THE SWIFT STALEY TEAM

Paducah Gaseous Diffusion Plant
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Dear Sirs:

SUBMISSION OF THE CALENDAR YEAR 2005 ANNUAL NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS REPORT, PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY

Enclosed is the *Paducah Gaseous Diffusion Plant United States Department of Energy Air Emissions Annual Report (40 CFR 61, Subpart H) Calendar Year 2005*. This report summarizes airborne radionuclide emissions from the Paducah Site, including both U.S. Department of Energy and United States Enrichment Corporation emissions for Calendar Year 2005.

If you have any questions or require additional information, please call Mitch Hicks at (270) 441-6820.

Sincerely,

William E. Murphie
Manager
Portsmouth/Paducah Project Office

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Paducah Gaseous Diffusion Plant
United States Department of Energy
Air Emissions Annual Report
(40 CFR 61, Subpart H)
Calendar Year 2005

Site Name: Paducah Gaseous Diffusion Plant

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Contents

EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA) regulates air emissions of radionuclides, other than radon, from the United States Department of Energy (DOE) facilities under 40 CFR 61, Subpart H. Since DOE owns the Paducah Gaseous Diffusion Plant (PGDP), all regulated airborne radionuclide emissions are subject to the regulation, whether they originate from the United States Enrichment Corporation (USEC) operations or DOE operations. The public effective dose equivalent (EDE) standard is 10 millirem (mrem) per year from the PGDP site. The EDE to the public is calculated using a computer modeling program (CAP-88) specified in 40 CFR 61.93. Inputs to the computer program are obtained through continuous monitoring, periodic confirmatory measurements, engineering estimates, emission factors, and other EPA-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 EDE to the maximally exposed member of the public in 2005 at 0.022 mrem, including USEC and DOE contributions. This EDE is well below the annual limit of 10 mrem per year. Since this report represents both DOE and USEC emissions, the report contains dual certifications.

SECTION I: FACILITY INFORMATION

INTRODUCTION

The Department of Energy (DOE) Paducah Site contains the Paducah Gaseous Diffusion Plant (PGDP), which is leased to the United States Enrichment Corporation (USEC). DOE manages the remaining, non-leased facilities at the Paducah Site. The DOE-managed facilities consist of various waste management facilities, inactive buildings, depleted uranium storage facilities, and environmental restoration facilities. This report analyzes emissions from USEC and DOE portions of the Paducah Site.

SITE DESCRIPTION

PGDP is an active uranium enrichment facility consisting of a diffusion cascade and extensive support facilities. The cascade, including product and tails withdrawal, is housed in 6 process buildings covering a total of approximately 80 acres. The plant is located on a reservation consisting of approximately 3,423 acres in western McCracken County, approximately 10 miles west of Paducah, Kentucky, and approximately 3 miles south of the Ohio River. Roughly 748 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. Beyond the DOE-owned buffer zone is an extensive wildlife management area consisting of approximately 6,800 acres managed by the Commonwealth of Kentucky. During World War II, the Kentucky Ordnance Works (KOW), a trinitrotoluene production facility, was operated in an area southwest of the plant on what is now the wildlife management area. The water treatment plant used by PGDP was originally a KOW facility.

Construction of the PGDP facility began in 1951 and the plant was fully operational by 1955, supplying enriched uranium for commercial reactors and military defense reactors. Enriched uranium is defined as uranium in which the concentration of the fissionable uranium-235 (^{235}U) isotope has been increased from its natural assay. Natural uranium is mostly ^{238}U with approximately 0.71 percent ^{235}U and 0.0055 percent ^{234}U. Uranium mills process the ores to produce concentrated uranium oxide (U_3O_8), which is then commercially converted to uranium hexafluoride (UF_6) for enrichment at a gaseous diffusion plant.

The Paducah Plant enriches the uranium isotope, ^{235}U, by utilizing a physical separation process. The separation is based on the faster rate at which ^{235}U diffuses through a barrier compared with the heavier ^{238}U isotope. During enriching operations from 1953 to 1975, feed material (called "reactor tails") from government reactors was also used intermittently in addition to the UF_6 typically used. Reactor tails were the spent fuel from nuclear reactors that is depleted in ^{235}U content and has been reprocessed to remove most of the fission products. The reactor fuel rods 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. Use of the reactor tails resulted in the introduction of technetium-99 (^{99}Tc), a fission by-product, and transuranics, most notably neptunium-237 (^{237}Np) and plutonium-239 (^{239}Pu), into the cascade. ^{99}Tc is a man-made radioactive substance (radionuclide) having a half-life estimated at between 212,000 and 250,000 years. ^{99}Tc decays by emitting beta radiation.

Extensive support facilities are required to maintain the diffusion process. Some of the major support facilities include a steam plant, four major electrical switchyards, four cooling tower complexes, a chemical cleaning and decontamination building, a water treatment plant, a cooling water blow down treatment facility, maintenance facilities, and laboratory facilities. Several inactive facilities are also located on the plant site.

The West Kentucky Wildlife Management Area and lightly populated farmlands are in the immediate environs of PGDP. The population within the 50-mile radius is approximately 520,000 persons. Of these, approximately 44,000 live within 10 miles of the plant and approximately 104,000 live within 20 miles of the plant. Population data were determined from the LandView 6 Census 2000 population estimator computer program. 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 approximately 10 air miles east of the plant; Cape Girardeau, Missouri, located approximately 40 air miles to the west; and Metropolis, Illinois, located approximately 6 air miles to the northeast.

Paducah is located in the humid continental zone. Summers are generally 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 approximately 49 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.

USEC SOURCE DESCRIPTIONS

The 40 CFR 61.92 standard states emissions to the ambient air shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 mrem/yr. The continuous emission monitoring requirements are listed in 40 CFR 61.93. Continuous radionuclide emission measurements must be made at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of one percent of the standard (0.1 mrem/yr). To determine if a release point is subject to the continuous emission monitoring requirements, the potential to emit radionuclides must be made assuming no pollution control existed, but the facility is operated normally. USEC has determined the only release point requiring continuous monitoring is the C-310 stack. For the purposes of this report, any radionuclide release point requiring continuous emission monitoring is a *major* source. A *minor* source is a source or group of sources that does not exceed the annual EDE 0.1 mrem/yr continuous monitoring requirement. The C-310 stack is the only major source.

