



Paducah Gaseous Diffusion Plant
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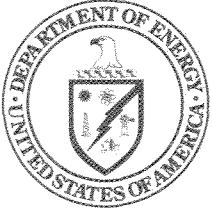
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## Department of Energy

Portsmouth/Paducah Project Office  
1017 Majestic Drive, Suite 200  
Lexington, Kentucky 40513  
(859) 219-4000

JUN 12 2013

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Mr. Ken Lapierre, Director  
U.S. Environmental Protection Agency, Region 4  
Air, Pesticides, and Toxics Management Division  
61 Forsythe, SW, Suite 9T43  
Atlanta, Georgia 30303-8960

Mr. John S. Lyons, Director  
Kentucky Department for Environmental Protection  
Division for Air Quality  
200 Fair Oaks Lane  
Frankfort, Kentucky 40601-1403

Mr. Reid Rosnick  
U.S. Environmental Protection Agency Headquarters  
Office of Radiation and Indoor Air  
MS6608J, 1200 Pennsylvania Avenue, Northwest  
Washington, DC 20460

Dear Mr. Lapierre, Mr. Lyons, and Mr. Rosnick:

**SUBMISSION OF THE NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS ANNUAL REPORT FOR 2012 U.S. DEPARTMENT OF ENERGY EMISSIONS AT THE PADUCAH GASEOUS DIFFUSION PLANT (PAD-REG-1019)**

Please find enclosed the calendar year 2012 Annual National Emissions Standards for Hazardous Air Pollutants Report, required by 40 *CFR* § 61, Subpart H. This report summarizes airborne radionuclide emissions from the Paducah Site, including both U.S. Department of Energy (DOE) and United States Enrichment Corporation (USEC) emissions for calendar year 2012. The total 2012 dose resulting from both DOE and USEC emissions was 0.0047 mrem. This is well below the annual limit of 10 mrem per year. DOE emissions contribution to this total was 0.000022 mrem.

If you have any questions or require additional information, please contact Don Dihel at (270) 441-6824.

Sincerely,

A handwritten signature in black ink, appearing to read "Rachel H. Blumenfeld".

Rachel H. Blumenfeld  
Acting Paducah Site Lead  
Portsmouth/Paducah Project Office

Enclosures:

1. Certification sheets
2. National Emissions Standards for Hazardous Air Pollutants Annual Report for 2012

e-copy w/enclosures:

brandy.mitchell@lataky.com, LATA/Kevil  
christie.lamb@lataky.com, LATA/Kevil  
c-mbmattheiss@duf6.com, BWCS/PAD  
don.dihel@lex.doe.gov, PPPO/PAD  
gustavo.vazquez@hq.doe.gov, HS-22  
jennifer.woodard@lex.doe.gov, PPPO/PAD  
mark.duff@lataky.com, LATA/Kevil  
myrna.redfield@lataky.com, LATA/Kevil  
pad.dmc@swiftstaley.com, SST/Kevil  
reinhard.knerr@lex.doe.gov, PPPO/PAD  
rob.seifert@lex.doe.gov, PPPO/PAD  
stanley.knaus@lataky.com, LATA/Kevil

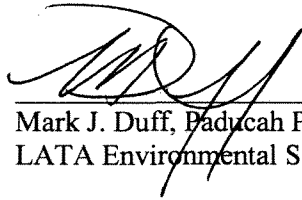
## CERTIFICATION

**Document Identification:** *National Emissions Standards for Hazardous Air Pollutants Annual Report for 2012 U.S. Department of Energy Emissions at the Paducah Gaseous Diffusion Plant (PAD-REG-1019)*

This certification pertains to the following U.S. Department of Energy emission sources:

Northwest Plume Treatment Facility (LATA KY)  
Northeast Plume Treatment Facility (LATA KY)  
Depleted Uranium Hexafluoride Conversion Facility (BWCS)  
Fugitive and Diffuse Sources

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (See 18 U.S.C. 1001.)



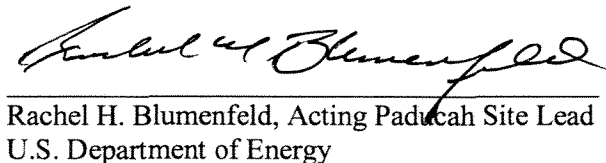
Mark J. Duff, Paducah Project Manager  
LATA Environmental Services of Kentucky, LLC

6-12-13  
Date Signed



George E. Dials  
Babcock and Wilcox Conversion Services, LLC

June 6, 2013  
Date Signed



Rachel H. Blumenfeld, Acting Paducah Site Lead  
U.S. Department of Energy

6-12-13  
Date Signed

**National Emissions Standards for Hazardous Air Pollutants  
Annual Report for 2012 U.S. Department of Energy  
Emissions at the Paducah Gaseous Diffusion Plant**



This document is approved for public release per review by:

Merlin Johnson      6-12-2013  
LATA Kentucky Classification Support      Date

**National Emissions Standards for Hazardous Air Pollutants  
Annual Report for 2012 U.S. Department of Energy  
Emissions at the Paducah Gaseous Diffusion Plant**

