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DOCUMENT DESCRIPTION (TO BE COMPLETED BY REQUESTER)

DOCUMENT NUMBER: PAGES:

DOCUMENT TITLE: 1999 Annual National Emission Standards for Hazardous Air Pollutants Report, PGDP

AUTHORS(S) (INDICATE OTHER DIVISIONS OR ORGANIZATIONS, IF APPLICABLE): D. Seaborg / DOE-PGDP

DOCUMENT TYPE (SEE DOC. PREP. GUIDE, CHS. 1 AND 2, FOR DEFINITIONS OF DOCUMENT TYPES): ☐ DRAWING ☐ PHOTO ☐ FORMAL REPORT

☐ OCCURRENCE REPORT ☐ PROGRESS REPORT ☒ INFORMAL REPORT ☐ ABSTRACT ☐ CORRESPONDENCE ☐ OTHER VISUALS

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CP-20382 (5-6-95)

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(2)

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June 15, 2000

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Dear Sirs/Ms:

1999 ANNUAL NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS REPORT, PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KENTUCKY

Enclosed is the 1999 Annual National Emission 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 Department of Energy and United States Enrichment Corporation emissions for calendar year (CY) 1999.

The radiological dose to the most exposed member of the public resulting from site emissions during 1999 is estimated as 1.2E-2 mrem/year. The dose for CY 1998 was estimated as 1.4E-2 mrem/year.

If you have any questions or require additional information, please call W. David Tidwell at (270) 441-6807.

Sincerely,

W. Don Seaborg, Site Manager
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United States Department of Energy
Air Emissions Annual Report
(40 CFR 61, Subpart H)
Calendar Year 1999

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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). The remaining, nonleased facilities at the Paducah Site are managed by DOE. 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 both portions of the Paducah Site.

SITE DESCRIPTION

PGDP 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, averages 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.

The West Kentucky Wildlife Management Area (WKWMA) and lightly populated farmlands are in the immediate environs of PGDP. The population within the 50-mile radius is approximately 535,000 persons. Of these, approximately 36,500 live within ten miles of the plant and approximately 104,000 within 20 miles. 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.

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 six process buildings covering a total of approximately 80 acres. The plant is located on a reservation consisting of approximately 1350 acres in Western McCracken County approximately 10 miles west of Paducah, Kentucky, and approximately three miles south of the Ohio River. Roughly 740 acres of the reservation, which contain a most of the operating facilities, 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 2100 acres either deeded or leased to 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 about 0.72 percent ^{235}U and 0.0051 percent ^{234}U. Uranium mills process the ores to produce concentrated uranium oxide

(U_3O_8) which is then commercially converted to gaseous uranium hexafluoride (UF_6) for enrichment at a gaseous diffusion plant. PGDP serves as a first step in the uranium enrichment process in which the ^{235}U is increased to approximately two percent. Products from PGDP must be further enriched prior to its use as a nuclear fuel; thus the plant provides an enriched feed stream to the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio, and provided a similar feed stream to the Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee, prior to its shutdown. A project to upgrade operations to be capable of 2.75 percent ^{235}U enrichment was completed in 1996. PGDP has not yet begun continuous operations at this higher enrichment level. Hazardous, nonhazardous, and radioactive wastes are generated and disposed of as a result of plant operations.

PGDP enriches the uranium isotope, ^{235}U, via 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 are the fuel from nuclear reactors that have had its ^{235}U content depleted, have been reprocessed to remove most of the fission products, and which must have its ^{235}U content replenished before it can be recycled. 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 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. It 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 blowdown treatment facility, maintenance facilities, and laboratory facilities. Several inactive facilities are also located on the plant site.

In 1993, USEC was formed. Although all the facilities at PGDP are still owned by DOE, the uranium enrichment enterprise is now the responsibility of USEC. According to the Lease Agreement between DOE and USEC, USEC retained responsibility for quantification of airborne radionuclide emissions and preparation of the annual report required by 40 CFR 61, Subpart H. DOE remains responsible for compliance with other requirements for DOE-operated sources.

On March 3, 1997, the Nuclear Regulatory Commission assumed regulatory responsibility for the USEC-leased portion of the plant. However, because the entire facility is still owned by DOE, both USEC and DOE facilities are still subjected to 40 CFR 61, Subpart H, requirements.

USEC SOURCE DESCRIPTIONS

The following are the potential USEC airborne radionuclide sources at PGDP. Although not all of them were used in 1999, they are included in this report due to their potential for future restart.

