APPENDIX C

MISCELLANEOUS ENVIRONMENTAL IMPACT STATEMENT DATA

PADUCAH DUF6 SITE CHARACTERIZATION PROJECT

CONTENTS

APPENDIX C

C.1. INTRODUCTION

The Paducah Gaseous Diffusion Plant (PGDP) is located in McCracken County in western Kentucky, about 12 miles west of the city of Paducah. The total site is about 3423 acres, 748 of which are fenced within the controlled plant boundary. PGDP houses 115 buildings, which account for over 8,183,000 ft^2 of floor space. The proposed area for the Depleted Uranium Hexafluoride (DUF6) Conversion Facility is found on the southern end of the plant boundary, southwest of the C-333 process building. The site is cleared, flat ground with a grade of less than 1%. Roadways are in place in this area and only require extension to new facilities.

The following sections of this appendix provide miscellaneous data about the proposed site for the DUF6 Conversion Facility. These data should be useful in the planning and design stage of the DUF6 Conversion Facility Project.

C.2. AIR AND BIOTA MONITORING DATA

(See attached)

C.2.1 AIR MONITORING DATA

United States Department of Energy
Air Emissions Annual Report
(40 CFR 61, Subpart H)
Calendar Year 1999

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*: (270) 441-6807

SITE INFORMATION

Contractors:

United States Enrichment Corporation
P. O. Box 1410
Paducah, Kentucky 42002-1410
Ronald K. Dierolf Jr.
(270) 441-5956

Bechtel Jacobs Corporation LLC
761 Veterans Avenue
Kevil, Kentucky 42053
Danny R. Guminski, P.E.
(270) 441-5051

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.

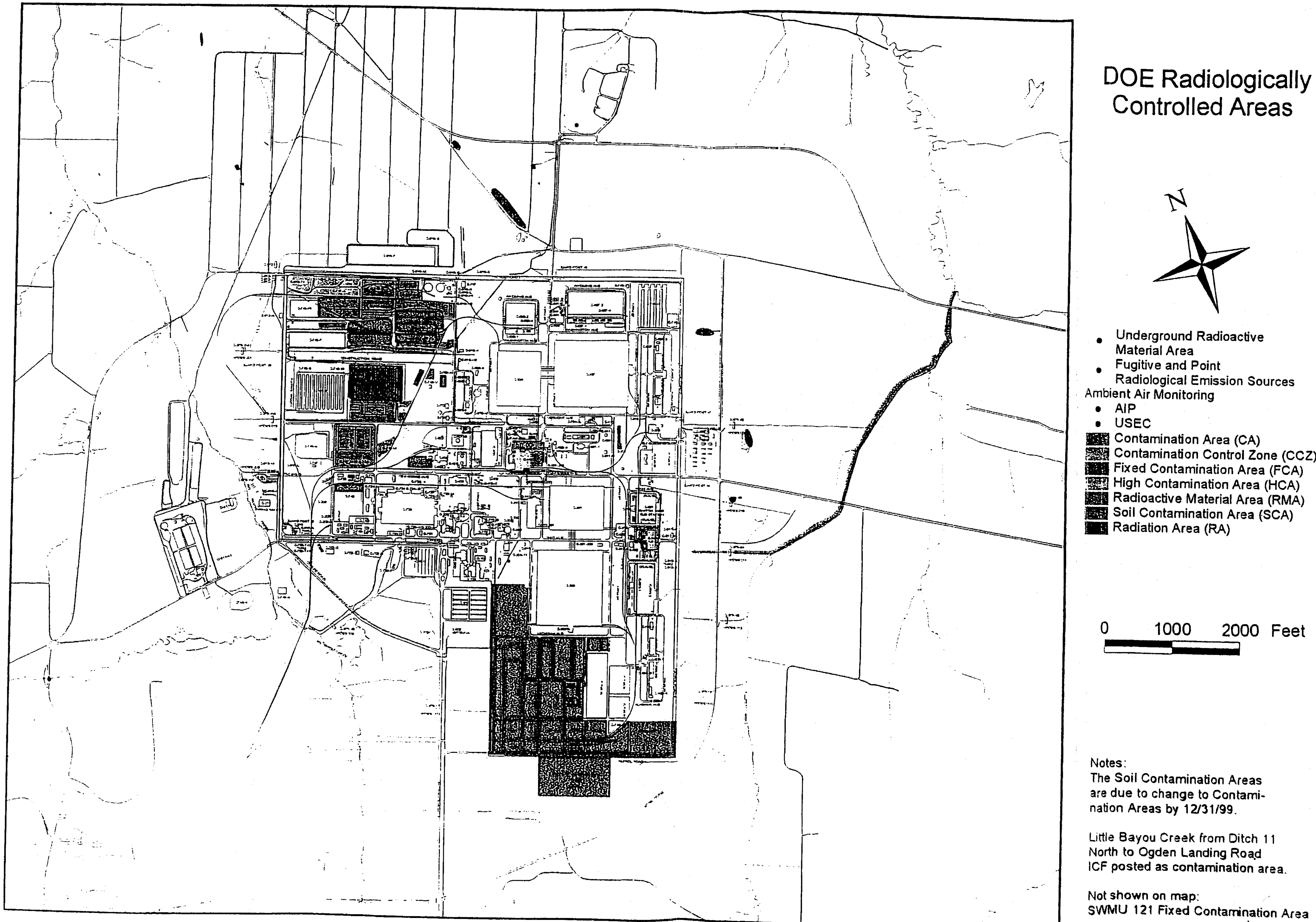

Fig. 1 Location of Paducah Site fugitive and diffuse sources

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 Davis

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.)

W. A. Seaborg [signature]
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.

C.2.2 BIOTA MONITORING DATA

The biota monitoring program was discontinued several years ago because no harmful effects or contaminant presence from plant operations were found during the program.

C.3. VEGETATIVE COVER AND PRECIPITATION DATA

C.3.1 VEGETATIVE COVER

The vegetation at the proposed site is mostly grass with several groups of second-growth timber. The terrestrial ecology of the property is typical of western Kentucky, except for the plant site and the land management for wildlife. Mature riparian hardwood forests dominate the communities on the banks of Little Bayou and Big Bayou creeks. Small wood lots above the stream banks and on the remainder of the reservation area are dominated by upland tree species. Grassland and immature forest are sparsely scattered over the U.S. Department of Energy (DOE) property. Upland forest communities are primarily the oak-hickory association with other miscellaneous species present.

C.3.2 CLIMATE AND PRECIPITATION DATA

The Paducah area has a humid continental climate. Temperatures for the summer months average 85^{o}F, while winter temperatures average 36^{o}F. During the winter months, temperatures will drop below freezing an average of 60 nights and 10 days. The summers are warm and humid with an average of 40 days of 90^{o}F or higher per year.

Precipitation is distributed relatively evenly throughout the year and averages 44.5 in. per year. A third of the precipitation occurs during March, April, and May. October is the driest month with an average of 2.6 in. of rain. The area is affected by an average of about 60 thunderstorms per year, but winds in excess of 50 knots occur slightly less than once per year, based on data that winds in excess of 50 knots have occurred 29 times between 1955 and 1990. Hail is detected on an average of less than once per year. The maximum annual frequency of hail is on the order of twice per year. Since 1955, hailstones in excess of 0.75 in. have been recorded nine times. Prevailing winds are normally from the southwest; calm periods are seldom longer than 24 hours.

C.3.3 FLOODING CONDITIONS

The probable maximum flood (PMF) level on the Ohio River is 10 to 20 ft below the Paducah plant grade. The PMF is estimated to have a 1 x 10^{-6} to 1 x 10^{-8} annual probability of occurrence, which is much lower than the UCRL 15910 requirements for a Moderate Hazard facility.

PGDP is located about 3 miles from the Ohio River mile 945. The nearest upstream dam on the Ohio River is Lock and Dam 52 at river mile 938.9. Failure of this dam navigation low rise is not a controlling factor in the flood hazard assessment of PGDP. Two upstream dams are located about 20 miles east of PGDP on the Tennessee and Cumberland Rivers. These dams are the Kentucky and Barkley dams. Failure of these dams is not a controlling factor in the flood hazard assessment of PGDP.

C.4. WETLANDS DELINEATION

C.4.1 INTRODUCTION

A delineation of the jurisdictional wetland boundary was performed on the proposed site of the DUF6 Conversion facility at the Paducah Gaseous Diffusion Plant (PGDP) in McCracken County, Kentucky. The objectives of this investigation are:

- to identify the present wetland types, extent, and functions using current regulatory guidance, and
- to confirm past wetland delineations.

The delineation supports the environmental impact assessment for the National Environmental Policy Act (NEPA) and is a part of a larger program to characterize the proposed site. A wetland assessment will be incorporated into the site-specific Environmental Impact Statement (EIS) to be prepared by Argonne National Laboratory in accordance with DOE regulations in 10 CFR 1022.

C.4.2 BACKGROUND

The proposed site is located on the southwest corner of the PGDP adjacent to existing DUF6 cylinder yards. The site is relatively flat and approximately 39 acres in size. Approximately half of the site is an open field located outside the security fence near the main plant entrance within Solid Waste Management Unit (SWMU) 194. SWMU 194 consists of the former locations of the McGraw Construction Facilities administration building, cafeteria, security guard headquarters, hospital, purchasing building, paper and stationary warehouse, and boiler house. These facilities have been demolished. The open field is bordered to the east by the Patrol Road 5 and to the west by the entrance highway. The other half of the proposed facility site is a wooded area located outside the security fence south of the open field and outside SWMU 194.

C.4.2.1 Regulatory Requirements

The U.S. Army Corps of Engineers regulates specific activities in waters of the United States under Section 404 of the Clean Water Act. Section 404 of this Act regulates the discharge of fill material into waters of the U.S. Waters of the U.S. include wetlands defined by 33 CFR 328.3 as "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated conditions."

The methods for identifying and delineating jurisdictional wetlands are outlined in the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987). Several changes to the methods have occurred including issuance of a 1989 manual, which was subsequently abandoned for the original 1987 manual. Recently changes to the 1987 guidance occurred in the updated electronic version of the 1987 manual primarily in the identification of field indicators of hydric soils.

Wetlands are identified by three different characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) hydrology. Hydrophytic vegetation is determined by surveying the vegetation to establish if the dominant plants are wetland species. Dominance was determined by using the 50/20 rule. The rule states that for each stratum in the plant community, dominant species are the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceed 50% of the total dominance measure for the stratum, plus any additional species that individually comprise 20% or more of the total dominance measure for the stratum. Cover estimates were established by ocular estimates for each species within sample quadrats 30 feet in radius. Dominant species were assigned a regional indicator status from the National List of Plant Species that Occur in Wetlands: Northeast Region (Reed, 1988). When 50% of the dominants had an indicator status of OBL, FACW or FAC, the vegetation was considered to be hydrophytic.

The hydric soil definition and criteria published in the 1987 Corps Manual are obsolete. Current hydric soils are defined by the USDA Natural Resources Conservation Service (formerly Soil Conservation Service). Hydric soils are now defined as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, July 13, 1994). Nearly all hydric soils exhibit characteristics that result from repeated periods of saturation and/or inundation for more than a few days. Saturation or inundation when combined with microbiological activity in the soil causes a depletion of oxygen. This anaerobiosis promotes biogeochemical processes such as the accumulation of organic matter and the reduction, translocation, and/or accumulation of iron and other reducible elements. These processes result in characteristic morphologies which persist in the soil during both wet and dry periods, making them particularly useful for identifying hydric soils (USDA NRCS, 1998). A relatively new field indicator, redoximorphic features, has been recommended to identify hydric soils (Vepraskas, 1999). The field indicator terms, mottles and low chroma colors used to identify hydric soils in the past are now replaced by redoximorphic features that include redox concentrations, redox depletions, and reduced matrices.

Wetland hydrology is defined by terms of permanent or periodic inundation or saturation to the soil surface, at some time during the growing season. Hydrology is often the least exact of the parameters, however it is essential to establish periodic inundation or saturation during the growing season. The growing season is approximated by the number of frost-free days. Start and end dates are usually available in NRCS county soil survey reports. An area has wetland hydrology, if it is inundated or saturated to the surface continuously for at least 5% of the growing season in most years.

A wetland assessment will be required (10 CFR 1022) if siting of the facility will impact onsite wetlands identified in this delineation report. The assessment will document the sequencing efforts of the siting process to avoid impacting the wetlands, to minimize the impacts and if impacts are unavoidable, to replace or restore the impacted wetland's functions. A semi-quantitative functional assessment may be required to identify the functions of the impacted wetlands. Quantitative methods of functional assessment are documented in the Wetland Evaluation Technique (WET) by Adamus et al., 1987 or in the Hydrogeomorphic Method (HGM) by Brinson, 1993.

When the discharge of fill material into waters of the U.S. (including wetlands) is proposed, a permit must be obtained from the COE pursuant to Section 404 of the Clean Water Act. Permits are issued either as individual permits or as nationwide permits. New replacement nationwide permits (March 6, 2000) require that the Corps be notified of activities impacting more than one-tenth of an acre (reduced from one-third of an acre) and limit the maximum acreage limit for the general permits to one-half acre (reduced from 3 acres). A delineation of the wetland-upland boundary is performed to identify the wetland acreage impacted. The permit application must also include a delineation of the boundary (33 CFR 330 Appendix A). The COE District Engineer will make a determination of the mitigation requirements. If mitigation is required, guidelines are outlined in the Wetland Compensatory Mitigation and Monitoring Plan Guidelines for Kentucky (U.S. Army COE, Louisville District, 1997). Wetland replacement size will likely be set forth at a minimum 3:1 ratio based on these guidelines.

C.4.2.2 Past Investigations

A planning level wetland delineation on the entire PGDP site was conducted during 1992-93 (USCOE-WES, 1993) using the 1989 Wetland manual. Subsequently, wetlands in the open field (SWMU 194) were delineated in September 1995 (CDM, 1996) and in the wooded area in June 1995 as an alternate site for the construction of the C-745-T cylinder storage yard (Balding, 1995).

The 1993 COE delineation classified the wetlands in the wooded area as Plain Forest Oak. A single quadrat within the wooded area was documented on a data form as Sample Point No. 29. The open field was not investigated in the 1993 COE delineation however a wet meadow/grassland classification was used to describe areas similar to those in the open field. The COE description of the two plant communities follows:

- Bottomland Hardwood Plain forest-oak: This type is the wet phase of the Oak-Hickory association. Cherry Bark Oak (Quercus falcata var. pogodifolia) and Shagbark Hickory (Carya ovata) dominate this plant community. Several other Oaks and Hickories are co-dominants including Pin Oak (Q. palustris), Bur Oak (Q. macrocarpa), Swamp Oak (Q. bicolor), White Oak (Q. alba), Butternut Hickory (Carya cordiformis), and Black Gum (Nyssa sylvatica). Dominant shrubs in this type include Spice Bush (Lindera benzoin) and Coral Berry (Symphoricarpus orbiculatus). The herbaceous layer is sparse in cover and includes Wood Reed (Cinna arundinacea), Japanese Honeysuckle (Lonicera japonica) and Virginia Rye Grass (Elymus virginiana). The Henry soils are commonly associated with this type. The hydrology of this type is seasonal saturation to within 30.5 cm (12 inches) of the surface or ponded water.

- Prairie Grassland wet meadow: The wet meadow type occurs as small wetlands and represents early phases of succession or areas being maintained by mowing. The wet meadow is dominated by Broom Sedge (Andropogon virginicus), Soft Rush (Juncus effusus), Fox Sedge (Carex vulpinoides), and Sensitive Fern (Onoclea sensibilis). The soil series associated with this type are Grenada and Calloway. The hydrology of this type is saturation to the surface or ponding of water to 15.2 cm (6 inches) until late spring.

The 1995 CDM wetland delineation of the wooded area by Balding describes the proposed action as the construction of a concrete pad storage yard and storm water drainage system with a detention pond and emergency spillway. The detention ponds were to be located within each yard and a drainage ditch proposed around the wooded area. Four areas were identified as wetlands in the wooded area west of the existing cylinder storage yard. Two types were identified - palustrine emergent in the grassy field on the northern edge of the wooded area and palustrine forested in the tree line. Henry silt loam underlain both wetland types. An unvegetated "vernal pool" was identified in the southeast corner of the wooded area adjacent to the central old roadbed. The wetland types were described by CDM as:

- Palustrine forested wetlands: This type consists of dominants in the tree layer including red maple (Acer rubrum), sweet gum (Liquidambar styraciflua), various Oaks (Quercus sp.), and various hickories (Carya sp.). The shrub/sapling layer is dominated by red maple, American elm (Ulmus americana), green ash (Fraxinus pennsylvanica), and white ash (F. americanus). Dominant vines identified in the area are Virginia creeper (Parthenocissus quinquefolia) and poison ivy (Toxicodendron radicans). The herbaceous layer in the forested wetland is dominated by stiff marsh bedstraw (Gallium tinctorium), blunt broom sedge (Carex tribuloides), cat tail sedge (Carex typhina), and water parsnip (Sium suave). Other species noted are pin Oak (Q. palustris) in the tree layer and in the herbaceous layer, buttercup (Ranunculus sp.), creeping manna grass (Glyceria acutiflora) and fox sedge (C. vulpinoides).

- Palustrine emergent wetlands: This type is dominated by the following species in the herbaceous layer – green bulrush (Scirpus atrovirens), needle-pod rush (Juncus scirpoides), fowl manna grass (Glyceria striata), and spikerush (Eleocharis sp.)

The palustrine forested wetland type was reported to provide the following functions: groundwater recharge and discharge, flood-flow alteration, nutrient removal and transformation; and wildlife habitat. The functions of the palustrine emergent wetland type were reported as groundwater recharge/discharge and flood-flow alteration.

The 1996 CDM delineation of the open field portion of SWMU 194 identified three separate linear wetlands in and along the bank of the drainage ditches as palustrine emergent wetland type. The type is dominated by the following herbaceous species: green bulrush (Scirpus atrovirens), field paspalum (Paspalum laeve), and spikerush (Eleocharis sp.).