Date Issued—June 2013

Prepared for the  
U.S. DEPARTMENT OF ENERGY  
Office of Environmental Management

Prepared by  
LATA ENVIRONMENTAL SERVICES OF KENTUCKY, LLC  
managing the  
Environmental Remediation Activities at the  
Paducah Gaseous Diffusion Plant  
under contract DE-AC30-10CC40020

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## ACRONYMS

CAP-88	Clean Air Act Assessment Package-1988
<i>CFR</i>	<i>Code of Federal Regulations</i>
DOE	U.S. Department of Energy
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
<i>KAR</i>	<i>Kentucky Administrative Regulations</i>
NESHAP	National Emission Standards for Hazardous Air Pollutants
PGDP	Paducah Gaseous Diffusion Plant
USEC	United States Enrichment Corporation

## EXECUTIVE SUMMARY

The Kentucky Division for Air Quality regulates air emissions of radionuclides, other than radon, from U.S. Department of Energy (DOE) facilities under 401 KAR 57:002. The Kentucky regulations cite 40 CFR § 61, Subpart H, regulations. Submission of this report fulfills the annual reporting requirements of 40 CFR § 61.94.

DOE owns the Paducah Gaseous Diffusion Plant, which has radionuclide air emissions from DOE operations. DOE leases a portion of the site to United States Enrichment Corporation (USEC) whose operations also have radionuclide air emissions. DOE and USEC operations were included in the estimate of the Paducah Site resultant dose to the public; however, DOE certifies the information relating to its operations only. USEC submits a separate National Emission Standards for Hazardous Air Pollutants report relating to emissions from its activities.

The dose to the public is calculated using the computer modeling program (CAP-88) specified in 40 CFR § 61.93. Inputs to the computer program for both DOE and USEC sources are obtained through continuous monitoring, periodic confirmatory measurements, engineering estimates, emission factors, and other U.S. Environmental Protection Agency-approved methods. Subpart H requires an annual compliance report covering site emissions from the previous year. This report meets the annual reporting requirements and establishes the total annual effective dose equivalent to the maximally exposed member of the public from both USEC and DOE emissions to be 0.0047 mrem for calendar year 2012. This is well below the annual limit of 10 mrem per year. DOE emissions contribution to this total was 0.000022 mrem.

# 1. FACILITY DESCRIPTION

Site Name: Paducah Gaseous Diffusion Plant (PGDP)

Location: Paducah, Kentucky

Owner: U.S. Department of Energy (DOE)  
Portsmouth/Paducah Project Office  
P.O. Box 1410  
Paducah, Kentucky 42002-1410  
Reinhard Knerr, Contracting Officer Representative  
(270) 441-6825

Operator: LATA Environmental Services of Kentucky, LLC  
761 Veterans Avenue  
Kevil, Kentucky 42053  
Mark J. Duff, Paducah Project Manager  
(270) 441-5100

Babcock and Wilcox Conversion Services, LLC  
1020 Monarch Street, Suite 300  
Lexington, Kentucky 40513  
George E. Dials, President and Project Manager  
(859) 685-2060

# 2. INTRODUCTION

The DOE Paducah Site includes the PGDP, which is leased to the United States Enrichment Corporation (USEC). DOE manages the remaining nonleased facilities at the Paducah Site. The DOE-managed facilities consist of various waste management facilities, inactive buildings, depleted uranium hexafluoride (DUF<sub>6</sub>) storage facilities, a DUF<sub>6</sub> conversion facility, and environmental restoration facilities.

Emissions from both DOE and USEC activities were analyzed together. DOE certifies only the information related to its emissions. DOE understands that USEC will be submitting a separate National Emission Standards for Hazardous Air Pollutants (NESHAP) report addressing a more detailed analysis of emissions from USEC operations. The combined emissions of both DOE and USEC were used to calculate the resultant dose. The reports have been separated to ease review and approval by the separate organizations.

# 3. SITE DESCRIPTION

PGDP is an active uranium enrichment facility consisting of a diffusion cascade system and extensive support facilities. The cascade system, including product and tails withdrawal, is housed in six large process buildings. The plant is located on a reservation consisting of approximately 3,500 acres in

western McCracken County, 10 miles west of Paducah, Kentucky, and 3.5 miles south of the Ohio River. The facility is on approximately 1,350 acres with controlled access. Roughly 650 acres of the reservation are enclosed within a fenced security area. An uninhabited buffer zone of at least 400 yards surrounds the entire fenced area. During World War II, Kentucky Ordnance Works, a trinitrotoluene production facility, was operated in an area southwest of the plant on what is now a wildlife management area.

Construction of the PGDP facility began in 1951 and the plant was fully operational by 1955, supplying enriched uranium for commercial reactors and defense uses. Enriched uranium is defined as uranium in which the concentration of the fissionable uranium-235 (U-235) isotope has been increased from its natural assay. Natural uranium is primarily uranium-238 (U-238), with about 0.71% U-235 and 0.0055% uranium-234 (U-234). Uranium mills process the ores to produce concentrated uranium oxide [triuranium octoxide ( $U_3O_8$ )], which then is converted commercially to uranium hexafluoride ( $UF_6$ ). The  $UF_6$  then is sent to PGDP for enrichment. In 2011, DOE began operation of a facility to convert the stored  $DUF_6$  to a more stable uranium oxide, primarily  $U_3O_8$ .