C-310 STACK

The primary source of potential radionuclide air emissions is the vent stack which 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 Purge Vent Stack. Small quantities of ^{234}U, ^{235}U, ^{238}U, ^{99}Tc, ^{237}Np, ^{239}Pu, and thorium-230 (^{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 eastside of C-310, is used to vent the low molecular weight gases from product cylinders. Product cylinders are steel UF_6 storage containers. This facility is also a potential source of uranium, ^{99}Tc, transuranics (minute quantities), and ^{230}Th. 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. The north bank has three sets of two traps each (primary, secondary, and standby). Each trap contains approximately 300 pounds of NaF. The south bank has seven traps. These traps contain approximately 130 pounds of NaF each. The smaller size of the traps is due to criticality safety concerns. Uranium recovered from the NaF traps flows back to the enrichment cascade. Emissions from the C-310 Stack were estimated based on daily results of 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 1999, there were two instances where the sample flow was outside of the established range. These instances were due to flow rate adjustments and 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 that they were within normal ranges.

SEAL EXHAUSTS

Seals on the UF_6 compressors are supplied with an intricate array of air pressures to reduce any UF_6 release which may occur in the unlikely 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 on each 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, gummy 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

Emissions from the seal exhaust grouped source were estimated based on results of Method 5 stack sampling performed in 1992. The seal exhausts were resampled in 1997. The results of the 1997 sampling were used for emission estimates for calendar year 1999.

A discussion of the potential to emit from the seal exhausts, wet air exhausts, 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.

WET AIR EXHAUST

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. In both the dry air purges and the five wet air withdrawals, 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-333, C-335, and C-337, the exhaust vent is also used by the seal exhaust system for those buildings. 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 (same as seal exhaust)
C-335 Process Building (same as seal exhaust)
C-337 Process Building (same as seal exhaust)

Emissions from the wet air exhausts in 1999 were estimated based on results of Method 5 stack sampling performed in 1997.

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 "puff" 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 any minute "whiff or puff" of UF_6 which is emitted from the pigtail disconnect process is captured by the HEPA vac.

Prior to 1996, cylinder disconnection activities in C-315 and C-360 were serviced by permanent HEPA filter-equipped vac systems. In late 1995, the system in C-360 was determined to be ineffective and was shut down. The C-315 system is also shut down. Emissions from all cylinder disconnection activities are now controlled through the use of portable vacuum systems as described above. 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 (portable HEPA vacs used).
C-315	Tails Withdrawal Building (controlled by portable HEPA vacs).
C-333-A	Feed Facility (UF_6 Vaporizer) (portable HEPA vacs used).
C-337-A	Feed Facility (UF_6 Vaporizer) (portable HEPA vacs used).
C-360	Toll Transfer and Sampling Facility (controlled by portable HEPA vacs).

Emissions from all of 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 which could have been released.

All 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. Quantities of UF_6 released as observed puffs are added to the releases estimated from normal operations.

C-360 has two stacks, one for the pigtail exhaust system and one for the sample cabinet exhaust. The HEPA filter system was shut down in 1995 for upgrading and was not used in 1999. Consequently, it was not resampled. Because the system was not used, releases from cylinder and sampling cabinet pigtails were estimated using the method described above.

LABORATORY HOODS

The C-710 Laboratory is operated by Production Support and is the main facility for sample analysis and research at PGDP. There are a total of 111 laboratory hoods and canopies in the C-710 Building. Eighty-two of the hoods are located in radiological areas. 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, ^{234}Th, and protactinium-234). In some cases, the hood exhausts combine with other hood exhausts, creating a discrepancy between the number of hoods and actual emission points. There are also eighty laboratory hoods in the C-409 Stabilization Facility. None of these hoods were used for work with radionuclides in 1999. The list below indicates the laboratory exhaust systems at PGDP:

Building	Hoods/Canopies	Hoods/Canopies Used in Radiological Areas in 1999
C-710 Laboratory	111	82
C-409	8	Not used

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 which could be lost based on laboratory methods (e.g., 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 loose, 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.