There are a number of minor, unmonitored radionuclide air sources at PGDP. Since these sources are not equipped with effluent samplers or monitors, emissions must be estimated using EPA-approved methods. Minor sources were identified during a 1991v1992 plant-wide vent stack survey. The source listing is maintained through internal review processes. For the purpose of estimating releases and submitting the annual report, minor sources may be grouped according to similar characteristics (e.g., general location, type of activity, or type of control, etc.). The number of minor sources may change from year to year due to cessation or start-up of operations.

Group A - C-400 Group

C-400 Decontamination Spray Booth

This facility is used to decontaminate equipment. It consists of a large booth equipped with an ultra high-pressure sprayer, which sprays a water solution on the contaminated machinery. The radionuclide emissions result from entrainment of radionuclides in the spray solution during the decontamination process. The booth is equipped with a mist eliminator as an emission control device. The mist eliminator is not listed as a pollution control device in 40 CFR 61, Appendix D, and no credit is taken for it. Emissions were estimated in accordance with Appendix D. The concentration of radionuclides in the spray booth water, multiplied by the total volume of water, was considered as the "curies used."

C-400 No. 5 Dissolver/Rotary Vacuum Filter

This facility is used to dissolve and precipitate the uranium in the solutions from the C-400 cylinder wash and decontamination spray booth. It is also used to treat uranium salvaged from C-710. The solution is chemically treated to precipitate the uranium forming a slurry solution. The solution is then passed through a rotary vacuum filter, which collects the precipitate (filter cake) for future disposal, leaving the filtrate. After sampling, the filtrate is discharged via permitted Kentucky Pollutant Discharge Elimination System (KPDES) outfalls. The radionuclide emissions come from the vent on the pump pulling the slurry solution through the rotary vacuum filter. Emissions from this vent are minimal because the pump and its vent are downstream of the rotary vacuum filter, which trap the uranium as filter cake. Emissions were estimated in accordance with 40 CFR 61, Appendix D. The concentration of radionuclides in the filtrate multiplied by the filtrate volume was considered as the "curies used."

C-400 Laundry

The C-400 Laundry washes and dries protective clothing used to prevent skin contamination on personnel working in radiological areas. The driers are equipped with lint filters. Emissions from the laundry are estimated using data from Health Physics surveys of the lint filters. The alpha radiation is assumed to be 10 percent due to ^{237}Np and 90 percent due to uranium. The beta emissions are assumed to be due to ^{99}Tc. The emission factor for cloth filters in 40 CFR 61, Appendix D, is used to estimate the emissions.

Group B—C-400 Cylinder Drying Station

This facility is used to dry UF_6 cylinders after the "heel" has been removed in the C-400 cylinder washstand. Dry plant air is passed through the cylinder to evaporate any moisture from the washing and hydrostatic testing processes. Emissions were estimated in accordance with 40 CFR 61, Appendix D. The concentrations of radionuclides in water used to wash the cylinders prior to drying, multiplied by the total volume of water used in the washing, were considered as the "curies used."

Group C—C-720

The motor burnout facility in C-720 is used to remove insulation from process motors in preparation for rebuilding. Administrative controls, such as limiting the level of radioactive contamination on the motors, are used to minimize emissions from this system. Emissions from the motor burnout facility are estimated using the results of radiological surveys of the motors placed in the facility. This facility was not operated in 2005.

Group D—C-709/C-710 Laboratory Hoods

The C-709/710 Laboratories are operated by Production Support and are the main facilities for sample analysis and research at PGDP. There are a total of 54 laboratory hoods and canopies in the C-709/710 Buildings that were used for radiological activities in 2005. The radionuclides involved in analyses consist primarily of uranium, with a slight potential for emissions of ^{99}Tc, ^{237}Np, ^{239}Pu, and the daughters of uranium (^{230}Th and ^{234}Th).

Four methods, depending on the type of operation occurring in the hood or radiological area in which the hood was located, were used to estimate emissions.

1. Estimation of the maximum quantity of uranium that could be lost based on laboratory methods. (If an ASTM analytical method specifies a maximum of 1.6 percent loss of mass during analysis, all samples analyzed using the method were assumed to lose, as an emissions from the hood, 1.6 percent of the uranium in the sample.)

2. Use of 40 CFR 61, Appendix D, emission factors.

3. Use of chemical trap efficiencies and uranium throughput information.

4. Knowledge of the analytical or sample preparation process.

All methods used the total inventory of uranium processed in the hood or radiological area as the basis for the emission estimate.

Group E—C-310 Stack

The primary source of potential radionuclide air emissions is the vent stack that serves the "top end" of the cascade process and the cylinder burping facility. This 200-foot stack, known as the C-310 stack, is located at the southwest corner of the C-310 Product Withdrawal Building. Low molecular weight gas compounds and contaminants, which have traveled up the cascade, are vented to the atmosphere via the C-310 stack. Small quantities of ^{234}U, ^{235}U, ^{238}U, ^{99}Tc, ^{237}Np, ^{239}Pu, and ^{230}Th are also emitted. The cascade effluent is routed through alumina traps prior to being emitted via the C-310 stack. The alumina traps were upgraded in 1990 to provide greater criticality safety. The improved system consists of an on-line bank of 13 traps and a standby bank of 13 traps. Each trap contains approximately 200 pounds of alumina.

The cylinder burp facility, located on the east side of C-310, is used to vent low molecular weight gases from product cylinders. This facility is also a potential source of uranium, ^{99}Tc, and minute quantities of transuranics. The effluent from the burp facility is routed through a bank of sodium fluoride

(NaF) traps prior to being emitted from the C-310 stack. There are 2 banks of chemical traps associated with this system. Each bank has 5 primary and 2 secondary traps. These traps contain approximately 130 pounds of NaF each. Uranium is recovered from the NaF traps back to the enrichment cascade.

Emissions from the C-310 stack were estimated based on daily emission samples from the continuous potassium hydroxide bubbler stack sampling system, which was approved by the Environmental Protection Agency (EPA) in 1992.

