EXECUTIVE SUMMARY and INDEX

Deviations, Changes and Adjustments to the Normal Sampling Program

- **Deviation from Required Milk Sampling & Analysis Schedule:** Two deviations from the required milk sampling and analysis schedule occurred for the reporting period. Sufficient milk samples were not available from locations within the 5 mile radius this year. The unavailability of milk caused the REMP to not meet the ODCM sample requirements in 1/2-ODC-2.03 and in 1/2-ODC-3.03, Attachment Q Table 3.12-1 stating that a minimum of four (4) milk locations shall be sampled. This initiated the ODCM requirement for sampling two (2) additional garden locations based upon the highest predicted annual average D/Q when milk locations are not available. The second deviation occurred when the vendor laboratory accidentally discarded the milk sample that was to be analyzed for strontium-89 and strontium-90, from Site No. 96, Windsheimer Dairy Farm, Burgettstown, PA. The analysis for strontium-89 and strontium-90 is not required by the ODCM. All other analyses such as gamma emitters (including cesium-137 by high resolution germanium gamma spectrometry), and iodine-131 high sensitivity analysis are required by the ODCM and were performed. The vendor was switching to a new refrigeration unit and accidentally discarded the milk sample. This issue was documented in Condition Report 2016-04028.
- **Deviation from Required Surface and Drinking Water Sampling and Analysis Schedule:** There was one deviation from the ODCM required water sampling and analysis schedule during the report. A surface water sample was not taken at sample location 49A, Upstream of Montgomery Dam, due to frozen river conditions. All other samples were obtained. This is not a missed surveillance as monthly and quarterly composite samples were still compiled and sent for analysis. The only weekly analysis effected is the I-131 which is not a requirement of the ODCM. This issue is documented in Condition Report 2015-02499.
- **Deviation from Required Air Particulate & Iodine Sampling and Analysis Schedule:** Two deviations occurred from the required airborne particulate and iodine sampling and analysis schedule during the report period. During the sampling period of 04/06/2015 – 04/13/2015, REMP air particulate and iodine control sampling station at Friendship Ridge in Beaver, PA (Site No. 29B) was found to be out of service. The cause was determined to be from shattered vanes in the air pump. Accordingly, the shattered vanes were replaced later that day. The sample station was out of service for approximately 93 hours, as reported by the REMP technician. This issue was documented in Condition Report 2015-05181. During the sampling period of 08/03/2015 – 08/10/2015, REMP air particulate and iodine control sampling station at Brunton Dairy in Aliquippa, PA (Site No. 27) was found to be out of service. The cause was determined to be from shattered vanes in the air pump. Accordingly, the shattered vanes were replaced later that day. The sample station was out of service for approximately 156 hours, as reported by the REMP technician. This issue was documented in Condition Report 2015-11091.
- **Deviation from Required Direct Radiation Monitoring:** There were no deviations from the required direct radiation monitoring sampling and analysis schedule during the report period.

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- **Deviations from Required Soil Sampling and Analysis Schedule:** Two deviations from the required soil sampling and analysis schedule occurred during the report period. Sample point 22, South of BVPS Property, was not sampled this year due to safety concerns. This issue was documented in Condition Report 2015-15097. Sample Point 27B, Brunton Farm, was paved over by the owner in which a new location was sampled for the year. This issue was documented in Condition Report 2015-15097.

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SECTION 1 - INTRODUCTION

A. Radiation Fundamentals

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

B. Radiation and Radioactivity

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

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

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

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

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

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

SECTION 1 - INTRODUCTION

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

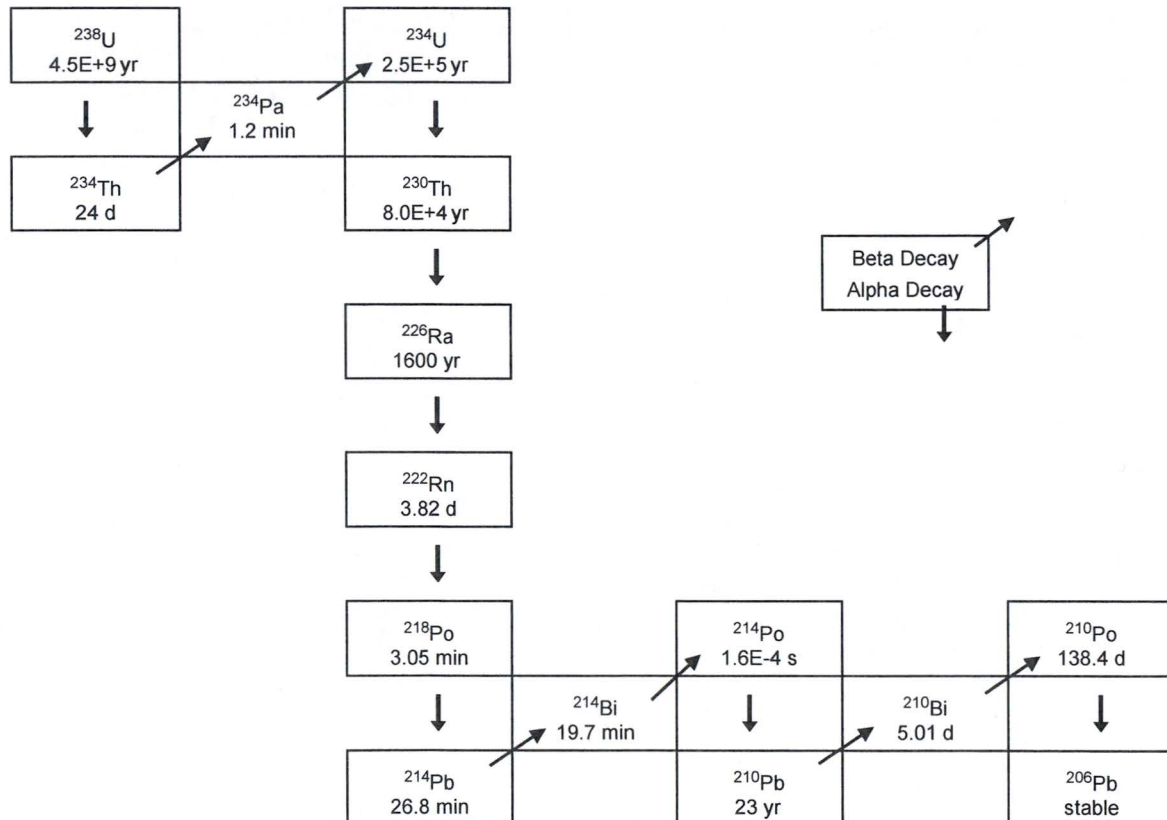
Isotopes: A group of identical atoms containing the same number of protons make up an element. In fact, the number of protons an atom contains determines its chemical identity. For instance, all atoms with one proton are hydrogen atoms, and all atoms with eight protons are oxygen atoms. However, the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

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

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

SECTION 1 - INTRODUCTION

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



Radionuclides: See description for "isotopes".

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

SECTION 1 - INTRODUCTION

C. Units of Measurement

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

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

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

D. Lower Limit of Detection

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

E. Scope and Objectives of REMP

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

SECTION 1 - INTRODUCTION

F. Description of the Beaver Valley Site

BVPS is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 453 acre tract of land. The site is approximately one mile from Midland, Pennsylvania, five miles from East Liverpool, Ohio, and twenty-five miles from Pittsburgh, Pennsylvania. Figure 1-1 shows the site location in relation to the principal population centers. Population density in the immediate vicinity of the site is relatively low. The population within a five mile radius of the plant is approximately 18,000. The only area within the radius of concentrated population is the Borough of Midland, Pennsylvania, with a population of approximately 2,635 as determined from the 2010 U.S. Census.

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 a maximum elevation of 1160 feet. Plant grade level is approximately 735 feet above sea level.

BVPS is on the Ohio River at river mile 34.8, a location on the New Cumberland Pool that is 3.1 river miles downstream from Montgomery Lock and Dam, and 19.6 miles upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is located 5.2 river miles downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela and Ohio Rivers and their tributaries. During the report period, the Ohio River flow (as obtained from the Corps of Engineers – Water Resources Engineering) at the New Cumberland Dam ranged from 7,897 cubic feet per second (minimum monthly average) to 104,336 cubic feet per second (maximum monthly average). The mean flow during the report period was approximately 40,848 cubic feet per second.

Water temperature of the Ohio River typically varies from 32° Fahrenheit to 82° Fahrenheit. The minimum temperatures occur in January and/or February and maximum temperatures in July and/or August. Water quality in the Ohio River at the site location is affected primarily by the water quality of the Allegheny, Monongahela and Beaver rivers.

The climate of the area may be classified as humid continental. The predominant wind direction is typically from the southwest in summer and from the west in winter. The National Climatic Data Center indicates the following data for the Beaver Falls, PA area:

- The total annual precipitation during the report period was 40.02 inches.
- The average mean temperature during the report period was 52.7° Fahrenheit.

SECTION 1 - INTRODUCTION

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

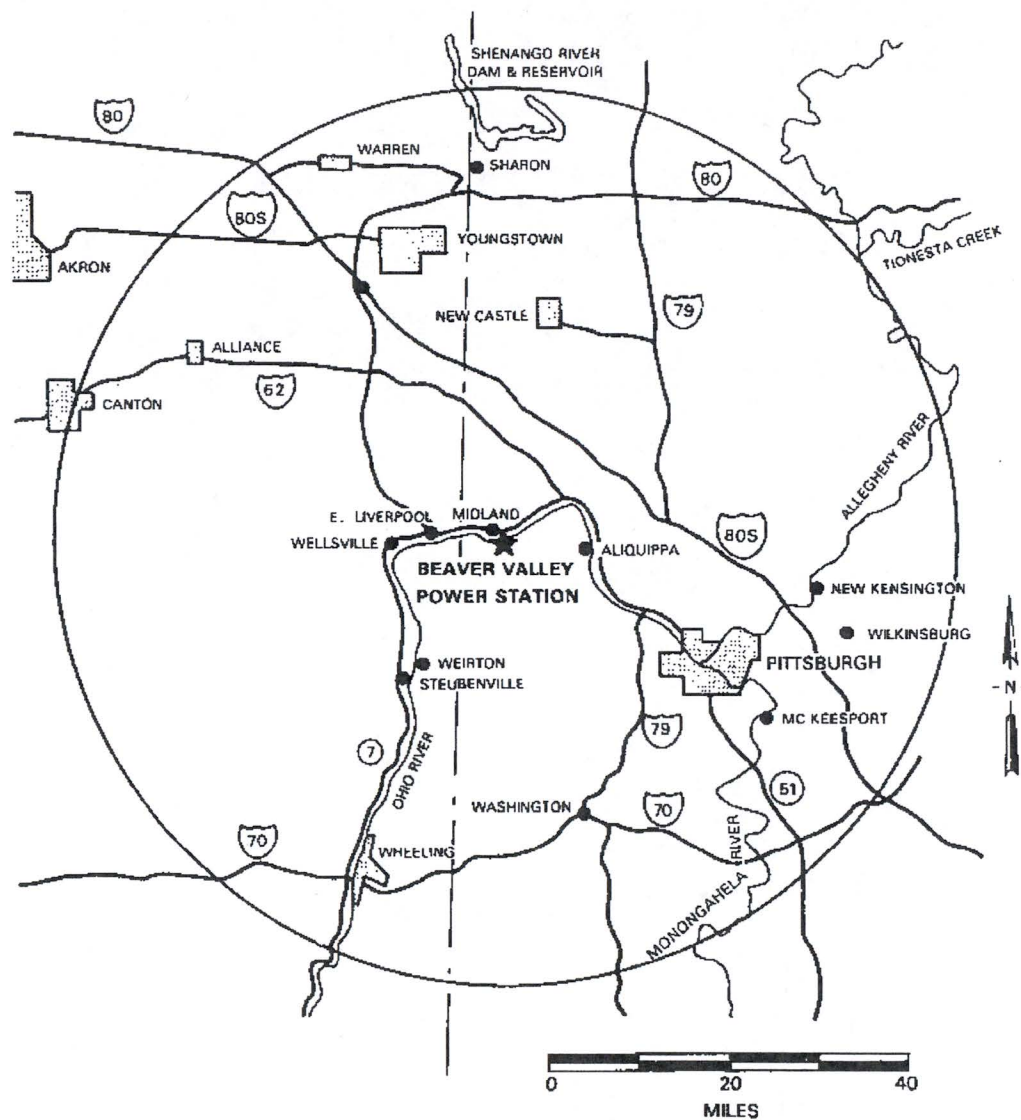
	<u>Beaver Valley Unit 1</u>	<u>Beaver Valley Unit 2</u>
Licensed Power Level	2900 – megawatts thermal	2900 – megawatts thermal
Type of Power	PWR	PWR
No. of Reactor Coolant Loops	3	3
No. of Steam Generators & Type	3 - Vertical	3 - Vertical
Steam Used by Main Turbine	Saturated	Saturated

The BVPS units utilize two separate systems (primary and secondary) for transferring heat from the source (the reactor) to the receiving component (turbine-generator). Because the two systems are isolated from each other, primary and secondary waters do not mix, and 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 transferred from the primary system to the secondary system in the steam generators. The steam is then formed and delivered to the main unit turbine, which drives the electrical generator. The steam is condensed after passing through the turbine, and returned to the steam generators to begin another steam/water cycle.