C.4.3 METHODOLOGY

The routine wetland identification method was used to verify past investigations and confirm the present extent of wetlands at the proposed site. The method involves walking the entire area, identifying the plant communities, selecting representative sample quadrats, identifying the dominant species in each of four layers (tree, sapling/shrub, herb, and vines), recording regional indicator status of the dominant species, determining whether hydrophytic vegetation is present, evaluating wetland hydrologic indicators, and determining whether hydrology is present. The determinaton of hydric soils was performed later in July due to the site requirement for an excavation/penetration permit. Six quadrats were assessed within the study area.

The growing season begins on April 7 and ends on October 26 extending 202 days (USDA SCS, 1976). Wetland hydrology criteria is met if an area is inundated or saturated to the surface continuously for at least 5% of the growing season or 10 days between April 7 and Oct 26.

C.4.4 FIELD RESULTS

The proposed site was visited on June 1-2, 2000 to perform the vegetation/hydrology portions of the routine delineation and again on July 17 to identify hydric soils. Data forms documenting the survey are included in Appendix A. The present extent of the wetlands is shown on Figure 1. Soil borings for site characterization are shown for reference. Vegetation quadrats and soil sample points are also shown in Figure 1. The acreage of jurisdictional wetlands in the grassy upper half of the site is 0.9 acres almost entirely comprised of drainageways, while the wooded lower half contains 6.3 acres of bottomland hardwood wetlands.

The entire western half of the wooded area was found to contain wetland vegetation, hydric soils and hydrology. A continuous berm of soil was observed along the edge of the wooded area next to the power line right of way (ROW). The source of or reason for the berm is unknown. A ponded shrub wetland extended from the southern boundary of the wooded area into the ROW. A linear open water feature was identified on the northern border of the wooded area. Runoff water from the cylinder yard is probably the source of this ponded area. A ditch from the cylinder yard discharges runoff into the northeastern corner of the wooded area. A sediment sample was collected within this ponded area as a part of the site characterization for the DUF6 Conversion facility. Standing water was present in June but not during soil sampling in July. Wetland vegetation and standing water also extended beyond the wooded boundary into the grassy area on the north border of the wooded area. The extent of the wetland required relocation of the soil boring (SB15) planned for this corner of the site. Small ponded wetlands were also found in the open field of SWMU 194 but none required relocation of planned soil borings.

The field indicator of hydric soils identified during the delineation is F3 Depleted matrix described as:

> "A layer at least 15 cm (6 in) thick with a depleted matrix that has 60% of more chroma 2 or less starting within 25 cm (10 in) of the surface. If the chroma is 2 and value less than 6, redox concentrations are required in this soil…(U.S. Dept of Ag. NRCS, 1998)."

The later survey to identify aquic conditions in soils verified the wetland-upland boundary. Soils were described from three north-south transects (S1-S4, S5-S6, S7-S8) and at each of the six vegetation quadrats. The absence of redoximorphic concentrations in soils along the first transect (S1-S3) confirmed the upland character of this area. The change in this feature was obvious along the hydrologic gradient when western soil sample points (S7-S8) were compared with eastern points (S1-S3).

Soil Sample Point	Description:
S1	0-20", E horizon, silt loam matrix 10YR7/2 uniform matrix color, no concentrations
S2	0-2", A horizon, silt loam 10YR3/1, uniform matrix, no concentrations; 2-10", E horizon, silt loam matrix 10YR6/2, no concentrations
S3	0-2", A horizon, silt loam matrix 2.5YR4/4 2-10", E horizon, silt loam matrix 10YR5/4, no concentrations 10-18", B horizon, silt loam matrix 10YR6/3, few indistinct yellow-brown (10YR5/8) concentrations
S4	0-2", O horizon, humus layer; 2-14", E horizon, silt loam matrix 10YR6/2, dark staining in pore linings, abundant red-yellow 7.5YR6/8 distinct concentrations, moist at 14".
S5	0-10", E horizon, light gray (10YR6/2) silt loam matrix, no concentrations 0-8" but at 8-10" abundant yellow-brown 10YR5/6 concentrations
S6	0-1", A horizon, silt loam 10YR4/1 1-18", E horizon, silt loam matrix 10YR6/2 with dark staining in pores and abundant distinct yellow-brown (10YR5/8) concentrations
S7	0-1", O horizon 1-18, E horizon, light gray (10YR6/2) silt loam matrix with abundant distinct yellow-brown (10YR5/8) concentrations
S8	0-1", O horizon 1-18, E horizon, light gray (10YR6/2) silt loam matrix with abundant distinct yellow-brown (10YR5/8) concentrations

The presence of saturation or inundation during the initial June field trip is assumed to indicate that wetland hydrology is present.

As described in previous reports, the wooded wetland plant community is described as bottomland hardwoods and the meadow wetlands as an emergent herbaceous plant community. The classification used by the National Wetland Inventory (NWI) might be forested broad-leaved deciduous and wet meadow (Cowardin et al, 1979). All of the onsite wetlands occupy depressional areas that receive surface water runoff and possibly some surficial groundwater discharge.

Wetland functions are physical, chemical, and biological processes or attributes of wetlands that are vital to the integrity of the wetland system and operate whether or not they are viewed as important to society (Adamus et al., 1991). Based on the best professional judgement, the onsite wetlands function as habitat, flood-flow alteration, and groundwater recharge as described by WET. Due to the low topography or depressional location of the onsite wetlands in the landscape, these areas detain or temporarily store storm-water run-off flows. The absence of an outlet for run-off implies that the standing water infiltrates into the soil and recharges the surficial groundwater aquifer. The island-like appearance of the wooded area surrounded by grassy or shrub plant cover suggests that wildlife may use the woods as a temporary refuge, shelter or habitat. Siting and replacement success for mitigation wetlands must use an assessment of function based upon the hydrogeomorphic classification system for wetlands (Brinson, 1993). This classification is based on geomorphic setting (riverine, depressional, fringe); water source (precipitation, lateral flows from upstream or upslope, and groundwater); and hydrodynamics (vertical, unidirectional and horizontal, and bidirectional and horizontal). Based upon professional judgement, the onsite wetlands are depressional in landscape receiving water from upslope lateral flows and discharging water vertically to the soil.

APPENDIX A

DATA FORMS

ROUTINE WETLAND DETERMINATION

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site - PGDP Applicant/Owner: DOE/BJC Investigator: D. Stair / G. Sisco	Date: 6/1/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: ____ Transect ID: ____ Plot ID: Q1

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Liquidamber styraciflua	T	FAC •	9. Bromus japonicus	H	FACU-
2. Acer rubrum	T	FAC •	10. Asclepias perennis	H	NI
3. Quercus falcata *	T	FACW •	11.		
4. Ulmus alata	S/S	FACU	12.		
5. U. americana	S/S	FACW-•	13.		
6. Parthenocissus quinquifolia	H	FACU	14.		
7. Symphoricarpus orbiculatus	H	UPL	15.		
8. Toxicodendron radicans	H	FAC •	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 5/10 = 50%

Remarks: * Q. falcata = cherry bark oak

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
___ Aerial Photographs
___ Other
✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: Ø (in.)

Depth to Free Water in Pit: ____ (in.)

Depth to Saturated Soil: ____ (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
___ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
✓ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 Inches
✓ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks: Continuous berm along south side between woods and power-line right of way; approx 40 ft to south of Q-1

Q-1

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Taxonomy (Subgroup): Typic Fragiaqualfs

Drainage Class: ______

Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-4"	A	10YR2/1	none	—	humus
4-18"	B	10YR6/2	7.5YR6/8	numerous	silt loam

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks: abundant red-yellow redox concentrations in pore linings and structure planes.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site - PGDP Applicant/Owner: DOE/BJC Investigator: D. Stair / E. Sisco	Date: 6/1/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: ____ Transect ID: ____ Plot ID: Q2

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Quercus falcata	T	FACU-	9.		
2. Liquidambar styraciflua	T	FAC o	10.		
3. Q. palustris	T	FACW o	11.		
4. Ulmus americana	S/S	FACW- o	12.		
5. Symphoricarpus orbiculatus	S/S	UPL	13.		
6. Ilex decidua	S/S	FACW o	14.		
7. Toxicodendron radicans	H	FAC o	15.		
8. Galium aparine	H	FACU	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 5/8

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: Ø (in.)

Depth to Free Water in Pit: ____ (in.)

Depth to Saturated Soil: ____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Taxonomy (Subgroup): Typic Fragiaqualfs

Drainage Class: ______

Field Observations Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-1	A				duff
1-18"	B	10YR 6/2	10YR 5/3	abundant/not distinct	Silt loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: boundary of redox concentrations not distinct

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site @ PGDP Applicant/Owner: DOE/BJC Investigator: D. Stair / G. Sisco	Date: 6/1/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: ____ Transect ID: ____ Plot ID: Q3

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Acer rubrum	T	FAC	9. Phlox glaberrima	H	FAC
2. Liquidambar styraciflua	T	FAC	10. Bromus japonicus	H	FACU-
3. Acer rubrum	S/S	FAC	11.		
4. Ulmus americana	S/S	FACW-	12.		
5. Glyceria sp	H	OBL	13.		
6. Sium suave	H	OBL	14.		
7. Panicum sp.	H	FACU-OBL	15.		
8. Carex squarrosa	H	FACW	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 8/10 = 80%

Remarks: adjacent to linear pond feature, berm on side side, standing water extends 10 ft wide by 300' long

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other ___ No Recorded Data Available Field Observations: Depth of Surface Water: 10" (in.) Depth to Free Water in Pit: ___ (in.) Depth to Saturated Soil: ___ (in.)	Wetland Hydrology Indicators: Primary Indicators: ✓ Inundated ___ Saturated in Upper 12 Inches ✓ Water Marks ___ Drift Lines ___ Sediment Deposits ✓ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ✓ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Drainage Class: ____

Taxonomy (Subgroup): Typic Fragiaqualfs

Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-2	A	10YR 2/2	—	—	Humus dry
2-14	B	10YR 6/2	7.5YR 6/8	abundant	Silt loam moist

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: 0-2" dark staining in pore linings at 2"
2-14 red-yellow redox concentrations abundant in pore linings and structure planes

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

inundated on 6/1
dry on 7/19

Approved by HQUSACE 3/92

47060024

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site @ PGDP Applicant/Owner: DOE/BJC Investigator: D. Stair / G. Sisco	Date: 6/1/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: ___ Transect ID: ___ Plot ID: Φ-4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Quercus palustris	T	FACW	9. Sium suave	H	OBL
2. Acer rubrum	T	FAC	10. Rosa palustris	H	OBL
3. Q. falcata	T	FACU-	11.		
4. Ulmus americana	S/S	FACW-	12.		
5. Liquidambar styraciflua	S/S	FAC	13.		
6. Carex squarrosa	H	FACW	14.		
7. Bromus sp.	H		15.		
8. Bidens sp.	H	FACW-OBL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 7/8

Remarks: –

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other ✓ No Recorded Data Available Field Observations: Depth of Surface Water: — (in.) Depth to Free Water in Pit: ___ (in.) Depth to Saturated Soil: Ø (in.)	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ✓ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ✓ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ✓ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks: crawfish tubes

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Taxonomy (Subgroup): Typic Fragiaqualfs

Drainage Class: ______

Field Observations Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-1	A	10YR 4/1	none	—	silt loam
1-18	B	10YR6/2	10YR 5/8	abundant	silt loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: dark staining at 2"; redox depletions and concentrations obvious and plentiful in B horizon – boundary of redoximorphic features distinct.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site C PGDP Applicant/Owner: DOE/BJC Investigator: D. Stair / G. Sisco	Date: 6/1/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? **(Yes)** No Is the site significantly disturbed (Atypical Situation)? Yes **(No)** Is the area a potential Problem Area? Yes **(No)** (If needed, explain on reverse.)	Community ID: ____ Transect ID: ____ Plot ID: Q5

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Acer rubrum	T	FAC	9. Rosa palustris	H	OBL
2. Quercus michauxii	T	FACW	10. Carex stipata	H	OBL
3. Q. bicolor	T	FACW+	11. Panicum sp.	H	FACU–OBL
4. Liquidambar styraciflua	T	FAC	12. Impatiens capensis	H	FACW
5. L. styraciflua	S/S	FAC	13.		
6. Ulmus rubra	S/S	FAC	14.		
7. Parthenocissus quinquefolia	H	FACU	15.		
8. Toxicodendron radicans	H	FAC	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 10/11

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake, or Tide Gauge
  ___ Aerial Photographs
  ___ Other
✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: ____ (in.)

Depth to Free Water in Pit: ____ (in.)

Depth to Saturated Soil: Ø (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
✓ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
✓ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 Inches
___ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Taxonomy (Subgroup): Typic Fragiaqualfs

Drainage Class: ______

Field Observations Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Size/Contrast	Texture, Concretions, Structure, etc.
0-8"	B	10YR6/2	none	–	silt loam
8-10	B	10YR6/2	10YR5/6	abundant	silt loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: none at 0-8" but abundant yellow brown redox concentrations below 8" to 10"

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: DUF6 Conversion Site C PGDP Applicant/Owner: Investigator:	Date: 6/2/00 County: McCracken State: KY
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: SWM4 194 Transect ID: Plot ID: C-6

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Eleocharis sp.	H	FACW-OBL	9.		
2. Sedium mutstoides	H	OBL	10.		
3. Carex tribuloides	H	FACW+	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 3/3 = 100%

Remarks:

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other ✓ No Recorded Data Available	Wetland Hydrology Indicators: Primary Indicators: ✓ Inundated ✓ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ✓ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: 2-6 (in.) Depth to Free Water in Pit: ____ (in.) Depth to Saturated Soil: ____ (in.)	

Remarks: Crayfish tubes

47060024

SOILS

Map Unit Name (Series and Phase): Henry silt loam

Taxonomy (Subgroup): Typic Fragiaqualfs

Drainage Class: ______

Field Observations
Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-18"	B	10YR 6/2	7.5YR 6/6	numerous	silt loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: light grey soil with numerous distinct yellow-brown redox concentrations

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle) Wetland Hydrology Present? (Yes) No Hydric Soils Present? (Yes) No	(Circle) Is this Sampling Point Within a Wetland? (Yes) No

Remarks:

Approved by HQUSACE 3/92

47060024

See Appendix B, Section 6 for Wetland Survey Map

C.5. HYDROGEOLOGICAL INFORMATION (GROUNDWATER AND SURFACE WATER)

C.5.1 GROUNDWATER

This section summarizes the stratigraphy and hydrogeology of the PGDP area. The information presented in this section is derived primarily from the *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III* (MMES, 1992a), unless otherwise indicated.

The PGDP is located in the Jackson Purchase region of western Kentucky, at the northern tip of the Mississippi Embayment. The stratigraphic sequence at the PGDP consists of a sequence of unconsolidated deposits unconformably overlying Paleozoic limestone bedrock at a depth of approximately 340 ft. The deposits overlying the bedrock consist of the following strata, in order of decreasing depth: the rubble zone, the McNairy Formation, the Porters Creek Clay, the Eocene Sands, the continental deposits, and surficial loess and/or alluvium.

The principal geologic feature in the PGDP area is the Porters Creek Clay Terrace, a large, low-angle, subsurface terrace trending approximately east-west across the southern portion of the plant. This terrace is believed to be the result of the erosion of the Porters Creek Clay by the ancestral Tennessee River. Due to the erosion, the Porters Creek Clay is essentially absent from the PGDP area north of the terrace slope.

North of the terrace slope, the McNairy Formation, a sequence of marine clays, silts, unconsolidated sands, and occasional fine gravel, is directly overlaid by continental deposits. The continental deposits are subdivided informally into the Lower Continental Deposits, consisting of chert gravel in a matrix of sand and silt, and the Upper Continental Deposits, which consist of thin interbedded layers of clayey silt, sand, and occasional gravel. The continental deposits commonly are overlaid by fine-grained aeolian deposits called loess. However, along rivers or creeks, the surficial deposits are typically alluvium.

In the PGDP area south of the terrace slope, the Porters Creek Clay directly overlies the McNairy Formation. The Porters Creek Clay is unconformably overlaid by either the Eocene Sands or the continental deposits. The principal gravel facies within the continental deposits south of the Porters Creek Clay Terrace slope are Miocene-Pliocene gravels, commonly referred to as Terrace Gravel deposits.

Several water-bearing zones are present in the PGDP area. The primary water-bearing units north of the Porters Creek Clay Terrace, in order of increasing depth, are the Upper Continental Recharge System (UCRS), the RGA, and the McNairy Formation. South of the buried terrace slope, the principal water-bearing units are the Terrace Gravel, the Eocene Sands, and the McNairy Formation.

C.5.2 SURFACE WATER

The PGDP is located in the western portion of the Ohio River basin. The plant's surface water drains to tributaries of the Ohio River; surface flow is to the east and northeast toward Little Bayou Creek, and to the west and northwest toward Big Bayou Creek. Both Big Bayou and Little Bayou Creeks are perennial streams that ultimately discharge into the Ohio River. The surface water and surface soils within their drainage areas generally are acidic.

Big Bayou Creek flows generally northward along the western boundary of the plant from approximately 4 km (2.5 miles) south of the plant to the Ohio River. Little Bayou Creek originates within the WKWMA and flows northward along the eastern boundary of the plant. Little Bayou Creek joins Big Bayou Creek in a marsh located approximately 4.8 km (3 miles) north of the PGDP. Other surface water bodies located in the area surrounding the PGDP include the Ohio River, Metropolis Lake, Crawford Lake, numerous small ponds, gravel pits, and settling basins.

At the PGDP, man-made drainage ditches receive storm water and effluent from the plant. These waters are routed through outfalls and eventually discharge into Big Bayou and Little Bayou Creeks. The Kentucky Pollutant Discharge Elimination System (KPDES) permitted outfalls have a combined average daily flow of 18.5 million liters per day (4.88 mgd) and are monitored by the PGDP. The mean and low flows from the 1999 year end report for Outfall 017, which is only sampled during rainfall events, are 1.389 mgd and 0.022 mgd respectively. The mean and low flows for Big Bayou Creek and Little Bayou Creek are 2.165/0.51 mgd and 6.9/1.24 mgd respectively.

Floodplains were evaluated during the 1994 COE environmental investigation of the PGDP. This evaluation used the Hydrologic Engineering Center Computer Program (HEC)-2 model to estimate 100- and 500-year flood elevations. Flood boundaries from the HEC-2 model were delineated on topographic maps of the PGDP area to determine areal extent of the flood waters associated with these events.