As part of the Quality Assurance/Quality Control (QA/QC) requirements for the C-310 stack sampler, a range for the sample flow has been established. During 2005, there were 13 instances where the sample flow was outside of the established range. These instances did not compromise the integrity of the sample. From operational records, there were no indications of excess emissions during these periods. Emissions immediately prior to and after the dates in question indicated they were within normal ranges.

Group F—Seal Exhaust/Wet Air Group

Seal Exhausts

Seals on the UF_6 compressors are supplied with an intricate array of air pressures to reduce any UF_6 release that may occur in the event of a seal failure. The seal exhaust flow is removed by large, oil-filled vacuum pumps and is routed from the seals through alumina traps, the pump, and to a common exhaust vent. There is one seal exhaust vent per cascade building, one on the C-310 Product Withdrawal Building and one on the C-315 Tails Withdrawal Building. Under normal operations, only trace amounts of UF_6 are present in the seal exhaust system. Occasionally, a seal or seal control system malfunction will allow greater quantities of UF_6 to enter the exhaust system. If UF_6 is allowed to enter the pump by virtue of trap breakthrough, it reacts with the pump oil creating a thick sludge, which overloads the pump in a short time. Due to the reaction between UF_6 and pump oil, the oil also serves as an excellent uranium emission control device; however, no credit is taken for the oil as a pollution abatement system because the oil is an integral part of the pumping system and is not included for emission control.
The list below indicates locations of the six seal exhausts at PGDP:

C-310 Product Withdrawal Building	C-333 Process Building
C-315 Tails Withdrawal Building	C-335 Process Building
C-331 Process Building	C-337 Process Building

An evaluation of the potential to emit radionuclides from the seal exhaust and wet air exhaust systems, and the conclusion that the alumina traps, which protect the pump oil, are not pollution control devices under 40 CFR 61, Subpart H, was forwarded to EPA on January 28, 1994.

Periodic confirmatory measurements are made on each type of seal exhaust and wet air system to verify low emissions. Emissions from these systems were originally estimated based on results of a modified 40 CFR 60 Method 5 stack sampling performed in 1992. The systems were resampled in 1997 and 2002. The seal exhaust/wet air system for the C-335 Process Building was sampled in 2004 as part of the CFC-114/UF_6 separator modifications. The most recent sampling results were used for emission estimates for CY 2005.

Wet Air Exhausts

When maintenance is required on cascade piping and equipment, the process gas (UF_6) is evacuated to other sections of the cascade or surge drums. The subject equipment and piping are swept in a series of purges with dry plant air. After maintenance, the system is closed and the ambient (wet) air is pumped from the system by the wet air pumps. During the dry air purges and wet air evacuations, the air is routed through alumina traps for uranium trapping to protect the wet air pump oil and then to an exhaust vent. In process buildings C-310, C-335, and C-337, the exhaust vent is the same one that services the seal exhaust system for those buildings. As discussed under seal exhausts, emissions from the wet air exhausts are estimated based on the most recent Method 5 stack sampling performed on this system. The list below indicates locations of the five wet air exhausts at PGDP:

C-310 Product Withdrawal Building (same as seal exhaust)
C-331 Process Building
C-333 Process Building
C-335 Process Building (same as seal exhaust)
C-337 Process Building (same as seal exhaust)

Chlorofluorocarbon-114 (CFC-114) UF_6 Separator

The CFC-114/UF_6 Separation System is located in C-335 and is used to freeze out UF_6 from process gas that has been significantly contaminated with R-114 coolant. Such mixtures usually result from equipment failure, but may also result from abnormal cascade operation. Surge drums are used to store these mixtures until they can be separated. The primary purpose of the CFC-114/UF_6 separation system is to remove the coolant and return the UF_6 to the cascade.

The separation system operates by freezing out the UF_6 from the process gas. To freeze out the UF_6, the UF_6/R-114 mixture is transferred from the surge drum (via pressure differential or process gas pumps) through a refrigerated set of favorable geometry cold traps. The gas stream then passes through NaF traps and alumina traps to absorb any residual UF_6. Typically, the gas stream flows through the alumina traps, although these traps can be bypassed. The trap discharge is connected to the seal exhaust/wet air (SX/WA) pump system and to atmosphere through the existing common discharge header. The UF_6 is sublimed back to cascade after the processing of the coolant-laden gas has been completed.

Modifications to the CFC-114/UF_6 Separation System to improve nuclear criticality safety characteristics were performed and initial baseline emissions testing completed in 2004. The modification reduced potential radionuclide emissions.

Cylinder Valve Connection Activities

Activities involving the connection and disconnection to UF_6 cylinders include cold pressure checks; sampling of feed, product, and tails cylinders; and product withdrawal, tails withdrawal, cylinder feeding, and cylinder burping. The cylinder valves are connected to the associated process via a "pigtail." Cylinder pigtails consist of a single length of copper tubing and threaded couplings. Pigtail disconnection procedures require a series of purges to ensure that no UF_6 remains in the pigtail prior to disconnection. Although adherence to these procedures minimizes UF_6 emissions, occasionally a small amount of UF_6 is observed during disconnection of the pigtails. As an additional measure to control radionuclide emissions, personnel performing the pigtail disconnects employ the use of a glove box containment device and/or portable high efficiency particulate air (HEPA) vacuums (vacs). The HEPA vacs are placed so that UF_6, which is emitted from the pigtail disconnect process, is captured by the HEPA vac.

Cylinder disconnection activities were serviced by HEPA filter-equipped vac systems. The list below indicates the locations of the pigtail systems:

C-310	Burp Station (located outside portable HEPA vacs used).
C-310	Product Withdrawal Building.
C-315	Tails Withdrawal Building.
C-333-A	Feed Facility (UF_6 Vaporizer).
C-337-A	Feed Facility (UF_6 Vaporizer).

Emissions from these systems were estimated by determining the total number of pigtail disconnections in each facility. An estimated quantity of UF_6 in each pigtail (based on the system volume, temperature, and pressure) multiplied by the number of disconnections was used to estimate the total quantity of UF_6 that could have been released.

Pigtails are evacuated and purged numerous times to reduce the quantity of UF_6 in the pigtail to very low levels. The method described above assumes that each pigtail has been evacuated or purged in accordance with operating procedures. Estimated quantities of UF_6 released during pigtail disconnections are added to the releases estimated from normal operations.