CHLOROFLUOROCARBON-114 (CFC-114) UF_6 SEPARATOR

The CFC-114/UF_6 separator is located in C-335 and can be used to separate relatively large amounts of CFC-114 coolant which has entered the cascade system and mixed with UF_6. The separator was installed in 1978, and pilot tests were conducted in 1979. When in use, the separator air effluent is passed through a cold trap at 0 F which condenses approximately 98.5 percent of the gaseous UF_6. The residual UF_6 in the effluent is trapped by two sodium fluoride (NaF) traps containing 900 pounds of NaF each. Uranium trapped by the NaF traps is returned back to the gaseous diffusion cascade. The outlet of the NaF traps is monitored by a flow-through ionization chamber. The effluent passes from the NaF traps through alumina traps and a header to the C-335 wet air/seal exhaust system. This facility was not operated in 1999.

The emissions from this system also have to pass through the wet air/seal exhaust pump oil which is an excellent scrubber of UF_6. Since this facility is used only when large amounts of CFC-114 leak into the cascade and is equipped with a two-stage control process, use of this facility is not expected to increase the emissions from the wet air/seal exhaust system. (Emissions from the wet air/seal exhaust were determined by EPA Method 5 stack sampling in 1997.) However, as a conservative measure, emissions from the unit are estimated using data from a sampling system similar to the C-310 system. No reduction in emission is assumed to occur as a result of system off-gas passing through the seal exhaust/wet air system.

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 potential of radionuclide emissions arises 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 which forms a slurry. The slurry is then passed through a rotary vacuum filter which collects the precipitate (filter cake) for future disposal.

After sampling, the filtrate is then discharged via permitted Kentucky Pollutant Discharge Elimination System outfalls. A possible radionuclide emission point is the vent on the pump which pulls the slurry through the rotary vacuum filter. Emissions from this vent should be minimal because the pump and its vent are downstream of the rotary vacuum filter which should trap the uranium as filter cake. Emissions were estimated in accordance with Appendix D. The concentrations of radionuclides in the filtrate multiplied by the filtrate volume were considered as the curies "used."

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 wash stand. 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 Appendix D. The concentrations of radionuclides in water used to hydrostatically test the cylinders prior to drying, multiplied by the total volume of water used in the hydrostatic test, were considered as the curies "used."

C-746-A LOW-LEVEL WASTE COMPACTOR

This facility is used to compact bagged, low-level radiological waste. The facility consists of a telescoping compacting arm which very slowly compacts bags of low-level contaminated material into a storage drum. The facility is equipped with HEPA filters. This facility was not used for radiological materials in 1999.

RADIOLOGICAL AREAS

Radiological areas are established under specific criteria listed in various worker protection procedures and standards. There are a number of radiological areas at PGDP that are monitored by Health Physics (HP) low-volume air samplers. The sampling systems consist of a low-volume pump (20 to 40 liters per minute) drawing the ambient building air through a Whatman No. 41 cellulose filter. The samplers run 24-hours per day and the filters are changed on 2-, 3-, 4-, or 5-day basis, depending upon weekend and holiday schedules. Typically, a minimum of two days of sample air is collected on each filter. After sample collection, the filters are counted for airborne radioactivity concentrations.

For the 1999 National Emission Standards for Hazardous Air Pollutants (NESHAP) Report, PGDP estimated the building ventilation grouped source according to the method stated in Section 3.1 of the revised PGDP NESHAP Compliance Plan submitted to EPA in January 1992.

According to PGDP's compliance plan, building emissions from nonradiological areas are not estimated due to their lack of potential for airborne radiological emissions.

The following is a list of PGDP's radiological areas from which emissions were evaluated using HP data:

C-310 Product Withdrawal Building
C-315 Tails Withdrawal Building
C-331 Uranium Enrichment Process Building
C-333 Uranium Enrichment Process Building

C-335 Uranium Enrichment Process Building
C-337 Uranium Enrichment Process Building
C-360 Toll Transfer/Sampling Building
C-400 Decontamination Building
C-720 Maintenance Building - This building is the primary maintenance building at PGDP. Maintenance on contaminated and uncontaminated machinery is performed here. Transferable contamination has been removed prior to maintenance; however, there is a potential for airborne radionuclide emissions from fixed contamination during maintenance procedures. Portable negative air machines which are equipped with HEPA filters are utilized whenever there is a potential for airborne radionuclide emissions.

The C-340, C-410, C-420, C-746-Q, C-754, and C-757 buildings are also categorized as radiological areas. However, the ventilation systems in C-340, C-410, and C-420 buildings are shut down and C-746-Q, C-754, and C-757 have no ventilation system. Any emissions from these buildings would be fugitive or diffuse in nature. Fugitive and diffused emissions are discussed later in this report.