Flooding is associated with the Ohio River, Big Bayou Creek, and Little Bayou Creek. The majority of overland flooding at the PGDP is associated with storm-water runoff and flooding from Big Bayou and Little Bayou Creeks. Drainage ditches inside the PGDP security fence can contain nearly all of the expected 100- and 500-year flood discharges.

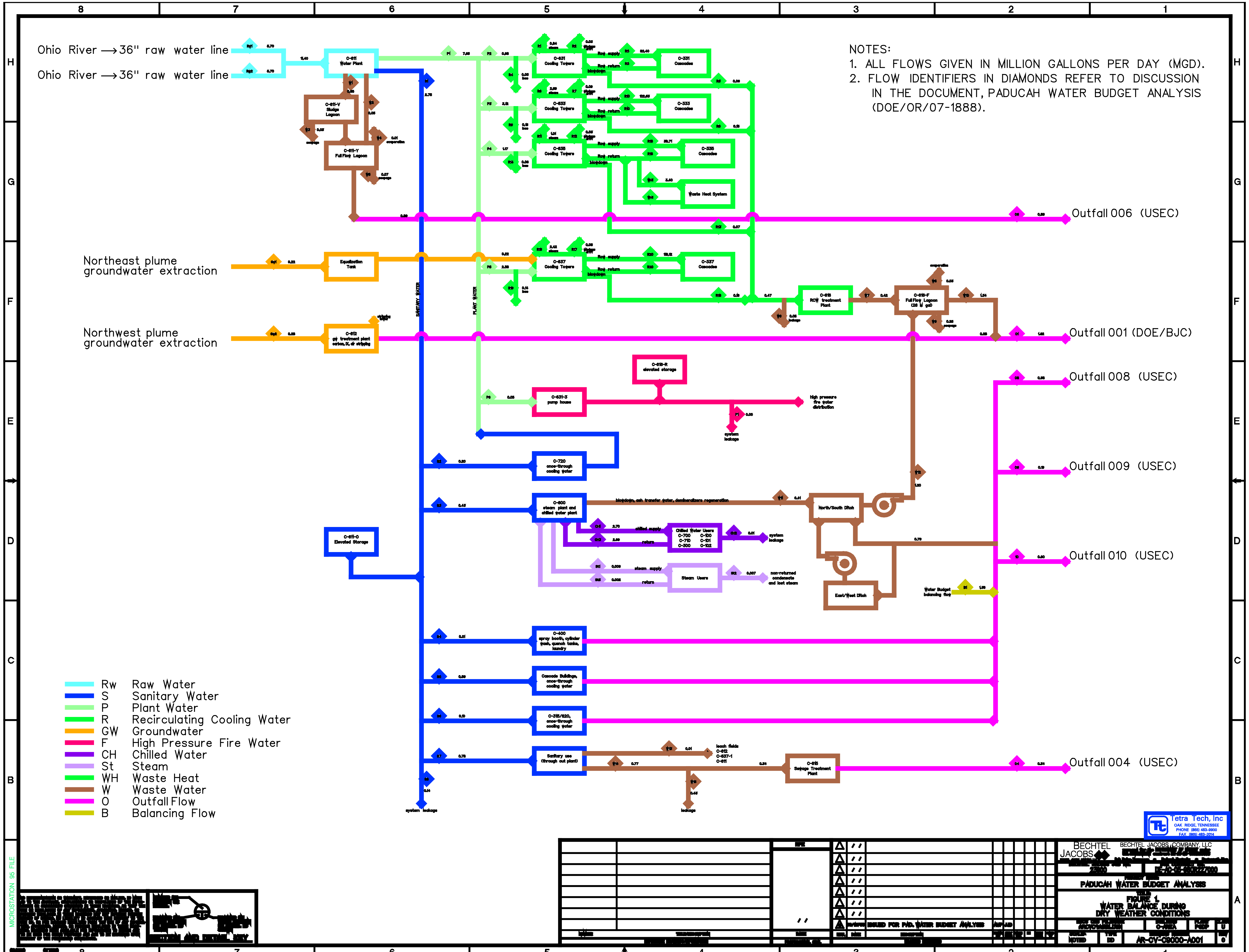
C.6. GROUNDWATER AND SURFACE WATER USAGE PATTERNS

The West Kentucky Wildlife Management Area and some lightly populated farmlands are in the immediate vicinity of the Paducah site. Homes are sparsely located along rural roads in the vicinity of the site. Three communities lie within two miles of the plant: Magruder Village to the southwest and Grahamville and Heath to the east.

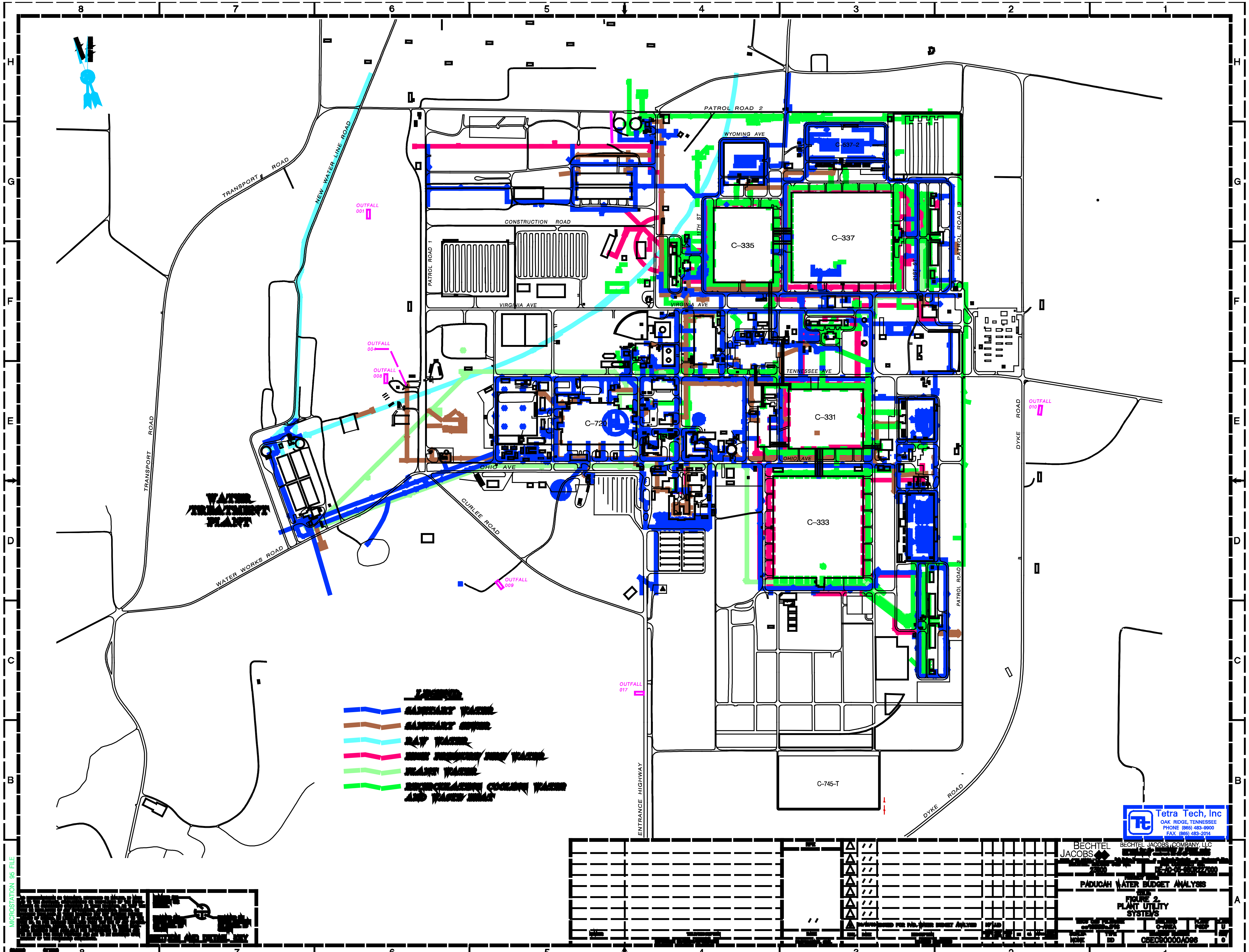
Both groundwater and surface water sources have been used for water supply to residents and industries in the plant area. Wells in the area are screened at depths ranging from 15 to 245 ft. Most of these wells are believed to be screened in the RGA. The Paducah site continues to provide municipal water to all residents within the area of groundwater contamination from the site. These residents' wells have been turned over to the DOE for sampling. Residential wells that are no longer sampled have been capped and locked. (PGDP 1998 Annual Environmental Report)

The PGDP continues to utilize the Ohio River for its process and sanitary water supply.

On the following pages are two figures from the Paducah Water Budget Analysis, June 2000, DOE/OR/07-1888&D1. See Figure 1 for the Water Balance Diagram and Figure 2 for Outfall Locations.



Ohio River → 36" raw water line
Ohio River → 36" raw water line
Northeast plume groundwater extraction
Northwest plume groundwater extraction
NOTES:
1. ALL FLOWS GIVEN IN MILLION GALLONS PER DAY (MGD).
2. FLOW IDENTIFIERS IN DIAMONDS REFER TO DISCUSSION IN THE DOCUMENT, PADUCAH WATER BUDGET ANALYSIS (DOE/OR/07-1888).
Outfall 006 (USEC)
Outfall 001 (DOE/BJC)
Outfall 008 (USEC)
Outfall 009 (USEC)
Outfall 010 (USEC)
Outfall 004 (USEC)
Rw Raw Water
S Sanitary Water
P Plant Water
R Recirculating Cooling Water
GW Groundwater
F High Pressure Fire Water
CH Chilled Water
St Steam
WH Waste Heat
W Waste Water
O Outfall Flow
B Balancing Flow
Tetra Tech, Inc
BECHTEL JACOBS
PADUCAH WATER BUDGET ANALYSIS
FIGURE 1
WATER BALANCE DURING DRY WEATHER CONDITIONS



WATER TREATMENT PLANT
TRANSPORT ROAD
NEW WATER LINE ROAD
WATER WORKS ROAD
CURLEE ROAD
ENTRANCE HIGHWAY
PATROL ROAD 1
PATROL ROAD 2
PATROL ROAD 3
DYKE ROAD
CONSTRUCTION ROAD
VIRGINIA AVE
WYOMING AVE
TENNESSEE AVE
OHIO AVE
OUTFALL 001
OUTFALL 008
OUTFALL 009
OUTFALL 010
OUTFALL 017
C-335
C-337
C-337-A
C-331
C-333
C-720
C-745-T
LEGEND
SANITARY WATER
SANITARY SEWER
RAW WATER
HIGH PRESSURE FIRE WATER
PLANT WATER
RECIRCULATING COOLING WATER AND WASTE HEAT
Tetra Tech, Inc
OAK RIDGE, TENNESSEE
PHONE (865) 483-9900
FAX (865) 483-2014
BECHTEL JACOBS
BECHTEL JACOBS COMPANY, LLC
23900
DE-AC-05-98OR22700
PADUCAH WATER BUDGET ANALYSIS
FIGURE 2.
PLANT UTILITY SYSTEMS
C-AREA
PGDP
NONE
DD
C5EC90000A096
MICROSTATION 95 FILE

C.7. SITE WASTE MANAGEMENT (GENERATION/CAPACITIES/DISPOSITION)

INTEGRATED WASTE MANAGEMENT PLAN FOR THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, BJC/PAD-49/R2, NOVEMBER 1999

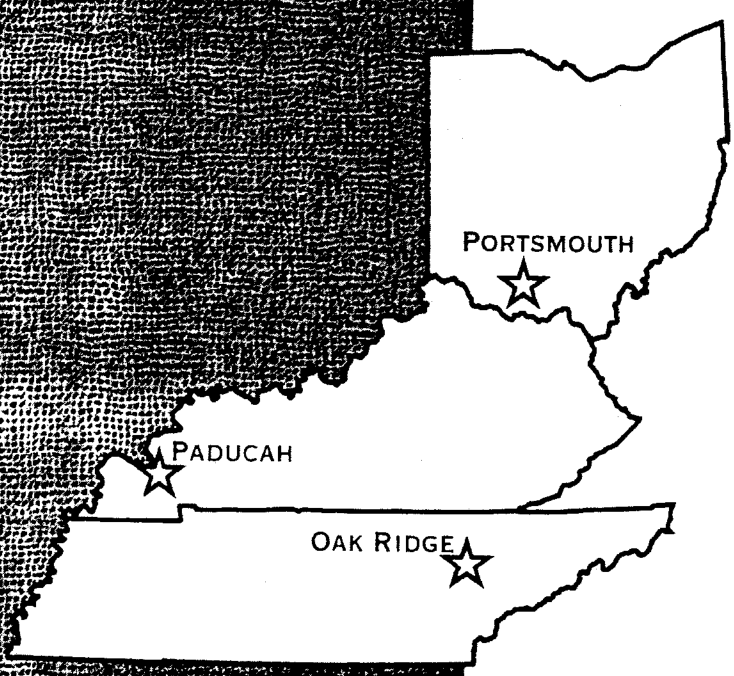
(see attached)

BECHTEL JACOBS
Bechtel Jacobs Company LLC

BJC/PAD-49/R2

ENVIRONMENTAL MANAGEMENT
& ENRICHMENT FACILITIES
MANAGEMENT AND INTEGRATION CONTRACT

Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky



MANAGED BY
BECHTEL JACOBS COMPANY LLC
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

This document has received the appropriate reviews for release to the public.

BJC/PAD-49/R2

Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued - November 1999

Prepared by
Pro-2-Serve Professional Project Services, Inc.
under subcontract 23900-BA-ES144

Prepared for the
U.S. Department of Energy
Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

PREFACE

This Integrated Waste Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, BJC/PAD-49/R2, was prepared under Work Breakdown Structure 04.03.02.01.02 and 04.03.01.01.02. This document meets the objectives of the task by providing waste management support for low-level and mixed low-level wastes. It describes the Bechtel Jacobs Company LLC plan for future management of waste at the Paducah Gaseous Diffusion Plant.

CONTENTS

APPENDICES

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

^{99}Tc	technetium-99
AW	accumulated waste
CBST	commercial broad spectrum treatment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
C.F.R.	*Code of Federal Regulations*
cm	centimeter(s)
DMSA	United States Department of Energy Material Storage Areas
DOE	United States Department of Energy
EA	environmental assessment
EE/CA	engineering evaluation/cost analysis
EF	Enrichment Facilities
EH	DOE Office of Environment, Safety, and Health
EM	environmental management
EPA	United States Environmental Protection Agency
ER	environmental restoration
ft^3	cubic feet
Fed. Reg.	*Federal Register*
FFCA	Federal Facility Compliance Agreement
FFC Act	Federal Facility Compliance Act
FY	fiscal year
FYB	fiscal year baseline
g	gram(s)
gal	gallon
HQ	headquarters
HSWA	Hazardous and Solid Waste Amendments of 1984
INEEL	Idaho National Engineering and Environmental Laboratory
IWMP	Integrated Waste Management Plan
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Department for Environmental Protection, Division of Water
KDWM	Kentucky Department for Environmental Protection, Division of Waste Management
km	kilometer(s)
KPDES	Kentucky Pollutant Discharge Elimination System
LCB	life cycle baseline
LDR	land disposal restriction
LLW	low-level waste
LMES	Lockheed Martin Energy Systems, Inc.
m	meter(s)
m^3	cubic meter(s)
M&I	management and integration
MLLW	mixed low-level waste
NEPA	National Environmental Policy Act
ORO	Oak Ridge Operations
PCB	polychlorinated biphenyl
pCi	picocurie(s)
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment

ppm	parts per million
RAD	radioactive
RCRA	Resource Conservation and Recovery Act of 1976
R&D	research and development
RD&D	research, development, and demonstration
RMMA	radioactive material management area
RWMB	radioactive waste management basis
sec	second
STP	site treatment plan
TCLP	Toxicity Characteristic Leaching Procedure
TRU	transuranic
TS	Technical Subcontractor
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage, and disposal
TSDF	treatment, storage, and disposal facility
UE	Uranium Enrichment
UF_6	uranium hexafluoride
U.S.C.	*United States Code*
U.S.C.A.	*United States Code Annotated*
USEC	United States Enrichment Corporation
WAC	waste acceptance criteria
WAG	waste area group
WERF	Waste Experimental Reduction Facility
WBS	work breakdown structure
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

WASTE MANAGEMENT

Bechtel Jacobs Company LLC manages and integrates the Environmental Management (EM) and Enrichment Facilities (EF) programs for the United States Department of Energy (DOE). Wastes managed by Bechtel Jacobs Company at the Paducah Gaseous Diffusion Plan (PGDP) include legacy wastes that were generated prior to the leasing of production facilities to the United States Enrichment Corporation (USEC) July 1, 1993, and wastes generated from EM and EF activities. These are classified into five major categories:

(1) MLLW [Resource Conservation and Recovery Act (RCRA)/radioactive (RAD), Toxic Substances Control Act (TSCA)/RCRA/RAD, and TSCA/RAD];

(2) LLW;

(3) Hazardous waste (RCRA and TSCA);

(4) Sanitary/industrial waste; and

(5) TRU waste.

As of July 30, 1999, the PGDP legacy waste inventory includes 3,821.0 m^3 of MLLW, 6,378.6 m^3 of LLW, and 4.6 m^3 of TRU waste. In addition, approximately 93,315 m^3 of scrap metal are in storage.

The waste projects to treat and/or dispose the stored waste currently planned by the Bechtel Jacobs Company for fiscal year (FY) 2000 are already incorporated into the fiscal year baseline (FYB). These waste volumes are deducted from the FY 1999 inventory accordingly. The waste reduction as a result of the FY 2000 projects and a projection of the end of year waste inventory through FY 2012 is presented in Table ES-1. The FY waste disposition volumes are offset by waste generated through onsite treatment in FY 2000.

Table ES-1. End of Year Waste Disposition

	Actual	FYB	Projected										
	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11-12
Waste Disposed		122.3	358.8	352.2	342.3	404.3	315.6	511.0	760.6	2343.7	2254.7	880.9	1650.6
Total Volume	10204.2	10174.7	9815.9	9463.7	9121.4	8717.1	8401.5	7890.5	7129.9	4786.2	2531.5	1650.6	0

All volumes are m^3

A graphical presentation of the end of year waste inventory by waste type and total inventory is presented in Figure ES-1. These projections, by waste type and FY, will be the basis for the development of a FY life cycle baseline (LCB) for the PGDP waste projects.