Building Ventilation

Radiological areas at PGDP are established under specific criteria defined in USEC Health Physics procedures and comply with the regulatory guidelines detailed in CFRs. As such, a radiological area is any area where: (1) an individual can receive a dose equivalent greater than 5 mrem in 1 hour, or (2) airborne radioactivity concentrations are greater than 10 percent of a derived air concentration (DAC); which is defined as the airborne concentrations of radionuclides in the workplace which would cause a maximum internal radiation dose of 5,000 mrem/year (regulatory exposure limit) to workers breathing the air over a normal year), or (3) surface contamination is present in excess of specified guidelines. Of the criteria for establishing radiological areas, the limits for airborne radioactivity relate directly to the potential exposure of the public from air emissions and are evaluated for radionuclide NESHAP considerations under the Building Ventilation Source category.

There are a number of radiological areas at PGDP with potential airborne radioactivity concentrations that could exceed threshold values. These areas are monitored by the Health Physics Group through the use of low-volume air samplers. These sampling systems consist of a low-volume pump (20 to 40 liters per minute) drawing ambient building air through a filter. The samplers run 24

hours per day and the filters are changed on 2-, 3-, 4-, or 5-day basis, depending on filter loading and weekend/holiday schedules. Typically, a minimum of 2 days of sample air is collected on each filter. After sample collection, the filters are counted for radioactivity concentrations.

For radionuclide NESHAP considerations, building ventilation sources from C-315, C-331, C-333, C-333A, C-335, C-337, C-337A, and C-720 are grouped with the Seal Exhaust/Wet Air Group. Building ventilation sources from C-310, C-360, C-400, and C-709/C-710 are grouped with the respective building emissions. Alpha and beta results from Health Physics air sampling are evaluated based on the most restrictive DAC applicable to PGDP, listed in 10 CFR 20. For alpha emissions, ^{237}Np is used. For beta emissions, ^{99}Tc is used. Only air sampling results exceeding 10 percent of the designated DAC are used in radionuclide NESHAP source emission calculations.

Group G—C-409 Dissolver/Rotary Vacuum Filter

This facility is used to dissolve and precipitate the high assay uranium in solutions from the C-710 Laboratory and various sources. The solution is chemically treated to precipitate the uranium forming a slurry solution. The solution is then passed through a rotary vacuum filter, which collects the precipitate (filter cake) for future disposal, leaving the filtrate. After sampling, the filtrate is then discharged via permitted KPDES outfalls. The radionuclide emissions come from the vent on the pump that pulls the slurry solution through the rotary vacuum filter. Emissions from this vent are minimal because the pump and its vent are downstream of the rotary vacuum filter, which trap the uranium as filter cake. Emissions are estimated in accordance with 40 CFR 61, Appendix D. The concentrations of radionuclides in the filtrate, multiplied by the filtrate volume, are considered as the "curies used."

Group H—C-360

The primary sources of radionuclide air emissions are cylinder valve connection activities and building ventilation. Emissions from the cylinder valve connections were estimated by determining the total number of pigtail disconnections. An estimated quantity of UF_6 in each pigtail multiplied by the number of disconnections was used to estimate the total quantity of UF_6 released.

CONSTRUCTION AND MODIFICATION ACTIVITIES

During the calendar year, there were no USEC construction or modification activities which were waived under 40 CFR 61.96.

USEC FUGITIVE AND DIFFUSE SOURCES

Site emissions of fugitive or diffuse sources of radionuclides are discussed in the DOE Fugitive/Diffuse Emissions section. A network of ambient air monitors is maintained at the PGDP site. Based on ambient air monitoring observations for CY 2005, plant derived radionuclides were not detected.

DOE SOURCE DESCRIPTION

New or Modified Sources

The Northeast Plume Treatment System was a new source for 2005. While no construction or modification occurred, radionuclide emissions began due to changing groundwater conditions as described below.

Northeast Plume Treatment Facility

DOE began normal operation of a groundwater treatment system on February 28, 1997 as an interim remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The system extracts contaminated groundwater and pumps it to the C-637 Cooling Towers operated by USEC. Initially the contaminated groundwater did not contain radionuclides; however during 2005, ^{99}Tc was detected in the groundwater and consequently emitted to the air. Emissions of ^{99}Tc were estimated using 40 CFR Subpart H, Appendix D, emission factors and the analysis of both the influent groundwater and the basin water in the cooling tower.

Northwest Plume Treatment Facility

On September 1, 1995, DOE began operation of a groundwater treatment plant designed for the removal of trichloroethylene and ^{99}Tc. The facility is located at the northwest corner of the PGDP site security area and is part of an interim remedial action under CERCLA. The facility consists of an air stripper to remove volatile organics and an ion exchange unit to remove of ^{99}Tc from the groundwater. The air stripper is located upstream of the ion exchange unit.

Emissions of ^{99}Tc were estimated using the analysis of the influent groundwater and the effluent water leaving the air stripper. Comparison of the ^{99}Tc concentration in the influent and effluent of the air stripper and the quantity of the water passing through the stripper were used to estimate the total quantity of ^{99}Tc emitted from the facility. The exhaust from the air stripper is passed through a carbon adsorption unit prior to exhaust. Extensive sampling has shown that ^{99}Tc is not retained in the carbon; therefore, no reduction in ^{99}Tc emissions due to the use of the adsorption unit were assumed.

Scrap Metal Projects

The Scrap Metal Projects removed scrap metal from the northwest portion of the Paducah Site (C-746-P yard) as well as the C-746-D yard in the eastern portion of the site. During 2005, fugitive airborne radionuclide emissions may have resulted from dust created by removal, size reduction, and loading the scrap into transportation containers. The amount of radionuclides released was estimated based on emission factors from the Environmental Protection Agency, Document AP-42.

C-410 Decontamination and Decommissioning Activities

DOE continued preparation of fluorine cells for off-site shipment. This preparation required removal of the paint on the exterior of the cells due to concerns about possible contaminants in the paint. The paint was removed by a sponge blasting process. A small amount of radionuclide contamination was present in the paint removed. The blasting occurred within the facility; however, room ventilation was exhausted through a HEPA filter. The amount of radionuclides released was estimated based on paint sampling data and 40 CFR Subpart H, Appendix D, emission factors.