Data from HP air sampling in radiological areas indicated that the trigger level of ten percent of the most restrictive Derived Air Concentration (DAC) in 10 CFR 20, Appendix B, (2E-12 µCi/ml for ^{237}Np) was exceeded several times in 1999. Using these samples, the maximum air concentration of alpha-emitting particles was calculated. Using a conservative approach, ten percent of the alpha particles were assumed to be ^{237}Np and 90 percent of the particles were assumed to be uranium. Using the air exchange rates determined from facility engineering data, the total emissions from each facility were estimated for the periods during which the samples exceeded ten percent of the ^{237}Np DAC.

The compliance plan states that non-radiological areas will not be evaluated as an airborne radiological source due to average concentrations of radionuclides less than 10 percent of the most stringent DAC. HP sample results indicate the average radionuclide air concentrations in radiological areas are usually less than 10 percent of the most stringent DAC. Therefore, building ventilation emissions from nonradiological areas were not considered to be an airborne radionuclide source and emissions were not be evaluated.

Finally, the dilution factor due to dispersion at PGDP based on 1992 meteorological data is 7.9E-7. Therefore, even if the average concentration of airborne nuclides was ten percent of the most stringent DAC, the resulting off-site dose to the public due to dispersion would not exceed 0.0004 mrem/year (0.000004 millisieverts/year).

C-400 LAUNDRY

The C-400 Laundry washes and dries coveralls and clothing used to prevent skin contamination on personnel working in radiological areas. The driers are quipped 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 ten 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.

NONPOINT SOURCES

Guidance from EPA which stated that provisions of 40 CFR 61, Subpart H, applied to fugitive and diffused emissions, was contained in correspondence dated March 24, 1992. EPA also forwarded to PGDP on September 21, 1992, questions pertaining to 1992 ambient air sampling results and their use as indications that fugitive and diffused emissions from PGDP operations were insignificant. PGDP's reply satisfied all of EPA's questions except the one pertaining to resuspension of contaminated soil which could result from such activities as well drilling activities or vehicular traffic upon contaminated earth. The question, as to whether such activities actually constitute fugitive or diffused sources, was forwarded to EPA headquarters for resolution. PGDP has not, as of this submittal, received guidance on this question. It is not expected that any activity would result in fugitive or diffuse emissions distinguishable from background at off-site locations.

DOE SOURCE DESCRIPTION: NORTHWEST PLUME INTERIM REMEDIAL ACTION PILOT PLANT

On September 1, 1995, DOE began operation of a pilot 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. The facility consists of an air stripper to remove volatile organics from water and an ion exchange unit for the removal of ^{99}Tc. 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 retained in the carbon, therefore, no reduction in ^{99}Tc emissions due to the use of the adsorption unit were assumed.

FUGITIVE AND DIFFUSE SOURCES

DOE has identified the areas listed below 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 is being conducted around the Paducah Site to verify their insignificance. In addition, some of these sources are listed due to posting of direct radiation, not airborne radiation.

LIST OF DOE FUGITIVE AND DIFFUSE POTENTIAL EMISSION SOURCES

1. C-745-T Cylinder Storage Yard
2. Area Next to Cylinder Yard
3. C-745-K Cylinder Storage Yard
4. Dirt Storage Area Near C-333
5. C-740 Material Yard
6. C-747 and C-748-B Burial Area
7. C-745-A Contamination Area
8. C-745-A Contamination Area
9. C-746-H3 Storage Area

10. C-410 Building
11. C-745-C, C-749 Cylinder Storage Yards, C-404 Burial Ground
12. C-746-P Scrap Material Storage Area
13. C-746-A and B Warehouses, C-746-C Scrap Material Storage Yard
14. Burial Area North of C-746-F
15. C-746-P Burial Area
16. C-747-A Burial Area
17. C-747-A Burial Area
18. Rubble Pile
19. Rubble Pile
20. Rubble Pile
21. Rubble Pile
22. C-301 Low-Level Waste Storage Area
23. C-340 Building
24. Rubble Pile
25. KPDES Outfall 011
26. Little Bayou Creek and Dikes Road
27. Little Bayou Creek Confluent with KPDES Outfall 002
28. Little Bayou Creek Crossing
29. Little Bayou Creek and Ogden Landing Road
30. North-South Diversion Ditch and Ogden Landing Road
31. Contaminated Ditch Flowing to KDPES Outfall 001
32. Contamination Area West of Plant
33. C-615 Sewage Treatment Facility
34. North-South Diversion Ditch
35. North-South Diversion Ditch
36. C-746-U Landfill

*37. C-746-S and C-746-T Landfills
*38. C-746-S and C-746-T Landfill Area

* DOE monitored the C-746-S&T Landfill vents for radionuclides on 10/06/99. No radionuclides were detected either in air emissions or smears of the vent pipe surfaces.

