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Author Hodges Corporate Author DOE
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Department of Energy

Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001

June 19, 1995

COPY

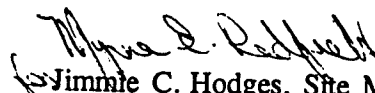
Winston A. Smith, Director
Air, Pesticides, and Toxic Management Division
United States Environmental Protection Agency
Region IV
345 Courtland Street, N. E.
Atlanta, Georgia 30365

1994 NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR POLLUTANT (NESHAP) ANNUAL REPORT FOR THE PADUCAH GASEOUS DIFFUSION PLANT (PGDP)

Dear Mr. Smith:

Enclosed is the annual NESHAP report required by 40 CFR 61, Subpart H, which summarizes the airborne radionuclide emissions from PGDP during Calendar Year (CY) 1994. This report is required to be submitted to your office by June 30, 1995. If you have any questions or require additional information, please call W. David Tidwell at (502) 441-6807.

Sincerely,


Jimmie C. Hodges, Site Manager
Paducah Site Office

EF-22:Tidwell

Enclosure

cc: R. K. Dierolf, MMUS/PGDP
W. D. Dillow, SE-31
J. W. Parks, EF-20
S. Shell/G. Giltner, MMUS/PGDP
T. T. Slack, CC-10



United States
Enrichment Corporation

Paducah Site Office
P.O. Box 1410
Paducah, KY 42001

Tel: 502 441-5803
Fax: 502 441-5801

June 7, 1995

Mr. Jimmie Hodges, Site Manager
Paducah Site Office
Department of Energy
Post Office Box 1410
Paducah, Kentucky 42002-1410

**1994 National Emission Standard for Hazardous Air Pollutant
(NESHAP) Annual Report for the Paducah Gaseous Diffusion Plant (PGDP)**

Attached is the annual NESHAP report required by 40 CFR 61, Subpart H, which summarizes the airborne radionuclide emissions from PGDP during CY 1994. This report is required to be submitted to the Environmental Protection Agency by June 30, 1995. The appropriate Department of Energy official should sign the certification located after the compliance assessment on page 17 of the report.

If you have any questions, please contact Ron Dierolf at (502) 441-5956.

Sincerely,

A handwritten signature in black ink, appearing to read "T. Michael Taimi".

T. Michael Taimi
Environmental Assurance & Policy Manager

TMT:RKD:mjw

Attachment

cc: Dane Bartlett - MMUS/PGDP
John Dietrich - MMUS/HQ
David Hutcheson
Wayne Kachel - LMC
Howard Pulley - MMUS/PGDP
Ken Tomko - MMUS/PORTS

cc/att: Linda Beach - MMUS/HQ
Ron Dierolf - MMUS/PGDP
Weldon Dillow - DOE/OR
Gail Giltner/Jimmie Hankins - MMUS/PGDP
Rodney Kingrea - MMES/OAK RIDGE
EC File - RC

United States Department of Energy
Air Emissions Annual Report
(Under Subpart H, 40 CFR 61.94)
Calendar Year 1994

Site Name: Paducah Gaseous Diffusion Plant

OPERATIONS OFFICE INFORMATION

Office: Paducah Site Office
P. O. Box 1410
Paducah, Kentucky 42002-1410

Contact: W. David Tidwell

Phone: (502) 441-6807

SITE INFORMATION

Operating Contractor:

United States Enrichment Corporation/Martin Marietta Utility Services, Inc.

Address: P. O. Box 1410
Paducah, Kentucky 42002-1410

Contact: Ronald K. Dierolf Jr.

Phone: (502) 441-5956

SECTION I--FACILITY INFORMATION

SITE DESCRIPTION

The Department of Energy (DOE) Paducah Gaseous Diffusion Plant (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 1350 acres in western McCracken County about 10 miles west of Paducah, Kentucky, and approximately 3 miles south of the Ohio River. Roughly 740 acres of the reservation are enclosed within a fenced security area. The raw water treatment plant, residential landfill, and inert landfill are the only operating areas outside of the 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) 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. The Paducah Plant serves as a first step in the uranium enrichment process in which the ^{235}U is increased to approximately 2 percent. Product 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. PGDP is in the process of upgrading its operations to be capable of 5 percent ^{235}U enrichment. The proposed date for this capability is 1995 or 1996. Hazardous, nonhazardous, and radioactive wastes are generated and disposed as a result of plant operations.