Fugitive and Diffuse Sources

DOE has identified many areas, such as inactive facilities, building roofs, scrap metal storage yards, landfills, equipment decontamination, and various contamination areas, as potential fugitive and diffuse sources. Based on prior Health Physics data and historical ambient air monitoring, it is unlikely that any of these potential sources are significant; however, ambient air monitoring has been conducted around the Paducah Site to verify this conclusion.

In accordance with *The Paducah Gaseous Diffusion Plant Department of Energy National Emission Standards for Hazardous Air Pollutants (NESHAP) Management Plan* (BJC/PAD-141, dated February 2000), DOE utilized 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. Ambient air monitoring locations are shown in Figure 1. The Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch of the Department for Public Health of the Kentucky Cabinet for Health Services operated the ambient air monitors during CY 2005. Based on observations for CY 2005, plant derived radionuclides were not detected. The results of the ambient air monitoring are in Table A-1 of this report.

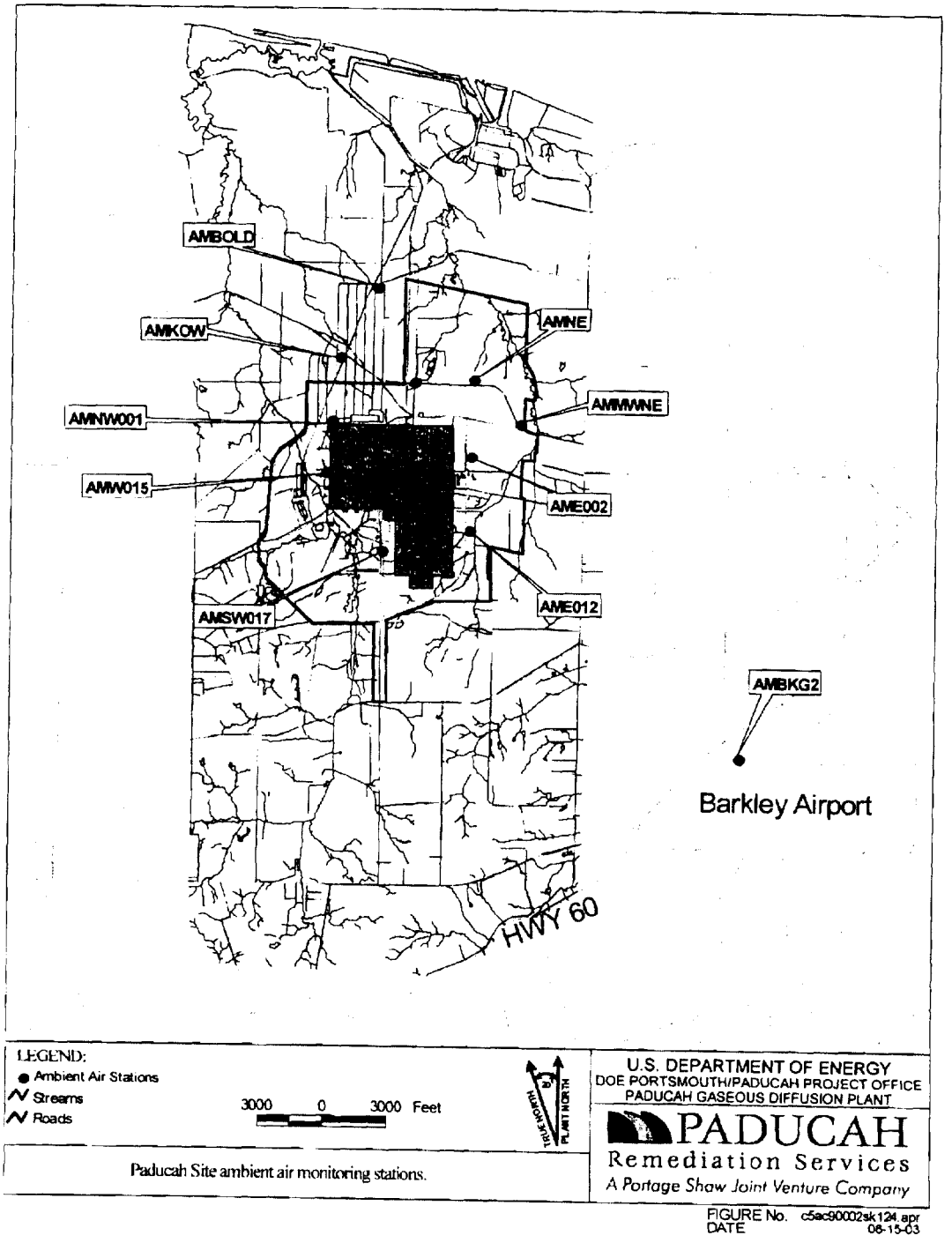

Figure 1. Location of Paducah Site ambient air monitors.

SECTION II: SOURCE CHARACTERISTICS AND AIR EMISSIONS DATA

USEC SOURCE CHARACTERISTICS AND RADIONUCLIDE EMISSIONS

MAJOR POINT SOURCE

Group	Major Point Source	Type Control	Efficiency %	Distance (m) and Direction to Nearest Receptor
E	C-310 Stack	NaF Traps	>99.9	1740 ESE
		Alumina Traps	~98.6	

MINOR POINT AND AREA SOURCES

Group	Minor Point and Area Sources	Type Control	Efficiency %	Distance (m) and Direction to Nearest Receptor
B	C-400 Cylinder Drying Station	None	0	1900 ESE
G	C-409 Dissolver	None	0	2060 ESE
H	C-360	None	0	1180 SE

MINOR GROUPED SOURCES

Group	Minor Grouped Sources	Type Control	Efficiency %	Distance (m) and Direction to Nearest Receptor
A	C-400 Group	None	0	1920 ESE
C	C-720 Motor Burnout Ovens	None	0	1960 ESE
D	C-709/C-710 Laboratory Hoods	None	0	1960 ESE
F	Seal Exhaust/Wet Air Group • Seal Exhausts; Wet Air Exhausts; CFC-114/UF_6 Separation System	Alumina Traps	~98.6	1490 ESE
	• Cylinder Valve Connection Activities	HEPA Vacuums[1]	99.0 (Appendix D)	1490 ESE
	• Building Ventilation	None	0	1490 ESE

NOTE: The building ventilation and cylinder valve connection activities not serviced by a stack are grouped with the SX/WA Group or respective building

[1]Credit for the use of HEPA vacuums for pigtail operations is not taken for the purposes of estimating emissions.