SECTION 1 - INTRODUCTION

Figure 1-1

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



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

A. Radiological Environmental Monitoring Program

1. Program Description

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

2-B - Air Monitoring

2-C - Monitoring of Shoreline Stream Sediment and Soil

2-D - Monitoring of Feedstuff and Foodcrops

2-E - Monitoring of Local Cow and Goat Milk

2-F - Environmental Radiation Monitoring

2-G - Monitoring of Fish

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

2-I - Estimates of Radiation Dose to Man

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1

Operational Radiological Environmental Monitoring Program

Section	Sample Type	Sample Site No.	Sample Location	Sample Frequency	Sample Preparation / Analysis Frequency	Analysis
1	Air Particulate & Radionuclide	13	Hookstown, PA (Old Meyer Farm)	Continuous Sampling with Sample Collection at least weekly	Weekly - Air Particulate Weekly – Charcoal Quarterly Composite (c)	Gross Beta (b) Iodine-131 Gamma Scan
		27	Aliquippa, PA (Brunton Farm)			
		28	Sherman Farm			
		29B	Beaver, Pa (Friendship Ridge)			
		30	Shippingport, PA (Cook's Ferry Substation)			
		32	Midland, PA (North Substation)			
		46.1	Industry, PA (McKeel's Service - Rt. 68)			
		47	East Liverpool, OH (Water Department)			
		48 (a)	Weirton, WV (Water Tower - Collier Way)			
		51	Aliquippa, PA (Sheffield Substation)			
2	Direct Radiation	7-8	BVPS Site Perimeter Locations	Continuous (TLD)	Quarterly (d)	Gamma Dose
		10	Shippingport, PA (Post Office)			
		13	Hookstown, PA (Old Meyer Farm)			
		14	Hookstown, PA			
		15	Georgetown, PA (Post Office)			
		27	Aliquippa, PA (Brunton Farm)			
		28	Sherman Farm			
		29B	Beaver, PA (Friendship Ridge)			
		30	Shippingport, PA (Cook's Ferry Substation)			
		32	Midland, PA (North Substation)			
		33-44	BVPS Site Perimeter Locations			
		45	Raccoon Township, PA (Christian House Baptist Chapel - Rt. 18)			
		45.1	Raccoon Township, PA (Kennedy's Corner)			
		46	Industry, PA (Midway Drive)			
		46.1	Industry, PA (McKeel's Service - Rt. 68)			
		47	East Liverpool, OH (Water Department)			
		48 (a)	Weirton, WV (Water Tower - Collier Way)			
		51	Aliquippa, PA (Sheffield Substation)			
		52-56	BVPS Site Perimeter Locations			
		59	236 Green Hill Road, Aliquippa, PA			
		60	444 Hill Road, Georgetown, PA			
		70	236 Engle Road, Industry, PA			
		71	Brighton Township, PA (First Western Bank)			
		72	Ohioview, PA (Lutheran Church – Rear)			
		73	618 Squirrel Run Road, Industry, PA			
		74	37 Poplar Avenue, Monaca, PA (CCBC)			
		75	117 Holt Road, Aliquippa, PA			
		76	Raccoon Township, PA (Elementary School)			
		77	3614 Green Garden Road, Aliquippa, PA			
		78	Raccoon Township, PA (Municipal Building)			
		79	106 Rt. 151, Aliquippa, PA			
		80	Raccoon Township, PA (Park Office -Rt. 18)			
		81	Millcreek United Presbyterian, Church Hookstown, PA			
		82	2697 Rt. 18, Raccoon Twp, PA			
		83	735 Mill Creek Road, Hookstown, PA			
		84	Hancock County, WV (Senior Center)			
		85	2048 Rt. 30, West Chester, WV			
		86	1090 Ohio Avenue, East Liverpool, OH			
		87	50103 Calcutta Smith Ferry Road, Calcutta, OH			
		88A	Route 168, Midland Heights, PA			
		89	488 Smith Ferry Road, Ohioville, PA			
		90	6286 Tuscarawas Road, Midland, PA			
		91	Pine Grove Road & Doyle Road, Industry, PA			
		92	Georgetown, PA (Georgetown Road Substation)			
		93	104 Linden, Midland, PA (Sunrise Hills)			
		94	Hookstown, PA (McCleary & Pole Cat Hollow Roads)			
		95	832 McCLeary Road, Hookstown, P)			
		111-112	BVPS Site Perimeter Locations			

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1 (Continued)

Operational Radiological Environmental Monitoring Program

Section	Sample Type	Sample Site No.	Sample Location	Sample Frequency	Sample Preparation / Analysis Frequency	Analysis
3	Surface Water	49A ^(a)	Industry, PA (Upstream of Montgomery Dam)	Weekly Grab Sample ^(h)	Weekly Sample from Site 49A only	Iodine-131
		2.1	Midland, PA (ATI Allegheny Ludlum)	Weekly Intermittent Composite Sample ^(h)	Monthly Composite of Weekly Sample ^(c)	Gamma Scan
		5	East Liverpool, OH (Water Department)	Daily Grab Sample Collected Weekly ^(h)	Quarterly Composite ^(c)	Tritium (H-3)
4	Groundwater	14A 15B	Hookstown, PA (Downstream) Georgetown, PA (Downstream)	Semi-Annual	Semi-Annual	Gamma Scan Tritium (H-3)
5	Drinking Water	4 5	Midland, PA (Water Department) East Liverpool, OH (Water Department)	Intermittent ^(d) Sample Collected Weekly	Weekly Composite of Daily sample ^(d) Monthly Composite ^(d) Quarterly Composite ^(d)	Iodine-131 Gamma Scan Tritium (H-3)
6	Shoreline Sediment	2A 49A ^(a) 50	BVPS Outfall Vicinity Industry, PA (Upstream of Montgomery Dam) New Cumberland, WV (Upstream of Dam)	Semi-Annual	Semi-Annual	Gamma Scan
7	Milk	27 96 ^(a) 114 ^(k)	Aliquippa, PA (Brunton Farm) Burgettstown, PA (Windsheimer Farm) Hookstown, PA (Covert Residence)	Biweekly ^(f) When animals are on pasture; monthly at other times	All other samples & analyses are Biweekly during grazing but Monthly during other times	Gamma Scan Iodine-131 Strontium-89 Strontium-90
8	Fish	2A 49A ^(a)	BVPS Outfall Vicinity Industry, PA (Upstream of Montgomery Dam)	Semi-Annual	Composite of edible parts by species ^(g)	Gamma Scan on edible parts
9	Food Crops	10 ^(l) (m) 15 ^(l) (m) 12 (l) (m) 46 ^(l) (m) 48 ^{(a)(l)(m)} * (l) (m)	Shippingport, PA Georgetown, PA Raccoon Township, PA Industry, PA Weirton, WV	Annual at Harvest if available	Composite of each sample species	Gamma Scan Iodine-131 on green leafy vegetables

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1 (Continued)

Operational Radiological Environmental Monitoring Program

Section	Sample Type	Sample Site No.	Sample Location	Sample Frequency	Sample Preparation / Analysis Frequency	Analysis
10	Feedstuff & Summer Forage	27	Aliquippa, PA (Brunton Farm)	Monthly	Monthly	Gamma Scan
11	Soil	13A 22 27B 29A 30A 32A 46B 47A 48 (a) 51A	Hookstown, PA (Old Meyer Farm) South of BVPS, Transmission Lines Aliquippa, PA (Brunton Farm) Beaver, PA (Nicol Farm) Shippingport, PA (Cook's Ferry Substation) Midland, PA (North Substation) Industry, PA (Willows Inn - Rt. 68) East Liverpool, OH (Water Department) Weirton WV (Water Tower - Collier Way) Aliquippa, PA (Sheffield Substation)	Every Three (3) Years (2015, 2018, 2021)	12 Core Samples 3" Deep (2" diameter at each location approx. 10' radius)	Gamma Scan
12	Precipitation	30 47 48 (a)	Shippingport, PA (Cook's Ferry Substation) East Liverpool, OH (Water Department) Weirton WV (Water Tower-Collier Way)	Weekly grab samples when available	Quarterly Composite (c)	Gamma Scan Tritium (H-3)

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-1 (Continued)

Operational Radiological Environmental Monitoring Program

Notes for Table 2-1

- (a) Control Sample Station: These Locations which are presumed to be outside the influence of plant effluents.
- (b) Particulate Samples are not counted within 24 hours after filter change. Perform Gamma isotopic analysis on each sample when gross beta is greater than 10 times the yearly mean of control samples.
- (c) Long-term composite samples are obtained from short-term composite samples at the specified locations.
- (d) Composite samples are collected at intervals not exceeding 2 hours.
- (e) Searight Dairy is no longer operational.
- (f) Milk samples are collected bi-weekly when animals are grazing. The milk samples are collected monthly at other times.
- (g) The fish samples contain whatever species are available.
IF adequate sample size is available, THEN the sample is separated according to species, and compositing will provide one sample of each species.
IF adequate sample size is not available, THEN separation by species is not practical. Therefore edible parts of all fish in the sample are mixed to provide one sample.
- (h) Composite samples are obtained by collecting an aliquot at intervals not exceeding 2 hours at location 2.1. The water treatment plant operator at location 5 obtains the weekly grab sample from the daily composite grab samples. For location 49A, the weekly grab sample is obtained by a field technician.
- (i) Two (2) TLDs are collected quarterly from each monitoring location.
- (k) ODCM procedure 1/2-ODC-3.03, Attachment Q, Table 3.12-1 requires three (3) dairies to be selected on basis of highest potential thyroid dose using milch census data. See Section 2-E of this report (Monitoring of Local Cows Milk) for specific locations sampled.
- (l) Three (3) garden locations required by 1/2-ODC-2.03, Attachment A Table 3.0-1; Sites designated by 1/2-ODC-2.03 Attachment B Figure 3.0-5. Sampling locations may be altered by the REMP Administrator at any time based on availability.
- (m) 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 (l). Three (3) different types of broad leaf vegetation shall also be sampled at one (1) control location when in this condition.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

2. Summary of Results

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

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

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

3. Quality Control Program

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

4. Program Changes

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Air Particulate and Radioiodine

Unit of Measurement: (picoCuries / cubic meter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gross Beta 519	< 0.002	0.025 (467 / 467) 0.004 - 0.077	No. 46.1 McKeel's Service, Industry 2.3 miles NNE/NE	0.027 (52 / 52) 0.009 - 0.076	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	0.024 (52 / 52) 0.006 - 0.056	0
I-131 519	< 0.04	LLD (0 / 467)		LLD (0 / 467)	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	LLD (0 / 52)	0
Gamma 40							
Be-7	NA	0.071 (36 / 36) 0.052 - 0.100	No. 29B Friendship Ridge, Beaver 8.0 miles NE	0.078 (4 / 4) 0.064 - 0.100	No. 48 Weirton, WV Water Tower Collier Way 16.3 miles SSW	0.068 (4 / 4) 0.058 - 0.078	NA
Co-60	NA	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	NA
Cs-134	< 0.0005	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	0
Cs-137	< 0.0005	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	0
Ba-La-140	NA	LLD (0 / 36)		LLD (0 / 36)		LLD (0 / 4)	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Drinking Water

Unit of Measurement: (picoCuries / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
I-131 156	< 0.5	0.5 (36 / 104) 0.3 - 1.4	No. 4 Midland Water 1.3 miles NW	0.5 (18 / 52) 0.3 - 1.4	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.5 (29 / 52) 0.2 - 1.2	0
H-3 12	< 200	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Gamma 36							
Mn-54	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Fe-59	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-58	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-60	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zn-65	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zr-Nb-95	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-134	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-137	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Ba-La-140	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Surface Water

Unit of Measurement: (picoCuries / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
I-131 51	< 0.5				No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.5 (29 / 51) 0.2 - 1.2	0
H-3 12	< 200	LLD (0 / 8)		LLD (0 / 8)		LLD (0 / 4)	0
Gamma 36							
Mn-54	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Fe-59	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-58	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Co-60	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zn-65	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Zr-Nb-95	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-134	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Cs-137	< 5	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0
Ba-La-140	< 10	LLD (0 / 24)		LLD (0 / 24)		LLD (0 / 12)	0

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Ground Water

Unit of Measurement: (picoCuries / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
H-3 4	< 200	LLD (0 / 4)		LLD (0 / 4)			
Gamma 4					Note: There is no longer a well available for sampling in Shippingport		
Mn-54	< 5	LLD (0 / 4)		LLD (0 / 4)			
Fe-59	< 10	LLD (0 / 4)		LLD (0 / 4)			
Co-58	< 5	LLD (0 / 4)		LLD (0 / 4)			
Co-60	< 5	LLD (0 / 4)		LLD (0 / 4)			
Zn-65	< 10	LLD (0 / 4)		LLD (0 / 4)			
Zr-Nb-95	< 5	LLD (0 / 4)		LLD (0 / 4)			
Cs-134	< 5	LLD (0 / 4)		LLD (0 / 4)			
Cs-137	< 5	LLD (0 / 4)		LLD (0 / 4)			
Ba-La-140	< 10	LLD (0 / 4)		LLD (0 / 4)			

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Precipitation Water

Unit of Measurement: (picoCuries / liter)

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

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: **Beaver Valley Power Station Unit 1 and Unit 2**

Docket No.: **50-334 / 50-412**

Location of Facility: **Beaver County, Pennsylvania**

Reporting Period: Calendar Year - 2015

Medium: Milk

Unit of Measurement: (picoCuries / liter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
I-131 59	< 0.5	LLD (0 / 39)		LLD (0 / 39)	No. 96 Burgettstown, PA Windsheimer Farm 10.4 miles SSW	LLD (0 / 20)	0
Sr-89 58	< 2.0	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 19)	NA
Sr-90 58	< 0.7	0.9 (13 / 39) 0.5 - 1.8	No. 114 Hookstown, PA Covert Residence 1.9 miles SW	1.1 (8 / 20) 0.8 - 1.8	No. 96 Burgettstown, PA Windsheimer Farm 10.4 miles SSW	0.9 (14 / 19) 0.6 - 1.3	NA
Gamma 59							
K-40	< 150	1497 (29 / 39) 1227 - 1836	No. 114 Hookstown, PA Covert Residence 1.9 miles SW	1649 (9 / 19) 1325 - 1836	No. 96 Burgettstown, PA Windsheimer Farm 10.4 miles SSW	1378 (20 / 20) 1257 - 1470	NA
Mn-54	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Fe-59	< 10	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Co-58	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Co-60	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Zn-65	< 10	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Zr-Nb-95	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	NA
Cs-134	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	0
Cs-137	< 5	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	0
Ba-La-140	< 10	LLD (0 / 39)		LLD (0 / 39)		LLD (0 / 20)	0

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Fish

Unit of Measurement: (picoCuries / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gamma 15					No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE		
Mn-54	< 0.05	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Fe-59	< 0.10	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Co-58	< 0.05	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Co-60	< 0.05	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Zn-65	< 0.10	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Zr-Nb-95	< 0.01	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	NA
Cs-134	< 0.05	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Cs-137	< 0.05	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	0
Ba-La-140	< 0.01	LLD (0 / 9)		LLD (0 / 9)		LLD (0 / 6)	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Foodcrops

Unit of Measurement: (picoCuries / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
I-131 12	< 0.06	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	0
Gamma 12							
K-40	NA	2.90 (9 / 11) 1.95 - 7.27	No. 12A Racoon, PA 2.3 miles E	4.01 (5 / 7) 2.13 - 7.27	No. 48B Weirton, WV 16.5 miles SSW	2.60 (1 / 1) 2.60 - 2.60	NA
Mn-54	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Fe-59	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Co-58	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Co-60	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Zn-65	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Zr-Nb-95	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
Cs-134	0.04	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	0
Cs-137	0.06	LLD (0 / 11)		LLD (0 / 11)	No. 48B Weirton, WV 16.5 miles SSW	LLD (0 / 1)	0
Ba-La-140	NA	LLD (0 / 11)		LLD (0 / 11)		LLD (0 / 1)	NA
C-14 4	NA	232.0 (2 / 2) 231.4 - 232.5	No. 10B Shippingport, PA 1.0 miles ENE	232.0 (2 / 2) 231.4 - 232.5	No. 48 Weirton, WV 16.5 miles SSW	227.0 (2 / 2) 226.5 - 227.6	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Feedstuff