The 146 individual waste streams in storage at the PGDP were ranked utilizing a risk-based ranking system that incorporates public safety and health, site personnel safety and health, compliance, mission impacts, and mortgage reduction (LMES, 1998a). Those with the higher risk were scheduled for treatment or disposal before the lower risk waste streams. The waste streams that remained at the end of FY 2000 were addressed in a decision-making process utilizing the risked-based methodology, regulatory drivers, waste disposition maps, and professional judgment. The detailed results of this waste disposition process are presented in Appendix A.

The waste disposition in Appendix A was developed from the risk-based ranking of waste. Waste in inventory at the end of FY 1999 is addressed by the FYB in FY 2000. The disposition is projected from FY 2001 through FY 2012. The majority of the high-risk waste is MLLW. Approximately 50% of the MLLW remaining at the end of FY 2003 is treated and/or disposed of from FY 2004 through FY 2008, and the remaining 50% of the waste is addressed in FY 2009 through FY 2012. The majority of the LLW (typically lower risk) is projected to be disposed of during FY 2008 through FY 2012.

Several waste streams in inventory may require further characterization in order to quantify the level of radioactive constituent or polychlorinated biphenyls (PCBs). When these levels are quantified, it is anticipated that an additional amount of waste that is currently scheduled for disposal as LLW or hazardous/TSCA may be disposed of onsite in the landfill. These assumptions will be evaluated further and incorporated into the waste disposition database at a later date.

During FYs 2000, 2001 and 2002, the PGDP EM program and other EF activities will generate a significant volume of waste. The wastes generated as a result of these projects are not incorporated into the legacy waste disposition process but are presented separately.

An estimate of the anticipated total waste, excluding scrap metal, to be generated for FYs 2000, 2001, and 2002 is presented in Table ES-2.

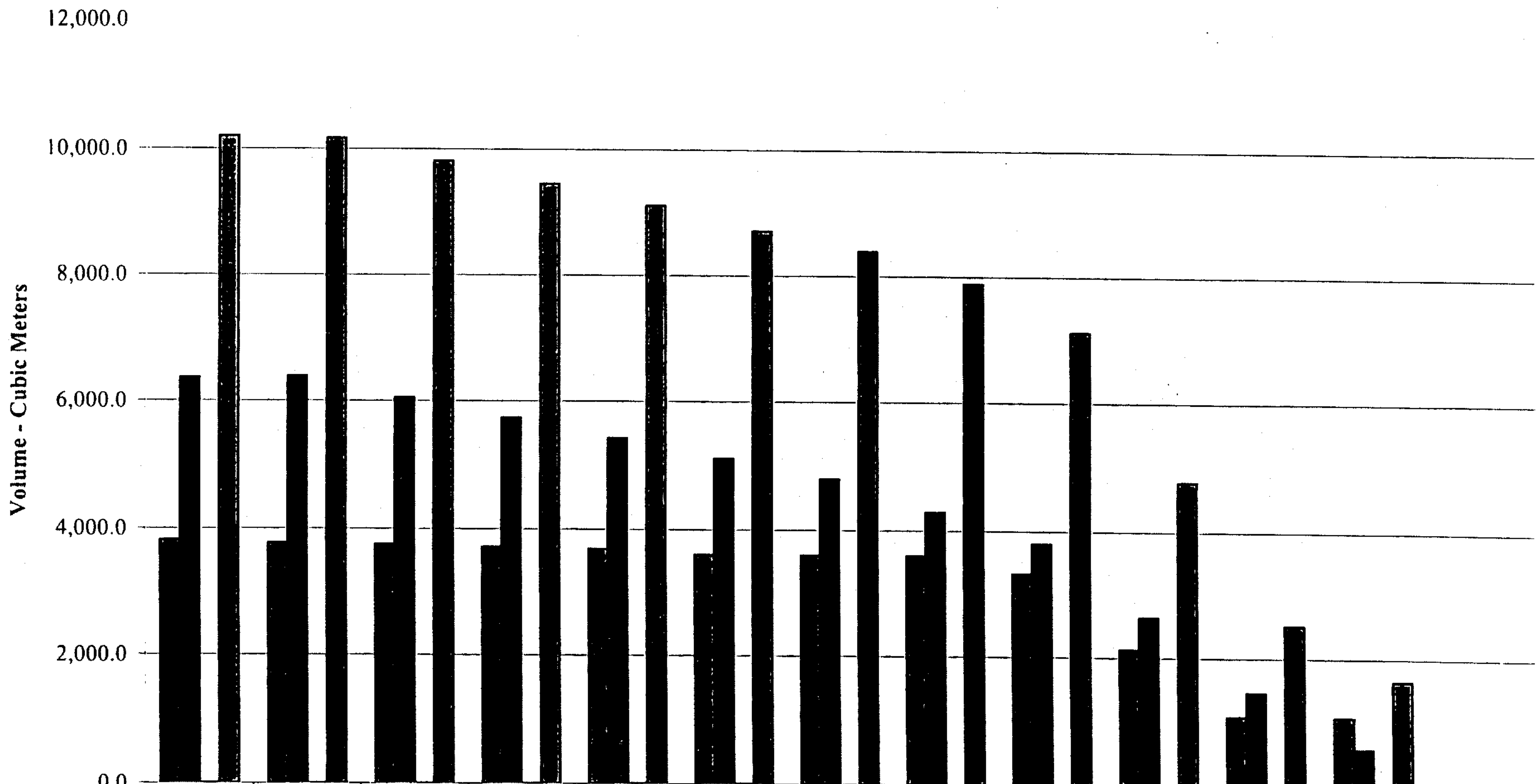
Table ES-2. Waste Generation Forecast

Year	FY 2000	FY 2001	FY 2002
Total Volume (m^3)	2,632	2,784	2,125

A detailed breakdown of each waste stream generated is presented in Appendix B.

Bechtel Jacobs Company is conducting waste project operations for DOE at the PGDP. A summary of the accomplishments for FY 1999 and descriptions of the waste projects planned for FY 2000 are provided in the following subsections.

Fig. ES-1 End of year waste disposition/projection



	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11-12
MLLW	3,821.0	3,771.7	3,755.8	3,718.4	3,687.0	3,593.8	3,593.8	3,593.8	3,323.2	2,132.2	1,075.6	1,074.5	0.0
LLW	6,378.6	6,398.4	6,055.6	5,740.8	5,429.8	5,118.8	4,807.8	4,296.8	3,806.8	2,654.0	1,456.0	576.2	0.0
TRU	4.6	4.6	4.6	4.6	4.6	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL:	10,204	10,175	9,816	9,464	9,121	8,717	8,402	7,891	7,130	4,786	2,532	1,651	0

Fiscal Year 1999 Accomplishments

- Issued an engineering evaluation/cost analysis (EE/CA) for the removal of all scrap metal by FY 2003.
- Shipped 21 m^3 (5,518 gallons) of PCB/RCRA/RAD liquid waste to the ETTP TSCA Incinerator.
- Treated 6.5 m^3 of pyrophoric uranium metal chips to meet Envirocare of Utah Waste Acceptance Criteria.
- Shipped 8 m^3 of newly generated MLLW to Envirocare for treatment and disposal.
- Shipped 12.6 m^3 of MLLW to Waste Control Specialists (WCS) for treatment.
- Shipped 120 m^3 of LLW to Envirocare for disposal.
- Disposed of 699 m^3 of reclassified LLW meeting the C-746-U WAC in the C-746-U Contained Landfill.
- Awarded the Waste Operations Subcontract to Weskem LLC.
- Characterized 29 waste streams, representing 760 containers under the TCLP FFCA.
- Disposed of approximately 5,213 tons of industrial waste/construction debris in the C-746-U Contained Landfill.
- Continued DMSA project field activities. Completed corrective actions within 13 DMSAs and 8 DMSAs are at least 90% complete.
- Closed 34 PCB gaskets spills and 23 PCB non-gasket spills.
- Modified the Paducah Hazardous Waste Permit to allow on-site treatment.
- Completed the construction of an enclosure located in C-752-A. The enclosure will be used for waste sampling, sorting, and treatment.
- Issued for public comments the Vortec Vitrification Demonstration NEPA Environmental Assessment (EA).

Fiscal Year 2000 Waste Projects

Low-Level Waste Projects - TCLP (WBS 04.03.01.01.01.01)

- Sample and characterize approximately 1760 containers of waste under the jurisdiction of the TCLP FFCA.

Mixed Low-Level Waste Projects - Vortec Vitrification Demonstration (WBS 04.03.02.01.01.01)

- Continue technical and permitting support, in support of RCRA, air and TSCA permits; continue database searches for candidate wastes; preparation and necessary revisions of operation and maintenance manual and construction project plan in conjunction with Vortec project development.

Mixed Low-Level Waste Projects - Mixed Waste Characterization and Treatment (WBS 04.03.02.01.01.02)

- Perform waste tracking, reporting, and documentation as required by the STP.

- Treat MLLW streams:

  - 150 containers of acids and bases
  - 38 containers of glass beads
  - 9 containers of nickel stripper sludge
  - 14 containers of hydrolyzed UF_6
  - 6 containers of ash material
  - 18 containers of high radioactivity solids
  - 12 containers of magnesium fluoride pellets
  - 17 containers of cylinder wash sludge

- Remove and treat ^{99}Tc sludge from the C-746-Q Building's 4,000 gallon container

- Perform waste sampling as needed to characterize newly generated waste for treatment within appropriate schedule.

Mixed Low-Level Waste Projects - Mixed Waste Disposals (WBS 04.03.02.01.03)

- Make two shipments of newly generated mixed wastes and stabilized wastes for disposal to Envirocare of Utah.

Mixed Low-Level Waste Projects - TSCA Incinerator (WBS 04.03.02.01.03)

- Make two shipments of liquid waste representing approximately 10,000 gallons of RCRA/TSCA oils, waters, and sludges to the TSCA Incinerator.

- Make four shipments of soft combustibles representing approximately 275 containers of RCRA/TSCA wastes to the TSCA Incinerator.

Mixed Low-Level Waste Projects - INEEL WERF (WBS 04.03.02.01.03)

- Make two shipments of RCRA soft solids representing approximately 100 containers to INEEL WERF.

Hazardous Waste Projects - Waste Water Treatment (WBS 04.03.04.01.01.01)

- Treat on-site and discharge approximately 5000 gal of organic contaminated wastewater.

Hazardous Waste Projects - PCB Capacitors Shipment (WBS 04.03.04.01.03)

- Ship off-site approximately 1,000 PCB capacitors for disposal at Safety Kleen in FY 2000. The units removed include both large high-voltage capacitors and small capacitors that are regulated waste under TSCA 40 CFR Part 761.

- Complete the planning and procurement for the FY 2001 disposal of 13 large PCB transformers.

Sanitary Waste Projects - Waste Water Disposal (WBS 04.03.05.01.03.03)

- Collect, characterize, and discharge 9,600 gallons of sanitary wastewater.

Scrap Removal Decision Documents (This work scope is included under the Paducah Surface Water Cleanup – WBS 04.01.02.04.02.06)

- Complete the decision documents for Drum Mountain removal consisting of an Engineering Evaluation/Cost Analysis (EE/CA) and an Action Memorandum.

Scrap Metal Removal Procurement (This work scope is included under the Paducah Surface Water - Cleanup WBS 04.01.02.04.02.06)

- Complete the removal of Drum Mountain.

1. INTRODUCTION

This document is an Integrated Waste Management Plan (IWMP) for the Bechtel Jacobs Company LLC at the Paducah Gaseous Diffusion Plant (PGDP), which is owned by the United States Department of Energy (DOE).

1.1 STATEMENT OF PURPOSE

This IWMP update presents a comprehensive plan for disposition of all legacy waste streams at the PGDP. The IWMP is driven by several factors including the following:

- Waste project requirements of the Bechtel Jacobs Company to meet waste management milestones in the U.S. *Department of Energy Environmental Management Program Initial Accelerating Cleanup Paths to Closure, Oak Ridge Operations Office* (DOE, 1999);

- Provision of a plan forward for disposition of all waste streams at the PGDP through this IWMP and waste projects; and

- Support of groundwork for a life cycle baseline (LCB) that will meet all of these goals by the end of fiscal year (FY) 2012.

- DOE Order 435.1, Radioactive Waste Management.

This plan incorporates risk-based waste rankings, regulatory and permit drivers, waste disposition maps, and professional judgment. The waste disposition/waste projects baseline process is presented in Figure 1.

The Bechtel Jacobs Company Paducah waste projects are organized by work breakdown structure (WBS) into five project categories. These categories include

(1) Mixed low-level waste (MLLW) (Section 2);

(2) Low-level waste (LLW) (Section 3);

(3) Hazardous waste (Section 4);

(4) Sanitary/industrial waste (Section 5); and

(5) Transuranic waste (TRU) (Section 6).

The waste disposition maps present a conceptual identification of treatment and disposal options for each category of waste (DOE, 1999). These maps will be used to support initial waste treatment and/or disposal options. The waste disposition maps include the Paducah environmental restoration (ER) disposition, MLLW disposition, LLW disposition, hazardous and TRU waste disposition. The complete set of disposition maps is presented in Appendix C (DOE, 1999).

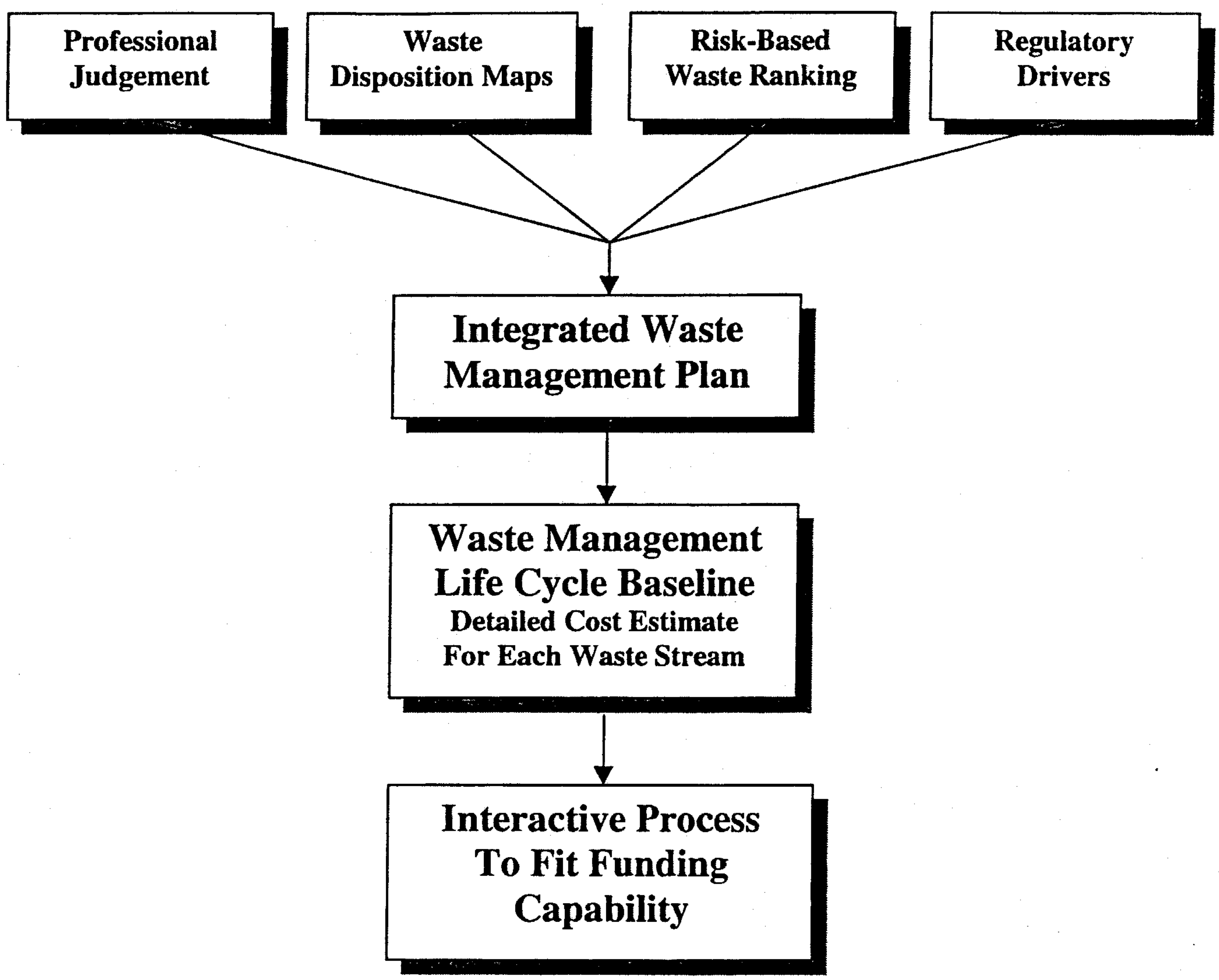


Figure 1. Waste disposition process

This process will be utilized for each individual waste stream from FY 2001 through FY 2012. When combined with the fiscal year baseline (FYB) and LCB tasks that are currently planned for FYs 2000, 2001, and 2002, the entire legacy waste inventory at the PGDP is addressed in a comprehensive plan, which is presented as Appendix A. This plan will be utilized to identify waste volumes by waste type, driver, treatment and disposal needs, and annual treatment/disposal requirements to support development of the waste projects LCB. This waste report will not include waste currently stored in DOE Material Storage Areas (DMSAs).

The PGDP ER Program waste generation forecasts and other on-site waste generation sources are also presented in this IWMP for FYs 2000, 2001, and 2002. These waste projections are categorized by waste type to match the waste projects WBS classifications (see Figure 2). The newly generated waste streams will not be added to the legacy waste disposition analysis, but will be projected by year and category parallel to the legacy waste information. A detailed description of the waste generation forecast for FYs 2000, 2001 and 2002 is presented in Appendix B.

To facilitate the new direction of this IWMP, the document sections are divided according to waste classifications consistent with the Bechtel Jacobs Company WBS. Each section will present

- The legacy waste inventory as of 1999;
- Disposition of the waste for FY 2000 according to the planned FYB and LCB tasks;
- Waste drivers; and
- Projection of waste disposition by fiscal year from FY 2001 through FY 2012.