USEC SOURCE CHARACTERISTICS

Group	Source Name	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)	Distance (m) and Direction to Maximally Exposed Individual	
							Source	Plant
A	C-400 Group	Point	11.3	N/A	0	Ambient	2040 N	2040 N
B	C-400 Cylinder Drying Station	Point	2.4	0.5	0	Ambient	2120 N	2120 N
C	C-720 Motor Burnout Ovens	Point	15.8	0.5	0	Ambient	NA	NA
D	C-709/C-710 Laboratory Hoods	Point	7.1	N/A	0	Ambient	2370 N	2370 N
E	C-310 Stack	Point	61.0	0.3	0	21.7	2430 N	2430 N
F	Seal Exhaust/ Wet Air Group	Point	21.0	N/A	0	Ambient	2350 N	2350 N
G	C-409 Dissolver	Point	2.3	0.08	0	Ambient	2134 N	2134 N
H	C-360	Point	16.0	N/A	0	Ambient	1180 SE	2370 NNW

Group	Source Name	Distances (m) to Selected Receptors		
		Nearest Individual/Farm	Nearest Business	Nearest School
A	C-400 Group	1920	2819	4225
B	C-400 Cylinder Drying Station	1900	2819	4100
C	C-720 Motor Burnout Ovens	1960	2705	3900
D	C-709/C-710 Laboratory Hoods	1960	2705	3900
E	C-310 Stack	1740	2705	3840
F	Seal Exhaust/Wet Air Group	1490	2438	3840
G	C-409 Dissolver	2060	2900	4040
H	C-360	1180	2000	3840

Note: Modeling was performed assuming a theoretical stack located at the approximate center of each grouped source.

USEC RADIONUCLIDE EMISSIONS

Radionuclide Emissions (Ci) - CY 2005										
			Emission Source							
			Group A	Group B	Group D	Group E	Group F	Group G	Group H	
Nuclide	Solubility	AMAD*	C-400 Grouped Sources	C-400 Cylinder Drying Station	C-709/ C-710 Lab Hoods	C-310 Stack	Seal Exhaust/ Wet Air Group	C-409 Dissolver	C-360	Total
^{234}U	D	1.0	3.52E-04	1.85E-06	5.99E-04	2.04E-04	1.10E-02	2.55E-07	1.91E-05	1.22E-02
^{235}U	D	1.0	1.22E-05	6.42E-08	2.08E-05	7.10E-06	3.82E-04	8.84E-09	6.64E-07	4.23E-04
^{238}U	D	1.0	4.29E-05	1.40E-06	5.55E-05	2.34E-05	3.80E-03	4.87E-08	1.98E-06	3.93E-03
^{99}Tc	W	1.0	9.98E-03	6.70E-07	0.00E+00	9.26E-04	3.34E-05	2.28E-06	0.00E+00	1.09E-02
^{230}Th	W	1.0	1.14E-07	2.22E-05	0.00E+00	6.30E-06	0.00E+00	6.07E-09	0.00E+00	2.86E-05
^{237}Np	W	1.0	4.48E-05	3.31E-07	2.97E-06	2.61E-05	1.05E-04	2.58E-08	2.41E-06	1.82E-04
^{239}Pu	W	1.0	1.36E-08	3.28E-09	0.00E+00	1.19E-06	0.00E+00	1.17E-09	0.00E+00	1.21E-06
Total Ci/year			1.04E-02	2.65E-05	6.78E-04	1.19E-03	1.53E-02	2.63E-06	2.42E-05	**2.77E-02**

*AMAD – Activity Median Aerodynamic Diameter
Note: The C-720 motor burnout facility, Group C, did not operate during 2005.

DOE SOURCE CHARACTERISTICS AND RADIONUCLIDE EMISSIONS DATA

Minor Point and Area Sources	Type Control	Efficiency%	Distance (m) and Direction to Nearest Receptor
Northwest Plume Treatment Facility	None	0	1080 NNE
C-746-P Scrap Metal Project	None	0	1205 NNE
C-746-D Scrap Metal	None	0	1220 ESE
C-410 Emissions	HEPA	99.7	1820 ESE
NE Plume Treatment Facility	None	0	1360 SE

Radionuclide Emissions (Ci) - CY 2005								
			Emission Source					
Nuclide	Solubility	AMAD	NW Plume Treatment Facility	C-746-P Scrap Metal Project	C-746-D Scrap Metal Project	C-410 Emissions	NE Plume Treatment Facility	Total
^{234}U	D	1.0	0.00E+00	3.39E-11	4.36E-04	4.50E-08	0.00E+00	4.36E-04
^{235}U	D	1.0	0.00E+00	1.33E-12	1.71E-05	8.20E-10	0.00E+00	1.71E-05
^{238}U	D	1.0	0.00E+00	1.01E-11	1.30E-04	4.40E-08	0.00E+00	1.30E-04
^{99}Tc	W	1.0	9.85E-05	2.40E-11	2.38E-06	1.00E-07	1.25E-04	2.26E-04
^{237}Np	W	1.0	0.00E+00	0.00E+00	3.29E-08	2.40E-10	0.00E+00	3.31E-08
^{239}Pu	W	1.0	0.00E+00	0.00E+00	2.86E-08	2.60E-10	0.00E+00	2.89E-08
^{241}Am	W	1.0	0.00E+00	0.00E+00	0.00E+00	3.00E-10	0.00E+00	3.00E-10
Total Ci/year			9.85E-05	6.93E-11	5.86E-04	1.91E-07	1.25E-04	**8.09E-04**

Source Name	Distances (m) to Selected Receptors		
	Nearest Individual/Farm	Nearest Business	Nearest School
Northwest Plume Treatment Facility	1080	2550	5150
C-746-P Scrap Metal Project	1234	3033	5490
C-746-D Scrap Metal	1220	2105	3873
C-410 Emissions	1820	2814	4360
NE Plume Treatment Facility	1268	2073	4207

Source Name	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)	Distance (m) & Direction to Maximally Exposed Individual (MEI) Source MEI
Northwest Plume Treatment Facility	Point	7.0	0.3556	9.45	37.8	1080 NNE
C-746-P Scrap Metal Project	Point	1.0	NA	0	Ambient	1205 NNE
C-746-D Scrap Metal	Point	1.0	NA	0	Ambient	1220 SE
C-410 Emissions	Point	4.6	NA	0	Ambient	2220 N
NE Plume Treatment Facility	Point	10.22	8.18	4.84	Ambient	2573 N

SECTION III: DOSE ASSESSMENT

DESCRIPTION OF DOSE MODEL

The radiation dose calculations were performed using the CAP-88 package of computer codes. This package contains 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 are then 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 the EPA with the CAP-88 package. Selection of the dose conversion factors follows guidance given by the EPA in its Federal Guidance Report No. 11.