The radioactive materials used at PGDP are associated with enrichment of the uranium isotope, U-235, by utilizing a gaseous diffusion process. During enriching operations from 1953 to 1975,  $UF_6$  feed material derived from recycled uranium (called “reactor tails”) from government reactors also was used intermittently in addition to the  $UF_6$  processed from uranium ore, which typically was used. Reactor tails were the spent fuel from nuclear reactors that is depleted in U-235 content that had been reprocessed to remove most of the fission products. The reactor fuel assemblies were processed at other DOE facilities (where most of the fission products were removed), and the enriched uranium and the remaining fission products were fed into the PGDP cascade system in the chemical form of  $UF_6$ . Use of the reactor tails resulted in the introduction of technetium-99 (Tc-99), a fission by-product, and transuranics, most notably neptunium-237 (Np-237) and plutonium-239 (Pu-239), into the cascade.

The West Kentucky Wildlife Management Area and lightly populated farmlands are in the immediate environs of PGDP. Based on population data from the 2010 census, the population within a 50-mile radius is approximately 534,000 persons. Of these, 44,000 live within 10 miles of the plant and 104,000 live within 20 miles of the plant. The unincorporated communities of Grahamville and Heath are 1.24 and 1.86 miles east of the plant, respectively. Portions of 28 counties—11 of which are in Kentucky, 4 in Missouri, 10 in Illinois, and 3 in Tennessee—are included within the 50-mile radius of the plant. Larger cities in the region include Paducah, Kentucky, located 10 air miles east of the plant; Cape Girardeau, Missouri, located 40 air miles to the west; and Metropolis, Illinois, located 6 air miles to the northeast. The nearest neighbor residences in each direction are observed and entered into the dose modeling software. The results of the dose modeling are presented in Section 6.

Paducah is located in the humid continental zone. Summers generally are dry; precipitation occurs mainly in the spring and fall. Winters are characterized by moderately cold days; the average temperature during the coldest month, January, is about 35°F. Summers are warm and humid; the average temperature in July is 79°F. Yearly precipitation averages about 44 inches. The prevailing wind direction is south to southwest.

In July 1993, USEC was formed as a government corporation and became a private corporation in July 1998. Although DOE still owns all the facilities at PGDP, the uranium enrichment enterprise is now the responsibility of USEC.

## **4. DOE SOURCE HANDLING AND PROCESSING DESCRIPTION**

The description of the handling and processing that the radioactive materials undergo with DOE operations at the Paducah Site is described in the following sections. The radioactive materials handled were containerized waste,  $\text{DUF}_6$  managed in cylinders, conversion of  $\text{UF}_6$  to  $\text{U}_3\text{O}_8$ , and radioactive contamination on equipment and facilities. DOE understands that USEC will be submitting a separate NESHAP report addressing more detailed analysis of USEC emissions from USEC operations.

### **4.1 DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITY**

The  $\text{DUF}_6$  conversion facility has operated since 2011. The facility converts  $\text{DUF}_6$  stored in cylinders to a more stable uranium oxide, primarily  $\text{U}_3\text{O}_8$ . Radioactive emissions from the conversion operations are monitored as required by its air permit.

### **4.2 NORTHWEST PLUME INTERIM REMEDIAL ACTION PROJECT**

On September 1, 1995, DOE began operation of a treatment plant designed to remove trichloroethene and Tc-99 from contaminated groundwater at the PGDP. The facility, C-612, is located at the northwest corner of the PGDP site security area. The facility consists of an air stripper to remove volatile organics.

Historical sampling has shown very little change in the concentration of Tc-99 as the water passes through the air stripper. Emissions of Tc-99 were estimated using 40 *CFR* § 61, Subpart H, Appendix D, emission factors and the analysis of the groundwater. The exhaust from the air stripper is passed through a carbon adsorption unit prior to release to the atmosphere. Data has shown that Tc-99 is not retained in the carbon; therefore, no reduction in Tc-99 emissions due to the use of the adsorption unit was assumed. The results of the analysis of the estimated emissions are reported in Section 6.

### **4.3 NORTHEAST PLUME CONTAINMENT SYSTEM**

DOE began normal operation of a second treatment system on February 28, 1997, as an interim remedial action to also treat contaminated groundwater. The system, C-614, extracts contaminated groundwater and pumps it to the C-637 Cooling Towers operated by USEC. Initially, the contaminated groundwater did not contain radionuclides; however, Tc-99 has been detected in the groundwater and, consequently, could have emitted to the air since 2005. Emissions of Tc-99 were estimated using 40 *CFR* § 61, Subpart H, Appendix D, emission factors and the analysis of the groundwater. The results of the analysis of the estimated emissions are reported in Section 6.