Drivers for each waste stream also are determined and incorporated into the decision-making process for waste disposition. A discussion of drivers for waste projects is presented in Section 1.3.

Bechtel Jacobs Company is developing a new plan for the radiologically contaminated scrap metal inventory at the PGDP. This goal is supported by the development of an engineering evaluation/costs analysis (EE/CA) for the PGDP scrap metal inventory in FY 1999. This EE/CA develops and evaluates alternatives for the scrap metal inventory. Plans for FY 2000 include obtaining approval of the EE/CA for Drum Mountain removal, preparation of a Request for Proposal, evaluations of the proposal(s), removal work plan(s), and completing the removal of Drum Mountain. Details regarding the scrap metal strategy and the inventory at the PGDP are presented in Section 7.

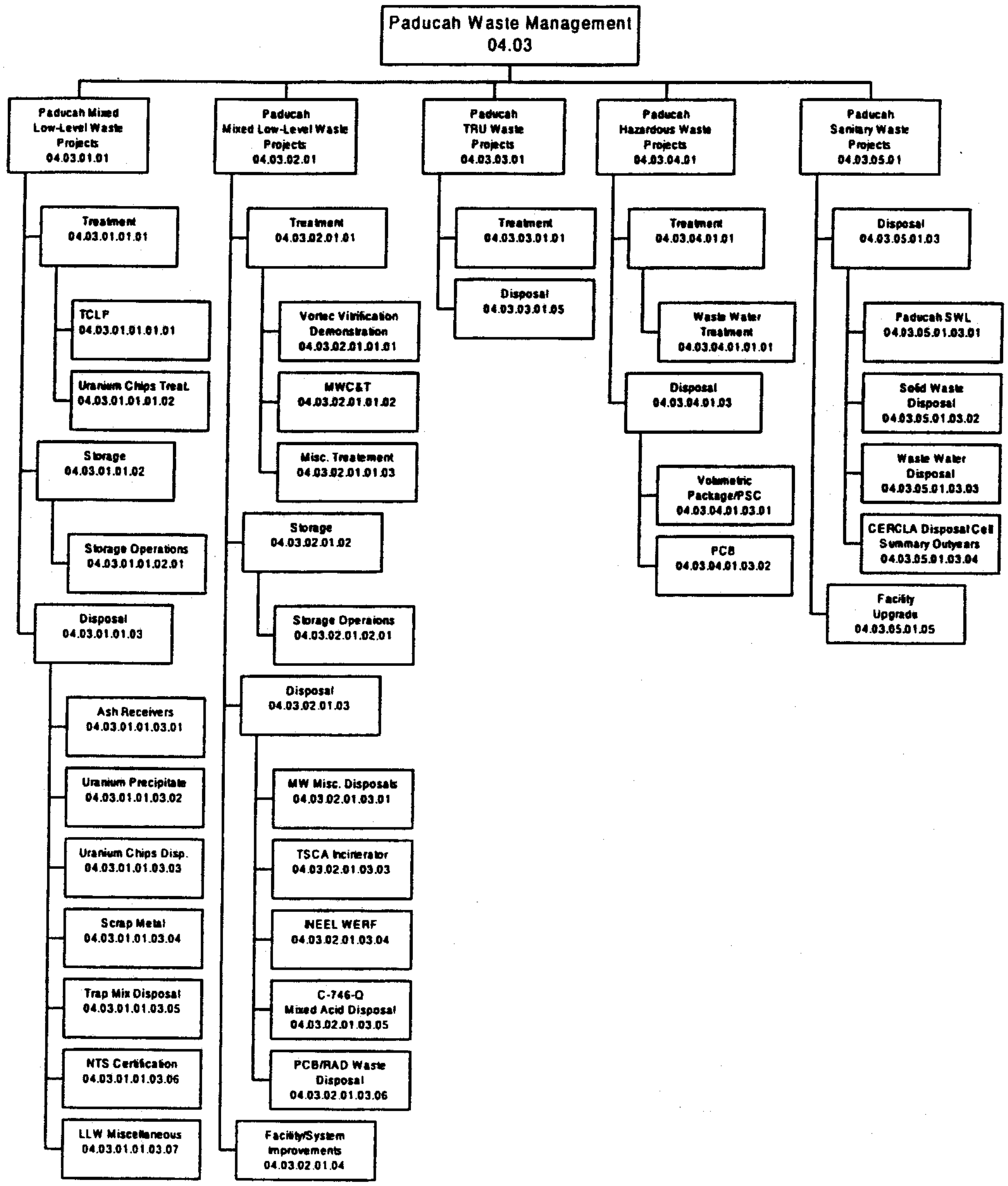


Figure 2. Work breakdown structure

1.2 FACILITY DESCRIPTION

The PGDP is located in McCracken County in western Kentucky, approximately 5.6 km (3.5 miles) south of the Ohio River and 32.2 km (20 miles) east of the confluence of the Ohio and Mississippi Rivers. Paducah, Kentucky is approximately 16.1 km (10 miles) east of the plant. Several small communities (including Heath and Grahamville to the east and Kevil to the southwest) are within a five-mile radius of DOE property boundaries.

Although construction of the plant began in 1951 and start-up occurred in 1952, full production of enriched uranium for commercial and national defense reactors was not achieved at the facility until 1955. Since beginning operation, the PGDP has generated and disposed of hazardous, nonhazardous, radioactive (RAD), polychlorinated biphenyl (PCB), TRU and mixed wastes.

In October 1992, congressional passage of the Energy Policy Act (Public Law No. 102486, 106 Statute 2776, codified in scattered sections of 42 U.S.C.A.) established the United States Enrichment Corporation (USEC) (42 U.S.C.A. 2297b). Effective July 1, 1993, DOE leased the plant production facilities to the USEC. Martin Marietta Utility Services, Inc., was created as a subsidiary of Martin Marietta Corporation to operate the leased facilities for the USEC under the prior operating contract. Martin Marietta Utility Services, Inc., is now known as Lockheed Martin Utility Services, Inc., due to the merger of Lockheed with Martin Marietta. Currently, Bechtel Jacobs Company manages and integrates the environmental and waste projects for DOE and is the retaining manager and co-operator of facilities not leased to the USEC.

The USEC is responsible for process wastes generated after July 1, 1993. The DOE is responsible for waste generated prior to that date (i.e., legacy wastes); certain waste streams generated by USEC per the lease agreement and for wastes generated through Environmental Management and Enrichment Facilities activities (presented separately).

1.3 ENVIRONMENTAL COMPLIANCE OVERVIEW

Regulatory drivers for the DOE's waste projects include the following:

- The Hazardous Waste Management Permit issued by the Commonwealth of Kentucky and the Hazardous and Solid Waste Amendments Permit issued by the United States Environmental Protection Agency;
- The PGDP's Site Treatment Plan (STP) Agreed Order, which provides a plan for the treatment, storage, and disposal (TSD) of hazardous waste as required by the Federal Facility Compliance Act (FFC Act);
- DOE Order 435.1, *Radioactive Waste Management*;
- The Uranium Enrichment (UE) Toxic Substances Control Act (TSCA) Federal Facility Compliance Agreement (FFCA) for the PGDP, pertaining to PCB waste; and
- The Toxicity Characteristic Leaching Procedure (TCLP) FFCA for the PGDP.

While waste management practices must adhere to other permits [e.g., the Kentucky Pollutant Discharge Elimination System (KPDES) Permit], the above-referenced drivers are the force for the DOE's waste projects. For more detailed information regarding the regulatory framework for the DOE's waste projects, including recent changes to certain regulatory drivers that could impact DOE's waste management practices (e.g., the TSCA regulatory revisions), refer to Appendix D.

1.4 RISK-BASED METHODOLOGY

The PGDP waste projects have adopted a risk-based waste management strategy to evaluate and prioritize treatment and/or disposal of waste streams (LMES, 1998a). This prioritization will incorporate several factors including public safety and health, site personnel safety and health, environmental protection, compliance, mission impact, and mortgage reduction.

Each waste stream has been ranked with a numerical factor by impact category, prioritized by total impact ranking score, and then addressed by fiscal year in the FYB and LCB. The scoring results by impact category and prioritization by total risk-based score are presented Appendix E (Leone, 1998).

This risked-based prioritization is utilized to identify annual waste stream disposition volumes to meet the program goal of complete disposition of all waste streams by the end of FY 2012.

The expected remaining legacy waste inventory at the end of FY 2001 is approximately 9,816 m^3. The disposition for the following 7 fiscal years will address 50% of the waste inventory. The remaining 50% will be addressed over the last 4 fiscal years. This distribution will facilitate the disposition of the MLLW inventory, which generallv is ranked higher in the risk-based rankings and for which disposal is more expensive. This initial distribution may be adjusted by waste stream and year to meet LCB requirements.

1.5 KEY ASSUMPTIONS

This IWMP is based, in part, on the following assumptions:

1.5.1 Mixed Low Level Waste

- MLLW will be treated and disposed of according to the Site Treatment Plan requirements
- The Vortec demonstration facility will be completed in FY 2001 and will process approximately 865 m^3 of waste (420 m^3 PCB/RAD, 25 m^3 RCRA/RAD, and 420 m^3 LLW)
- Treatment technologies exist for all MLLW utilizing a combination of the Broad Spectrum Procurement and other commercial treatments
- Treated waste volumes will increase by a factor of two and one half
- PCB/RAD wastes will not require treatment prior to disposal
- No new permitted facilities will be required
- Envirocare of Utah will be able to dispose of PCB/RAD
- Disposal options exist for legacy MLLW
- The disposal of waste generated after October 1, 1998 will be the responsibility of the generator

1.5.2 Low Level Waste

- No treatment is required for LLW
- No new waste storage facilities will be required
- Current LLW storage is not in full compliance with DOE 435.1
- Envirocare of Utah will be available for the disposal of LLW
- The disposal of waste/scrap materials generated after October 1, 1998 will be the responsibility of the generator

1.5.3 Hazardous Waste

- Hazardous wastewater will be treated on-site and discharged in compliance with Kentucky Pollution Discharge Elimination System limitations
- The generator will be financially responsible for newly generated hazardous waste characterization, treatment, and discharge activities
- PCB capacitors and transformers will be disposed of at commercial PCB-licensed facilities
- PCB capacitors and transformers will meet off-site release criteria as "no rad added." Decontamination may be required.
- USEC will remove the remaining PCB capacitors by the beginning of FY 2002.

1.5.4 Sanitary Waste

- Waste in storage will be evaluated and characterized against the Paducah Solid Waste Landfill waste acceptance criteria and disposed of accordingly
- Sanitary wastewater disposal estimates are based on average rainfall events and the current facilities being managed
- Landfill leachate will not require any treatment for PCBs or uranium prior to discharge
- Additional landfill cells will be installed to receive solid waste

1.5.5 Transuranic Waste

- The TRU waste treatment formula developed from each treatability study is acceptable and meets RCRA limits as well as the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria.
- The volume of treated TRU waste will increase by approximately a factor of 2.5
- Oak Ridge Legacy Waste will accept Paducah treated TRU waste and will combine the Paducah treated waste with disposal shipment to WIPP

1.5.6 Scrap Metal

- Scrap material tasks will be funded by the Remedial Action Project, but will be managed by the Waste Management Project

1.6 SUBCONTRACTING

The principal PGDP Waste Management FY 2000 subcontracting activities that support the final management and integration goal of subcontracting over 90% of environmental and waste management projects by April 2000 include the following:

- Waste Operations Services (September 1999)
- Drum Mountain Removal

1.7 INTEGRATED SAFETY MANAGEMENT

The PGDP Waste Management Project is committed to ES&H excellence through the implementation of Integrated Safety Management, consistent with the "Integrated Safety Management System Description (BJC/OR-87, Revision 2). Quality control, quality assurance, and operational measures are utilized as appropriate to ensure that wastes are accounted for and confined, and to minimize the potential risk to workers, the public, and the environment. The operational measures include, but are not limited to, adherence to established programs for radiological controls, facility safety, criticality safety, emergency management, fire protection, packaging and transportation safety, industrial hygiene, industrial safety, and lessons learned.

Before a subproject begins, all potential hazards must be identified and participants must demonstrate completion of rigorous health and safety reviews and the identification of all potential hazards. The routine activities in WM are conducted in accordance with standard operating procedures, activity hazard analyses, and Integrated Safety Management plans. Nonroutine work requires a readiness assessment as necessary to ensure complete health, safety, and environmental reviews prior to work start. This assessment is performed by fully qualified personnel with relevant experience that are given the latitude to examine all aspects of a project prior to commencement. The project team must provide documented evidence that all applicable requirement of the job have been met.

2. MIXED LOW-LEVEL WASTE (RCRA/RAD, PCB/RAD & RCRA/PCB/RAD)

MLLW is a waste containing both a hazardous waste subject to Resource Conservation and Recovery Act (RCRA) and/or a PCB waste subject to the Toxic Substances Control Act (TSCA) as well as a source, special nuclear, or byproduct material, subject to the Atomic Energy Act (42 U.S.C. 2011 *et seq.)*

2.1 WASTE INVENTORY/PROJECTIONS

The FYB for FY 2000 includes numerous treatment and disposal tasks to address the 3,821 m^3 of MLLW currently in storage. Tasks will address solid, soft solids, and liquid MLLW based on risk rankings and regulatory drivers. The projects for FY 2000 are scheduled to dispose of approximately 122 m^3 of MLLW, while generating approximately 73 m^3 of MLLW residuals, for a net inventory reduction of 49 m^3 MLLW.

The detailed breakdown of the MLLW in inventory and the waste stream disposition are presented in Appendix A. The annual disposition of MLLW by fiscal year is presented in Figure 3. Generation of residual waste from treatment is incorporated into volume projections.

The waste projections for FY 2001 through FY 2012 were developed utilizing risk rankings, regulatory and permit drivers, waste disposition maps, and the professional judgment of the Bechtel Jacobs Company waste projects staff. Projections by year are developed to eliminate all legacy MLLW at the PGDP by the end of FY 2012. This distribution of waste by fiscal year will be the basis for the LCB for MLLW tasks.

The generation of MLLW during the FY 2000 through FY 2002 time frame is presented in Table 1. These waste streams are presented parallel to the legacy waste projections. A detailed description of the MLLW forecast for FYs 2000, 2001, and 2002 is presented in Appendix B.

Table 1. Mixed low level waste generation forecast

Year	FY 2000	FY 2001	FY 2002
Total Volume (m^3)	54.2	101.0	52.7

2.2 REGULATORY DRIVERS

As discussed above, MLLW is a waste containing RCRA and/or a PCB waste subject to TSCA as well as a source, special nuclear, or byproduct material, subject to the Atomic Energy Act (42 U.S.C. 2011 *et seq.)*. The following sections provide information regarding the PGDP's management of mixed wastes.

Management and disposal of radioactive waste must follow applicable DOE orders. If the radioactive waste also contains PCBs, the UE TSCA FFCA requirements would apply. In addition, if it contains hazardous waste, the requirements of the PGDP's RCRA permits would apply.

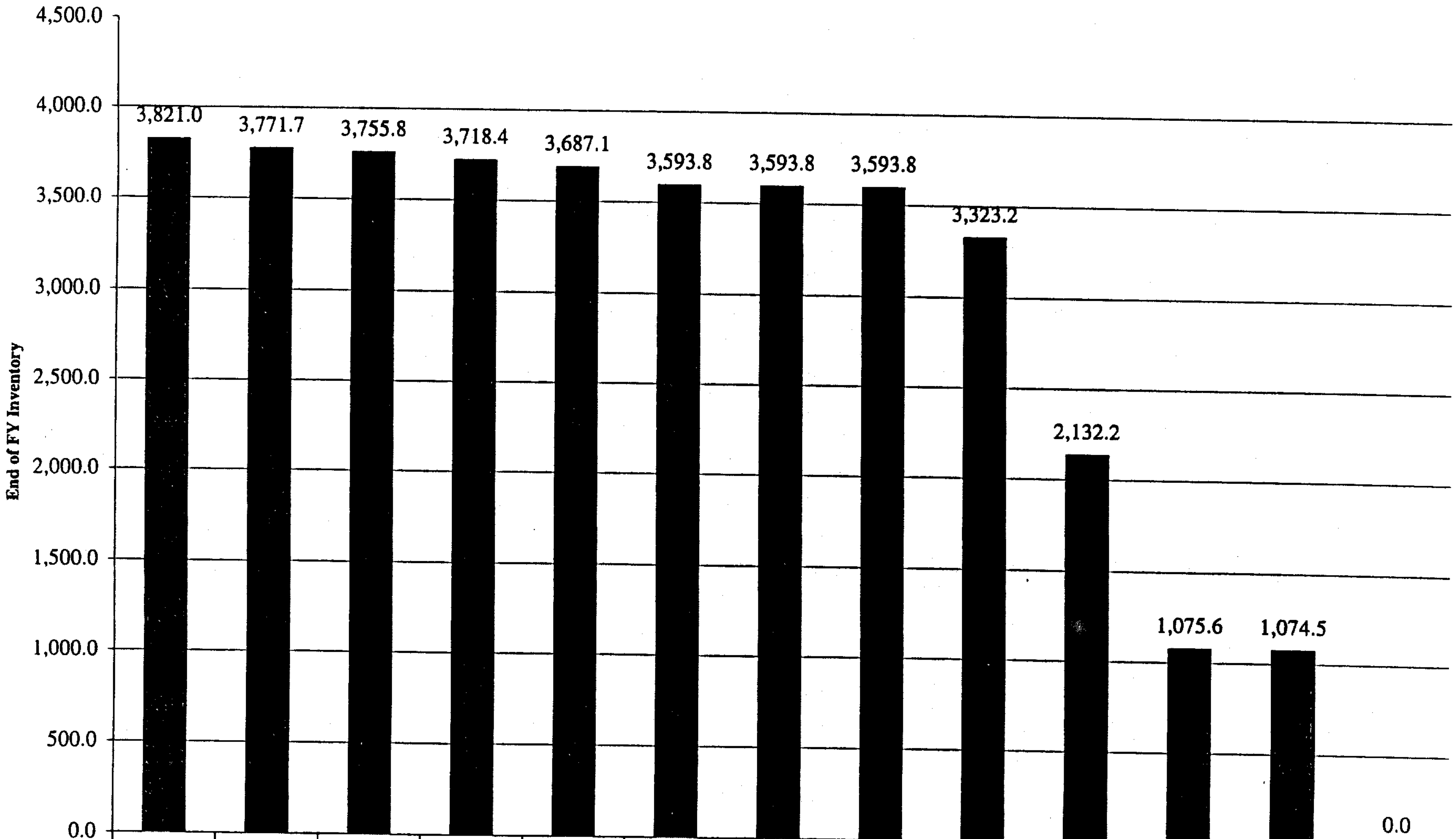
2.3 SITE TREATMENT PLAN

According to the STP Annual Update (Bechtel Jacobs Co. LLC, 1999), DOE is currently storing 475.28 m^3 of mixed waste (RCRA/LLW). The following are the treatment options for DOE's RCRA mixed waste streams.