The potential sources are shown in Fig. 1. The categorizes the sources by the following definitions:

- ***Contamination Area (CA):*** Any area, accessible to individuals, where removable surface contamination levels exceed or area likely to exceed the removable surface contamination values specified in Appendix D of 10 CFR 835, but do not exceed 100 times those values.

- ***Contamination Control Zone (CCZ):*** An area where activity levels are normally less than the removable levels in Appendix D of 10 CFR 835, but there is potential to exceed the total contamination levels.

- ***Fixed Contamination Area (FCA):*** Any area with detectable removable contamination less than the removable contamination values of Appendix D of 10 CFR 835 and fixed contamination at levels that exceed the total contamination values of Appendix D of 10 CFR 835.

- ***High Contamination Area (HCA):*** Any area within a controlled area, accessible to individuals, in which items or containers of radioactive material exist and the total activity of radioactive material exceeds the applicable values provided in Appendix E of 10 CFR 835.

- ***Soil Contamination Area (SCA):*** Any area where radioactive material contamination exists in a matrix (e.g. soil) at levels exceeding natural background and has not been released for unrestricted use according to DOE Order 5400.5, Radiation Protection of the Public and the Environment (*DOE, 1990*).

- ***Radiation Area (RA):*** Any area, accessible to individuals, in which radiation levels could result in an individual receiving a deep dose equivalent in excess of 0.005 rem (mSv) in one hours at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Another potential fugitive or diffused source of radionuclides, albeit a minor one, results from the decontamination of machinery and equipment used in remediation activities such as well drilling. The equipment is washed with high-powered sprayers to remove any contaminants (radiological or nonradiological). The contaminants originate from the soil and groundwater.

In accordance with methods utilized at other DOE facilities, DOE utilized ambient air monitoring data to verify insignificant levels of radionuclides in off-site ambient air. Ambient air data collected at sites surrounding the plant capture radionuclides from all sources including fugitive and diffuse. 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 has conducted ambient air monitoring during 1999. Based on observations for 1999, plant derived radionuclides were not detected.

CERTIFICATION

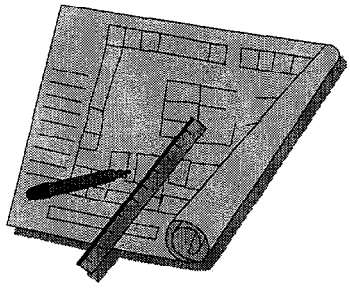
This certification pertains to the following DOE emission source:

Northwest 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. C1001.)

W. A. Seaborg
Department of Energy

6/13/00
Date



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SECTION II. SOURCE CHARACTERISTICS AND AIR EMISSIONS DATA

USEC SOURCE CHARACTERISTICS AND RADIONUCLIDE EMISSIONS

MAJOR POINT SOURCE

Major Point Source	Type Control	Efficiency %	Distance (meters) and Direction to the Nearest Receptor[1]
C-310 Purge Stack	NaF Traps[2]	>99.9	1740 ESE
	Alumina Traps[3]	98.6	

MINOR POINT AND AREA SOURCE

Minor Point and Area Source	Type Control	Efficiency %	Distance (meters) and Direction to the Nearest Receptor[1]
C-360[3]	None	0	1180 SE

[1]Distances in receptors were resurveyed in 1999 due to residential construction in the vicinity of the plant.
[2]See January 28, 1994, correspondence from D. F. Hutcheson to W. A. Smith discussing "Potential to Emit."
[3]Emissions estimated in accordance with 40 CFR 61, Appendix D.