The Paducah Plant 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, laboratory facilities, and an active landfill. 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 535,000 persons. Of these, approximately 36,500 live within 10 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.

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, 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.

In 1993, the United States Enrichment Corporation (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 Regulatory Oversight 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.

SOURCE DESCRIPTION

The following are the potential airborne radionuclide sources at the Paducah Plant. Although not all of them were used in 1994, 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 such as fluorides and chlorides, 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 stand-by bank of 13 traps. Each traps contains approximately 200 pounds of alumina.

The cylinder burp facility, located on the east side of C-310, is used to vent the low molecular weight gases from product cylinders. This facility is also a potential source of uranium, ^{99}Tc , minute quantities of transuranics, 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 3 sets of traps (primary, secondary, and standby). Each trap contains approximately 300 pounds of NaF. The south bank has 7 traps, the first 5 of which are operated in series with the last 2 operated in parallel with each other. These traps contain approximately 100 pounds of NaF each. The smaller size of the traps is due to criticality safety concerns. Uranium is recovered from the NaF traps back to the enrichment cascade. Emissions from the C-310 stack were estimated based on results of the continuous potassium hydroxide bubbler stack sampling system which was approved by the Environmental Protection Agency (EPA) in 1992.

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 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, 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. No credit is taken for the oil as a pollution abatement system, however, because the oil is an integral part of the pumping system and in no way is included for emission control. The list below indicates locations of the seal exhausts at PGDP:

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

Emissions from the seal exhaust grouped source were estimated based on results of Method 5 stack sampling performed in 1992. The seal exhausts are scheduled to be resampled in 1997.

A discussion of the potential to emit from the seal exhausts and 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 wet air withdrawal, 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 the same one which services the seal exhaust system for those buildings. The list below indicates locations of 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 were estimated based on results of Method 5 stack sampling performed in 1992. The wet air exhausts are scheduled to be resampled 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, 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 doubling 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) filters. The HEPA vacuums (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. Furthermore, some of the pigtail connect/disconnect areas are serviced by large HEPA filter-equipped exhaust hood systems which exhaust any "puffs" not contained by the HEPA vacs from the area to a vent stack. Cylinder valve connection activities are divided into two major categories: activities which are serviced by a permanent exhaust system and stack, and activities which are not serviced by a permanent exhaust system. For those activities serviced by a permanent exhaust system and stack, the emissions were determined by EPA Method 5 stack sampling in 1992. For those activities not serviced by a permanent exhaust system, the emissions were determined by Appendix D emission factors. There was one recorded UF_6 "whiff or puff" which occurred in the category "not serviced by a permanent exhaust system" in 1994 at the C-315 Building. The quantity of UF_6 released was estimated at 0.1 grams. This release is included in the seal/wet air exhausts source. Any "whiffs or puffs" which occurred inside a building are included in the discussion on building ventilation. The list below indicates locations of the pigtail exhaust systems:

- C-310 Burp Station (located outside--no exhaust system, portable HEPA vacs used).
- C-310 Product Withdrawal Building (HEPA filters failed test--exhaust system not used in 1994, HEPA vacs used).
- C-315 Tails Withdrawal Building (controlled by permanent HEPA-filtered stack and portable HEPA vacs).
- C-333-A Feed Facility (UF_6 Vaporizer) (No exhaust system--HEPA vacs used).
- C-337-A Feed Facility (UF_6 Vaporizer) (No exhaust system--HEPA vacs used).
- C-360 Toll Transfer and Sampling Facility (controlled by permanent HEPA-filtered stack and portable HEPA vacs).

Laboratory Hoods

The C-710 laboratory is operated by the Technical Services Division, 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. All of the hoods and canopies were not used in 1994. Thirty-six of the hoods were used for exhaust of analyses and research involving radionuclides. This number does not include 11 hoods which contain closed systems with no potential for radionuclide emissions under normal conditions. 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 3 HEPA filters in the C-710 laboratory. Two of the HEPA filters serve as controls only in accidental release situations, and the third is used when samples are being taken or transferred. There are also 8 laboratory hoods in the C-409 stabilization facility. Analysis and research in only one of these hoods involved radionuclides in 1994. The estimated emissions were so insignificant that for modeling purposes they were included in emissions from the C-710 laboratory. Three laboratory hoods in the C-410 feed plant are permanently shut down. Although only 36 of the C-710 hoods dealt with exhaust of activities involving radionuclides in 1994, it can be assumed that many of the hoods plantwide have historically dealt with radionuclide exhaust at some time. To estimate emissions from the laboratory hoods, supervisors of the hoods used process knowledge to determine the number of curies of uranium "used" in each hood. Emissions factors from Appendix D were then applied to the curies "used" to determine the emissions. The list below indicates the laboratory exhaust systems at PGDP:

<u>Building</u>	<u>Hoods/Canopies</u>	<u>Hoods/Canopies used for Radionuclide Analyses in 1994</u>
C-710 Laboratory	111	36
C-409	8	1
C-410	3	0

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 NaF traps containing 900 pounds of NaF each. Uranium trapped by the NaF traps is recovered 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 operated in January and February 1994 due to an incident in the C-337 building in December 1993 during which a UF_6 compressor motor failed due to excessive vibration and was extensively damaged. The vibration caused a breach in the associated CFC-114/ UF_6 systems and an in-leakage of CFC-114 into the UF_6 cascade. The CFC-114/ UF_6 separator was used to separate the CFC-114 from the UF_6 . The UF_6 was recovered back to the cascade. Six samples from a system similar to the one on the C-310 stack, downstream of the alumina traps, indicated total "emissions" over the 3-day operating period of less than 0.07 grams ($1.03\text{E-}7$ curies of 2 percent uranium). These "emissions" 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 it 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 1992¹.) Under normal operations, this facility is not used.

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 by 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. The possibility for radionuclide emissions arises from the vent on the pump which pulls the slurry through the rotary vacuum filter. Emissions from this vent should be minimal because the pump

¹See correspondence from Hutcheson to Smith, January 28, 1994.

and its vent are downstream of the rotary vacuum filter, which should trap the uranium as filter cake. Emissions were estimated by 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 by 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. It is equipped with HEPA filters. This facility was not used in 1994.

RADIOLOGICAL AREAS

Radiological areas are established under specific criteria listed in various worker protection procedures and standards. There are a number of minor radiological areas at PGDP which are monitored by Health Physics (HP) 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. A minimum of 2 days of sample air is collected on each filter. After sample collection, the filters are counted for gross alpha concentrations.

For the 1994 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 non-radiological areas are not estimated due to their lack of potential for airborne radiological emissions. One of the criteria for establishing a radiological area is airborne concentrations of radionuclides in that area which are greater than 10 percent of a derived air concentration (DAC). DACs are established in 10 CFR 835 and represent the airborne radionuclide

concentrations which would cause a maximum internal radiation dose of 5000 millirem (mrem)/year (50 millisieverts/year). According to the compliance plan, if an area does not have airborne radionuclide concentrations greater than 10 percent of a DAC, it is not required to be classified a radiological area and will therefore not be evaluated for radionuclide emissions. (It could be classified a radiological area due to other HP criteria, however).

Over 17,000 air samples were taken by HP air samplers in radiological areas in 1994. Less than 2 percent of these samples indicated alpha concentrations greater than the most stringent transuranic DAC. Furthermore, isotopic analysis of the samples indicated that the alpha activity on the filter was primarily due to uranium and not transuranics. Although a few of the uranium concentrations were above the uranium DAC, the average, and by far the vast majority, of the samples were much less than 10 percent of DAC.

Although 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, even in radiological areas, are less than 10 percent of the most stringent DAC. Therefore, building ventilation emissions, even from radiological areas, will not be considered an airborne radionuclide source and emissions will 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 10 percent of the most stringent DAC, the resulting off-site dose due to the public due to dispersion would not exceed 0.0004 mrem/year (0.000004 millisieverts/year).

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-409 Stabilization Building--The stabilization process is shut down. This building now houses some laboratory hoods (discussed under the laboratory hood section) and decontamination equipment to be used after the proposed increase to 5 percent enrichment assay.

C-720 Maintenance Building--This building is the primary maintenance building at PGDP. Maintenance on contaminated and uncontaminated machinery is performed here. Transferrable 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.

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

In addition to the general emissions from radiological areas, PGDP also has a number of minor sources which do not have direct exhausts into the ambient air. These minor sources are located in radiological areas and contribute to the emissions from the radiological areas as calculated by the HP samplers. A list of these minor sources with no direct exhaust to the ambient air, and which are located in radiological areas, is as follows: (This list also contains sources which did not operate in 1994.)