Unit of Measurement: (picoCuries / gram) Wet

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gamma 12							
Be-7	< 0.2	0.36 (1 / 12) 0.36 - 0.36	No. 27 Brunton Farm 3681 Ridge Road Aliquippa, PA 6.2 miles SE	0.36 (1 / 12) 0.36 - 0.36	No. 27 Brunton Farm 3681 Ridge Road Aliquippa, PA 6.2 miles SE	0.36 (1 / 12) 0.36 - 0.36	NA
K-40	< 0.15	8.09 (12 / 12) 5.43 - 11.67	No. 27 Brunton Farm 3681 Ridge Road Aliquippa, PA 6.2 miles SE	8.09 (12 / 12) 5.43 - 11.67	No. 27 Brunton Farm 3681 Ridge Road Aliquippa, PA 6.2 miles SE	8.09 (12 / 12) 5.43 - 11.67	NA
Mn-54	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Fe-59	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Co-58	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Co-60	< 0.02	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Zn-65	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Zr-Nb-95	< 0.03	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
Ru-103	< 0.03	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA
I-131	< 0.06	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Cs-134	< 0.04	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Cs-137	< 0.06	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	0
Ba-La-140	< 0.01	LLD (0 / 12)		LLD (0 / 12)		LLD (0 / 12)	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Sediment (page 1 of 2)

Unit of Measurement: (picoCuries / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gamma 6							
K-40	NA	8.88 (4 / 4) 6.23 - 12.83	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	10.67 (2 / 2) 8.50 - 12.83	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	11.90 (2 / 2) 11.72 - 12.07	NA
Mn-54	< 0.02	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Fe-59	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Co-58	< 0.02	0.14 (1 / 4) LLD - 0.14	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.14 (1 / 2) 0.14 - 0.14		LLD (0 / 2)	NA
Co-60	< 0.02	0.53 (1 / 4) LLD - 0.53	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.53 (1 / 2) 0.53 - 0.53		LLD (0 / 2)	NA
Zn-65	< 0.04	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Zr-95	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Nb-95	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Cs-134	< 0.06	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	0
Cs-137	< 0.08	0.08 (3 / 4) 0.05 - 0.10	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.10 (2 / 2) 0.10 - 0.10	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.09 (2 / 2) 0.08 - 0.09	0
Ba-La-140	< 0.03	LLD (0 / 4)		LLD (0 / 4)		LLD (0 / 2)	NA
Tl-208	NA	0.29 (4 / 4) 0.21 - 0.37	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.34 (2 / 2) 0.30 - 0.37	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	0.34 (2 / 2) 0.32 - 0.36	NA

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Sediment (page 2 of 2)

Unit of Measurement: (picoCuries / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Bi-214	NA	0.74 (4 / 4) 0.55 - 0.93	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.88 (2 / 2) 0.83 - 0.93	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.05 (2 / 2) 0.94 - 1.15	NA
Pb-212	NA	0.90 (4 / 4) 0.72 - 1.28	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	1.06 (2 / 2) 0.84 - 1.28	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.18 (2 / 2) 1.01 - 1.35	NA
Pb-214	NA	0.86 (4 / 4) 0.70 - 1.02	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	0.99 (2 / 2) 0.95 - 1.02	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.11 (2 / 2) 0.99 - 1.23	NA
Ra-226	NA	1.79 (4 / 4) 1.33 - 2.32	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	2.18 (2 / 2) 2.04 - 2.32	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	2.17 (2 / 2) 2.16 - 2.18	NA
Ac-228	NA	0.93 (4 / 4) 0.66 - 1.31	No. 2A BVPS Outfall Vicinity 0.2 miles WSW	1.14 (2 / 2) 0.96 - 1.31	No. 49A Industry, PA Upstream of Montgomery Dam 5.0 miles NE	1.19 (2 / 2) 1.06 - 1.31	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Soil (page 1 of 2)

Unit of Measurement: (picoCuries / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gamma 9							
K-40	NA	11.71 (8 / 8) 9.37 - 14.84	No. 29A Beaver, PA 8.1 miles NE	14.84 (1 / 1) 14.84 - 14.84	No. 48 Weirton, WV 16.4 miles SSW	13.04 (1 / 1) 13.04 - 13.04	NA
Mn-54	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Fe-59	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Co-58	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Co-60	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Zn-65	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Zr-95	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Nb-95	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Cs-134	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Cs-137	NA	0.14 (8 / 8) 0.06 - 0.21	No. 46B Industry, PA 2.7 miles NE	0.21 (1 / 1) 0.21 - 0.21	No. 48 Weirton, WV 16.4 miles SSW	0.25 (1 / 1) 0.25 - 0.25	NA

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: Soil (page 2 of 2)

Unit of Measurement: (picoCuries / gram) Dry

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Ba-La-140	NA	LLD (0 / 8)		LLD (0 / 1)		LLD (0 / 1)	NA
Tl-208	NA	0.35 (8 / 8) 0.24 - 0.42	No. 46B Industry, PA 2.7 miles NE	0.42 (1 / 1) 0.42 - 0.42	No. 48 Weirton, WV 16.4 miles SSW	0.39 (1 / 1) 0.39 - 0.39	NA
Bi-214	NA	0.90 (8 / 8) 0.54 - 1.13	No. 29A Beaver, PA 8.1 miles NE	1.13 (1 / 1) 1.13 - 1.13	No. 48 Weirton, WV 16.4 miles SSW	1.19 (1 / 1) 1.19 - 1.19	NA
Pb-212	NA	0.97 (8 / 8) 0.78 - 1.16	No. 29A Beaver, PA 8.1 miles NE	1.16 (1 / 1) 1.16 - 1.16	No. 48 Weirton, WV 16.4 miles SSW	0.97 (1 / 1) 0.97 - 0.97	NA
Pb-214	NA	1.01 (8 / 8) 0.68 - 1.31	No. 29A Beaver, PA 8.1 miles NE	1.31 (1 / 1) 1.31 - 1.31	No. 48 Weirton, WV 16.4 miles SSW	1.27 (1 / 1) 1.27 - 1.27	NA
Ra-226	NA	2.07 (8 / 8) 1.39 - 2.87	No. 29A Beaver, PA 8.1 miles NE	2.87 (1 / 1) 2.87 - 2.87	No. 48 Weirton, WV 16.4 miles SSW	2.02 (1 / 1) 2.02 - 2.02	NA
Ac-228	NA	1.04 (8 / 8) 0.72 - 1.24	No. 46B Industry, PA 2.7 miles NE	1.24 (1 / 1) 1.24 - 1.24	No. 48 Weirton, WV 16.4 miles SSW	1.14 (1 / 1) 1.14 - 1.14	NA

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 - ENVIRONMENTAL MONITORING PROGRAM

Table 2-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Name of Facility: Beaver Valley Power Station Unit 1 and Unit 2

Docket No.: 50-334 / 50-412

Location of Facility: Beaver County, Pennsylvania

Reporting Period: Calendar Year - 2015

Medium: External Radiation

Unit of Measurement: (mR / Quarter)

Type and Total Number of Analysis Performed	Lower Limit of Detection LLD ^(a)	All Indicator Locations Mean (fraction) ^(b) Range ^(b)	Locations with Highest Annual Mean		Control Location		Number of Nonroutine Reported Measurements ^(c)
			Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	Name Distance and Direction	Mean (fraction) ^(b) Range ^(b)	
Gamma 528	4.6	18.1 (520 / 520) 9.8 - 31.1	No. 112 BVPS Site Perimeter Location 0.3 miles SSE	25.3 (8 / 8) 19.1 - 31.1	No. 48 Weirton, WV Water Tower Collier Way 16.4 miles SSW	19.4 (8 / 8) 18.5 - 21.0	0

^a Nominal Lower Limit of Detection

^b Mean and range based upon detectable measurements only.

Fraction of detectable measurements at specified locations is indicated in parentheses (fraction)

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

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

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3
Pre-Operational Environmental Radiological Monitoring Program Summary

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

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

(f) Fraction of detectable measurements at specified location.

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

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

Location of Facility: Beaver County, Pennsylvania Reporting Period: Calendar years 1974 - 1975

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean, (f) Range		
Soil - Core Samples - (picoCurie /gram) dry	Gross Alpha (0)	--	--		
	Gross Beta (8)	1	21	(8/8)	16 - 28
	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 (picoCurie / liter)	Gross Alpha (40)	0.3	0.75	(5/40)	0.6 - 1.1
	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 (picoCurie / liter)	I-131 (0)	--	--		
	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)	--	--		
Ground Water (picoCurie / liter)	Sr-90 (0)	--	--		
	Gross Alpha (19)	0.3		< LLD	
	Gross Beta (76)	0.6	2.9	(73/75)(b)	1.3 - 8.0
	Tritium (81)	100	440	(77/81)	80 - 800
Air Particulates and Gaseous (picoCurie /cubic meter)	Gamma (1)	10 - 60		< LLD	
	Gross Alpha (188)	0.001	0.003	(35/188)	0.002 - 0.004
	Gross Beta (927)	0.006	0.07	(927/927)	0.02 - 0.32
	Sr-89 (0)	--	--		
	Sr-90 (0)	--	--		
	I-131 (816)	0.04	0.08	(2/816)	0.07 - 0.08
	Gamma (197)	--	--		
	Zr/Nb-95	0.005	0.04	(122/197)	0.01 - 0.16
	Ru-106	0.010	0.04	(50/197)	0.02 - 0.09
	Ce-141	0.010	0.02	(3/197)	0.01 - 0.04
	Ce-144	0.010	0.02	(44/197)	0.01 - 0.04
	Others			< LLD	
(f) Fraction of detectable measurements at specified location.					

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Table 2-3 (Continued)

Pre-Operational Environmental Radiological Monitoring Program Summary

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

Location of Facility: Beaver County, Pennsylvania **Reporting Period:** Calendar years 1974 - 1975

Medium or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean, (f) Range		
Milk (picoCurie / liter)	I-131 (91)	0.25	0.6	(4/91)	0.3 - 0.8
	Sr-89 (134)	5	7	(4/134)	6 - 11
	Sr-90 (134)	1	5.3	(132/134)	1.5 - 12.8
	Gamma (134)	--	--	--	--
	Cs-137	10	13	(19/134)	11 - 16
	Others			< LLD	
External Radiation (milli Roentgen / day)	γ - Monthly (599)	0.5 mR*	0.20	(599/599)	0.08 - 0.51
	γ - Quarterly (195)	0.5 mR*	0.20	(195/195)	0.11 - 0.38
	γ - Annual (48)	0.5 mR*	0.19	(48/48)	0.11 - 0.30
Fish (picoCurie / gram) wet	Gross Beta (17)	0.01	1.9	(15/17)	1.0 - 3.2
	Sr-90 (17)	0.005	0.14	(17/17)	0.02 - 0.50
	Gamma (17)	0.5			
	K-40	--	2.4	(17/17)	1.0 - 3.7
	Others	--		< LLD	
<p>* LLD in units of mR - Lower end of useful integrated exposure detectability range for a passive radiation detector (TLD).</p> <p>(a) May include Ru-106, Ru-103, Be-7.</p> <p>(b) One outlier not included in mean. (Water taken from dried-up spring with high sediment and potassium content. Not considered typical groundwater sample).</p> <p>(f) Fraction of detectable measurements at specified location.</p>					

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

B. Air Monitoring

1. Characterization of Air and Meteorology

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

2. Air Sampling Program and Analytical Techniques

a. Program

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

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

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

b. Procedures

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

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

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

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

3. Results and Conclusions

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

a. Airborne Radioactive Particulates

Gross Beta: A total of five hundred nineteen (519) weekly samples from ten (10) locations were analyzed for gross beta. The results were comparable to that of previous years. Figure 2-2 indicates the weekly average concentration of gross beta in air particulates.

Gamma Spectrometry: A total of forty (40) quarterly samples were composited from ten (10) locations and analyzed for gamma spectrometry. Naturally occurring beryllium-7 was identified in thirty six of thirty six (36 of 36) indicator samples, and four of four (4 of 4) control samples. No other gammas were identified. A summary of the analysis results during the report period are listed in Table 2-2. A trend graph of analyses (including the pre-operational period through the report period) is shown on Figure 2-2.

Deviations from Required Sampling and Analysis Schedule: Two deviations occurred from the required airborne particulate sampling and analysis schedule during the report period.

During the sampling period of 04/06/2015 – 04/13/2015, REMP air particulate and iodine control sampling station at Friendship Ridge in Beaver, PA (Site No. 29B) was found to be out of service. The cause was determined to be from shattered vanes in the air pump. Accordingly, the shattered vanes were replaced later that day. The sample station was out of service for approximately 93 hours, as reported by the REMP technician. This issue was documented in Condition Report 2015-05181.

During the sampling period of 08/03/2015 – 08/10/2015, REMP air particulate and iodine control sampling station at Brunton Dairy in Aliquippa, PA (Site No. 27) was found to be out of service. The cause was determined to be from shattered vanes in the air pump. Accordingly, the shattered vanes were replaced later that day. The sample station was out of service for approximately 156 hours, as reported by the REMP technician. This issue was documented in Condition Report 2015-11091.

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

b. Airborne Radioiodine

Iodine-131: A total of five-hundred-nineteen (519) weekly charcoal filter samples were analyzed for iodine-131. Iodine-131 was **not** identified in any of the four hundred sixty seven (467) indicator samples, nor was it identified in any of the fifty two (52) control samples.

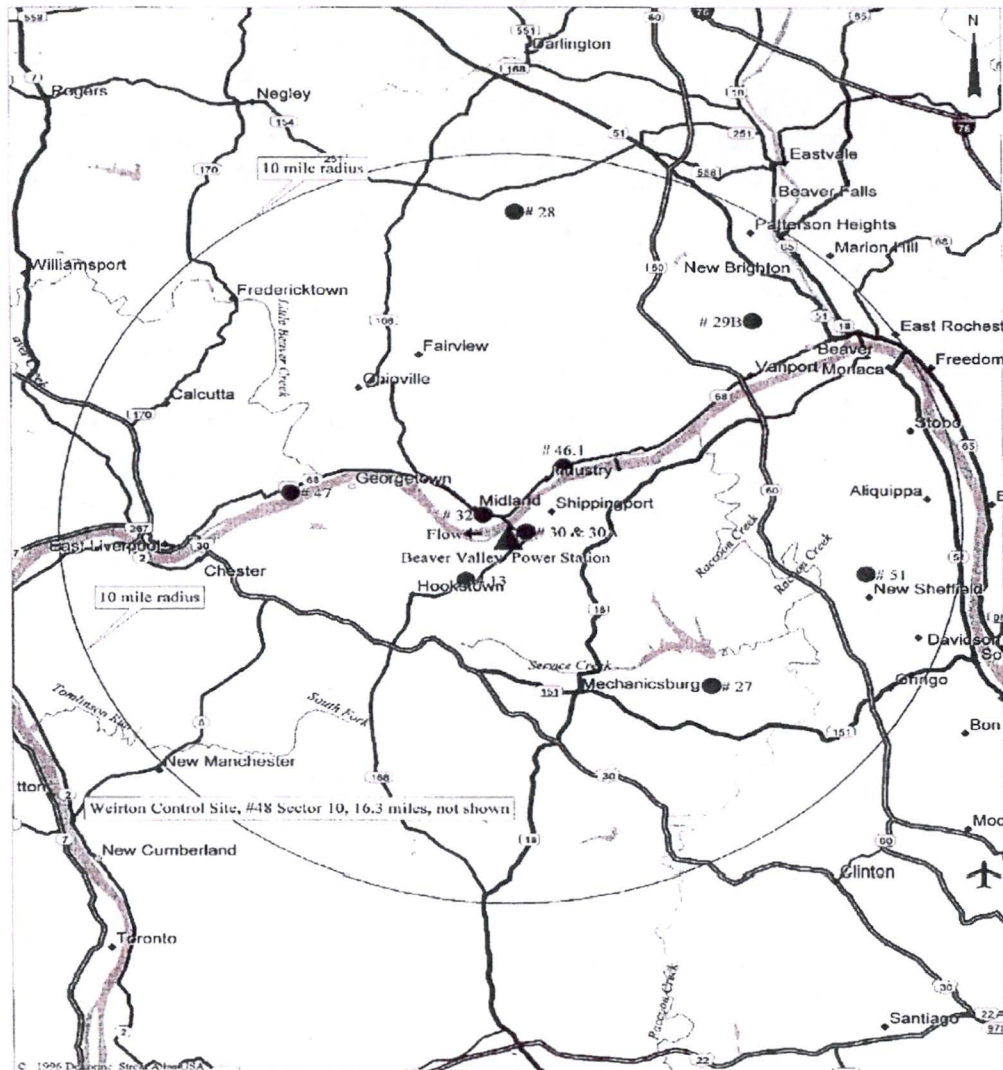
Deviations from Required Sampling and Analysis Schedule: The deviations are the same as described above for airborne particulates.