MINOR GROUPED SOURCES

Grouped Sources	Type Control	Efficiency %	Distance (meters) and Direction to the Nearest Receptor[1]
Seal/Wet Air Exhausts (6)	Alumina Traps[2]	98.6	1490 ESE
Cylinder Valve Connection Activities not included above; i.e., not serviced by a stack (7).[3]	HEPA Vacuums[4]	99.0 (Appendix D)	1490 ESE
C-400 Sources (3)[3]	None	0	1920 ESE
C-710 Laboratory Hoods (66)[3]	None	0	1960 ESE
Building Ventilation (10)	None	0	1490 ESE

Note: The Building ventilation and cylinder valve connection activities not serviced by a stack are grouped with the Seal/Wet Air Exhausts group in further analyses.

[4]Distances in receptors were resurveyed in 1999 due to residential construction in the vicinity of the plant.
[2]See January 28, 1994, correspondence from D. F. Hutcheson to W. A. Smith discussing "Potential to Emit."
[3]missions estimated in accordance with 40 CFR 61, Appendix D.
[4]Credit for the use of HEPA vacuums for pigtail operations is not taken for the purposes of estimating emissions.

USEC SOURCE CHARACTERISTICS

Source Name	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)	Distance (m) and Direction to Maximally Exposed Individual (MEI)	
						Source MEI	Plant MEI
C-310	Point	61.0	0.3	0	21.7	3040 NNE	2430 N
C-360	Point[1]	16.00	N/A	0	Ambient	1180 SE	2370 NNW
C-400 Group	Point[1]	11.3	N/A	0	Ambient	2040 N	2040 N
C-400 Cylinder Drying Station	Point	2.4	0.05	0	Ambient	2120 N	2120 N
C-710	Point[1]	7.1	N/A	0	Ambient	2370 N	2370 N
Seal/Wet Air Exhaust Group[2]	Point[1]	21.0	N/A	0	Ambient	2350 N	2350 N

[1]Modeling was performed assuming a theoretical stack located at the approximate center of each grouped source.
[2]Grouped source includes building ventilation and cylinder valve disconnections from systems not served by permanent HEPA filter systems.

USEC SOURCE CHARACTERISTICS (Continued)

Source Name	Distances (m) to Selected Receptors		
	Nearest Individual/Farm	Nearest Business	Nearest School
C-310	1740	2705	3840
C-360	1180	2000	3840
C-400 Group	1920	2819	4225
C-400 Cylinder Drying Station	1900	2819	4100
C-710	1960	2705	3900
Seal/Wet Air Exhaust Group	1460	2438	3840

PGDP USEC RADIONUCLIDE EMISSIONS

Radionuclide Emissions (Ci)[1] During 1999

Emission Source / Nuclide	Solubility	AMAD	C-310	C-710 Lab	Seal/Wet Air Exhaust Grouped Sources	C-400 Grouped Sources	C-400 Cylinder Drying Station	C-360 Sampling	Total
^{99}Tc	W	1.0	4.08E-4	6.35E-6	2.24E-3	1.03E-3	2.07E-7	NA[2]	3.68E-3
^{230}Th	W	1.0	2.37E-6	NA[2]	2.07E-6	3.59E-7	1.33E-10	NA[2]	4.80 E-6
^{234}U	D	1.0	4.46E-5	1.35E-3	1.05E-3	9.95E-5	5.44E-6	3.13E-9	2.55E-3
^{235}U	D	1.0	1.75E-6	6.59E-5	6.44E-5	2.97E-5	3.38E.7	1.37E-10	1.62E-4
^{238}U	D	1.0	1.33E-5	1.23E-4	2.10E-3	6.15E-5	4.31E-6	1.99E-9	2.30E-3
^{237}Np	W	1.0	8.50E-7	2.97E-5	1.31E-4	1.49E-5	2.65E-9	NA[2]	1.76E-4
^{239}Pu	W	1.0	7.00E-9	NA[2]	1.38E-6	1.37E-8	4.42E-11	NA[2]	1.40E-6
	Total Ci/year		4.71E-4	1.57 E-3	5.59 E-3	1.24E-3	1.03E-5	5.26E-9	8.88E-3
	Check totals								8.88E-3

[1] 1 Curie=3.7×10^{10} Becquerels.