SUMMARY OF INPUT PARAMETERS

Except for the radionuclide parameters given in Section II and those given below, all important input parameter values used are the default values provided with the CAP-88 computer codes and data bases. The meteorological information comes from either the on-site meteorological station or the Paducah National Weather Service.

Joint frequency distribution:	Five-year STAR distribution from 60-meter station on PGDP meteorological tower for the years 1988 through 1992.
Rainfall rate:	116.3 centimeters/year
Average air temperature:	14.7° C
Average mixing layer height:	930 meters

Fraction of foodstuffs from[1]:	Local Area	50-Mile Radius	Beyond 50 Miles
Vegetables and produce:	0.700	0.300	0.000
Meat:	0.442	0.558	0.000
Milk:	0.399	0.601	0.000

DISCUSSION OF RESULTS

Due to the conservative nature of the estimates, it is likely that the actual radiological dose from site operations was significantly lower than the calculated dose. Using the conservative estimates, however, PGDP was in compliance with requirements of 40 CFR 61 because the total dose from all airborne radionuclides (including fugitive and diffuse sources) is less than the standard of 10 mrem per year.

[1]Rural default values.

COMPLIANCE ASSESSMENT

Effective dose equivalent (mrem) to the maximally exposed member of the public is provided below. The maximally exposed member of the public is identified by the shortest distance in 16 different compass directions from each source. Each individual source may or may not share a public receptor with another source depending on the geographic location of the source compared to the closet public receptor. Using these public receptors, the CAP-88 computer dose modeling program determines maximum dose from each individual source and from all sources combined. Each source will produce a maximum dose, but it may not be the maximum for the plant because a different public receptor receives a greater combined dose total from the plant.

USEC Emission Sources		Maximum for Source	Maximum for Plant
A	C-400 Group	3.7E-03	3.7E-03
B	C-400 Cylinder Drying Station	8.3E-04	8.3E-04
C	C-720 Motor Burnout Ovens	0.0E+00	0.0E+00
D	C-709/C-710 Laboratory Hoods	5.1E-04	5.1E-04
E	C-310 Stack	6.1E-03	5.8E-03
F	Seal Exhaust/Wet Air Group	1.1E-02	1.1E-02
G	C-409 Dissolver	2.2E-06	2.2E-06
H	C-360	2.1E-04	9.1E-05
Total From USEC Sources		**N/A**	**2.19E-02**
DOE Emission Sources		**Maximum for Source**	**Maximum for Plant**
Northwest Plume Treatment Facility		1.8E-05	1.8E-05
C-746-P Scrap Metal Project		8.5E-11	8.5E-11
C-746-D Scrap Metal		6.0E-04	2.2E-04
C-410 Emissions		1.1E-07	1.1E-07
Northeast Plume Treatment Facility		8.5E-06	6.3E-06
Total From DOE Sources		**N/A**	**2.44E-04**
Total From All Sources		**N/A**	**2.2E-02**

The effective dose equivalent to the maximally exposed individual from plant emissions is 2.2E-02 mrem.

The maximally exposed individual is located 2,350 meters north of the SX/WA Group Source.

NOTE: Based on 2000 census data obtained from the LandView 6 computer program, the total collective effective dose equivalent (CEDE) to the 50-mile population (520,000 persons) was 0.15 person-rem.

SECTION IV: ADDITIONAL INFORMATION

UNPLANNED RELEASES – USEC

There was one unplanned release in USEC facilities occurring outside of a building not included in Health Physics air sampling program during the year. The estimated total quantity of uranium released was one gram. The release was included in the seal/wet air exhaust group.

UNPLANNED RELEASES – DOE

There was one unplanned release within C-410 during D&D activities. The release was contained within the building. Any release outside the building was a diffuse/fugitive release.

DOE – FUGITIVE/DIFFUSE EMISSIONS

Fugitive/diffuse sources include any source that is spatially distributed, diffuse in nature, or not emitted with forced air from a stack, vent, or other confined conduit. Fugitive/diffuse 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 fugitive/diffuse 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; leaks in piping, valves, or other process equipment; and cylinder valve changes.

The Paducah Gaseous Diffusion Plant Department of Energy National Emission Standards for Hazardous Air Pollutants (NESHAP) Management Plan, (BJC/PAD-141, dated February 2000), outlines the DOE Paducah Site use of ambient air monitors to demonstrate that total emissions (from point, diffuse, and fugitive sources) result in doses significantly less than the 10-mrem/year (0.1-mSv/year) standard.

AMBIENT AIR MONITORING

In accordance with the plan, the Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch of the Department for Public Health of the Kentucky Cabinet for Health Services conducted ambient air monitoring around the Paducah Site during CY 2005. The Radiation Health and Toxic Agents Branch reports that weekly air filters were screened for gross alpha and beta activity and then composited on a quarterly basis. The quarterly composites were analyzed by gamma spectroscopy using a thin window 40 percent high purity germanium detector, which allows for detection of low energy gamma emitters. Americium-241 (^{241}Am) and ^{234}Th were not detected by gamma spectroscopy for the quarterly composites.

In accordance with the Radiation Health and Toxic Agents Branch's protocol, plutonium and uranium isotopic analyses were not performed on the quarterly composites since ^{241}Am and ^{234}Th were not detected. Since ^{241}Am and ^{234}Th were not present, the quarterly composites were analyzed for ^{99}Tc. ^{99}Tc was also not detected in the quarterly composites. ^{210}Pb and ^{40}K were detected on filters, which accounts for the presence of the gross alpha and beta activities.

