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Document Title/Date 1996 NESHAPS Annual Report For the PGDP 6/11/97

Author Hodges Corporate Author DOE

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☑ Paper ☐ Photo ☐ Diskette ☐ Drawing ☐ Video ☐ CD ☐ Report/Letter ☐ Other ____

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BJCF-552 (10/01)

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

June 11, 1997

Mr. Winston A. Smith, Director
Air, Pesticides, and Toxic Management Division
United States Environmental Protection Agency
Region IV
61 Forsyth Street
Atlanta, Georgia 30303

1996 NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR POLLUTANTS (NESHAPS) ANNUAL REPORT FOR THE PADUCAH GASEOUS DIFFUSION PLANT (PGDP)

Enclosed is the annual NESHAPS report required by 40 CFR 61, Subpart H, which summarizes airborne radionuclide emissions from PGDP during Calendar Year (CY) 1996. If you have any questions or require additional information, please call W. David Tidwell at (502) 441-6807.

Sincerely,

for Jimmie C. Hodges, Site Manager
Paducah Site Office

EF-22:Tidwell

Enclosure

cc:
J. B. Benton, NE-40
N. L. Carnes/R. Blumenfeld, CC-10
R. K. Dierolf, LMUS/PGDP
L. A. Eaton, JEG/Kevil
C. S. Gist, EW-91
P. J. Gross, SE-31
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United States
Enrichment Corporation

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

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

USEC

May 23, 1997

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

1996 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 airborne radionuclide emissions from PGDP during CY 1996. This report is required to be submitted to the Environmental Protection Agency by June 30, 1997. The appropriate Department of Energy official should sign the certification located after the compliance assessment on page 16 of the report.

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

Sincerely,

T. Michael Taimi
Environmental Assurance & Policy Manager

TMT:RKD:mjw

Attachment

cc: Dane Bartlett - LMUS/PGDP
John Dietrich - LMUS/HQ
David Hutcheson
Steve Polston - LMUS/PGDP
David Tidwell - DOE/PGDP
Ken Tomko - LMUS/PORTS

cc/att: Linda Beach - LMUS/HQ
Ron Dierolf - LMUS/PGDP
Weldon Dillow - DOE/OR
Steve Shell/Jimmie Hankins - LMUS/PGDP
Bill Sykes - LMUS/PGDP
✓EC File - RC

United States Department of Energy
Air Emissions Annual Report
(40 CFR 61, Subpart H)
Calendar Year 1996

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/Lockheed Martin 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 approximately 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 (U^{235}) has been increased from its natural assay. Natural uranium is mostly U^{238} with about 0.72 percent U^{235} and 0.0051 percent U^{234}. 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 U^{235} 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. A project to upgrade operations to be capable of 2.75 percent U^{235} enrichment was completed in 1996. PGDP has not yet begun operations at this higher enrichment level. Hazardous, nonhazardous, and radioactive wastes are generated and disposed as a result of plant operations.

The Paducah Plant enriches the uranium isotope, U^{235}, via a physical separation process. The separation is based on the faster rate at which U^{235} diffuses through a barrier compared with the heavier U^{238} 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 U^{235} content depleted, have been reprocessed to remove most of the fission products, and which must have its U^{235} 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 (Tc^{99}), a fission by-product and transuranics, most notably neptunium-237 (Np^{237}) and plutonium-239 (Pu^{239}), into the cascade. Tc^{99} 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.

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 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.

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 the USEC and DOE facilities are still subjected to CFR 61, Subpart H, requirements.

SOURCE DESCRIPTION

The following are the potential airborne radionuclide sources at the Paducah Plant. Although not all of them were used in 1996, 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 U^{234}, U^{235}, U^{238}, Tc^{99}, Np^{237}, Pu^{239}, and thorium-230 (Th^{230}) 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 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, Tc^{99}, minute quantities of transuranics, and Th^{230}. 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. 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-333 Process Building
C-335 Process Building
C-337 Process Building
C-310 Product Withdrawal 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.

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, while still in operation, is also ineffective due to the age of the system. 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–no exhaust system, 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) (No exhaust system–portable HEPA vacs used).
C-337-A	Feed Facility (UF_6 Vaporizer) (No exhaust system–portable HEPA vacs used).
C-360	Toll Transfer and Sampling Facility (controlled by portable HEPA vacs).

The C-310 product withdrawal and burp stations, C-315, C-333-A, and C-337-A systems emissions 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. This quantity was multiplied by the emission factor for HEPA filters in accordance with 40 CFR 61, Appendix D, to determine the emissions.

This is a conservative method. 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 not been evacuated or purged. Consequently, the emissions from these activities are over-estimated.