[2] NA = Not Analyzed

DOE SOURCE CHARACTERISTICS AND RADIONUCLIDE EMISSIONS

Minor Point and Area Sources	Type Control	Efficiency %	Distance (meters) and Direction to the Nearest Receptor[1]
Northwest Plume Treatment Facility	None	0	1080 NNE

Radionuclide Emissions (Ci)[2] During 1999	
Emission Source	**Northwest Plume Treatment Facility**
^{99}TC	8.47E-3
Total Ci/year	8.47E-3

Source Name	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)	Distance (m) and Direction to Maximally Exposed Individual (MEI)	
						Source MEI	Plant MEI
Northwest Plume Treatment Facility	Point	7.0	0.3556	9.45	37.8	1080 NNE	1080 NNE

Source Name	Distances (m) to Selected Receptors		
	Nearest Individual/Farm	Nearest Business	Nearest School
Northwest Plume Treatment Facility	1080	3850	5150

[1]Distances in receptors were resurveyed in 1999 due to residential construction in the vicinity of the plant.
[2]1 Curie = 3.7×10^{10} Becquerels.

SECTION III. DOSE ASSESSMENT

DESCRIPTION OF DOSE MODEL

The radiation dose calculations were performed using the Clean Air Act (CAA) Assessment Package-88 of computer codes. This package contains EPA's most recent 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 Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used by EPA's latest 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 in the latest version of the RADRISK data file which is provided by EPA with CAA Assessment Package-88.

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 databases.

Joint frequency distribution:	Five-year STAR distribution from 60-meter stations on PGDP meteorological tower for the years 1988 through 1992.
Rainfall rate:	121 centimeters/year
Average air temperature:	20 C
Average mixing layer height:	930 meters

Fraction of foodstuffs from:	Local Area	50-Mile Radius	Beyond 50 Miles
Vegetables and produce[1]:	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 does. Using the conservative estimates, however, PGDP was in compliance with requirements of 40 CFR 61.

[1]Rural default values.

COMPLIANCE ASSESSMENT

Effective dose equivalent (mrem)[1] to maximally exposed individual for each individual source and the plant:

USEC Emission Sources		
	Maximum for Source	**Maximum for Plant**
C-310	8.5E-5	8.2E-5
C-360	4.3E-9	2.1E-9
C-400 Group	1.1E-3	1.1E-3
C-400 Cylinder Drying Station	6.5E-6	6.5E-6
C-710	2.5E-3	2.3E-3
Seal/Wet Air Exhaust Group	7.2E-3	7.2E-3
Total From USEC Sources		**1.1E-2**

DOE Emission Sources		
	Maximum for Source	**Maximum for Plant**
Northwest Plume Treatment Facility	1.7E-3	1.7E-3
Total From DOE Sources		**1.7E-3**

Total From All Sources	**1.2E-2**

Maximum effective dose equivalent to the maximum exposed individual for the plant = 1.2E-2 mrem.

Location of maximally exposed individual: 2350 meters north of greatest contributor to dose (Seal/Wet Air Exhaust Group).

[1] 1 mrem=0.01 millisieverts.

CERTIFICATION

This certification pertains to the following USEC emission sources:

C-310 Purge and Vent Stack
C-360
C-400 Group
C-400 Cylinder Drying Station
C-710
Seal Exhaust/Wet Air Group

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. C1001.)

J. Michael Lee
United States Enrichment Corporation

6/1/2000
Date

CERTIFICATION

This certification pertains to the following DOE emission source:

Northwest 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. C1001.)

Department of Energy

6/13/00
Date

SECTION IV. ADDITIONAL INFORMATION

UNPLANNED RELEASES

There were seven unplanned releases in USEC facilities occurring outside of a building not included in HP air sampling program during 1999. The estimated total quantity of uranium released was less than 30 g. These releases are included in the seal/wet air exhaust grouping.

DIFFUSE/FUGITIVE EMISSIONS

Diffuse/fugitive 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. 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.

EPA has not identified a methodology or requirements for determining airborne radionuclide source terms for many unique fugitive and diffuse emission sources characteristic of DOE facilities, nor does the Paducah Site currently have any available methods to selectively and accurately quantify airborne radionuclide source terms from specific fugitive emission sources. However, consistent with the April 1995 memorandum of understanding (MOU) between DOE and EPA Headquarters, information on diffuse/fugitive emissions is being provided to EPA as additional information. On February 8, 2000, DOE submitted to Kentucky Division for Air Quality and EPA Region IV the *Paducah Gaseous Diffusion Plant Department of Energy National Emission Standards for Hazardous Air Pollutants (NESHAP) Management Plan.* This plan outlined the DOE Paducah Site plans for using 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. Section I provides a list of potential fugitive/diffuse sources on the Paducah Site.