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

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-1

Environmental Monitoring Locations - Air Sampling Stations

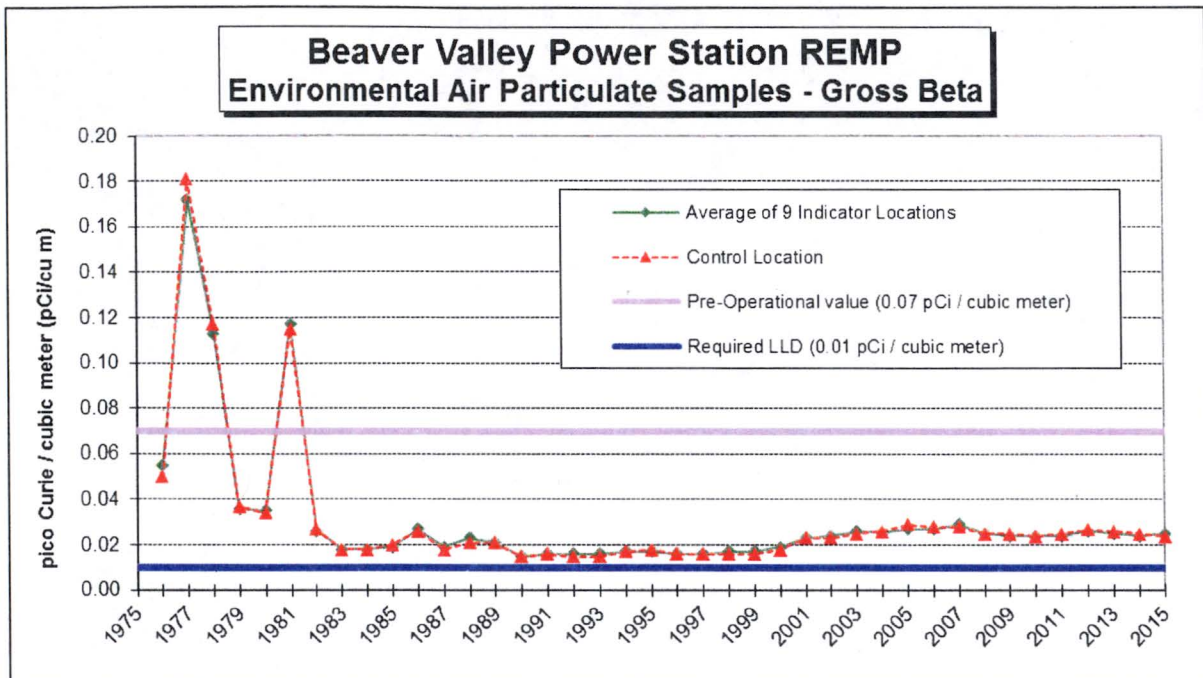


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Air Particulate & Radioiodine	13	11-SW	1.49	Hookstown, PA (Old Meyer Farm)
	27	7-SE	6.14	Aliquippa, Pa (Brunton Farm)
	28	1-N	8.60	Beaver Falls, PA (Sherman Farm)
	29B	3-NE	7.97	Beaver, PA (Friendship Ridge)
	30	4-ENE	0.43	Shippingport,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

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-2

Graph of Annual Average Concentration: Gross Beta in Air Particulates



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

C. Monitoring of Shoreline Stream Sediment and Soil

1. Characterization of Shoreline Stream Sediment and Soil

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

2. Sampling Program and Analytical Techniques

a. Program

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

Although not required by the ODCM, soil samples are collected every three (3) years. Soil samples were collected at each of the nine (9) locations during 2015 and are scheduled to be collected again in 2018. At each location, twelve (12) core samples (3" diameter by 2" deep) are gathered at prescribed points on a 10 foot radius circle. Each location is permanently marked with reference pins. Each set of samples is systematically selected by moving along the radius in such a manner as to assure representative undisturbed samples. Sampling locations are listed in Table 2-1 and are shown in Figure 2-3.

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

b. Analytical Procedures

Gamma Emitter Analysis of Stream Sediment: Analysis is performed in a 300 mL plastic bottle and analyzed by gamma spectrometry.

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

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3. Results and Conclusions

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

a. Shoreline Stream Sediment

Gamma Spectrometry: A total of six (6) sediment samples were analyzed by gamma spectrometry during the report period. Naturally occurring potassium-40, thallium-208, lead-212, lead-214, bismuth-214, radium-226 and actinium-228, were detected in four of four (4 of 4) indicator samples and two of two (2 of 2) control samples.

Cesium-137: Radionuclide cesium-137 was identified in three of four (3 of 4) indicator samples and two of two (2 of 2) control samples. The results were similar to that of previous years (current annual range = 0.05 to 0.10 picoCurie / gram) and less than the pre-operational level of 0.4 picoCurie / gram. Also, because cesium-137 was identified at the control location (upstream), then it was not due to plant effluent releases and is most likely residual contamination due from previous nuclear weapons tests.

Cobalt-58: Radionuclide cobalt-58 was identified in one of four (1 of 4) indicator samples and zero of two (0 of 2) control samples. The sample, which indicated cobalt-58, was obtained at the shore line of the BVPS Main Outfall Facility. The result was similar to the previous years (current annual range = LLD to 0.14 picoCurie / gram) and the data is slightly higher than the BVPS Main Outfall Facility pre-operational level of 0.098 picoCurie / gram.

Cobalt-60: Radionuclide cobalt-60 was identified in one of four (1 of 4) indicator samples and zero of two (0 of 2) control samples. The sample, which indicated cobalt-60, was obtained at the shore line of the BVPS Main Outfall Facility. The result was similar to previous years (current annual range = LLD to 0.53 pico Curie / gram), and the data is currently slightly higher than the BVPS Main Outfall Facility pre-operational level of 0.4 picoCurie / gram.

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

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

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b. Soil

Gamma Spectrometry: A total of nine (9) soil samples were analyzed by gamma spectrometry during the report period. Naturally occurring potassium-40, thallium-208, lead-212, lead-214, bismuth-214, radium-226 and actinium-228, were detected in eight of eight (8 of 8) indicator samples and one of one (1 of 1) control samples.

Cesium-137: Radionuclide cesium-137 was identified in nine of nine (9 of 9) indicator samples and one of one (1 of 1) control samples. The results were similar to previous years (current year range = 0.06 to 0.21 pico Curie / gram) and less than the pre-operational level of 1.2 pico Curie / gram. Also, because cesium-137 was identified at the control location (Weirton), then it was not due to plant effluent releases and is most likely residual contamination from previous nuclear weapons tests.

Deviations from Required Sampling and Analysis Schedule: Two deviations from the required soil sampling and analysis schedule occurred during the report period.

Sample point 22, South of BVPS Property, was not sampled this year due to safety concerns. This issue was documented in Condition Report 2015-15097.

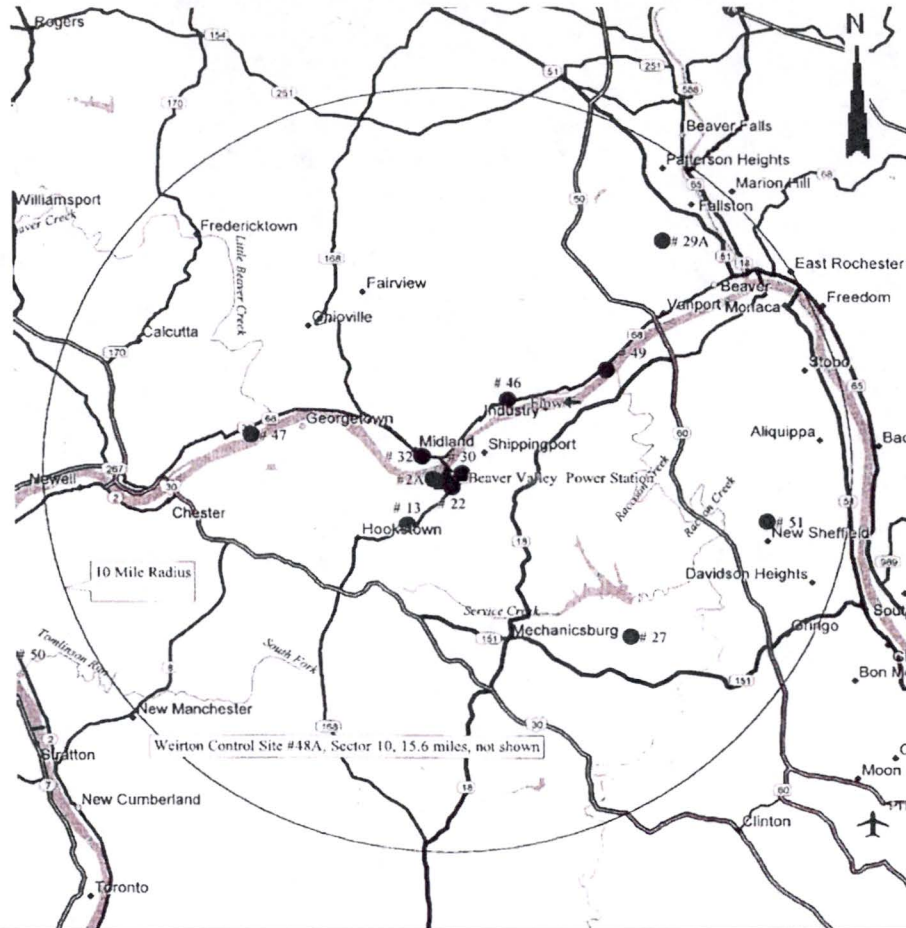
Sample Point 27B, Brunton Farm, was paved over by the owner in which a new location was sampled for the year. This issue was documented in Condition Report 2015-15097.

Summary: The identification of cesium-137 and barium-lanthanum-140 in the soil samples around the plant is not unusual because these radionuclides have been found in the environment from previous nuclear incidents and testing.

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Figure 2-3

Environmental Monitoring Locations - Shoreline Sediments and Soil

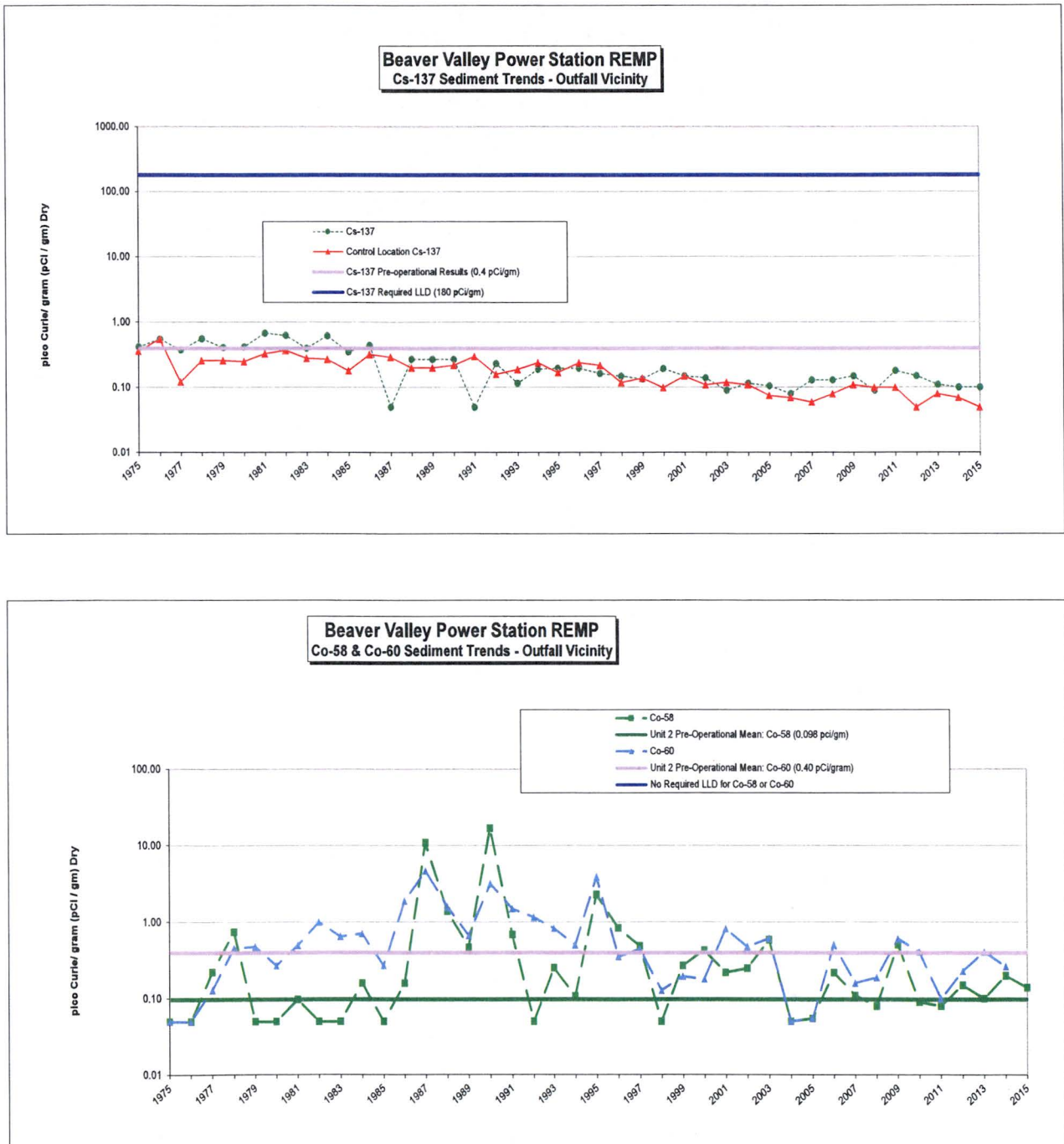


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Soil	13A	11-SW	1.49	Hookstown, PA (Old Meyer Farm)
	22	8-SSE	0.28	South of BVPS, Transmission Lines
	27B	7-SE	6.19	Aliquippa, PA (Brunton Farm)
	29A	3-NE	8.09	Beaver, PA (Nicol Farm)
	30A	4-ENE	0.43	Shippingport, PA (Cooks Ferry Substation)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