C-310 Burp Station, C-333-A and C-337-A Feed Cylinder Connection Activity Emissions

These pigtail systems, unlike those in the C-360 Toll Transfer Building, the C-310 Product Withdrawal Building, and the C-315 Tails Withdrawal Building, have no specific ventilation system. Furthermore, the C-333-A and C-337-A feed cylinder vaporizers are not located in completely enclosed buildings. The C-310 Burp Station is outside with no enclosure. As stated previously, HEPA vacs are used to control any potential radionuclide emissions during the disconnection of the pigtails. The vaporizer buildings are enclosed on three sides only. Since the vaporizers and the C-310 Burp Station are not located in an enclosed structure, building ventilation data could not be used to estimate emissions. Emissions from the vaporizers and the C-310 Burp Station cylinder connection activities were estimated as described previously in the "cylinder valve connection activities" section. There were no documented "whiffs and puffs" from these systems in 1994.

C-400 Compressor Pit

This area was used for maintenance on UF₆ compressors and has not been used since 1989. PGDP intends to use this facility in 1995 and methods to estimate emissions will be developed.

C-400 Cylinder Wash

This facility is used to remove the solid UF_6 "heel" from cylinders. The cylinder heel is dissolved in a boric acid solution and the solution is transferred to the C-400 No. 5 Dissolver for uranium recovery. The only potential for radionuclide emissions are "whiffs and puffs" when the cylinder valve is opened for introduction of the sodium carbonate solution. The facility does not have a dedicated exhaust system. Any potential emissions will be included in the estimates from the C-400 HP air samplers.

Nonpoint Sources

Guidance from EPA which stated that provisions of 40 CFR 61, Subpart H, applied to fugitive and diffuse 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 diffuse 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 diffuse 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 which would result in fugitive or diffuse emissions would result in emissions which would be distinguishable from background at off-site locations.

PGDP intends to upgrade its ambient air monitoring system to be capable of isotopic analysis of the samples collected. The present ambient air network is incapable of producing isotopic results and thus incapable of producing data from which off-site dose can be estimated. PGDP intends to use the new ambient air monitoring data to confirm that off-site dose due to fugitive and diffuse emissions is insignificant.

Another potential fugitive or diffuse 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 non-radiological). The contaminants originate from the soil and groundwater. The concentrations of contaminants on the equipment are so small that employees who operate the sprayers are not required by HP to wear any radiological protection.

SECTION II--AIR EMISSIONS DATA

MAJOR POINT SOURCE

Major Point Source	Type Control	Efficiency	Distance to Nearest Receptor
C-310 Purge Stack	NaF Traps ²	>99.9%	1755 M ESE
	Alumina Traps ²	≈98.6%	

MINOR POINT SOURCES

Minor Point Source	Type Control	Efficiency	Distance to Nearest Receptor
C-400 Cylinder Drying Station ³	None	0	1908 M ESE

MINOR GROUPED SOURCES

Grouped Sources	Type Control	Efficiency %	Distance to Nearest Receptor
Wet air/seal exhausts (6)	Alumina Traps ²	≈ 98.6	1524 M ESE
Cylinder valve connection activities (3)	HEPA Filters and Vacuums	99.95	N/A ⁴
Cylinder valve connection activities not included above; i.e., not serviced by a stack (3). ³ No "whiffs and puffs" documented in 1994.	HEPA Vacuums	99.0 (Appendix D)	1524 M ESE
C-400 sources (3) ³	None	0	1901 M E ESE
C-710 laboratory hoods (36) ³	None	0	1944 M NNE
Building ventilation (10) ⁵	None	0	1524 M ESE
C-720 motor burnout ovens (2) ³	None	0	1944 M N

²See January 28, 1994, correspondence from D. F. Hutcheson to W. A. Smith discussing "Potential to Emit."

³Emissions estimated by 40 CFR 61, Appendix D.

⁴Stack sampling data results indicated that emissions were not distinguishable from zero, based on a statistical one-tailed test of significant difference from zero. Therefore, dose modeling was not performed and no receptor was determined.

⁵Average air concentrations were less than 10 percent of the most stringent DAC.