### **4.4 FUGITIVE AND DIFFUSE SOURCES**

Diffuse/fugitive sources include any source that is distributed spatially, diffuse in nature, or not emitted with forced air from a stack, vent, or other confined conduit. Diffuse/fugitive sources also include emissions from sources where forced air is not used to transport the radionuclides to the atmosphere. In this case, radionuclides are transported entirely by diffusion and/or thermally driven air currents. Typical examples of diffuse/fugitive sources include emissions from building breathing; resuspension of contaminated soils, debris, or other materials; unventilated tanks; ponds, lakes, and streams; wastewater treatment systems; outdoor storage and processing areas; and leaks in piping, valves, or other process

equipment. DOE has identified many potential fugitive and diffuse sources such as inactive facilities, building roofs, scrap metal storage yards, landfills, and various contamination areas. Specific activities that could generate fugitive emissions include transport and disposal of contaminated material in the C-746-U Landfill, demolition of contaminated facilities, decontamination of contaminated equipment, and most environmental remediation activities. The use of ambient air monitors to evaluate emissions from fugitive and diffuse sources is described in Section 9.

## 5. WAIVER OF CONSTRUCTION AND MODIFICATION ACTIVITIES

No DOE construction or modification activities occurred in this reporting period that were waived under 40 *CFR* § 61.96.

## 6. DOE SOURCE CHARACTERISTICS AND AIR EMISSIONS DATA

Tables 1 through 4 contain specific emission information for each DOE emission point. Table 1 lists the emission points and efficiency of control devices as required by 40 *CFR* § 61.94 (b) (4) and (5). Table 2 lists the distances from each emission point to receptors of concern as listed in 40 *CFR* § 61.94 (b) (6). Table 3 contains emission point information required to estimate the resulting potential exposure as required by 40 *CFR* § 61.94 (b) (7). Table 4 contains a list of site radioactive materials and their emission rates as required by 40 *CFR* § 61.94 (b) (2).

**Table 1. Emission Point Effluent Controls and Efficiencies**

Emission Points	Type Control	Efficiency%
Northwest Plume Treatment Facility	Carbon	0
Northeast Plume Treatment Facility	None	0
DUF <sub>6</sub> Conversion Facility	HEPA	99

**Table 2. Distances to Selected Receptors**

Emission Points	Distances (m) to Selected Receptors		
	Nearest Farm	Nearest Business	Nearest School
Northwest Plume Treatment Facility	1,100	2,550	5,150
Northeast Plume Treatment Facility	1,400	2,100	4,200
DUF <sub>6</sub> Conversion Facility	2,550	3,250	3,400

**Table 3. Characteristics of Stacks, Vents, or Other Emission Points that Emit Radionuclides**

<b>Emission Points</b>	<b>Type</b>	<b>Height (m)</b>	<b>Diameter (m)</b>	<b>Gas Exit Velocity (m/s)</b>	<b>Gas Exit Temp. (°C)</b>	<b>Distance (m) &amp; Direction to Maximally Exposed Individual for Each Source</b>
Northwest Plume Treatment Facility	Point	7.0	0.35	9.45	37.8	1,080 NNE
Northeast Plume Treatment Facility	Point	10.22	8.18	4.84	Ambient	1,360 SE
DUF <sub>6</sub> Conversion Facility	Point	21.95	1.067	16.19	33.9	2,171 S

**Table 4. Radionuclide Materials and Emissions Data (Curies)**

<b>Nuclide</b>	<b>Northwest Plume Treatment Facility</b>	<b>Northeast Plume Treatment Facility</b>	<b>DUF<sub>6</sub> Conversion Facility</b>	<b>Total*</b>
U-234	0	0	2.19E-07	2.62E-03
U-235	0	0	1.00E-08	9.09E-05
U-238	0	0	5.36E-07	3.25E-04
Tc-99	1.32E-04	5.93E-06		2.97E-03
Th-230	0	0		1.40E-05
Th-231	0	0	3.68E-08	3.68E-08
Th-234	0	0	3.36E-06	3.36E-06
Np-237	0	0		8.51E-05
Pu-239	0	0		1.43E-06
Pa-234m	0	0	3.36E-06	3.36E-06
<b>Total Curies/Year</b>	<b>1.32E-04</b>	<b>5.93E-06</b>	<b>7.52E-06</b>	<b>6.11E-03</b>

\*The total curies emitted reflect both USEC and DOE emissions; however, the source-specific columns show only DOE emissions.

## 7. DOSE ASSESSMENT

### 7.1 DESCRIPTION OF DOSE MODEL

The radiation dose calculations were performed using the Clean Air Act Assessment Package-1988 (CAP-88) package of computer codes that were converted from the mainframe CAP-88 version. This package contains the U.S. Environmental Protection Agency's (EPA's) version of the AIRDOS-EPA computer code, which implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides and then uses Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to the environmental concentrations. The human exposure values then are used by the EPA's version of the DARTAB computer code to calculate radiation doses to man from radionuclides released during the year. The dose calculations use dose conversion factors contained in the RADRISK data file, which is provided by EPA

with the CAP-88 package. Selection of the dose conversion factors follows guidance given by EPA in its Federal Guidance Report No. 11.

## 7.2 SUMMARY OF INPUT PARAMETERS

Default input parameters are used except for those provided in Section 6 and immediately below. Meteorological input information is from the National Weather Service at Paducah, except for the on-site joint frequency distribution information. The average mixing layer height was derived from area upper air data from 2007 and supplied by Oak Ridge National Laboratory.