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Figure 2-4

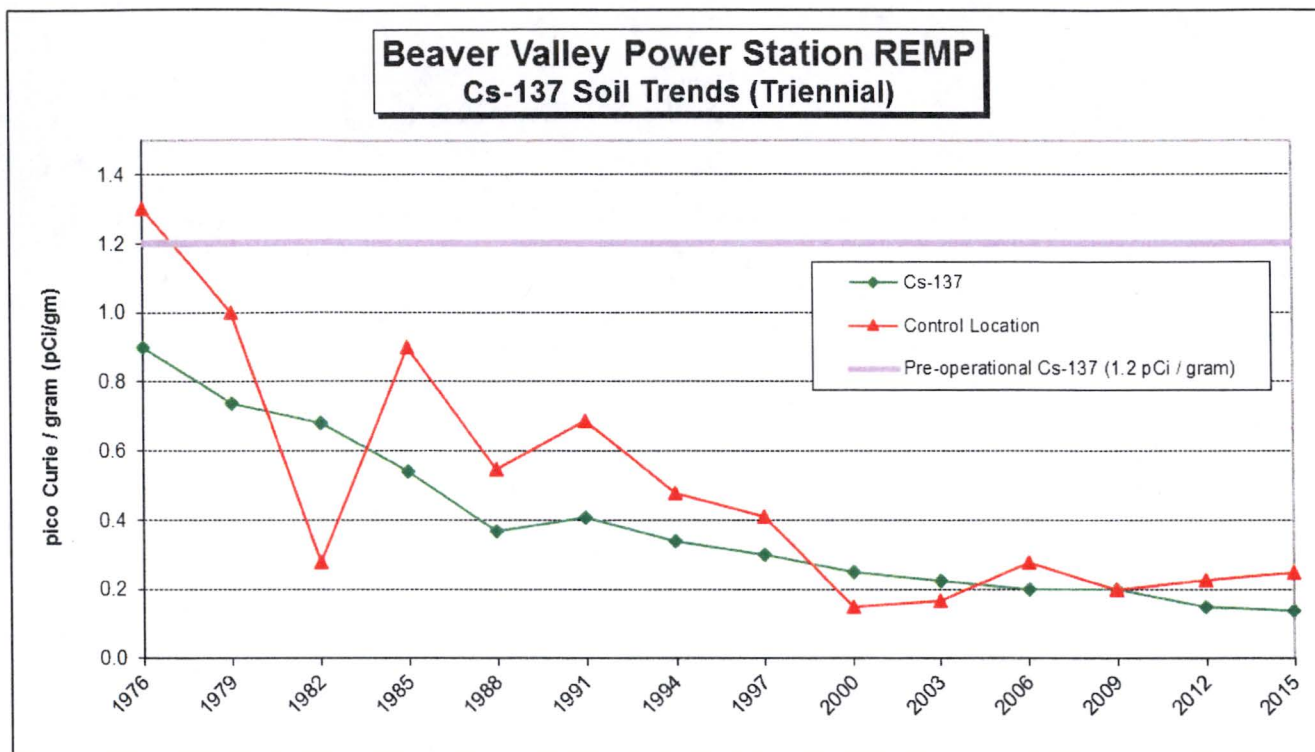
Graph of Annual Average Concentration: Cesium-137, Cobalt-58 & Cobalt-60 in Sediment



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Figure 2-5

Graph of Annual Average Concentration: Cesium-137 in Soil



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

D. Monitoring of Feedstuff and Foodcrops

1. Characterization of Farm Products

According to the 2012 Census of Agriculture ⁽¹⁾, there were six hundred and forty six (646) farms in Beaver County. Total market value of production was \$20,913,000.00 and of the total market value, \$10,879,000.00 from crops and \$10,035,000.00 from livestock. Some of the principal sources of revenue (>\$25,000.00) are as follows:

Milk and Other Dairy Products from Cows	\$5,271,000.00
Grains, Oil Seeds, Dry Beans and Dry Peas	\$4,419,000.00
Cattle and Calves	\$3,331,000.00
Other Crops and Hay	\$2,673,000.00
Nursery, Greenhouse, Floriculture and Sod	\$1,989,000.00
Vegetables, Melons, Potatoes and Sweet Potatoes	\$826,000.00
Other Animals and Other Animal Products	\$89,000.00
Sheep, Goats and their Products	\$59,000.00
Poultry and Eggs	\$38,000.00
Fruits, Tree Nuts and Berries	Undisclosed Amount
Cut Christmas Trees, and Short Rotation Woody Crops	Undisclosed Amount
Horses, Ponies, Mules, Burros, and Donkeys	Undisclosed Amount
Hogs & Pigs	Undisclosed Amount
Tobacco	Undisclosed Amount

(1) http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Pennsylvania/cp42007.pdf

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

2. Sampling Program and Analytical Techniques

a. Program

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

Foodcrops (leafy vegetables): Foodcrops are collected at garden locations during the growing season. Leafy vegetables (e.g. cabbage) are obtained from Shippingport, Racoon, Georgetown, and Industry, Pennsylvania. Samples are obtained from two (2) additional locations based upon the highest predicted annual average ground D/Q when milk locations are unavailable. Samples are also obtained from the control location in Weirton, West Virginia. All samples are analyzed for gamma emitters by gamma spectrometry. Samples are also analyzed by radiochemical analysis for iodine-131.

b. Procedures

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

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

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

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Carbon-14 Analysis of Foodcrops: Analysis is performed by accelerator mass spectrometry radiocarbon dating. Samples are converted into solid graphite via combustion and various chemical reactions. Samples (and reference materials) are pressed into metal discs and loaded onto a target wheel. Ions from a cesium gun are fired at the discs to create negatively charged carbon atoms. Ions are then passed along a stripper causing them to lose their electrons and gain a triple positive charge. At this point, only carbon atoms remain because other molecules in the sample cannot exist in this triple positive state. For mass analysis, a magnetic field is applied to the moving particles which causes them to deflect along the path they are traveling in relation to their masses, allowing the number of particles to be measured.

3. Results and Conclusions

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

a. Feedstuff

Gamma Spectrometry: Although not required by the ODCM, a total of twelve (12) samples were analyzed by gamma spectrometry. Naturally occurring potassium-40 was identified in twelve of twelve (12 of 12) samples. Naturally occurring beryllium-7 was found in one of twelve (1 of 12) samples.

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

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

b. Foodcrops

Iodine-131: A total of twelve (12) samples were analyzed for iodine-131. No detectable concentrations were present in the eleven (11) indicator samples or the one (1) control sample.

Gamma Spectrometry: A total of twelve (12) samples were analyzed by gamma spectrometry. Naturally occurring potassium-40 was identified in nine of eleven (9 of 11) indicator samples and one of one (1 of 1) control sample.

Carbon-14: Although not required by the ODCM, a total of four (4) samples were analyzed. Radionuclide carbon-14 was identified in two of two (2 of 2) indicator samples and two of two (2 of 2) control samples.

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

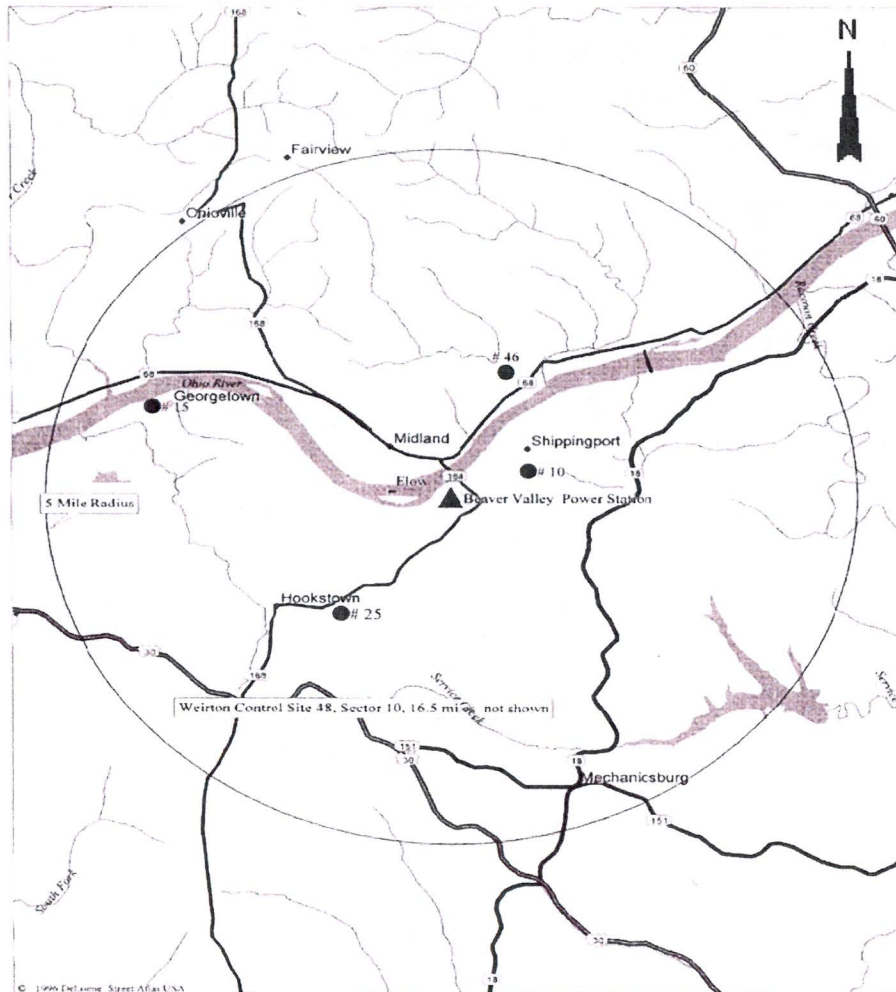
SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

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

SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Figure 2-6

Environmental Monitoring Locations – Feedstuff and Foodcrops

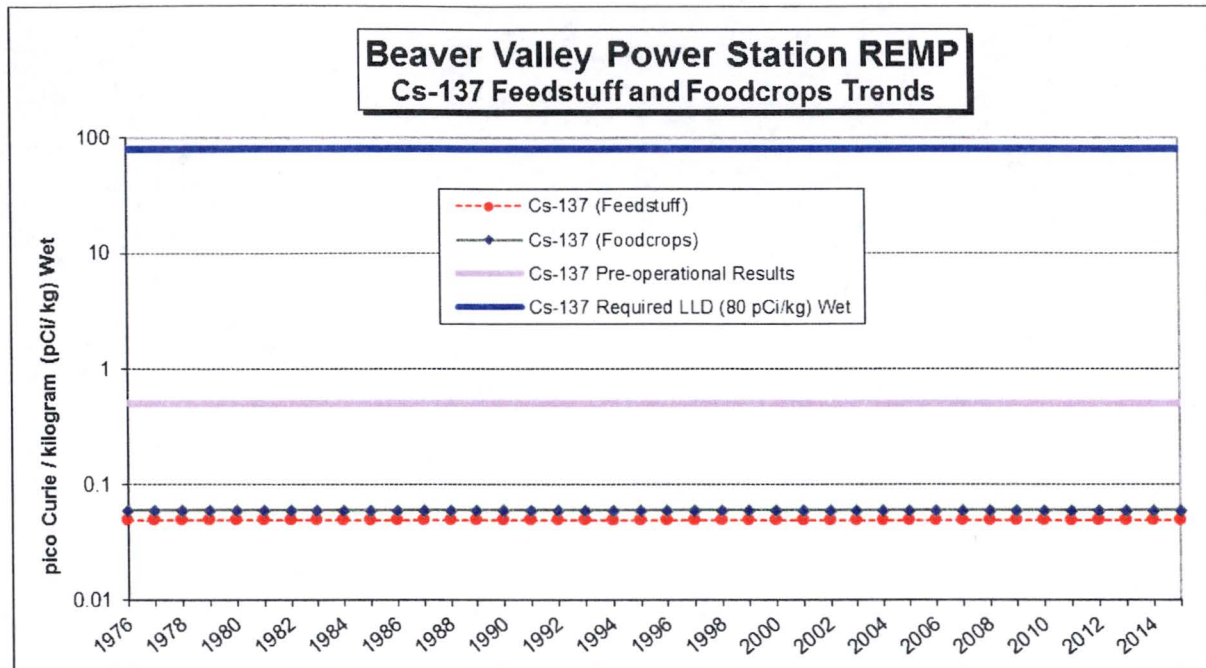


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Feed	27	7-SE	6.16	Aliquippa, PA (Brunton Farm)
Food	10*	*	*	Shippingport, PA
	15*	*	*	Georgetown, PA
	46*	*	*	Industry, PA
	48*	*	*	Weirton, WV
	*	*	*	2 locations based on highest predicted D/Q
Individual garden locations may change based upon availability. The requirements are met as long as one garden is sampled from each of these communities.				

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Figure 2-7

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



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

E. Monitoring of Local Cow and Goat Milk

1. Description - Milch Animal Locations

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

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

2. Sampling Program and Analytical Techniques

a. Program

Cow milk was collected from the one (1) reference dairy farm within a 10-mile radius of the BVPS, Brunton Dairy Farm (6.1 miles SE) and one (1) control location dairy farm outside of the 10-mile radius, Windsheimer Dairy Farm (10.4 miles SSW).

Dairy cow sampling was performed at Brunton Dairy in 2015 due to the fact that Halstead Dairy and Searight Dairy closed in 2014.

Additionally, one goat location was available for sampling and samples were obtained at the Covert Residence (1.9 miles SW).

The dairies are subject to change based upon availability of milk or when more recent data (milch animal census, and/or change in meteorological conditions) indicate other locations are more appropriate.

The milk samples are collected and analyzed biweekly when the animals are on pasture and monthly at other times. The monthly and/or bi-weekly sample is analyzed for principle gamma emitters (including cesium-137 by high resolution germanium gamma spectrometry), and iodine-131 high sensitivity analysis. Although not required by the ODCM, the monthly and/or biweekly sample is also analyzed for strontium-89, strontium-90.