Ambient air monitoring conducted by the Kentucky Radiation Health and Toxics Branch did not detect plant derived radionuclides above background levels during CY 2005. The actual results, even though less than the measurement error, of each air monitor are listed in Table A-1 of this report. The ratio of each isotopic concentration to the standard for that isotope in 40 CFR 61, Appendix E, Table 2, was calculated. The sum of all of these ratios should be less than one to meet the standard. The sum of the ratios is listed in Table A–1 for each monitoring station for each quarter.

Table A-1. Kentucky Radiation Health and Toxics Branch Ambient Air Monitoring Results[1]

		Ambient Air Station									
		AMSW017	AMW015	AMNW001	AMNE	AME002	AME012	AMBKG2	AMBOLD	AMKOW	AMMWNE
Quarter	Nuclide	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3	Ci/m^3
1	^{241}Am	3.03E-18	6.03E-18	0.00E+00	2.00E-18	-3.54E-18	6.25E-18	3.95E-18	3.06E-18	1.77E-18	1.12E-17
	^{237}Np	-9.52E-17	-1.60E-16	3.43E-16	2.83E-16	2.03E-16	-1.73E-16	-2.94E-16	-6.62E-17	-4.14E-16	-2.81E-16
	^{99}Tc	1.52E-17	3.55E-16	2.37E-16	1.74E-16	2.44E-16	2.19E-16	-1.11E-17	2.15E-16	-6.35E-17	2.45E-16
	^{238}U	1.73E-16	1.94E-16	2.29E-16	1.95E-16	2.07E-16	2.23E-16	1.72E-16	2.10E-16	2.22E-16	1.65E-16
	Sum of ratios	-0.06	-0.10	0.32	0.26	0.19	-0.11	-0.22	-0.03	-0.32	-0.21
2	^{241}Am	5.15E-18	-4.42E-18	7.36E-18	1.30E-17	5.38E-18	-1.84E-18	6.55E-18	2.07E-18	-1.77E-18	-3.70E-18
	^{237}Np	6.16E-18	-9.72E-17	7.55E-18	7.07E-18	7.16E-18	5.73E-18	3.90E-17	7.55E-18	-6.64E-18	-3.71E-17
	^{99}Tc	2.83E-16	3.34E-16	8.86E-16	6.90E-16	1.40E-15	8.30E-16	1.03E-15	9.69E-16	1.04E-15	6.13E-16
	^{238}U	1.75E-16	1.96E-16	1.69E-16	2.12E-16	2.00E-16	1.77E-16	1.24E-16	1.99E-16	1.67E-16	1.77E-16
	Sum of ratios	0.03	-0.06	0.04	0.04	0.04	0.03	0.06	0.04	0.02	-0.01
3	^{241}Am	9.74E-23	-6.21E-18	-5.21E-18	0.00E+00	0.00E+00	4.96E-18	0.00E+00	1.45E-17	-7.77E-18	-1.81E-18
	^{237}Np	9.58E-18	-2.75E-17	7.73E-18	9.72E-18	5.81E-18	-3.29E-18	2.22E-17	2.35E-18	-2.06E-18	-2.36E-17
	^{99}Tc	1.07E-15	2.50E-16	7.17E-16	3.10E-16	7.64E-16	4.32E-16	2.48E-16	4.17E-16	7.00E-16	3.94E-16
	^{238}U	3.12E-16	2.52E-16	2.07E-16	2.54E-16	2.85E-16	2.35E-16	1.87E-16	2.35E-16	2.42E-16	2.29E-16
	Sum of ratios	0.05	0.01	0.03	0.04	0.04	0.03	0.04	0.04	0.03	0.01
4	^{241}Am	1.2E-17	6.7E-18	8.2E-18	-1.8E-18	7.6E-18	1.3E-17	9.2E-18	-8.6E-18	1.1E-17	-1.7E-18
	^{237}Np	-2.4E-18	-4.1E-18	2.1E-18	1.2E-17	7.7E-18	2.2E-17	1.0E-17	2.2E-18	-1.5E-17	-2.6E-17
	^{99}Tc	4.9E-16	6.3E-16	1.0E-15	1.0E-15	4.5E-16	2.7E-16	1.9E-16	4.4E-16	8.8E-16	6.1E-16
	^{238}U	1.7E-16	1.7E-16	1.4E-16	1.9E-16	1.3E-16	1.7E-16	1.4E-16	2.2E-16	2.0E-16	1.6E-16
	Sum of ratios	0.03	0.03	0.03	0.04	0.03	0.05	0.03	0.03	0.02	0.00

[1] 40 CFR 61, Table 2, Limiting Values (Ci/m3): ^{241}Am 1.9E-15, ^{237}Np 1.2E-15, ^{99}Tc 1.4E-13, and ^{238}U 8.3E-15.

STATUS OF NESHAP MONITORING REQUIREMENTS, SUBPART H COMPLIANCE

DOE has remained in compliance with 40 CFR 61, Subpart H, since 1993. KDAQ received a delegation of authority to administer the NESHAP program in July 1999. A NESHAP Management Plan has been developed by DOE, which addresses 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 and Toxics Branch did not detect plant derived radionuclides above background levels during CY 2005. Therefore, the facility is in compliance with 40 CFR 61, Appendix E, Table 2 values.

Based on the results included within this report, during 2005 the facility was in compliance with 40 CFR 61, Subpart H, for all airborne radionuclide emissions.

USEC CERTIFICATION

This certification pertains to the following USEC emission sources:

Group A	C-400
Group B	C-400 Cylinder Drying Station
Group C	C-720 Motor Burnout Ovens
Group D	C-709/C-710 Laboratory Hoods
Group E	C-310 Stack
Group F	Seal Exhaust/Wet Air Group
Group G	C-409 Dissolver
Group H	C-360
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.)

Steven Penrod
United States Enrichment Corporation

6-5-06
Date

DOE CERTIFICATION

This certification pertains to the following DOE emission source:

C-410 D&D Activities
C-746-D Scrap Metal Project
C-746-P Scrap Metal Project
Northwest Plume Treatment Facility
Northeast Plume Treatment Facility
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.)

WJ Wyf
Department of Energy

6/29/06
Date