PGDP RADIONUCLIDE EMISSIONS

Radionuclide emissions (Ci) ⁶ during 1994											
Emission source			C-310	C-710 Lab	Seal/wet air exhaust	C-400	C-400 cyl. drying station	C-720 Motor burnout ovens	Cyl. conn.—no dedicated exhaust	Cyl. conn.—dedicated exhaust ⁷	Total
Nuclide	Solubility	AMAD									
⁹⁹ Tc ⁸	W	1.0	5.9E-4			1.6E-5	8.9E-9	1.3E-6			6.0E-4
²³⁰ Th ⁸	W	1.0	5.8E-6			1.5E-7	7.0E-10	6.4E-7			6.6E-6
²³⁴ U	D	1.0	6.4E-5 ⁹	1.1E-3	2.0E-5	3.0E-5	8.1E-7	9.9E-7	4.4E-11		1.2E-3
²³⁵ U	D	1.0	2.5E-6 ⁹	3.4E-5	6.0E-7	1.6E-6	4.1E-8	3.9E-8	5.6E-9		3.9E-5
²³⁸ U	D	1.0	1.9E-5 ⁹	1.1E-4	5.8E-6	3.2E-5	8.9E-7	2.9E-7	2.3E-8		2.0E-4
²³⁷ Np ⁸	W	1.0	1.2E-6			1.1E-7	2.3E-12	4.3E-8			1.4E-6
²³⁹ Pu ⁸	W	1.0	8.7E-7		2.3E-6	7.7E-9	5.0E-12	7.9E-8			3.3E-6
Total Ci/year			7.0E-4	1.2E-3	2.9E-5	1.0E-4	1.8E-6	3.4E-6	2.9E-8		2.0E-3
Check totals											2.0E-3

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⁶ 1 Curie=3.7x10¹⁰ Becquerels.

⁷ No emissions distinguishable from zero, based on one-tailed test of significance of difference from zero.

⁸ PGDP is only required to sample for uranium from the C-310 stack since none of the other potential radionuclide emissions comprise 10 percent of the resulting potential dose (see correspondence from W. L. Smith to D. C. Booher dated January 10, 1992). Emission data from all sources pertaining to the other radionuclides, if available, is included in the actual dose calculations and is presented in this report for informational purposes only. Also, the uranium emissions from the C-310 stack were enriched to a 1.9 percent ²³⁵U assay or less for 1994. As a conservative measure, dose assessment was based on enrichment to 2.0 percent assay.

⁹ For release of 57.6 grams of 2 percent enriched uranium based on an isotopic distribution as follows: ²³⁸U, 3.292E-7 Ci/gU; ²³⁵U, 4.320 E-8 Ci/gU; ²³⁴U, 1.102 E-6 Ci/gU.

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 data bases.

Joint frequency distribution: 1992¹⁰ data from 60 meters station on Paducah meteorological tower

Rainfall rate: 121 centimeters/year

Average air temperature: 20°C

Average mixing layer height: 930 meters

Fraction of foodstuffs from:	<u>Local area</u>	<u>50-mile radius</u>	<u>Beyond 50 miles</u>
Vegetables and produce:	0.700	0.300	0.000
Meat:	0.442	0.558	0.000
Milk:	0.399	0.601	0.000

¹⁰Due to technical problems in the meteorological system computer software, 1994 meteorological data recovery was only 25 percent and not sufficient for modeling purposes. 1992 data was used.

SOURCE CHARACTERISTICS

Source Name	Type	Height (m)	Diameter (m)	Gas exit velocity (m/s)	Gas exit temperature (°C)	Distance (m) and direction to <u>maximally exposed individual</u>	
						Source	Plant
C-310	Point	61.0	0.3	0	Ambient	2438 N	2438 N
C-400	Point ¹¹	11.3	None	0	Ambient	2097 N	2097 N
C-400 Cyl. drying station	Point	2.4	0.05	0	Ambient	2170 N	2170 N
C-710	Point ¹¹	7.1	None	0	Ambient	2401 N	2401 N
C-720 Ovens	Point	15.8	0.5	0	Ambient	1944 N	1944 N
Seal/wet air exhausts	Point ¹¹	21.0	None	0	Ambient	2365 N	2743 NNW
Cylinder valve connection	Point ¹¹	1.0	None	0	Ambient	N/A	N/A

Source Name	Nearest individual	Distances (m) to selected receptors				
		Nearest Business	Nearest School	Nearest Farms		
				Dairy	Beef	Vegetable
C-310	1755	2705	3962	>5000	2896	1700
C-400	1901	2819	4267	>5000	3124	1943
C-400 Cyl. drying station	1908	2819	4267	>5000	3124	1943
C-710	1944	2705	3962	>5000	2896	1700
C-720 Ovens	1944	3086	4267	>5000	3048	2210
Seal/wet air exhausts	1524	2438	3962	>5000	3124	1524
Cylinder valve connection	1524	2705	3962	>5000	2896	1700

¹¹Modeling was performed assuming a theoretical stack located at the approximate center of each grouped source.