Joint frequency distribution: Five-year stability array (STAR) distribution from 60-m station on PGDP meteorological tower for the years 1988 through 1992.

Rainfall rate: 76.35 cm/year

Average air temperature: 16°C

Average mixing layer height: 659 m

Fraction of foodstuffs from (rural default values):

	<u>Local Area</u>	<u>50-Mile Radius</u>	<u>Beyond 50 Miles</u>
Vegetables and produce:	0.700	0.300	0.000
Meat:	0.442	0.558	0.000
Milk:	0.399	0.601	0.000

## 7.3 DOSE ESTIMATE

Effective dose equivalent (EDE) to maximally exposed individual for each individual point source and the plant is provided in Table 5. The dose estimate is based on both the DOE and USEC point sources combined (data provided by USEC).

**Table 5. Dose Analysis**

<b>USEC Emission Sources*</b>	<b>Dose to the Maximum Exposed Individual for Each Source (mrem)</b>	<b>Dose to the Maximum Exposed Individual for the Plant (mrem)</b>
C-400 Group	9.8E-04	9.8E-04
C-709/C-710 Laboratory Hoods	1.3E-03	1.3E-03
C-310 Stack	1.4E-03	1.3E-03
Seal Exhaust/Wet Air Group	1.1E-03	1.1E-03
C-409 Group	1.9E-07	1.9E-07
C-360	2.3E-07	1.1E-07
<b>Total from USEC Sources</b>		<b>4.7E-03</b>
<b>DOE Emission Sources</b>		
Northwest Plume Treatment Facility	2.2E-05	2.2E-05
Northeast Plume Treatment Facility	2.2E-05	2.5E-07
DUF <sub>6</sub> Conversion Facility	2.8E-07	1.9E-07
<b>Total from DOE Sources</b>		<b>2.2E-05</b>
<b>Total from All Sources</b>		<b>4.7E-03</b>

\*Certified by USEC in its annual report.

The maximally exposed individual from all plant emissions is located 2,430 m north of the C-310 stack (a USEC source).



Based on population data from the 2010 census, the total collective EDE to the 50-mile population (approximately 534,000 persons) was 0.035 person-rem.

## **8. UNPLANNED RELEASES**

There were no DOE unplanned releases in 2012.

## **9. AMBIENT AIR MONITORING**

In accordance with the *Paducah Gaseous Diffusion Plant Department of Energy National Emission Standards for Hazardous Air Pollutants (NESHAP) Management Plan*, BJC/PAD-141, February 2000, DOE used ambient air monitoring data to verify insignificant levels of radionuclides in off-site ambient air. Ambient air stations collect radionuclide samples at sites surrounding the plant. The ambient air monitors capture airborne radionuclides emitted from all sources, including fugitive and diffuse sources. The Radiation/Environmental Monitoring Section of the Radiation Health Branch of the Department for Public Health of the Kentucky Cabinet for Health and Family Services operated the ambient air monitors and was responsible for sample analysis. DOE is including the ambient monitoring results in this report, but DOE is not responsible for and does not certify the data.

DOE installed a second ambient air monitoring network that began operation in July 2012. Several stations experienced mechanical failures and were repaired promptly during 2012. The laboratory analysis of the uranium isotopes for the DOE air stations was rejected during data assessment for the initial quarter of operation, July through September, because the tracer results for the uranium were too high. The uranium results for the following quarter were not rejected.

Analysis of the results of both ambient air monitoring networks indicate that the networks did not detect plant-derived radionuclides above 40 *CFR* § 61, Appendix E (3), Table 2, concentrations. The actual results of each air monitoring station are listed in Tables 6 and 7 of this report. The locations of the ambient air monitoring stations are shown in Figure 1.

## **10. STATUS OF 40 CFR § 61 SUBPART H COMPLIANCE**

DOE has remained in compliance with 40 *CFR* § 61, Subpart H, since 1993. Kentucky Division for Air Quality received a delegation of authority to administer the NESHAP program. A NESHAP Management Plan has been developed by DOE that addresses all emissions including fugitive and diffuse emissions. EPA Region 4 concurred with the DOE NESHAP Management Plan on September 19, 2000. In accordance with the management plan, ambient air monitoring was utilized to verify compliance of the Paducah Site with 40 *CFR* § 61, Subpart H, for all emissions. Ambient air monitoring conducted by the Kentucky Radiation Health Branch and DOE did not detect plant-derived radionuclides above 40 *CFR* § 61, Appendix E (3), Table 2, concentrations during calendar year 2012; therefore, the facility is in compliance with 40 *CFR* § 61 Appendix E, Table 2 values, and the management plan.

Based on the results included in this report, during 2012, the Paducah Site was in compliance with 40 *CFR* § 61, Subpart H, for all airborne radionuclide emissions.