- The photographic fixer solution waste stream will be shipped to a commercial vendor for treatment by January 31, 2002. The miscellaneous TCLP waste developer solution, photo chemicals, and miscellaneous TCLP waste carbon filters waste streams will be shipped for commercial recycling by January 31, 2002.

- Applicable waste streams will be characterized for surface radiological contamination by July 31, 2001. The DOE must submit a treatment plan for these waste streams to regulatory agencies by January 31, 2002.

Figure 3. Mixed low level waste disposition/projection



	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11-12
m3	3,821.0	3,771.7	3,755.8	3,718.4	3,687.1	3,593.8	3,593.8	3,593.8	3,323.2	2,132.2	1,075.6	1,074.5	0.0

- A waste stream of 111.70 m^3 of RCRA/RAD solids has been targeted for treatment at Idaho National Engineering and Environmental Laboratory (INEEL) Waste Experimental Reduction Facility (WERF) Incinerator by January 31, 2004.

- A waste stream of 72.13 m^3 of solids containing PCBs has been targeted for treatment at the TSCA Incinerator by January 31, 2004. Residues from the waste stream will be stored at Oak Ridge Operations (ORO) until it is shipped to the Envirocare mixed waste disposal facility in Utah.

- Waste streams that need further characterization will be characterized by January 31, 2006, and DOE must submit a treatment plan for these waste streams to regulatory agencies by July 1, 2006.

- Waste streams scheduled for treatment at a commercial stabilization facility must be shipped for stabilization by January 31, 2008.

- Mixed TRU liquid waste and TRU solid waste will be characterized, treated, packaged, and shipped to ORO for storage until eventual disposal at the Waste Isolation Pilot Plant (WIPP) by January 31, 2016.

2.4 TREATMENT/STORAGE/DISPOSAL

Treatment of MLLW will be conducted either onsite or offsite for the waste streams identified in Appendix A. Several waste streams will be addressed by treatability studies performed through subcontracts under the Bechtel Jacobs Company and treatment technologies will be selected through the competitive procurement process. Treatment goals will be consistent with the request for proposal requirements, which will identify STP requirements, transportation requirements, and the waste acceptance criteria (WAC) of the treated waste.

The Hanford, Washington, DOE facility can accept RCRA/RAD-contaminated wastes for disposal, and the Envirocare, Utah, commercial disposal facility can accept TSCA/RCRA/RAD-contaminated waste for treatment and disposal. The DOE also can dispose of mixed waste at Diversified Scientific Services, Inc., and can treat mixed waste at Rust/Oil and Hazardous Materials Remedial Services as well as the INEEL and the Broad Spectrum Treatment Subcontractors.

The DOE is making preparations to demonstrate a transportable vitrification technology to treat mixed and low-level waste at the PGDP. This vitrification technology, developed by the Vortec Corporation, treats wastes by destroying organic contaminants and chemically bonding the inorganic contaminants, including radionuclides, in an inert, glass-like matrix. The system consists of a melting device designed to provide process conditions that will allow the destruction of the organic compounds and the formation of the glass product. This vitrification system will be tested on RCRA and LLW during the initial trials and if successful will be tested on TSCA waste. A tentative schedule for a process demonstration test of this technology follows.

- November 1999 - Environmental Assessment (EA) approved

- November 1999 - RCRA Research, Development, and Demonstration (RD&D) Permit signed

- February 2000 - Construction starts

- April 2000 – TSCA Research and Development (R&D) approval
- November 2000 - Construction finished
- December 2000 - Begin cold check/hot check
- February - March 2001 - LLW/RCRA waste trials
- April - May 2001 - Risk assessment of LLW/RCRA waste trials
- June – July 2001 - TSCA waste trials
- August - September 2001 - TSCA waste risk assessment

At present, the Vortec demonstration is scheduled to process approximately 25 m^3 of RCRA/RAD and 420 m^3 of LLW during the LLW/RCRA waste trials in FY 2001. If the risk assessment of the processed waste indicates that the technology is successful, an additional 420 m^3 of PCB/RAD will also be processed in FY 2001. For development of the waste disposition projections, it is assumed that the Vortec unit would treat the LLW and MLLW as planned. Bechtel Jacobs Company identified waste streams Number 27, PCB soil, and Number 60, soil/trash/Zorball, rock, gravel, in Appendix A for the Vortec treatment system. It is assumed that Vortec will reduce the volume of each processed waste stream by 20%.

On-site facilities for storing MLLW include the following:

- C-337, which houses DMSAs, is currently used to store PCB wastes, and has a capacity of 39,704 ft^3;
- C-733, a diked, concrete storage pad used for RCRA, PCB/RCRA, and ignitable waste, with a total storage capacity of 2,459 ft^3;
- C-746-A, used for the storage and treatment of containerized RCRA and PCB wastes with a total storage capacity of 43,808 ft^3;
- C-746-B, used for the storage of PCB, LLW, and/or classified wastes with a total storage capacity of 71,268 ft^3;
- C-746-Q, a storage facility for containerized RCRA, PCB wastes and LLW with a capacity of 25,693 ft^3;
- C-752-A (storage capacity of 53,280 ft^3) which is used for storing and treating containerized RCRA, PCB and LLW; and
- C-753-A, a facility used for the storage of PCB and LLW with a capacity of 73,260 ft^3

3. LOW-LEVEL WASTE

Operations at the PGDP have generated a variety of LLWs. The principal RAD contaminant is uranium. Other radionuclides of concern are ^{99}Tc, thorium-230, neptunium-237, americium-241, and plutonium-239 and uranium decay products. Solid LLW at the PGDP exists in a variety of waste materials such as concrete, drill mud, personal protective equipment (PPE), powders, sludges, soils, loose trash, and miscellaneous debris. No gaseous LLW, naturally occurring RAD waste, or accelerator-produced material is generated or stored at the PGDP (MMES, 1990). Low-level wastes stored at the PGDP are primarily legacy materials that have not been categorized sufficiently (i.e., specific identification and quantification of container contents) and characterized (i.e., analyses have not been performed to establish the concentrations of RAD constituents) to determine if the waste is acceptable for treatment and/or disposal.

3.1 WASTE INVENTORY/PROJECTIONS

At the end of FY 2000, approximately 6,398 m^3 of legacy LLW will remain at the PGDP. The LLW in inventory, a breakdown of the inventory by fiscal year from FY 2000, and a projection of the disposition for FY 2001 through 2012 are presented in Table 3.

A graphical presentation of the LLW inventory through FY 2000 and the projected rate of LLW disposition through FY 2012 are presented in Figure 4. The outyear waste projections were developed utilizing waste risk rankings, regulatory and permit drivers, waste disposition maps, and professional judgment. Projections by year are developed to eliminate all legacy LLW by end of the FY 2012. The waste projections by year will be the basis of the PGDP LCB.

The projected LLW generated from FY 2000 through FY 2002 from the PGDP ER program and other programs is presented in Table 2. A detailed description of the LLW generation forecast is presented in Appendix B.

Table 2. Low Level Waste Generation Forecast

Year	FY 2000	FY 2001	FY 2002
Total Volume (m^3)	828.4	969.2	739.0

3.2 REGULATORY DRIVERS

United States Department of Energy Order 435.1, *Radioactive Waste Management,* was issued in July 1999. Compliance is required by July 2000 unless an exemption is obtained.

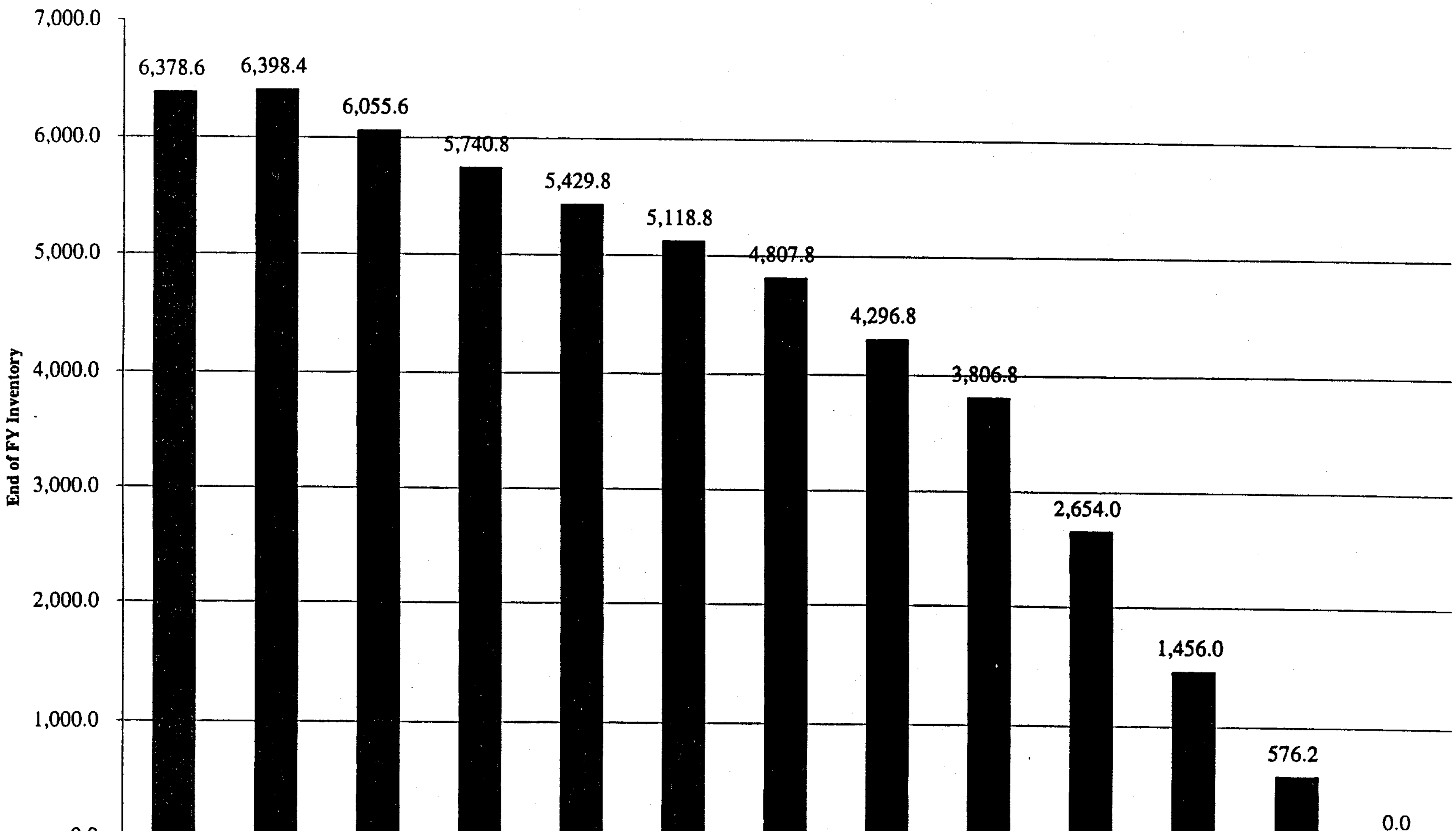
3.3 TREATMENT/STORAGE/DISPOSAL

The DOE is making preparations to demonstrate a transportable vitrification technology to process mixed and low-level waste at the PGDP. This technology demonstration was developed by the Vortec Corporation and is scheduled to process 420 m^3 of LLW during the LLW/RCRA waste trials in the spring of FY 2001. When the specific LLW streams are identified, the volume changes will be incorporated into the waste disposition database.

The only practical method for reducing the radiation hazard from LLW is to isolate it from the public and the environment until the radioactivity has decayed. Isolation is achieved, in varying degrees, by disposal

[redacted]

Figure 4. Low level waste disposition/projection



	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11-12
m3	6,378.6	6,398.4	6,055.6	5,740.8	5,429.8	5,118.8	4,807.8	4,296.8	3,806.8	2,654.0	1,456.0	576.2	0.0

methods (EPA, 1994). At present, the PGDP does not operate a LLW disposal facility; therefore, all LLW at the PGDP must be stored onsite or shipped offsite to a disposal facility.

The C-746-U Solid Waste Landfill, which became operational in FY 1997, allows for the on-site disposal of solid wastes. Radiological disposal criteria in the operating permit are being discussed with the KDEP. Depending on the disposal level, some wastes that are currently classified as LLW may be reclassified as suitable for disposal in the on-site landfill.

The IWMP team identified waste stream Number 60, soil/trash/Zorball, rock, gravel, and Number 61, PPE, plastic, rags, pads, as waste streams that may meet the on-site C-746-U Solid Waste Landfill WAC. A portion of these waste streams also will be included in the Vortec demonstration. Additional characterization of several LLW streams may result in further disposal of waste in the on-site landfill. The DOE can currently dispose of LLW at the DOE disposal facilities in Hanford, Washington, and the Envirocare facility in Utah.

On-site facilities for storing LLW include the following:

- C-301, which has an outside storage capacity of 16,423 ft^3;
- C-333, with an indoor capacity of 16,423 ft^3 which houses DMSAs and is used to store LLW;
- C-733, a diked, concrete storage pad used primarily for RCRA, PCB/RCRA, and ignitable waste, with a total storage capacity of 2,459 ft^3;
- C-745-K, a gravel pad with a capacity of 190 ft^3;
- C-746-A, also used for the storage and treatment of containerized RCRA and PCB wastes with a total storage capacity of 43,808 ft^3;
- C-746-B, used for the storage of PCB, LLW, and/or classified wastes with a total storage capacity of 71,268 ft^3;
- C-746-H3, which has a capacity of 47,360 ft^3 and is used primarily for storing wastes generated by ER projects;
- C-746-Q, a storage and treatment facility for containerized RCRA, PCB wastes and LLW with a capacity of 25,693 ft^3;
- C-746-V, a gravel pad with a storage capacity of 66,600 ft^3;
- C-752-A (storage capacity of 53,280 ft^3) which is used for storing and treating containerized RCRA, PCB and LLW; and
- C-753-A, a facility used for the storage of PCB and LLW with a capacity of 73,260 ft^3

4. HAZARDOUS WASTE

Both RCRA hazardous and PCB waste management activities are conducted under the Hazardous Waste Activity WBS at this site; however, compliance with regulatory requirements for management of these wastes are separate and distinct. Definitions, criteria, and management requirements for RCRA hazardous waste are covered under 40 C.F.R. Parts 260-272; definitions, criteria, and management requirements for PCB wastes are found in 40 C.F.R. Part 761.

The PGDP has been more proactive in segregating wastes and keeping materials in the nonradioactive material management areas (non-RMMAs) separate from the potentially contaminated materials located within the RMMAs. As a result, there has been a small amount of RCRA waste, primarily fluorescent light bulbs that were not radiologically contaminated.

4.1 WASTE INVENTORY/PROJECTIONS

The primary focus of the hazardous waste FYB tasks for FY 2000 will be the treatment and discharge of approximately 19 m^3 (5,000 gal) of wastewater collected from various environmental management projects. The tasks will address all leachate collected throughout the year so the remaining inventory of wastewater will be treated and disposed of annually.

The environmental management program at the PGDP and other on-site operations will continue to generate some hazardous waste. A forecast of the hazardous waste that may be generated, in addition to the wastewater collection and treatment, is presented in Table 3.

Table 3. Hazardous waste generation forecast

Year	FY2000	FY 2001	FY 2002
Total Volume (m^3)	78.9	19.1	0.9

4.2 REGULATORY DRIVERS

For the waste streams identified in this section, the waste is currently governed by DOE Order 435.1, the KPDES permit, the STP, and the UE TSCA FFCA. Treatment and disposal of both PCB and hazardous capacitors must meet the requirements of the TSCA FFCA and the STP.

Polychlorinated biphenyls are not regulated as a hazardous waste under the RCRA. However, if PCBs are mixed with those hazardous wastes listed in 40 C.F.R. § 261.31 to § 261.33 (e.g., spent trichloroethene that was used to clean electrical equipment), the mixture is subject to RCRA hazardous waste regulations. Similarly, if PCBs are mixed with other wastes and the resulting mixture exhibits one or more of the hazardous characteristics identified in 40 C.F.R. § 261.21 to § 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity), the mixture must be managed as hazardous waste until the waste no longer exhibits the characteristic.

4.3 TREATMENT/STORAGE/DISPOSAL

The treated wastewater will be discharged through a permitted KPDES outfall at the PGDP. Treatment will accommodate all wastewater generated; therefore, no leachate will accumulate in storage. The 1,000 PCB capacitors currently removed from service at the PGDP will be disposed of at Safety Kleen in FY 2000.

5. SANITARY/INDUSTRIAL WASTE

In general, sanitary/industrial waste includes trash, sanitary waste, construction debris and industrial wastes. For the purposes of this section, sanitary/industrial waste includes wastes that are not classified as RCRA, low-level, mixed, TSCA, or wastewater.

Historically, most sanitary/industrial wastes have been landfilled at the PGDP. The new landfill, designated as the C-746-U Solid Waste Contained Landfill, began operation and started accepting waste on February 7, 1997. As of September 1999, the landfill has accepted approximately 14,600 tons of solid waste.

5.1 WASTE INVENTORY/PROJECTIONS

The PGDP waste inventory includes a significant amount of waste such as soil, Zorball, rocks, rags that is currently classified as LLW or potential LLW. This waste contains little or no radiological contaminants and may be disposed of in the on-site landfill once it is definitively characterized and determined that the WAC are met. These waste streams will be included in the sanitary/industrial waste tasks WBS since the waste will be disposed of in the on-site landfill, which is detailed in Section 3 of this document.