In the case of C-360, there are two stacks–one for the pigtail exhaust system and one for the sample cabinet exhaust. The emissions from both systems were determined by EPA Method 5 stack sampling in 1992 to be zero. While the pigtail exhaust system was shut down, the sample cabinet exhaust system is still in operation and emissions are considered to be zero.

The C-360 building is an enclosed facility. Any release from pigtail activities would be detected by the Health Physics air sampling program. Releases from pigtails in C-360 are estimated as part of the building ventilation system emission as described in that section.

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. All of the hoods and canopies were not used in 1996. Sixty-six of the hoods were located in radiological areas. The radionuclides involved in analyses consist primarily of uranium, with a slight potential for emissions of Tc^{99}, Np^{237}, Pu^{239}, and the daughters of uranium (Th^{230}, Th^{234}, 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 8 laboratory hoods in the C-409 Stabilization Facility. None of these hoods were used for work with radionuclides in 1996. The list below indicates the laboratory exhaust systems at PGDP:

Building	Hoods/Canopies	Hoods/Canopies Used in Radiological Areas in 1996
C-710 Laboratory	111	66
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 assume 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 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 several times in 1996.

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 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 1992[1].) 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."

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[1]See correspondence from D. F. Hutcheson to W. A. Smith, dated January 28, 1994.

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 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. It is equipped with HEPA filters. This facility was not used for radiological materials in 1996.

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 which 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 2 days of sample air is collected on each filter. After sample collection, the filters are counted for airborne radioactivity concentrations.

For the 1996 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.

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. 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.

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 10 percent of the most restrictive DAC in 10 CFR 20, Appendix B, (2E-12 uCi/ml for Np^{237}) was exceeded several times in 1996. Using these samples, the maximum air concentration of alpha-emitting particles was calculated. Using a conservative approach, 10 percent of the alpha particles were assumed to be Np^{237} 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 10 percent of the Np^{237} 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 usually less than 10 percent of the most stringent DAC. Therefore, building ventilation emissions from non-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 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 10 percent due to Np^{237} and 90 percent due to uranium. The beta emissions are assumed to be due to Tc^{99}. The emission factor for cloth filters in 40 CFR 61, Appendix D, is used to estimate the emissions.

Northwest Plume Interim Remedial Action Pilot Plant

On September 1, 1995, DOE began operation of a pilot plant designed for the removal of trichloroethylene and Tc^{99} from groundwater. The facility is located at the northwest corner of PGDP's 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 Tc^{99}. The air stripper is located upstream of the ion exchange unit.

Emissions of Tc^{99} were estimated using the analysis of the influent groundwater and the water leaving the air stripper. The Tc^{99} 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 Tc^{99} emitted from the facility. While the exhaust from the air stripper is passed through a carbon adsorption unit prior to exhaust, no data concerning Tc^{99} retention in the unit was obtained and, therefore, no reduction in Tc^{99} emissions due to the use of the adsorption unit were assumed.

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 which would result in fugitive or diffused emissions would result in emissions which would be distinguishable from background at off-site locations.

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 non-radiological). The contaminants originate from the soil and groundwater.

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
Northwest Plume Treatment Facility	None	0	1170 M NNE

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 (1)	HEPA Filters and Vacuums	99.95	N/A[4]
Cylinder valve connection activities not included above; i.e., not serviced by a stack (6).[3]	HEPA Vacuums	99.0 (Appendix D)	1524 M ESE
C-400 sources (3)[3]	None	0	1901 M E NNE
C-710 laboratory hoods (66)[3]	None	0	1944 M NNE
Building ventilation (10)	None	0	1524 M ESE

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[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.

[4]Stack sampling data results indicted 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. This represents the C-300 sample cabinet exhaust.

PGDP RADIONUCLIDE EMISSIONS

Radionuclide Emissions (Ci)[5] during 1996										
Emission Source			C-310	C-710 Lab	Seal/Wet Air Exhaust Grouped Sources	C-400 Grouped Sources	C-400 Cylinder Drying Station	Northwest Plume Treatment Facility	C-360 Sample Cabinet–Dedicated Exhaust[6]	Total
Nuclide	Solubility	AMAD								
Tc^{99} [7]	W	1.0	3.44E-4		2.11E-2	1.44E-3		1.30E-2		3.59E-2
Th^{230} [8]	W	1.0	2.06E-6			1.37E-10				2.06E-6
U^{234}	D	1.0	2.00E-4[8]	8.61E-4	1.68E-3	1.42E-4	5.00E-6			2.89E-3
U^{235}	D	1.0	7.89E-6[8]	2.65E-5	7.71E-5	7.01E-6	2.51E-7			1.19E-4
U^{238}	D	1.0	6.17E-5[8]	7.8E-5	1.05E-3	1.68E-4	5.42E-6			1.36E-3
Np^{237} [8]	W	1.0	1.05E-6			1.61E-6				2.66E-6
Pu^{239} [8]	W	1.0			2.26E-6	2.43E-11				2.26E-6
Total Ci/year			6.17E-4	9.65E-4	2.39E-2	1.76E-3	1.07E-5	1.30E-2		4.02E-2
Check totals										4.02E-2

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[5]1 Curie=3.7×10^{10} Becquerels.