**Table 6. Kentucky Radiation Health Branch Ambient Air Monitoring Results<sup>a,b</sup>**  
**(Curies per Cubic Meter of Air for each Ambient Air Station for each Quarter)**

<b>Quarter 1</b>						
<b>Nuclide</b>	<b>AMSW017</b>	<b>AMW015</b>	<b>AMNW001</b>	<b>AMNE</b>	<b>AME002</b>	<b>AME012</b>
<b>Am-241</b>	-1.06E-15	-9.73E-16	6.41E-17	-4.02E-17	-2.81E-15	-4.13E-16
<b>Np-237</b>	4.10E-16	-1.83E-16	5.97E-16	-2.51E-16	-3.97E-16	-1.29E-16
<b>Tc-99</b>	-2.86E-18	1.79E-16	1.33E-16	1.36E-16	1.37E-16	6.23E-17
<b>U-238/Th-234</b>	3.15E-18	4.41E-18	3.68E-17	6.08E-18	3.16E-17	4.69E-18
	<b>AMBKG2</b>	<b>AMBOLD</b>	<b>AMKOW</b>	<b>AMMWNE</b>	<b>TRPBLK</b>	
<b>Am-241</b>	-4.42E-17	-8.20E-16	-9.49E-16	-1.89E-15	-4.54E-18	
<b>Np-237</b>	4.81E-16	-4.25E-17	-8.50E-17	1.22E-16	-4.19E-16	
<b>Tc-99</b>	1.48E-16	5.10E-17	8.48E-18	3.12E-17	-3.35E-17	
<b>U-238/Th-234</b>	1.98E-18	3.63E-17	1.16E-17	3.16E-17	1.99E-18	
<b>Quarter 2</b>						
	<b>AMSW017</b>	<b>AMW015</b>	<b>AMNW001</b>	<b>AMNE</b>	<b>AME002</b>	<b>AME012</b>
<b>Am-241</b>	-1.34E-15	-1.64E-16	2.30E-18	-8.87E-16	-1.21E-15	-1.60E-17
<b>Np-237</b>	-3.96E-16	7.55E-17	3.15E-16	-4.81E-16	-2.37E-16	5.84E-16
<b>Tc-99</b>	-2.09E-16	-6.42E-17	-2.44E-16	2.04E-17	-2.80E-16	1.17E-17
<b>U-238/Th-234</b>	6.50E-17	6.87E-17	6.68E-17	9.34E-17	1.07E-17	5.16E-17
	<b>AMBKG2</b>	<b>AMBOLD</b>	<b>AMKOW</b>	<b>AMMWNE</b>	<b>TRPBLK</b>	
<b>Am-241</b>	-2.31E-15	-9.53E-16	-1.29E-15	1.74E-17	-1.74E-15	
<b>Np-237</b>	-1.35E-17	-3.65E-16	-1.82E-16	-8.54E-17	-7.63E-17	
<b>Tc-99</b>	-2.45E-16	-3.01E-16	-2.14E-16	-6.15E-17	-2.53E-16	
<b>U-238/Th-234</b>	3.89E-17	1.26E-16	1.17E-16	6.77E-17	-2.44E-18	
<b>Quarter 3</b>						
	<b>AMSW017</b>	<b>AMW015</b>	<b>AMNW001</b>	<b>AMNE</b>	<b>AME002</b>	<b>AME012</b>
<b>Am-241</b>	-8.52E-16	-1.57E-17	-9.19E-16	-1.40E-17	-7.45E-16	7.57E-17
<b>Np-237</b>	-6.74E-17	9.88E-17	3.10E-16	2.04E-16	1.57E-17	-1.07E-16
<b>Tc-99</b>	8.76E-17	1.60E-17	2.02E-16	2.92E-16	4.14E-16	2.43E-16
<b>U-238/Th-234</b>	2.17E-17	2.52E-18	3.99E-17	2.41E-17	4.06E-17	-7.90E-18
	<b>AMBKG2</b>	<b>AMBOLD</b>	<b>AMKOW</b>	<b>AMMWNE</b>	<b>TRPBLK</b>	
<b>Am-241</b>	-2.00E-15	-6.11E-17	-1.02E-15	-8.77E-16	-1.81E-15	
<b>Np-237</b>	1.91E-16	-2.49E-16	2.12E-16	-8.44E-17	1.80E-16	
<b>Tc-99</b>	2.36E-16	6.41E-17	2.81E-16	5.31E-17	-2.15E-16	
<b>U-238/Th-234</b>	-3.16E-18	2.43E-17	1.13E-17	1.74E-17	-3.73E-18	
<b>Quarter 4</b>						
	<b>AMSW017</b>	<b>AMW015</b>	<b>AMNW001</b>	<b>AMNE</b>	<b>AME002</b>	<b>AME012</b>
<b>Am-241</b>	-2.30E-15	-3.45E-17	-1.60E-15	-1.02E-15	-1.05E-15	-1.17E-15
<b>Np-237</b>	-2.20E-19	-1.51E-16	-2.95E-16	1.47E-16	2.90E-16	4.83E-16
<b>Tc-99</b>	4.87E-16	6.89E-16	5.33E-16	3.88E-16	6.77E-16	6.83E-16
<b>U-238/Th-234</b>	3.19E-17	1.93E-17	6.07E-17	5.43E-17	1.33E-16	7.58E-17
	<b>AMBKG2</b>	<b>AMBOLD</b>	<b>AMKOW</b>	<b>AMMWNE</b>	<b>TRPBLK</b>	
<b>Am-241</b>	8.15E-17	-1.04E-16	-1.43E-15	-1.04E-15	-2.92E-15	
<b>Np-237</b>	-7.07E-18	1.18E-16	-2.43E-16	-9.72E-17	-4.52E-18	
<b>Tc-99</b>	5.86E-16	3.84E-16	5.79E-16	6.31E-16	2.24E-16	
<b>U-238/Th-234</b>	1.32E-17	1.02E-16	9.43E-17	4.23E-17	-5.17E-18	

<sup>a</sup> All results are below the applicable limiting values of 40 CFR § 61 Appendix E (3), Table 2 (see table note b).