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 has conducted ambient air monitoring around the Paducah Site during 1999. 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% high purity germanium detector which allows for detection of low energy gamma emitters. Americium-241 (^{241}Am) and thorium-234 (^{234}Th) were not detected by gamma spectroscopy for the quarterly composites.

Because ^{241}Am and ^{234}Th were not detected, plutonium and uranium isotopic analyses were not performed on the quarterly composites. Since ^{241}Am and ^{234}Th were not present, the quarterly composites were analyzed for technetium-99. Technetium-99 was also not detected in the quarterly composites. Lead-210 and potassium-40 were detected on filters, which accounts for the presence of the gross alpha and beta activities.

Based on observations for 1999, plant derived radionuclides were not detected by the Radiation

Health and Toxic Agents Branch's air monitoring network.

COMPLIANCE WITH 40 CFR 61, SUBPARTS Q AND T

Not applicable

RADON 220 AND RADON 222 EMISSIONS

Although radon 222 is a decay product of uranium, the long half-lives of the elements in the decay chain preceding radon 222 preclude its presence or emission in any significant amounts from PGDP operations. There are no known sources of ^{232}Th and ^{232}U at PGDP; therefore, there are no known emissions of radon 220.

STATUS OF COMPLIANCE WITH NESHAP MONITORING REQUIREMENTS OF SUBPART H

The status of compliance with the new NESHAP monitoring requirements is thoroughly described in the revised NESHAP Compliance Plan which was submitted to EPA January 1992. PGDP has only one stack subject to the continuous monitoring requirements of Subpart H, the C-310 stack.[1] Particulate stack sampling was performed on the C-310 purge cascade stack February 1992. Results of the sampling project were forwarded to EPA by March 31, 1992. Documentation from EPA[2] stated that PGDP is exempted from the requirement to install an isokinetic sampling system.

Minor Sources: The periodic confirmatory measurement plan for minor sources is outlined in detail in the Revised NESHAP Compliance Plan for PGDP which was submitted to EPA on January 15, 1992. The initial plan for confirmatory measurements is to estimate emissions using Appendix D and/or mass balance methods on an annual basis, and to stack sample those sources for which stack sampling is the only feasible estimation method on a five-year basis.

On May 26, 1992, PGDP and EPA entered into a Federal Facility Compliance Agreement (FFCA) to bring PGDP into compliance with the sampling provisions established in accordance with 40 CFR 61, Subpart H. Appendix A of the FFCA contains a schedule establishing compliance commitments. The major effort of the compliance schedule was the site evaluation in which all potential sources of airborne radionuclides were identified and emissions were determined. The radionuclide sources were identified through a preliminary stack vent survey which was completed in 1991. In November 1992, a more in-depth survey was completed which did not discover any previously unknown airborne radionuclide sources. In September 1992, representatives from EPA inspected PGDP for NESHAP compliance. Correspondence from EPA summarizing the inspection stated there were no NESHAP violations identified during the inspection. PGDP fulfilled all commitments in accordance with Appendix A of the FFCA in June 1992; submitted results of the updated, in-depth vent stack survey in December 1992; and officially requested a Certification of Completion of the FFCA on March 11, 1993. EPA issued the Certification of Completion on March 26, 1993. Certification of Completion of the FFCA indicates that PGDP is in compliance with the provisions in accordance with 40 CFR 61, Subpart H.

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[1]See correspondence from D. F. Hutcheson to D. C. Booher, dated January 28, 1994, discussing "Potential to Emit."

[2]See correspondence from W. A. Smith to D. C. Booher, dated April 20, 1992.

DOE has remained in compliance since 1993. KDAQ received delegated authority NESHAP in July 1999. In 1999, DOE became concerned that fugitive and diffuse emissions may not have been properly evaluated for NESHAP compliance. A NESHAP Management Plan has been developed by DOE, which addresses fugitive and diffuse emissions. The NESHAP Management Plan has been submitted to KDAQ and EPA Region 4 for approval in February 2000. The plan had not been approved as of December 1999.

The detection limits for the ambient air monitoring system were not low enough in CY 1999 to enable comparison of ambient radionuclide concentrations to 40 CFR, Appendix E, Table 2, to verify compliance. DOE anticipates that adjustments made by the Radiation Health and Toxics Branch to the ambient air monitoring system will result in lower detection limits in CY 2000, so that compliance can be verified.

STATUS OF QA PLAN

The revised NESHAP Quality Assurance Plan was issued in 1999.