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

[7]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. A. 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 U^{235} assay or less for 1994. As a conservative measure, dose assessment was based on enrichment to 2.0 percent assay.

[8]For release of 57.6 grams of 2 percent enriched uranium based on an isotopic distribution as follows: U^{238}, 3.292E-7 Ci/gU, U^{235}, 4.320 E-8 Ci/gU, U^{234}, 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 databases.

Joint frequency distribution:	5-year STAR distribution from 60 meter stations on Paducah meteorological tower for the years 1989 through 1993.
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:	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.

SOURCE CHARACTERISTICS

Source Name	Type	Height (m)	Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (oC)	Distance (m) and Direction to Maximally Exposed Individual Source	Plant
C-310	Point	61.0	0.3	0	Ambient	2483 N	3084 NNE
C-400	Point[9]	11.3	None	0	Ambient	2097 N	2097 N
C-400 Cylinder drying station	Point	2.4	0.05	0	Ambient	2170 N	2170 N
C-710	Point[9]	7.1	None	0	Ambient	2401 N	2401 N
Seal/wet air exhausts[10]	Point[9]	21.0	None	0	Ambient	2365 N	2743 NNW
Cylinder valve connection	Point[9]	1.0	None	0	Ambient	N/A[11]	N/A[11]
Northwest Plume Treatment Facility	Point	7.0	0.3556	9.45	37.8	1170 NNE	1170 NNR
Building ventilation	Area	25.3 (maximum)	N/A	N/A	Ambient	N/A[11]	N/A[11]

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 Cylinder drying station	1908	2819	4267	>5000	3124	1943
C-710	1944	2705	3962	>5000	2896	1700
Seal/wet air exhausts	1524	2438	3962	>5000	3124	1524
Cylinder valve connection	1524	2438	3962	>5000	3124	1524
Northwest Plume Treatment Facility	1170	3850	5150	>5000	1475	1250
Building ventilation	1529	2438	3962	>5000	3124	1524

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

[10] Grouped source includes building ventilation and cylinder valve disconnections from systems not served by permanent HEPA filter systems.

[11] Cylinder valve connection activities and building ventilation included in seal/wet air exhaust group.

COMPLIANCE ASSESSMENT

Effective dose equivalent (mrem)[12] to maximally exposed individual for each individual source and the plant:

Emission Source	Maximum for Source	Maximum for Plant
C-310	1.4E-4	1.3E-4
C-400	3.8E-4	3.8E-4
C-400 cylinder drying station	6.4E-6	6.4E-6
C-710	5.0E-4	5.0E-4
Northwest Plume Treatment Facility	2.3E-3	2.3E-3
Seal/wet air exhausts	2.6E-3	1.9E-3
Total		**5.2E-3**

Maximum effective dose equivalent to the maximum exposed individual for the plant = 5.2E-3 mrem

Location of maximally exposed individual: 2365 meters north of greatest contributor to dose (seal/wet air exhausts).

[12] 1 mrem=0.01 millisieverts.

CERTIFICATION

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 individual 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.)

Jimmie C Hodges
Department of Energy

6-2-97
Date

J. Michael Lai
United States Enrichment Corporation

5/19/97
Date

SECTION IV–ADDITIONAL INFORMATION

UNPLANNED RELEASES

There were four unplanned releases occurring outside of a building not included in HP air sampling program during 1996. The estimated total quantity of uranium released was less than 25 g. These releases are included in the seal/wet air exhaust grouping.

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	0.003
C-400 cylinder drying facility	0.0004
C-710	0.004
Wet air/seal exhausts	0.03
Northwest Plume Treatment Facility	0.01
Total	**0.05**

COMPLIANCE WITH 40 CFR 61, SUBPARTS Q AND T

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 Th^{232} and U^{232} 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.[13] 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[14] 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.

STATUS OF QUALITY ASSURANCE (QA) PLAN

A surveillance of the PGDP NESHAP QA Plan was performed in December 1996. A number of discrepancies were identified. A revised plan will be issued in 1997.

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

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