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

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Figure 2-8

Table of Local Cow and Goat Locations

Site	Dairy	Approximate Number of Animals being Milked	Distance and Direction from Midpoint between Unit 1 and Unit 2 Reactor	Collection Period
25*	Searight Dairy 948 McCleary Road Hookstown, PA	0 Cows Dairy Closed end of 2013	2.1 miles SSW	January thru December
27	Brunton Dairy 3681 Ridge Road Aliquippa, PA	104 Cows	6.1 miles SE	January thru December
96	Windsheimer Dairy 20 Windsheimer Lane Burgettstown, PA	83 Cows	10.4 miles SSW	January thru December
113*	Halstead Dairy 104 Tellish Drive Hookstown, PA	0 Cows Dairy Closed beginning of 2014	5.1 miles SSW	January thru December
* Highest potential pathway dairies based on evaluation of deposition parameters				

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b. Procedure

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

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

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

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

3. Results and Conclusions

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

- a. Strontium-89: Although not required by the ODCM, a total of **fifty eight (58)** milk samples were analyzed for strontium-89 during the report period. Strontium-89 was **not detected** in any of the **thirty nine (39)** indicator samples, nor was it detected in any of the **nineteen (19)** control samples.
- b. Strontium-90: Although not required by the ODCM, a total of **fifty eight (58)** milk samples were analyzed for strontium-90 during the report period. Strontium-90 was **detected** in **thirteen of thirty nine (13 of 39)** indicator samples and **fourteen of nineteen (14 of 19)** control samples. The levels detected were attributed to previous nuclear weapons tests and are within the expected range.
- c. Gamma Spectrometry: A total of **fifty nine (59)** milk samples were analyzed by gamma spectrometry during the report period. Naturally occurring potassium-40 was present in **twenty nine of thirty nine (29 of 39)** indicator samples and **twenty of twenty (20 of 20)** control samples. No other gamma-emitting radionuclides were identified during analysis.

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- d. Iodine-131: A total of fifty nine (59) milk samples were analyzed for iodine-131 during the report period. Iodine-131 was not detected in any of the thirty nine (39) indicator samples, nor was it detected in any of the twenty (20) control samples.
- e. Deviations from Required Sampling and Analysis: Two deviations from the required milk sampling and analysis schedule occurred for the reporting period.

Sufficient milk samples were not available from locations within the 5 mile radius this year. The unavailability of milk caused the REMP to not meet the ODCM sample requirements in 1/2-ODC-2.03 and in 1/2-ODC-3.03, Attachment Q Table 3.12-1 stating that a minimum of four (4) milk locations shall be sampled. This initiated the ODCM requirement for sampling two (2) additional garden locations based upon the highest predicted annual average D/Q when milk locations are not available.

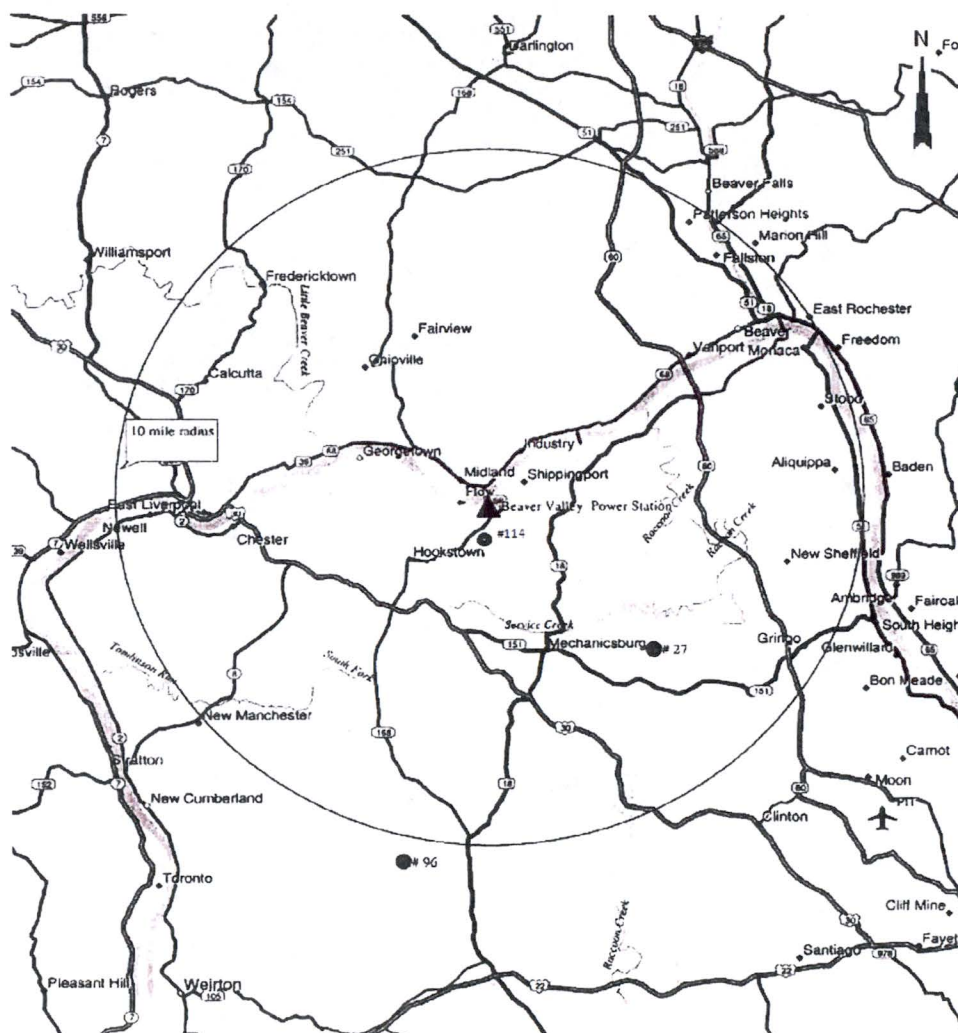
The second deviation occurred when the vendor laboratory accidentally discarded the milk sample that was to be analyzed for strontium-89 and strontium-90, from Site No. 96, Windsheimer Dairy Farm, Burgettstown, PA. The analysis for strontium-89 and strontium-90 is not required by the ODCM. All other analyses such as gamma emitters (including cesium-137 by high resolution germanium gamma spectrometry), and iodine-131 high sensitivity analysis are required by the ODCM and were performed. The vendor was switching to a new refrigeration unit and accidentally discarded the milk sample. This issue was documented in Condition Report 2016-04028.

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

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Figure 2-8

Environmental Monitoring Locations – Milk

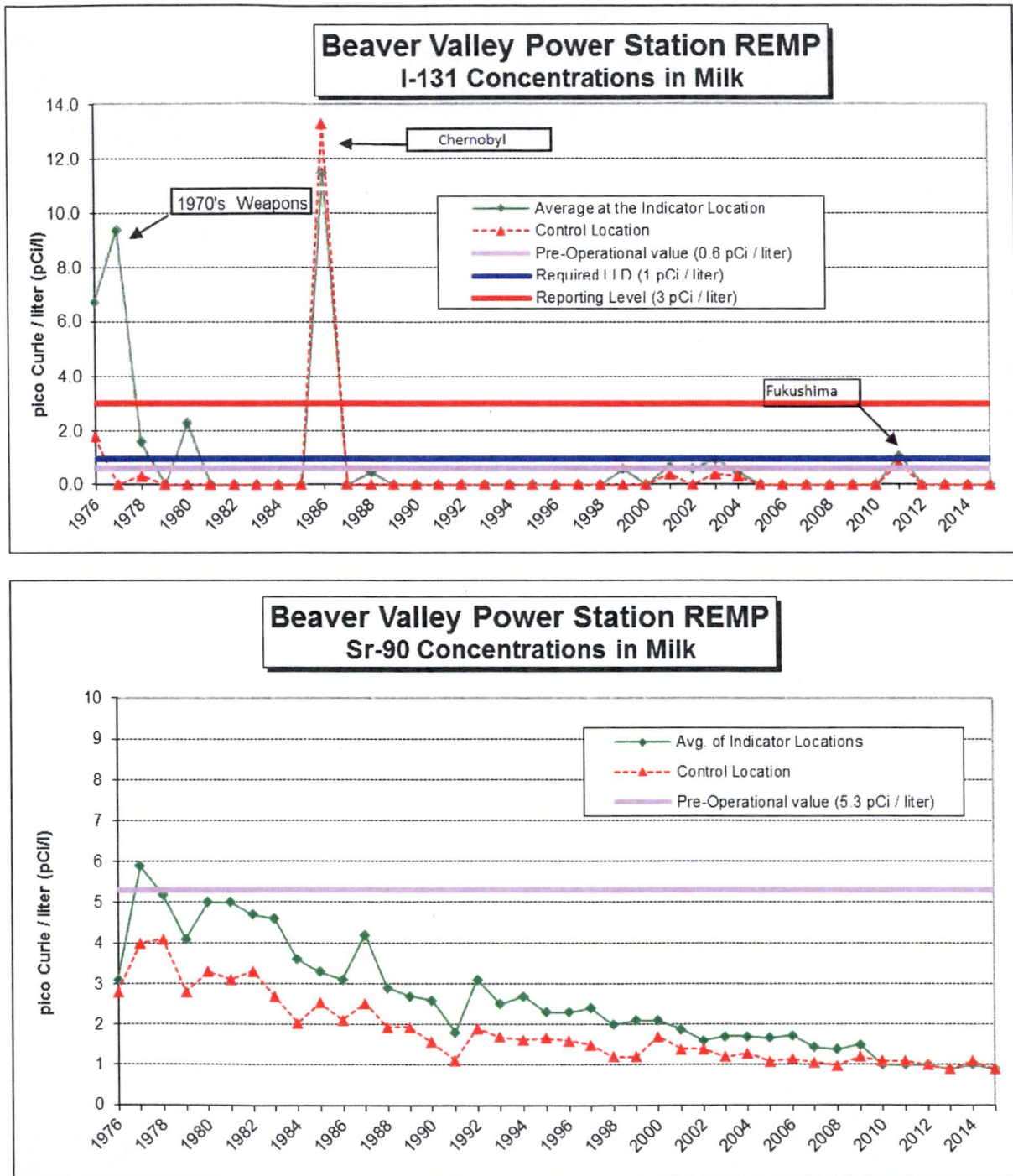


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Milk	27	7-SE	6.1	Aliquippa, PA (Brunton Farm)
	96	10-SSW	10.4	Burgettstown, PA (Windsheimer Farm)
	114	11-SW	1.9	Hookstown, PA (Covert Residence)

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Figure 2-9

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



SECTION 2 – ENVIRONMENTAL MONITORING PROGRAM

Environmental Radiation Monitoring

1. Description of Regional Background Radiation and Sources

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

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

2. Locations and Analytical Procedures

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

During the report period, there were a total of sixty six (66) environmental TLD locations. This is comprised of forty four (44) offsite locations, along with twenty two (22) fence perimeter locations. The offsite TLD locations are plotted on Figure 2-10, but the fence perimeter locations are not plotted due to the large scale of the figure.

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

3. Results and Conclusions

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

TLD Analysis: During the report period, the average quarterly external exposure rate (as measured from TLD) was 18.1 mR at the sixty six (66) indicator locations, and 19.4 mR at the control location. This external exposure rate is comparable to previous years. As expected, there was some variation in external exposure rate among locations and seasons.

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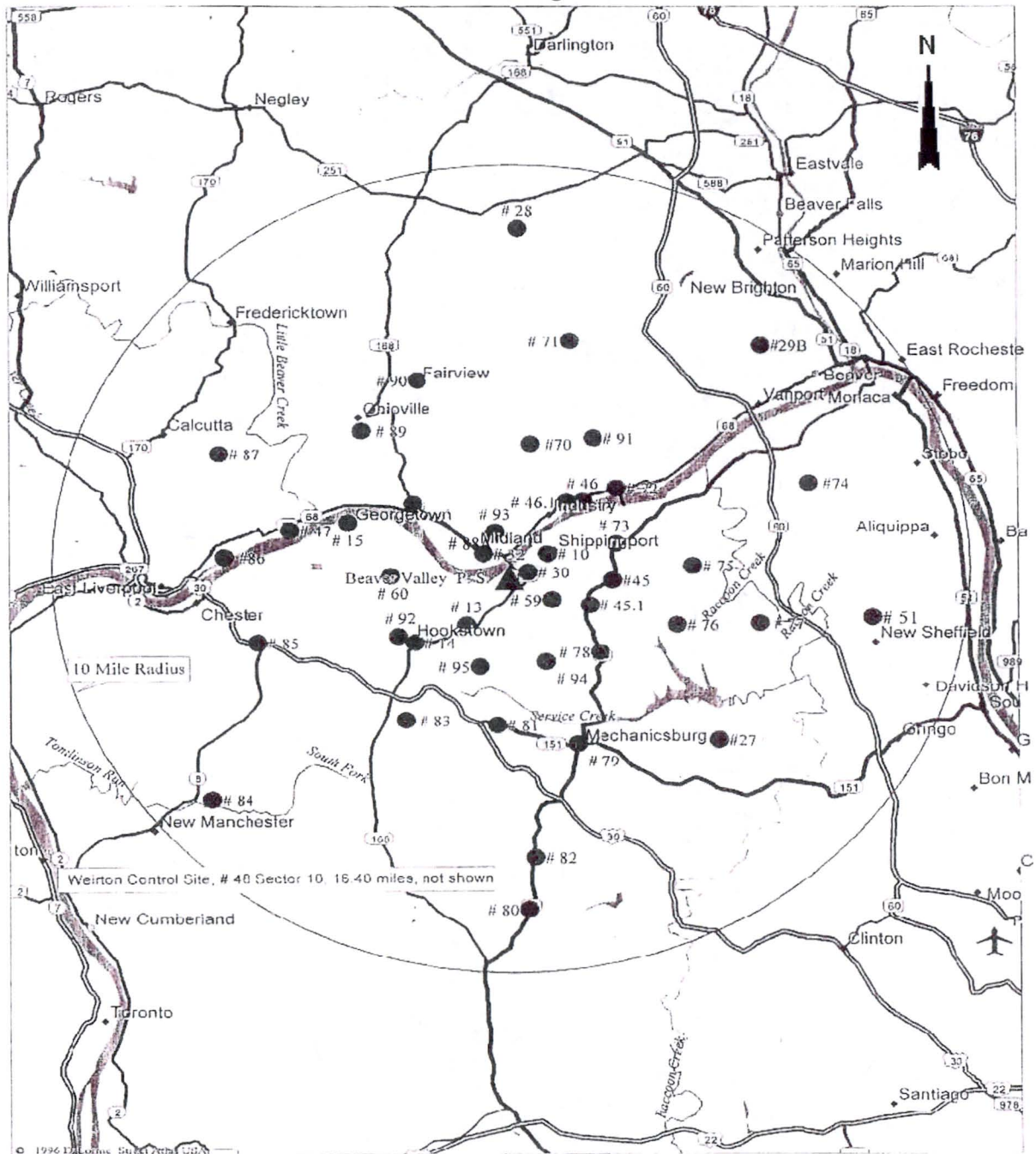
Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required TLD sampling and analysis schedule during the report period.