A projection of the sanitary/industrial project waste to be generated in FYs 2000, 2001, and 2002 is presented in Table 4. A detailed description of the waste generation forecast is presented in Appendix B.

Table 4. Sanitary/industrial waste generation forecast

Year	FY 2000	FY 2001	FY 2002
Total Volume (m^3)	1273.2	1382.8	1021.2

5.2 REGULATORY DRIVERS

Disposal of sanitary/industrial waste must be in compliance with the requirements found in the C-746-U Solid Waste Contained Landfill Permit (permit number 073-00045).

5.3 TREATMENT/STORAGE/DISPOSAL

The C-746-U Solid Waste Landfill is a modern on-site disposal facility with a low-permeability synthetic liner consisting of material with a maximum permeability coefficient of 1×10^{-12} cm/sec and a leachate collection system to control fluid migration. The landfill is permitted with a 10.1-hectare (25-acre) waste boundary and a final design volume of 1,146,900 m^3 of air space. Construction of the initial phase was completed by the end of 1996 and the landfill began accepting waste when it was put into operation on February 7, 1997. The first five cells consist of 2.0 hectares (5 acres), which are expected to meet the PGDP's needs for 8 to 10 years if waste streams and forecasts remain as currently projected (Vander Boegh, 1996).

6. TRANSURANIC WASTE

The PGDP facility has a small amount of TRU waste that is categorized as mixed waste and stored in Building C-746-Q RCRA Waste Storage Facility. The TRU waste resulted from reprocessing spent nuclear fuel where the fission products (TRUs) were introduced in the gaseous diffusion process.

6.1 WASTE INVENTORY/PROJECTIONS

The TRU waste in inventory at the PGDP includes 2.9 m^3 of liquid and 1.7 m^3 of solids. A projection of the TRU waste generated by EM projects is presented in Table 5.

Table 5. Transuranic waste generation forecast*

Year	FY 2000	FY 2001	FY 2002
Total Volume (m^3)	1.04	1.04	0

* from the characterization and treatment of TRU waste

6.2 REGULATORY DRIVERS

The regulatory drivers for treatment and disposal of TRU waste are DOE Order 435.1 and the STP.

6.3 TREATMENT/STORAGE/DISPOSAL

The DOE addresses TRU waste in the STP and will maintain compliance with the FFC Act ultimately by disposing of the waste at the WIPP located in New Mexico. Table 12 in the Appendix of the STP lists the DOE PGDP TRU wastes proposed for shipment to Oak Ridge, TN in FY 2005, after treatment in FY 2004, pending final shipment to the WIPP by FY 2016.

7. SCRAP METAL

The approximately 65,000 tons of scrap metal currently stored at the PGDP were generated as a result of numerous cascade upgrades and other activities conducted at the plant over the past 47 years. This scrap material is surface contaminated with uranium tetrafluoride, uranium hexafluoride, and trace amounts of ^{99}Tc, TRU elements and uranium decay products. The ultimate goal for this inventory is to allow DOE to reuse or recycle economically a large percentage of the contaminated scrap metal directly from the PGDP. In addition to this scrap metal inventory, DOE also has approximately 9,700 tons of volumetrically contaminated nickel ingots in storage at the PGDP. These radioactive nickel ingots are the result of cascade improvements and cascade upgrade programs conducted at the Oak Ridge, TN, Portsmouth, OH, and Paducah cascade facilities.

Cleanup at the scrap yard units has been delayed in the Path to Closure due to funding reductions. This delay has impacted cleanup of the surface soils in the scrap yards, the buried radiological waste under the scrap piles, and the related surface-water units that receive runoff from the scrap yards. These units have been identified as potential sources of off-site surface-water contamination. Removal of these materials is necessary before scheduled FFA actions can be achieved. A listing of the scrap metal by metal type is given in Table 6 as prepared by Parsons Engineering Science, Inc. for the DOE, March 1995.

Table 6. Estimated scrap metal inventory

Scrap Metal	Totals (tons)*
Aluminum	3,277
Nickel	9,700
Copper	43
Iron	31,516
Stainless steel	29
Classified scrap	15,713
Total	60,278

* (DOE, 1995)

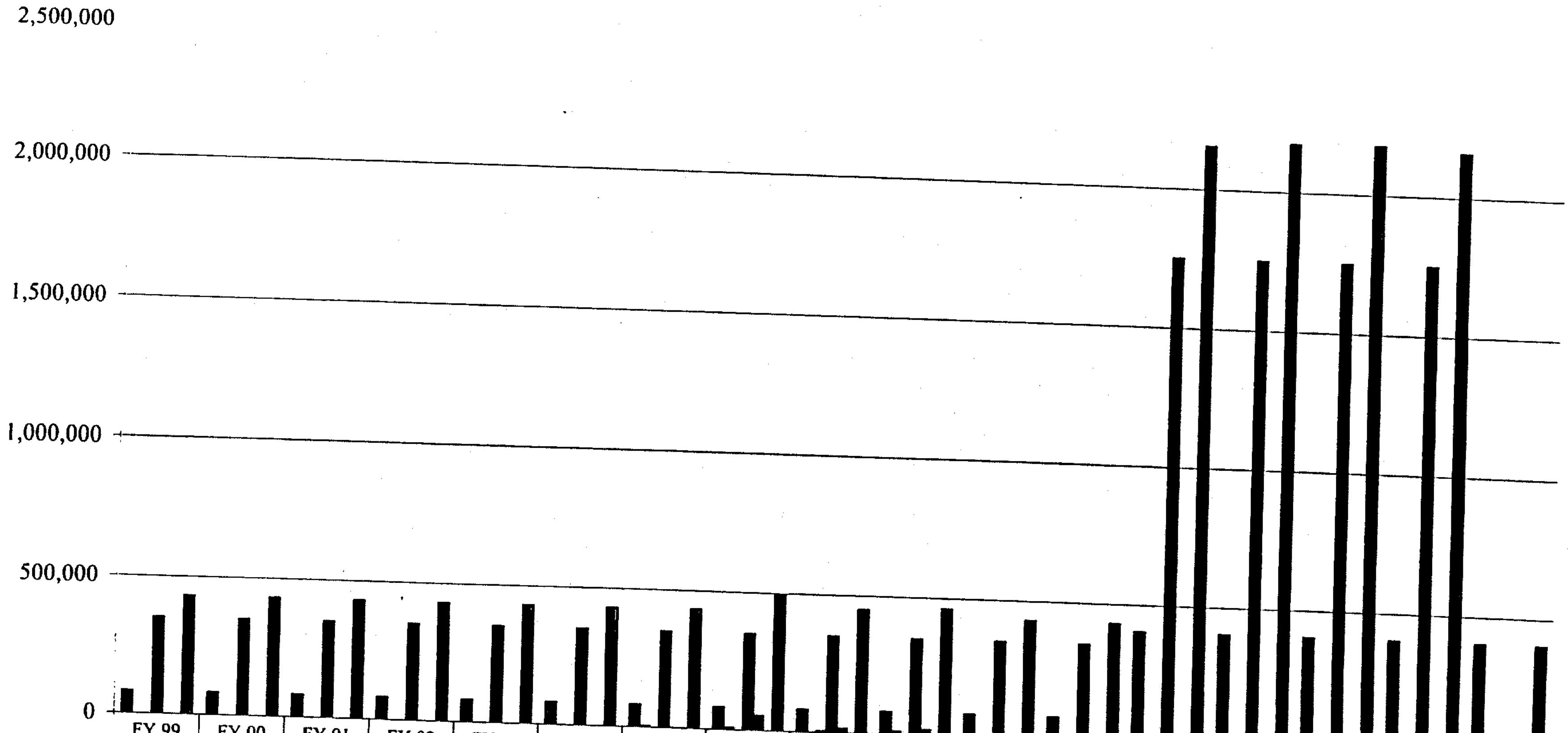
The Bechtel Jacobs Company has initiated an EE/CA in FY 1999 to support an action memorandum to address the scrap metal inventory. A procurement to recycle and/or dispose of the scrap metal will be initiated in FY 2000.

8. ENVIRONMENTAL RESTORATION WASTES

Approximately 14,357,692 m^3 of waste is projected to be generated as a result of ER activities at PGDP from FY 2000 through approximately FY 2035. These wastes will be dispositioned as they are generated (with possible short-term storage onsite) and are not included in the legacy waste inventory. A total of 2,984,514 m^3 of aqueous MLLW, 56,759 m^3 of solid MLLW, 16,560 m^3 of solid LLW, 11,208,181 m^3 of aqueous sanitary waste, and 91,678 m^3 of solid sanitary waste are projected to be generated. No TRU wastes are anticipated to be generated from ER activities. The projected disposition, by fiscal year and waste type, is presented in Figure 5. The Baseline Disposition Maps for ER wastes are provided in Appendix C.

In addition, approximately 46,450 m^3 of LLW scrap metal will be collected and recycled, approximately 32,904 m^3 of LLW scrap metal will be collected and disposed of at Envirocare, and approximately 14,000 of LLW scrap metal will be collected and disposed of at Hanford.

Fig. 5 Projected generation/disposition of ER wastes



	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11-15	FY 16-20	FY 21-25	FY 26-30	FY 31-35
Aq. MLLW	80,669	80,679	80,720	80,663	80,663	80,660	80,660	80,660	80,660	80,660	80,660	80,660	403,300	403,300	403,300	403,300	403,300
Solid MLLW	95	10	7	4	3	3	3,350	7,811	8	11,476	1	1	7	13,594	16,991	3,398	0
Solid LLW	22	22	22	22	73	92	119	15	4,212	531	15	15	73	4,531	5,663	1,133	0
Aq. Sanitary	350,256	350,256	350,256	350,256	350,256	350,256	350,256	350,256	350,256	350,256	350,256	350,256	1,751,278	1,751,278	1,751,278	1,751,275	0
Sol. Sanitary	33	148	39	62	413	468	401	54,675	15,585	19,690	82	3	15	31	29	4	0
TRU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	431,075	431,115	431,044	431,007	431,408	431,479	434,786	493,417	450,721	462,613	431,014	430,935	2,154,673	2,172,734	2,177,261	2,159,110	403,300

9. REFERENCES

Bechtel Jacobs Company LLC, 1999. *The Site Treatment Plan Annual Update for the United States Department of Energy Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* BJC/PAD-94 (formerly Y/EM-147) Revision 3, Bechtel Jacobs Company LLC, Paducah, KY, March 1999.

DOE, 1995, *U.S. Department of Energy Scrap Metal Inventory Report for the Office of Technology Development, Office of Environmental Management*, DOE/HWP-167, prepared by Parsons Engineering Science, Inc., RMI Environmental services, and U.S. Steel Facilities Redeployment Group for the Hazardous Waste Remedial Actions Program managed by Martin Marietta Energy Systems, Inc. March 1995.

DOE, 1999. *U.S. Department of Energy Environmental Management Program Initial Accelerating Cleanup Paths to Closure, Oak Ridge Operations Office,* DOE/OR/01-1746, United States Department of Energy, Oak Ridge, TN, June 1999.

DOE, 1999. *Engineering Evaluation/Cost Analysis for Scrap Metal Removal at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1797&D1, United States Department of Energy, Paducah Site Office, Paducah, Kentucky, May 1999.

EPA, 1994. *Environmental Radiation Protection Standards for the Management, Storage, and Disposal of Low-Level Radioactive Wastes,* preproposal draft 40 C.F.R. Part 193, United States Environmental Protection Agency, Washington, DC, November 1994.

Leone, 1996. Leone, Sam M., Lockheed Martin Energy Systems, Inc., Waste Management Team, personal conversation with Jay Maudlin, Jacobs ER Team, Paducah, KY, November 18, 1996.

Leone, 1998. Leone, Sam M., Bechtel Jacobs Company LLC, electronic mail with Excel table attachment to Kevin Barber, Jacobs EM Team, Paducah, KY, September 29, 1998.

LMES, 1998a. Draft *Risk Based Waste Management Strategy and Evaluation Methodology,* Lockheed Martin Energy Systems, Paducah, KY, February 1998.

MMES, 1990. *Radioactive Waste Management Plan,* KY/F-160, Martin Marietta Energy Systems, Inc., Paducah, KY, March 12, 1990.

Vander Boegh, 1996. Vander Boegh, Gary, Lockheed Martin Energy Systems, Inc., personal conversation with Jay Maudlin, Jacobs EM Team, Paducah, KY, September 1996.

APPENDIX A

Fiscal Year Baseline Disposition/Projections of Waste Streams at the Paducah Gaseous Diffusion Plan

Risk Rank	1-Nov-99 Waste Stream	Map Record Number	Invent. m^3 FY 1999	FY 2000		FY 2001		FY 2002		FY 2002 Rem. Inv. m^3	Waste Projections m^3									Driver	Treatm.	Disp.
				Treat	Disposal	Treat	Disposal	Treat	Disposal		FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 11-12			
1	AC1 Miscellaneous Acids & Bases	2969	18.29	18.29					-15.00	30.72	-15.72	-15.0								STP	Comm Stab	Comm Disp
2	TRU2 TRU Liquids	444/1360	2.90							2.90			-2.90							STP/435.1	TS	Oak Ridge
3	LLW U Chips	3653/3654	6.15							26.00						-26.0				435.1	TS	Envirocare
4	TRU1 TRU Solids	444/1360	1.69							1.69			-1.69							STP/435.1	TS	Oak Ridge
5	HR1 High Rad Solids	2786	4.69	4.69						11.72					-11.72					STP/435.1	CBST	Envirocare
6	HU1 Hydrolyzed UF_6	2786	3.91	3.91						9.78					-9.78					STP/435.1	CBST	Envirocare
7	AR Ash Receivers (Ash)	2786	1.26	1.26						3.15					-3.15					STP/435.1	CBST	Envirocare
8	MF1 MgF2 Pellets	2786	5.84	5.84						14.60					-14.60					STP/435.1	CBST	Envirocare
9	TC1 Tc-99 Waste (4,000 gal cont.)	2786	0.76	0.76						1.90					-1.90					STP/435.1	CBST	Envirocare
10	LLW Radioactive Chemicals	2643	0.02							0.02				-0.02						435.1		Envirocare
11	NS1 Nickel Stripper Sludge	2786	3.76	3.76						9.40					-9.40					STP/435.1	CBST	Envirocare
12	SA1 Sodium Azide	2786	0.02							0.02					-0.02					STP/435.1	CBST	Envirocare
13	R3 Organic Peroxide	2786	0.11							0.11					-0.11					STP/435.1	CBST	Envirocare
14	TSCAICS TSCAI Combustible Solids	447	37.86		-37.86					0										STP/TSCA FFCA/435.1		TSCA Incin
15	INEELICS INEEL WERF Comb Solids	441	34.19							34.19		-34.19								STP/TSCA FFCA/435.1	INEEL Incin	INEEL
16	INEELICS1 INEEL WERF Comb Solids	441	37.86							37.86		-37.86								STP/TSCA FFCA/435.1	INEEL Incin	INEEL
17	INEELPW Paint Waste	441	6.27							6.27		-6.27								STP/TSCA FFCA/435.1	INEEL Incin	INEEL
18	TSCAICS1 TSCAI Comb Solids	447	18.52						-18.52	0										STP/TSCA FFCA/435.1		TSCA Incin
19	PCB Water/C-404 Liquid*	434	40.13		-40.13		-19.38		-19.38	0	-19.38	-19.38	-19.38	-19.38	-19.38	-19.38	-19.38	-19.38	-19.38	TSCA FFCA		TSCA Incin
20	CCS1 Cr Contaminated Solids	2772	4.08			4.08	-4.08			0										STP/435.1	Comm Treat	Envirocare
21	BAT1 Batteries	2786	6.17							6.17					-6.17					STP/435.1	CBST	Envirocare
22	SSS1 Spent Solvent Solids	2786	4.31							4.31					-4.31					STP/435.1	CBST	Envirocare
23	HWRTS1 Hot Water Rinse Tank Sludge	2786	7.14							7.14					-7.14					STP/435.1	CBST	Envirocare
24	SP1 Spill Cleanup Materials	2772	3.40			3.40	-3.40			0										STP/435.1	Comm Treat	Envirocare
25	PA-M001 Misc Oxidizers	2786	0.44							0.44					-0.44					STP/435.1	CBST	Envirocare
26	TW1 Tc Waste	2786	0.95							0.95					-0.95					STP/435.1	CBST	Envirocare
27	PCB Soil	2766	1188.48			420				1188.48						-591.00	-503.00		-94.48	TSCA FFCA	Vortec I	MEWC
28	DEV1 Developer Solution	2772	2.72			2.72	-2.72			0										STP/435.1	Comm Treat	Envirocare
29	FL1 Misc. Flammable Materials	2786	1.39							1.39					-1.39					STP/435.1	CBST	Envirocare
30	LPFL Labpack With Flammable Mat.	2786	4.99							4.99					-4.99					STP/435.1	CBST	Envirocare
31	R2 Hydrogen Peroxide	2786	0.02							0.02					-0.02					STP/435.1	CBST	Envirocare
32	R1 Miscellaneous Reactives	2786	0.21							0.21					-0.21					STP/435.1	CBST	Envirocare
33	MSL1 Misc. Sludge	2786	16.88							16.88					-16.88					STP/435.1	CBST	Envirocare
34	MS1 Miscellaneous Inorganic Solids	2786	2.15							2.15					-2.15					STP/435.1	CBST	Envirocare
35	MSL2 Miscellaneous Sludges	2786	1.05							1.05					-1.05					STP/435.1	CBST	Envirocare
36	WP1 Wooden Pallets	2786	9.00							9.00					-9.00					STP/435.1	CBST	Envirocare
37	CARB1 Activated Carbon	2786	20.73							20.73					-20.73					STP/435.1	CBST	Envirocare
38	CYL1 Compressed Gas Cylinder	2786	0.14							0.14					-0.14					STP/435.1	CBST	Envirocare
39	GB1 Glass Bead & Sandblasting	2786	7.19	7.19						17.98					-17.98					STP/435.1	CBST	Envirocare
40	CAP1 Mixed Waste Capacitors	2786	29.11							29.11					-29.11					STP/435.1	CBST	Envirocare
41	MD1 Metal & Miscellaneous Debris	2772	44.33		-44.33					0										STP/435.1	Comm Treat	Envirocare
42	VD1 Vacuum Dust	2786	0.645							0.645					-0.645					STP/435.1	CBST	Envirocare
43	CWS1 Cyl Wash & Hand Table Sludge	2786	2.92	2.92						7.29					-7.29					STP/435.1	CBST	Envirocare
44	FC1 F2 Cell & Electrolyte	2786	71.83							71.83					-71.83					STP/435.1	CBST	Envirocare
45	WW1 Misc. Waste Water	448	10.99							10.99	-10.99									STP/435.1	TSCA Incin	TSCA Incin
46	SSS2 Spent Solvent Solids	2786	2.13							2.13					-2.13					STP/435.1	CBST	Envirocare
47	MCD1 Mercury Cont. Debris	2772	5.71			5.71	-5.71			0										STP/435.1	Comm Treat	Envirocare
48	LP2 Miscellaneous Labpack	2786	15.40							15.40					-15.4					STP/435.1	CBST	Envirocare
49	PCB/Asbestos	436	178.58							178.58							-100		-78.58	TSCA FFCA		MEWC
50	PCB/Concrete	2765	460.6							460.60						-460.6				TSCA FFCA		Envirocare
51	PCB Zorball/Floor Sweep	2765	176.5							176.50						-139.4	-37.1			TSCA FFCA		Envirocare
52	PCB Sludges	2765	239.21							239.21							-239.21			TSCA FFCA		Envirocare
53	PCB Misc. Oil	434	8.42						-3.87	4.55	-4.55									TSCA FFCA/435.1		TSCA Incin
54	LLW Radium Source/Lead Plate/Lead	438	0.11							0.11						-0.11				435.1		Envirocare