COMPLIANCE ASSESSMENT

Effective dose equivalent (mrem)¹² to maximally exposed individual for:

Emission Source	EDE
C-310	0.0002
C-400	0.0002
C-400 Cyl. drying station	0.000004
C-710	0.0025
C-720 Ovens	0.00009
Seal/wet air exhausts	0.0001
C-310 Release ¹³	0.003
C-337-A Release ¹³	0.01
Total	0.0161

Maximum effective dose equivalent = 0.0161 mrem

Location of maximally exposed individual: 2401 meters north of greatest contributor to dose (C-710)

¹²1 mrem=0.01 millisieverts.

¹³Perimeter ambient air monitors detected no significant increase in radioactivity during the release periods.

SECTION IV--ADDITIONAL INFORMATION

There were no construction projects of radionuclide point sources at PGDP in 1994. However, PGDP did use one existing facility, the C-720 motor burn-out ovens, which had not been used in recent years. Refer to Section I, *Source Description*, for a discussion of this minor source.

For a discussion of diffuse and fugitive sources, see Section I *Nonpoint Source*.

UNPLANNED RELEASES

"Whiffs and puffs" of UF_6 are classified in the DOE Occurrence Reporting System as unplanned releases. These insignificant emissions occur primarily during cylinder valve cold pressure checks and pigtail disconnections. The "whiffs and puffs" are usually described as resembling cigar smoke. There was one documented "whiff and puff" at C-315 to the ambient air in 1994.

On February 17, 1994, at 1438, during a routine cylinder change at the C-310 Burp Station, a UF_6 release occurred when a cylinder which was still connected to a pigtail was moved by mistake. The cylinder movement ruptured the pigtail and caused the closed cylinder valve to leak. An estimated 454 grams of UF_6 was released during a 30-minute period. Air samples taken by HP in the vicinity of the release indicated the presence of uranium in the immediate area of the release. Based on the estimated quantity of the release and an assay of 1.95 percent, the estimated off-site dose from the release is 0.003 mrem. Ambient air samples from site boundary locations indicated no significantly elevated values of uranium; therefore, it is likely that actual off-site dose from this event was significantly less than that estimated from modeling.

On December 14, 1994, at 1326, a rupture in a feed header released an estimated 4536 grams of UF_6 . The rupture was caused by the expansion of solidified UF_6 in the header as it was heated following the flooding of a steam trap on the feed header steam heating system. Based on the estimated quantity released, a uranium assay of 0.711 percent, and air dispersion modeling from the point of the release, the resulting off-site dose is estimated at 0.01 mrem. However, ambient air samples from site boundary fence locations indicated no significantly elevated levels of uranium, so it is likely that the actual off-site dose from this event was significantly less than that estimated from modeling.

**SECTION V--SUPPLEMENTAL INFORMATION
REQUESTED BY DOE**

Collective effective dose equivalent (person-Roentgen Equivalent Man [rem]/year)-50-mile radius:

Emission Source	CEDE, person/rem
C-310 purge stack	0.002
C-400	0.0006
C-400 cylinder drying facility	0.00001
C-710	0.008
C-720 ovens	0.0003
Wet air/seal exhausts	0.0015
C-310 Release ¹³	0.004
C-337-A Release ¹³	0.02
Total	0.025

COMPLIANCE WITH SUBPARTS Q AND T OF 40 CFR 61

Not applicable.

RADON 220, RADON 222 EMISSIONS

Although radon 222 is an uranium decay product, 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 ²³²Th and ²³²U 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.¹⁴ 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 EPA¹⁵ 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 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 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 of 40 CFR 61, Subpart H.

¹⁴See correspondence from D. F. Hutcheson to D. L. Booher, January 28, 1994, discussing "Potential to Emit."

¹⁵See correspondence from W. A. Smith to D. C. Booher, April 20, 1992.

STATUS OF QUALITY ASSURANCE PLAN

PGDP's NESHAP Quality Assurance Plan was revised and issued in August 1994.