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

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Figure 2-10

Environmental Monitoring Locations - TLDs



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Figure 2-10 (Continued)

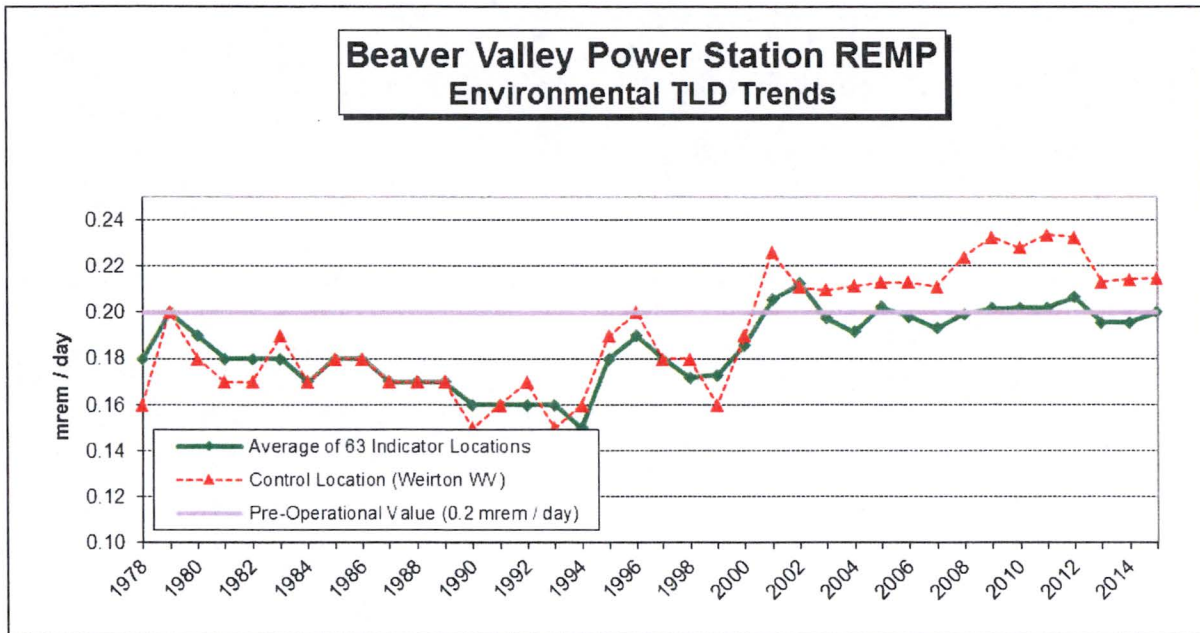
TLD Locations

SOUTHEAST QUADRANT							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
27	7-SE	6.14	Brunton Dairy Farm Aliquippa, PA	78	7-SE	2.72	Raccoon Twp Municipal Building Raccoon Township, PA
45.1	6-ESE	1.92	Kennedy's Corners Raccoon Township, PA	79	8-SSE	4.46	106 State Route 151 Green Twp. Aliquippa, PA
51	5-E	8.00	Sheffield Substation Aliquippa, PA	80	9-S	8.27	Park Office, State Route 18 Raccoon Township, PA
59	6-ESE	0.99	236 Green Hill Road Aliquippa, PA	82	9-S	6.99	2697 State Route 18 Raccoon Twp, PA
76	6-ESE	3.80	Raccoon Elementary School Raccoon Township, PA	94	8-SSE	2.25	McCleary & Pole Cat Hollow Road Hookstown, PA
77	6-ESE	5.52	3614 Green Garden Road Aliquippa, PA				
NORTHWEST QUADRANT							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
15	14-WNW	3.75	Post Office Georgetown, PA	87	14-WNW	7.04	50103 Calcutta Smith Ferry Road Calcutta, OH
32	15-NW	0.75	North Substation Midland, PA	88A	15-NW	2.8	Route 168 Midland Heights PA
47	14-WNW	4.88	Water Department East Liverpool, OH	89	15-NW	4.72	488 Smith's Ferry Road Ohioville, PA
60	13-W	2.51	444 Hill Road Georgetown, PA	90	16-NNW	5.20	6286 Tuscarawas Road Midland, PA
86	13-W	6.18	1090 Ohio Avenue East Liverpool, OH	93	16-NNW	1.10	104 Linden - Sunrise Hills Midland, PA
NORTHEAST QUADRANT							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
10	3-NE	0.94	Post Office Shippingport, PA	70	1-N	3.36	236 Engle Road Industry, PA
28	1-N	8.60	Sherman Farm Brighton Twp, PA	71	2-NNE	6.01	First Western Bank Brighton Township, PA
29B	3-NE	7.97	Friendship Ridge Beaver, PA	72	3-NE	3.25	Ohioview Lutheran Church – Rear Raccoon Twp, PA
30	4-ENE	0.43	Cook's Ferry Substation Shippingport, PA	73	4-ENE	2.48	618 Squirrel Run Road Industry, PA
45	5-E	2.19	Christian House Baptist Chapel, State Rte 18 Raccoon Township, PA	74	4-ENE	6.92	137 Poplar Avenue (CCBC) Monaca, PA
46	3-NE	2.49	Midway Drive Industry, PA	75	5-E	4.08	117 Holt Road Aliquippa, PA
46.1	2-NNE 3-NE	2.28	McKeel's Service, State Route 68 Industry, PA	91	2-NNE	3.89	Pine Grove Road & Doyle Road Industry, PA
SOUTHWEST QUADRANT							
Site No.	Sector	Distance (miles)	Location	Site No.	Sector	Distance (miles)	Location
13	11-SW	1.49	Old Meyer Farm Hookstown, PA	84	11-SW	8.35	Senior Center Hancock County, WV
14	11-SW	2.53	Hookstown, PA	85	12-WSW	5.73	2048 State Route 30 West Chester, WV
48	10-SSW	16.40	Collier Way Water Tower Weirton, WV	92	12-WSW	2.81	Georgetown Road Substation Georgetown, PA
81	9-S	3.69	Millcreek United Presbyterian Church Hookstown, PA	95	10-SSW	2.37	832 McCleary Road Hookstown, PA
83	10-SSW	4.26	735 Mill Creek Road, Hookstown, PA				

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Figure 2-11

Graph of Annual Average Exposure: Direct Radiation in Environment



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G. Monitoring of Fish

1. Description

During the report period, fish species collected for the radiological monitoring program included flathead catfish, black buffalo, smallmouth bass, freshwater drum, quillback, redhorse, longnose gar, shorthead buffalo and channel 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 species caught is analyzed by gamma spectroscopy. Fish sampling locations are shown in Figure 2-12.

b. Procedure

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

3. Results and Conclusions

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

Gamma Spectrometry: A total of fifteen (15) fish samples were analyzed by gamma spectrometry during the report period. Gamma emitting radionuclides were not detected in any of the nine (9) indicator samples, nor were they detected in any of the six (6) control samples.

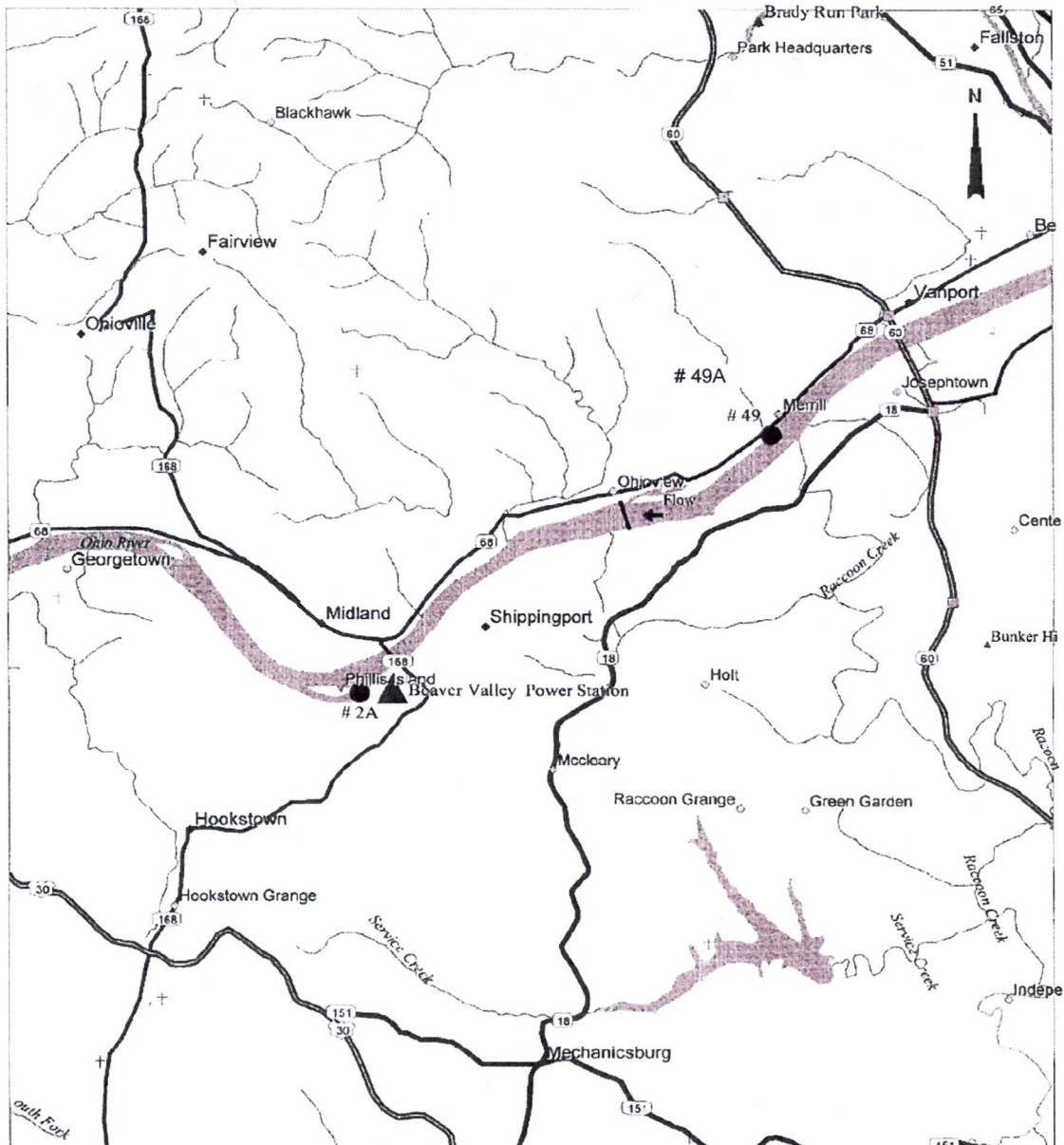
Deviations from Required Sampling and Analysis Schedule: There were no deviations from the required fish sampling and analysis schedule during the report period.

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

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Figure 2-12

Environmental Monitoring Locations - Fish

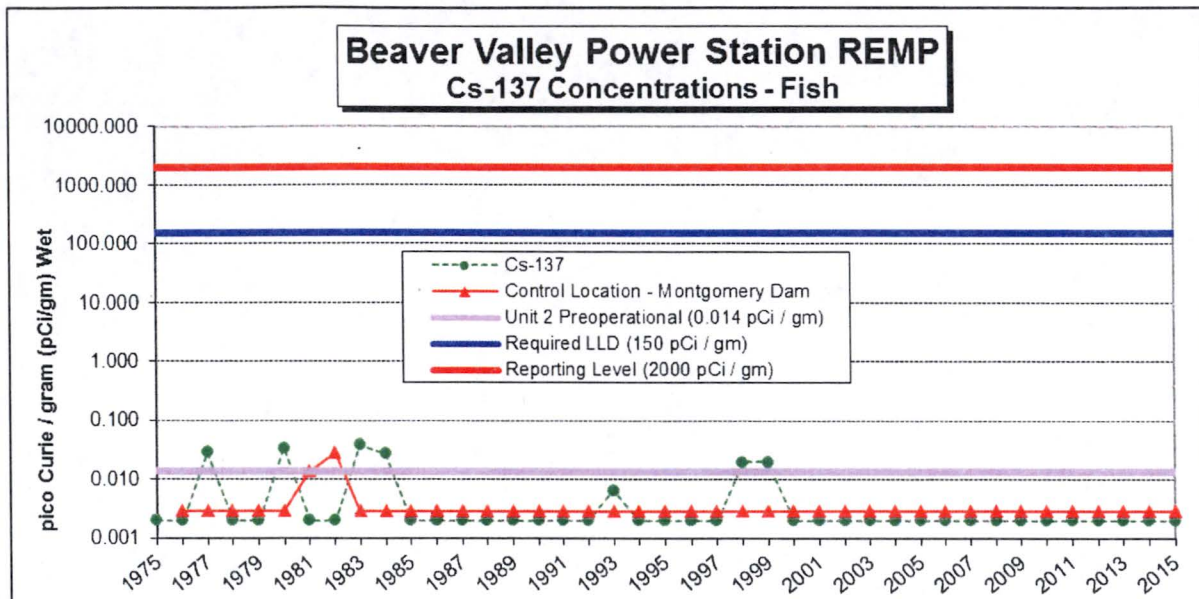


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Fish	2A	12-WSW	0.31	BVPS Outfall Vicinity
	49A	3-NE	4.93	Industry, PA (Upstream Montgomery Dam)

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Figure 2-13

Graph of Annual Average Concentration: Cesium-137 in Fish



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

1. Description of Water Sources

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

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

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

In general, the BVPS site experiences cool winters and moderately warm summers with ample annual precipitation evenly distributed throughout the year. The National Climate Data Center indicated the total annual precipitation during the report period for the Beaver Falls, PA area was 40.02 inches.

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2. Sampling and Analytical Techniques

a. Surface (Raw River) Water

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

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

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

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

b. Drinking Water (Public Supplies)

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

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

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

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c. Groundwater

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

One (1) well in Hookstown, PA

One (1) well in Georgetown, PA

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

d. Precipitation

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

e. Procedures

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

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

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

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3. Results and Conclusions

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

a. Surface Water

Tritium: A total of twelve (12) surface water samples were analyzed for tritium during the report period. Tritium was not detected in the eight (8) indicator samples, nor was it detected in the four (4) control samples.

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

Iodine-131: Although not required by the ODCM, a total of fifty one (51) surface water control samples were analyzed for iodine-131 using radiochemical methods during the report period. Iodine-131 was detected in twenty nine of fifty one (29 of 51) weekly control samples, of which zero (0) analysis exceeded the reporting level of 2 picoCurie / liter. The results were similar to previous years, (current annual range = 0.2 to 1.2 picoCurie / liter). The positive results were detected at the control location, which is five (5) miles upstream (not influenced by BVPS operation). Identification of iodine-131 during the report period was most likely due to medical diagnostic and treatment procedures performed at upstream facilities.

b. Drinking Water

Tritium: A total of twelve (12) drinking water samples were analyzed for tritium during the report period. Tritium was not detected in any of the eight (8) indicator samples nor was it detected in any of the four (4) control samples.