<sup>b</sup> 40 CFR § 61 Appendix E (3), Table 2, Limiting Values (Ci/m<sup>3</sup>): Am-241, 1.9E-15; Np-237, 1.2E-15; Tc-99, 1.4E-13; Th-234, 2.2E-12; and U-238, 8.3E-15 Ci/m<sup>3</sup> annual average.

**Table 7. DOE Ambient Air Monitoring 2012 Results<sup>a,b</sup> Isotopic Concentrations  
(Curies per Cubic Meter of Air)  
Quarter 1 (July–September 2012)**

Nuclide	AMD002	AMD012	AMD015	AMD57	AMD612	AMD746S
Am-241	-5.41E-18	9.91E-16	2.94E-16	7.94E-16	-4.18E-16	7.27E-16
Np-237	-1.04E-16	-7.85E-16	-1.24E-16	4.09E-16	4.51E-16	-4.67E-16
Pu-238	-2.11E-18	-3.52E-18	4.64E-18	1.84E-19	-9.57E-19	3.78E-18
Pu-239/240	1.23E-18	5.39E-18	3.78E-18	4.42E-17	-1.73E-18	2.97E-18
Tc-99	1.80E-16	-5.34E-16	-8.59E-17	-1.04E-16	7.41E-17	1.01E-17
Th-234	-3.07E-16	2.08E-15	6.49E-15	1.25E-15	-5.47E-16	9.56E-15
U-234 <sup>c</sup>	5.81E-17	6.44E-16	1.30E-16	2.42E-16	4.69E-17	3.61E-17
U-235	1.25E-17	1.36E-16	9.30E-18	2.80E-17	9.00E-18	1.55E-17
U-238	2.60E-17	4.25E-16	6.20E-17	6.37E-17	2.01E-17	7.13E-18
Sum of Fractions <sup>d</sup>	-7.60E-02	1.91E-02	8.36E-02	8.24E-01	1.65E-01	8.91E-03
	AMD746U	AMDBCP	AMDNE			
Am-241	9.90E-18	-1.27E-16	-4.45E-16			
Np-237	6.88E-16	-4.07E-17	2.24E-16			
Pu-238	2.62E-18	1.09E-19	9.55E-20			
Pu-239/240	6.70E-18	8.03E-18	4.00E-19			
Tc-99	1.89E-16	-2.45E-16	-1.09E-16			
Th-234	2.93E-17	-2.96E-15	-3.49E-15			
U-234	2.98E-17	1.31E-17	2.28E-17			
U-235	1.49E-17	1.50E-17	2.13E-17			
U-238	2.67E-17	5.15E-18	2.55E-17			
Sum of Fractions	5.94E-01	-9.52E-02	-4.07E-02			

**Quarter 2 (October–December 2012)**

	AMD002	AMD012	AMD015	AMD57	AMD612	AMD746S
Am-241	4.40E-16	1.57E-16	6.67E-17	1.90E-16	-1.01E-16	1.98E-16
Np-237	-1.17E-16	-6.75E-17	-8.55E-17	2.78E-17	-3.18E-16	-3.44E-16
Pu-238	3.79E-18	-3.74E-19	-1.54E-18	1.10E-18	8.27E-19	2.66E-18
Pu-239/240	2.44E-18	1.86E-18	-1.50E-18	-2.38E-18	6.64E-19	2.50E-18
Tc-99	1.51E-16	2.28E-16	-7.60E-17	3.14E-16	3.23E-16	9.44E-17
Th-234	-2.55E-15	-5.63E-15	-4.97E-15	-5.98E-16	1.55E-15	-5.13E-15
U-234	1.48E-15	1.59E-15	1.78E-15	1.29E-15	1.73E-15	1.56E-15
U-235	5.72E-17	5.67E-17	7.44E-17	4.74E-17	5.69E-17	6.15E-17
U-238	3.32E-16	3.44E-16	3.21E-16	2.16E-16	3.10E-16	3.05E-16
Sum of Fractions	3.78E-01	2.82E-01	2.40E-01	3.25E-01	-4.52E-02	6.72E-02
	AMD746U	AMDBCP	AMDNE			
Am-241	3.70E-16	-9.27E-16	1.16E-15			
Np-237	-1.71E-16	6.42E-16	9.32E-17			
Pu-238	-2.47E-18	6.05E-18	2.73E-18			
Pu-239/240	4.36E-18	2.21E-18	1.48E-18			
Tc-99	3.93E-16	3.71E-16	4.61E-16			
Th-234	-2.00E-15	2.70E-15	-1.53E-15			
U-234	1.55E-15	2.86E-16	3.62E-16			
U-235	4.97E-17	8.20E-18	2.16E-17			
U-238	2.67E-16	1.27E-16	1.32E-16			
Sum of Fractions	2.96E-01	1.09E-01	7.60E-01			

<sup>a</sup> All results are below the applicable limiting values of 40 CFR § 61 Appendix E (3), Table 2 (see table note b).