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

Iodine-131: A total of one hundred fifty six (156) drinking water samples were analyzed for iodine-131 (using radiochemical methods) during the report period. Iodine-131 was detected in thirty six of one hundred four (36 of 104) indicator samples and twenty nine of fifty two (29 of 52) control samples. Some of the positive results at the downstream location exceeded the positive results from the upstream surface water Control location, but none of these analyses exceeded the reporting level of 2 picoCurie / liter. Because positive results were detected in the upstream control sample, some positive results are most likely due to medical diagnostic and treatment procedures performed at upstream

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facilities, and not caused by BVPS operations. However, the analyses are also consistent with discharge data of authorized liquid effluent releases, and all liquid effluent releases during the report period did not exceed the release limits set forth in the ODCM.

c. Groundwater

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

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

d. Precipitation

Tritium: Although not required by ODCM, a total of twelve (12) precipitation samples were analyzed for tritium during the report period. Tritium was not detected in the eight (8) indicator samples, and it was not detected in the four (4) control samples.

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

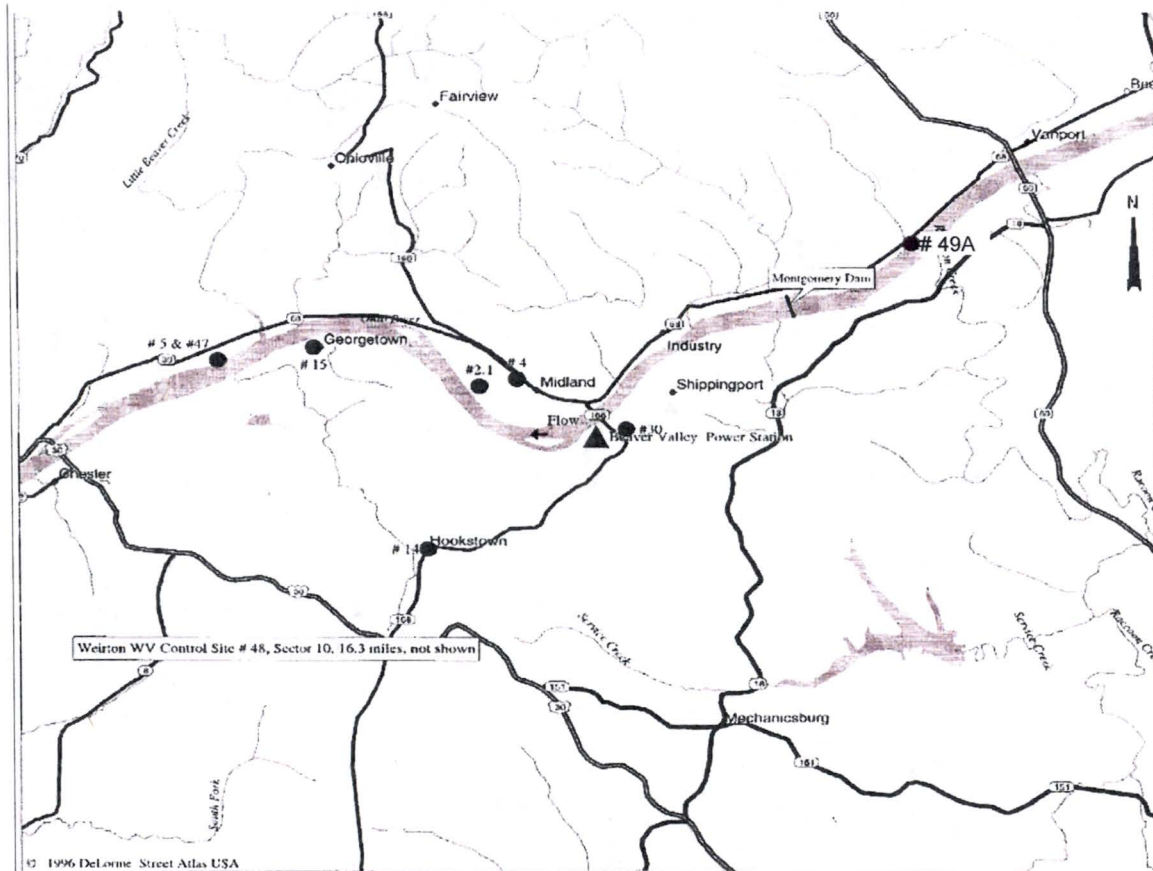
e. Deviations from Required Sampling and Analysis Schedule: There was one deviation from the ODCM required water sampling and analysis schedule during the report. A surface water sample was not taken at sample location 49A, Upstream of Montgomery Dam, due to frozen river conditions. All other samples were obtained. This is not a missed surveillance as monthly and quarterly composite samples were still compiled and sent for analysis. The only weekly analysis effected is the I-131 which is not a requirement of the ODCM. This issue is documented in Condition Report 2015-02499.

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

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Figure 2-14

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

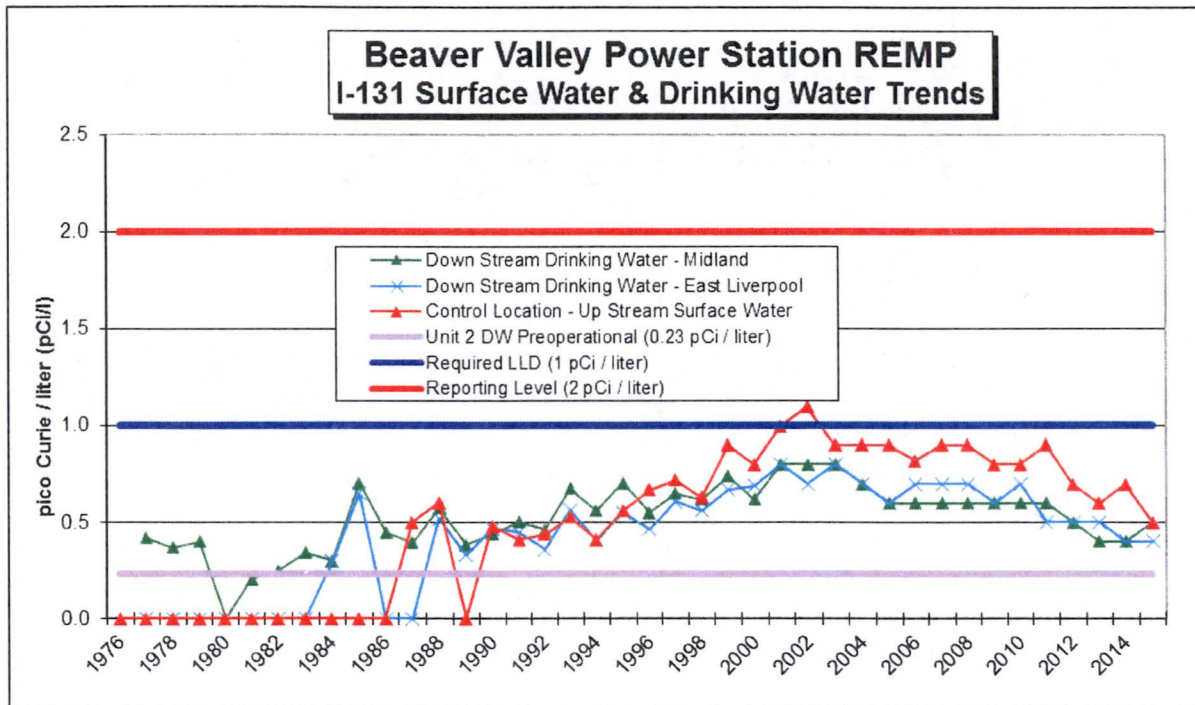


Sample Type	Site No.	Sector	Distance (miles)	Sample Point Description
Drinking Water	4	15-NW	1.26	Midland, PA (Water Department)
	5	14-WNW	4.90	East Liverpool, OH (Water Department)
Surface Water	2.1	14-WNW	1.43	Midland, PA (ATI Allegheny Ludlum)
	5	14-WNW	4.90	East Liverpool, OH (Water Department)
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

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Figure 2-15

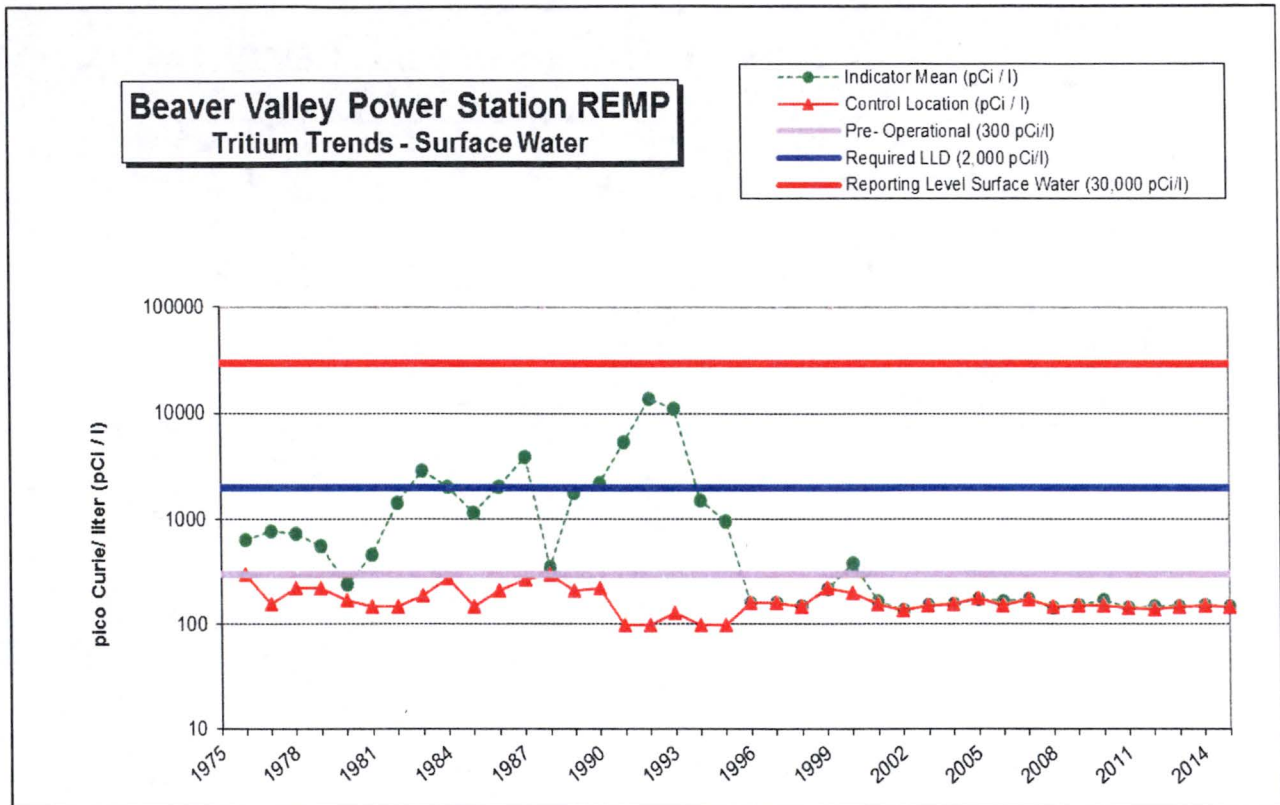
Graph of Annual Average Concentration: Iodine-131 in Surface Water & Drinking Water



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Figure 2-16

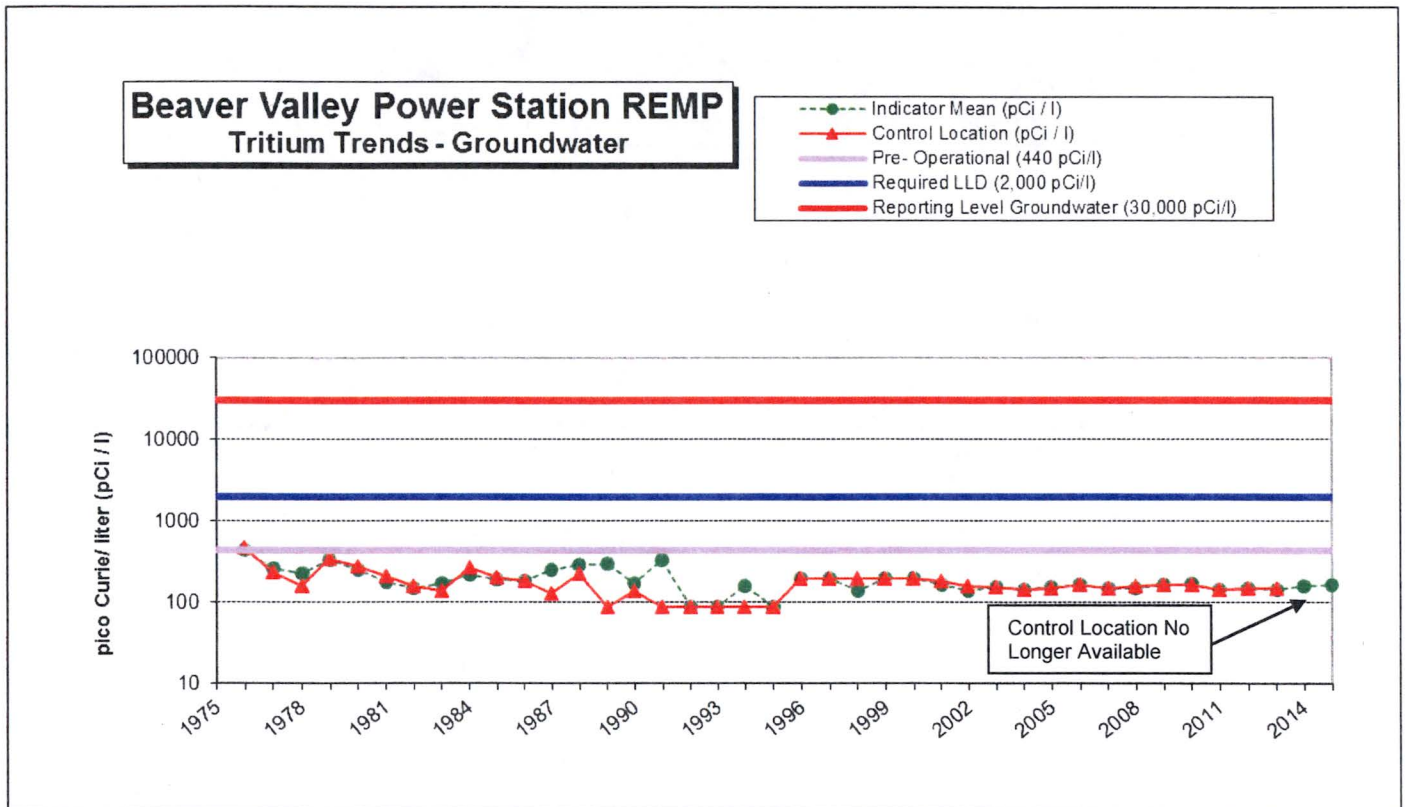
Graph of Annual Average Concentration: Tritium in Surface Water



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Figure 2-17

Graph of Annual Average Concentration: Tritium in Ground Water



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Figure 2-18

Graph of Annual Average Concentration: Tritium in Drinking Water