<sup>b</sup> 40 CFR § 61 Appendix E (3), Table 2 Limiting Values (Ci/m<sup>3</sup>): Am-241, 1.9E-15; Np-237, 1.2E-15; Pu-238, 2.1E-15; Pu-239/240, 2E-15; Tc-99, 1.4E-13; Th-234, 2.2E-12; U-234, 7.7E-15; U-235, 7.1E-15; U-238, 8.3E-15.

<sup>c</sup> All Quarter 1 isotopes of uranium results were rejected.

<sup>d</sup> Sum of the Fractions—The sum of the individual fraction of each isotopic result compared to the limiting value.

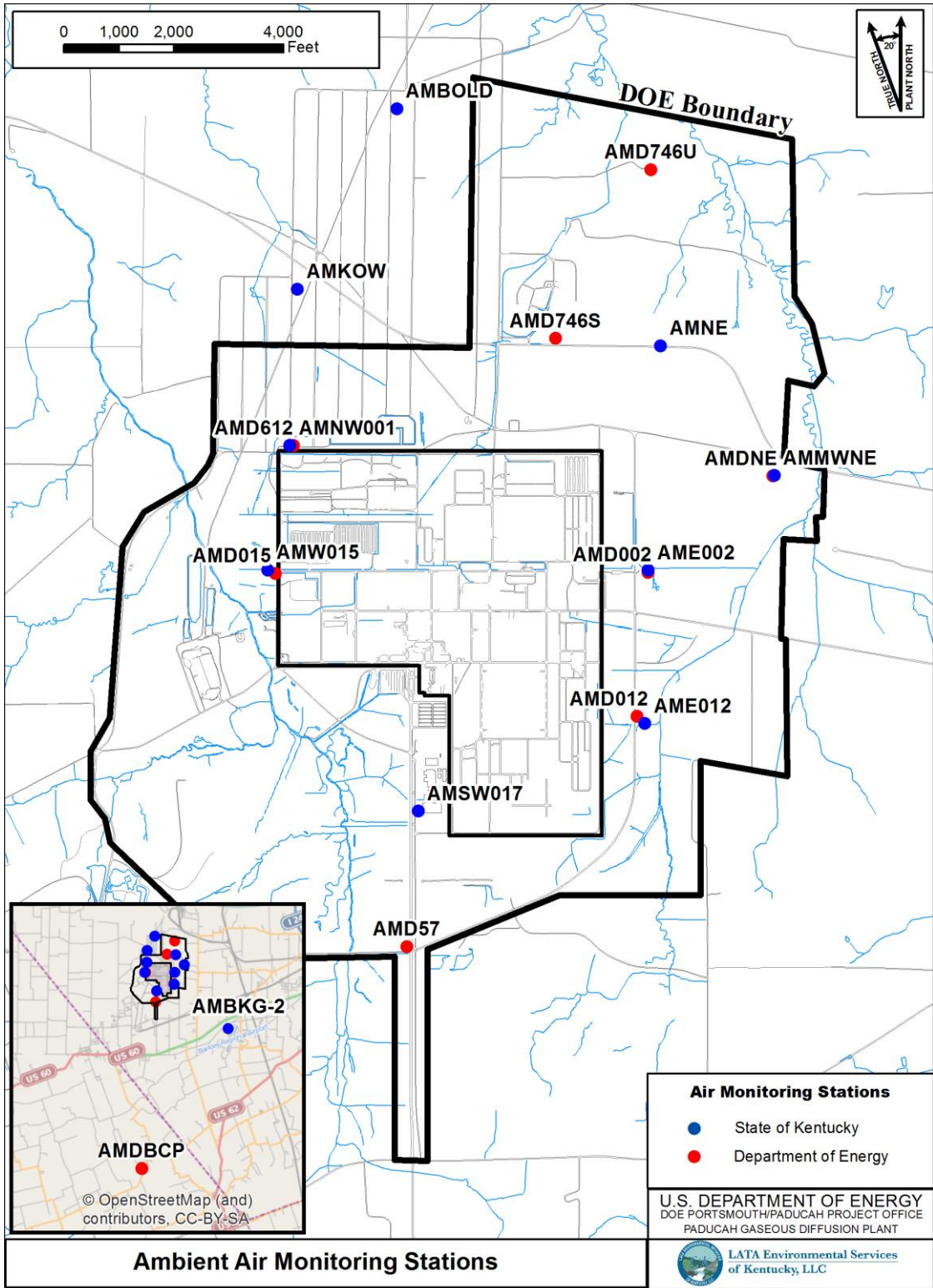


Figure 1. Location of Paducah Site Ambient Air Monitoring Stations