	1-Nov-99			Fiscal Year Baseline Disposition/Projection of Waste Streams																		
Risk Rank	Waste Stream	Map Record Number	Invent. m^3 FY 1999	FY 2000 Treat	FY 2000 Disposal	FY 2001 Treat	FY 2001 Disposal	FY 2002 Treat	FY 2002 Disposal	FY 2002 Rem. Inv. m^3	Waste Projections m^3 FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 11-12	Driver	Treatm.	Disp.
55	LLW Asbestos	438	373.32							373.32						-143	-230.32			435.1		Envirocare
56	LLW Pure Thorium Fluoride	438	0.004							0.004							-0.004			435.1		Envirocare
57	LLW Metal (Ash Receivers)	2643	792.41							792.41				-200	-90	-502.41				435.1		Envirocare
58	LLW Miscellaneous Batteries	438	22.63							22.63								-22.63		435.1		Envirocare
59	LLW Tc-99/Grout Tiles	438	0.21							0.21						-0.21				435.1		Envirocare
60	Soil/Trash/Zorball/Rock/Gravel	437/2664	2695.4			420	-311		-311	2073.40	-311	-311	-311	-311	-400	-400	-29.4			C-746-U Permit	Vortec I	C-746-U
61	PPE/Plastic/Rags/Pads/Absorbents	2664	651.01							651.006							-370.6	-280.406		C-746-U Permit		C-746-U
62	Misc. PCB Absorbents	2765	159.82							159.82							-159.82			TSCA FFCA/435.1		Envirocare
63	PCB Scrap Metal Alum/Steel/Iron	436	105.57							105.57									-105.57	TSCA FFCA/435.1		MEWC
64	PCB/Asphalt	2765	0							0.00										TSCA FFCA/435.1		Envirocare
65	PCB Ballasts/Capacitors	436	82.37							82.37									-82.37	TSCA FFCA/435.1		MEWC
66	PCB Glass/Bottles	2765	7.61							7.61							-7.61			TSCA FFCA/435.1		Envirocare
67	PCB Bushings	436	25.49							25.49									-25.49	TSCA FFCA/435.1		MEWC
68	PCB Carbon	2765	4.2							4.20							-4.2			TSCA FFCA/435.1		Envirocare
69	PCB/Coolant Sludge	2765	0							0.00										TSCA FFCA/435.1		Envirocare
70	PCB Uranium Precipitate	2766	3.58							3.58							-3.58			TSCA FFCA/435.1		MEWC
71	PCB Trash	2765	226.78							226.78							-2.06		-224.72	TSCA FFCA/435.1		Envirocare
72	PCB Equipment	436	167.01							167.01									-167.01	TSCA FFCA/435.1		MEWC
73	PCB Lab Residue/Waste	436	44.48							44.48									-44.48	TSCA FFCA/435.1		MEWC
74	PCB Plastic/PPE	436	125.94							125.94									-125.94	TSCA FFCA/435.1		MEWC
75	PCB Empty Drums	436	47.43							47.43									-47.43	TSCA FFCA/435.1		MEWC
76	PCB Sodium Sulfate	2765	0							0.00										TSCA FFCA/435.1		Envirocare
77	PCB Wood	2765	28.5							28.50									-28.5	TSCA FFCA/435.1		Envirocare
78	PCB Filters	436	2.87							2.87									-2.87	TSCA FFCA/435.1		MEWC
79	PCB Vacuum Dust	2765	0.86							0.86								-0.86		TSCA FFCA/435.1		Envirocare
80	PCB PVC Pipe	436	36.21							36.21									-36.21	TSCA FFCA/435.1		MEWC
81	PCB Misc./Unknown	436	4.93							4.93									-4.93	TSCA FFCA/435.1		MEWC
82	PCB Grease	2765	0.25							0.25								-0.25		TSCA FFCA/435.1		Envirocare
83	PCB Samples	436	5.87							5.87									-5.87	TSCA FFCA/435.1		MEWC
84	LLW Bird Poison	2643	0.21							0.21							-0.21			435.1		Envirocare
85	LLW Alkali Tank Sludge	2643	12.16							12.16							-12.16			435.1		Envirocare
86	LLW Hydrolyzed UF6	2643	0							0.00										435.1		Envirocare
87	LLW Water	439	31.87				-31.87			0.00										435.1		TSCA Incin
88	LLW Drilling Mud	2643	191.44							191.44							-191.44			435.1		Envirocare
89	LLW Propylene Glycol	2643	1.6							1.60							-1.6			435.1		Envirocare
90	LLW Elemental Powders/Oxides	2643	0.11							0.11							-0.11			435.1		Envirocare
91	LLW Metal Oxides/Chlorides	2643	0.02							0.02							-0.02			435.1		Envirocare
92	LLW Wood	2643	799.24							799.24							-362.24	-437		435.1		Envirocare
93	LLW Nickel Stripper Sludge	2643	0.84							0.84								-0.84		435.1		Envirocare
94	LLW Vacuum Dust	2643	39.51							39.51								-39.51		435.1		Envirocare
95	LLW Nickel Dust	2643	0							0.00										435.1		Envirocare
96	LLW Nickel Arsenate (Sulfate)	2643	11.3							11.30								-11.3		435.1		Envirocare
97	LLW Filter Cake	2643	88.14							88.14								-88.14		435.1		Envirocare
98	LLW Uranium Compounds	2643	27.76							27.76									-27.76	435.1		Envirocare
99	LLW Glass	2643	31.95							31.95									-31.95	435.1		Envirocare
100	LLW Trap Mix	2643	113.19							113.19									-113.19	435.1		Envirocare
101	LLW Floor Sweep	2643	118.98							118.98									-118.98	435.1		Envirocare
102	LLW Blasting Media	2643	71.28							71.28									-71.28	435.1		Envirocare
103	LLW Nickel Compounds	2643	0.84							0.84									-0.84	435.1		Envirocare
104	LLW Sodium Hydrogen Sulfate	2643	0.64							0.64									-0.64	435.1		Envirocare
105	LLW Oxalic Acid	2643	0.87							0.87									-0.87	435.1		Envirocare
106	LLW Diesel Sludge	2643	1.07							1.07									-1.07	435.1		Envirocare
107	LLW Trioxide Sludge	2643	0							0.00										435.1		Envirocare
108	LLW Dye/Chemicals	2643	0.84							0.84									-0.84	435.1		Envirocare

Risk Rank	Waste Stream (1-Nov-99)	Map Record Number	Invent. m³ FY 1999	FY 2000 Treat	FY 2000 Disposal	FY 2001 Treat	FY 2001 Disposal	FY 2002 Treat	FY 2002 Disposal	FY 2002 Rem. Inv. m³	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 11-12	Driver	Treatm.	Disp.
											Waste Projections m³											
109	LLW Cresol	2643	0							0.00										435.1		Envirocare
110	LLW Oakite 62	2643	0.21							0.21									-0.21	435.1		Envirocare
111	LLW Misc. Compounds	2643	0.84							0.84									-0.84	435.1		Envirocare
112	LLW Soda Ash	2643	1.17							1.17									-1.17	435.1		Envirocare
113	LLW Weld-Kleen	2643	0.08							0.08									-0.08	435.1		Envirocare
114	LLW Red Alumina Powder	2643	0.42							0.42									-0.42	435.1		Envirocare
115	LLW Ammonia Sulfate	2643	0.21							0.21									-0.21	435.1		Envirocare
116	LLW Epoxy	2643	1.89							1.89									-1.89	435.1		Envirocare
117	LLW Ferrous Sulfate	2643	1.18							1.18									-1.18	435.1		Envirocare
118	LLW Calcium Fluoride	2643	0.21							0.21									-0.21	435.1		Envirocare
119	LLW Zinc Chloride	2643	0.36							0.36									-0.36	435.1		Envirocare
120	LLW Ion Exchange Resin	2643	16.25							16.25									-16.25	435.1		Envirocare
121	LLW 1,4 Butanediol	2643	0.06							0.06									-0.06	435.1		Envirocare
122	LLW Chem-Calk	2643	0.21							0.21									-0.21	435.1		Envirocare
123	LLW Magnesium	2643	0.019							0.019									-0.019	435.1		Envirocare
124	LLW Protein Firefighting Foam	2643	0.21							0.21									-0.21	435.1		Envirocare
125	LLW Lithium Carbonate	2643	0.32							0.32									-0.32	435.1		Envirocare
126	LLW Cerium Hydrate	2643	1.26							1.26									-1.26	435.1		Envirocare
127	LLW Sludges	2643	31.83							31.83									-31.83	435.1		Envirocare
128	LLW Misc. Equipments	438	55.87							55.87						-55.87				435.1		Envirocare
129	LLW Insulation/Fiberglass Sheets	2643	64.38							64.38									-64.38	435.1		Envirocare
130	LLW Paint Wastes	2643	9.12							9.12									-9.12	435.1		Envirocare
131	LLW Oil Filters	438	0.21							0.21						-0.21				435.1		Envirocare
132	LLW Activated Carbon/Wicks	438	23.01							23.01						-23.01				435.1		Envirocare
133	LLW Lab Samples/Residuals	2643	10.56							10.56									-10.56	435.1		Envirocare
134	LLW Rust	2643	2.76							2.76									-2.76	435.1		Envirocare
135	LLW Sewer Sludge	2643	60.05							60.05									-60.05	435.1		Envirocare
136	LLW Sodium Orthosilicate	2643	1.05							1.05									-1.05	435.1		Envirocare
137	LLW Petroleum Jelly	438	0.21							0.21						-0.21				435.1		Envirocare
138	LLW Contact Cement	438	0.21							0.21						-0.21				435.1		Envirocare
139	LLW Non-Regulated Materials	2643	0.06							0.06									-0.06	435.1		Envirocare
140	LLW Pure Gold Gel	2643	1.05							1.05									-1.05	435.1		Envirocare
141	LLW Lab Waste (Liquid)	439	3.83						-3.83	0.00										435.1		TSCA Incin
142	LLW Grease	438	1.41							1.41						-1.41				435.1		Envirocare
143	LLW Graphite	2643	0.21							0.21									-0.21	435.1		Envirocare
144	LLW Flux	2643	0.02							0.02									-0.02	435.1		Envirocare
145	LLW Film	2643	1.47							1.47									-1.47	435.1		Envirocare
146	LLW Collection Drum	2643	1.28							1.28									-1.28	435.1		Envirocare
	ANNUAL TOTAL		10204.2	48.6	-122.3	855.91	-358.8	0	-352.2	9463.7	-342.3	-404.3	-315.6	-511.0	-760.6	-2343.7	-2254.7	-880.9	-1650.6			
	ANNUAL INVENTORY				10174.7		9815.9		9463.7		9121.4	8717.1	8401.5	7890.5	7129.9	4786.2	2531.5	1650.6	0			

Y 2000 annual volume incorporates generation of 92.8 cubic meters of waste from treatment; *PCB Water/C-404 Liquid generated and disposed of annually

APPENDIX B

Waste Generation Forecast

Paducah Gaseous Diffusion Plan Waste Generation Forecast								
PROJECT	FY 2000		FY 2001		FY 2002		Waste Type	Expected Disposition
	Solid*	Liquid*	Solid*	Liquid*	Solid*	Liquid		
C-750 A&B UST Closure								
Cylinder Coating	28.09		28.3		28.3		Sanitary	Landfill
Cylinder Management							Sanitary	Landfill
Cylinder Yards PH9	229.39		229.39				Sanitary	Landfill
Cylinder Yards PH9			7.65		7.65		Scrap Metal	Reuse/Recycle
ER D&D Surveillance and Maintenance	0.42	0.42	0.42	0.42	0.42	0.42	MLLW	Envirocare
ER D&D Surveillance and Maintenance	14.63		14.63		14.63		LLW	Hanford
ER D&D Surveillance and Maintenance	0.63		0.63		0.63		Hazardous	Envirocare
DMSA Project	283.2		283.2		283.2		Scrap Metal	Reuse/Recycle
DMSA Project	141.6		141.6		141.6		Sanitary	Landfill
DMSA Project	141.6		141.6		141.6		LLW	Storage within DMSAs
EF Maintenance of Non-Leased Facilities	0.42		0.42		0.42		LLW	Storage
EF Maintenance of Non-Leased Facilities	31.63		31.63		31.63		Sanitary	Landfill
C-752-A Enclosure								
Fluorine Cells	0.42		0.42				MLLW	Envirocare
Fluorine Cells	0.62		0.62				LLW	Hanford
Fire Protection Upgrades			1.46				Sanitary	Landfill
Lasagna	0.21		0.21				Sanitary	Landfill
Lasagna		1.14		1.14			Hazardous	Onsite Treatment
Mixed Waste Characterization and Treatment	385.73		385.73		385.73		LLW	Storage
Northeast Plume Operations	0.42		0.42		0.42		Scrap Metal	Reuse/Recyle
Northeast Plume Operations		0.04		0.04		0.04	Hazardous	Storage
Northeast Plume Operations	0.48		0.48		0.48		LLW	Storage
Northwest Plume Operations	16.75	0.06	16.75	0.06	16.75	0.06	MLLW	Storage
Northwest Plume Operations	0.63		0.63		0.63		Scrap Metal	Storage
Northwest Plume Operations		0.04		0.04		0.04	Hazardous	Storage
Northwest Plume Operations	8.12	0.08	8.12	0.08	8.12	0.08	LLW	Storage
PCB Project	27.75		27.75		27.75		MLLW	Storage
PCB Project		1.25		1.25		1.25	MLLW	TSCA Incinerator
PCB-Hazardous	12.75			12.75			LLW	Storage
ER RA Surveillance and Maintenance	3.31		3.31		3.31		Sanitary	Landfill
ER RA Surveillance and Maintenance	0.42		0.42		0.42		LLW	
ER RA Surveillance and Maintenance	0.21		0.21		0.21		Hazardous	
ER RA Surveillance and Maintenance	1.66		1.66		1.66		MLLW	
Waste Storage Operations	0.85		0.85		0.85		Sanitary	Landfill
Waste Storage Operations	0.85		0.85		0.85		MLLW	Envirocare
Solid Waste Disposal	396.00		311.00		311.00			
Solid Waste Landfill Operations	61.17	340.65	61.17	340.65	61.17	340.65	Sanitary	Landfill/C-615
TCLP FFCA Project	1.04						MLLW	Offsite Disposal

Paducah Gaseous Diffusion Plan Waste Generation Forecast								
PROJECT	FY 2000		FY 2001		FY 2002		Waste Type	Expected Disposition
	Solid*	Liquid*	Solid*	Liquid*	Solid*	Liquid		
TRU Waste Projects	4.16		4.16				LLW	Envirocare
TRU Waste Projects	1.04		1.04				TRU	Storage/WIPP
TSCA Incinerator Shipments	2.50		2.50		2.50		MLLW	Storage
Uranium Chips								
Wastes Generated by USEC	364.62		364.62		364.62		Sanitary	Landfill
Vortec Demonstration Project	45.31		90.62		45.31		Sanitary	Landfill
Vortec Demonstration Project	187.48		372.13		187.48		LLW	Offsite Disposal
WAGs 16 and 19			14.28	2.72			TSCA	Storage
WAGs 16 and 19			1.22				Sanitary	Landfill
WAGs 18 and 25		76.84					Hazardous	On-site Treatment
WAGs 18 and 25	22.62						Sanitary	Landfill
WAGs 2 and 5				4.06			MLLW	On-site Treatment
WAGs 2 and 5			0.42				MLLW	Envirocare
WAGs 2 and 5				4.16			MLLW	On-site Treatment
WAGs 2 and 5			0.42				Sanitary	Landfill
WAGs 20 and 21			4.16				MLLW	Storage
WAGs 20 and 21				75.7			Sanitary	On-site Treatment
WAGs 20 and 21			2.08				Sanitary	Landfill
WAGs 20 and 21			4.16				LLW	Storage
WAG 28								
WAG 28								
WAG 3	55.87		18.9				LLW	Storage
WAG 3		16.00		5.00			LLW	On-site Treatment
WAG 6								
WAG 8								
WAGs 9 and 11			5.83				Sanitary	Landfill
WAGs 9 and 11			1.04				MLLW	Storage
WAGs 9 and 11				34.06			MLLW	On-site Treatment
Well Sampling		0.19		0.19		0.19	MLLW	On-site Treatment
Well Sampling		3.78		3.78		3.78	Sanitary	On-site Treatment
Waste Water Treatment	0.85		0.85		0.85		MLLW	C-752-A
	2475.45	440.49	2589.96	486.1	2070.19	346.51		
Annual Totals	2915.94		3076.06		2416.7			
* All volumes are in m^3								

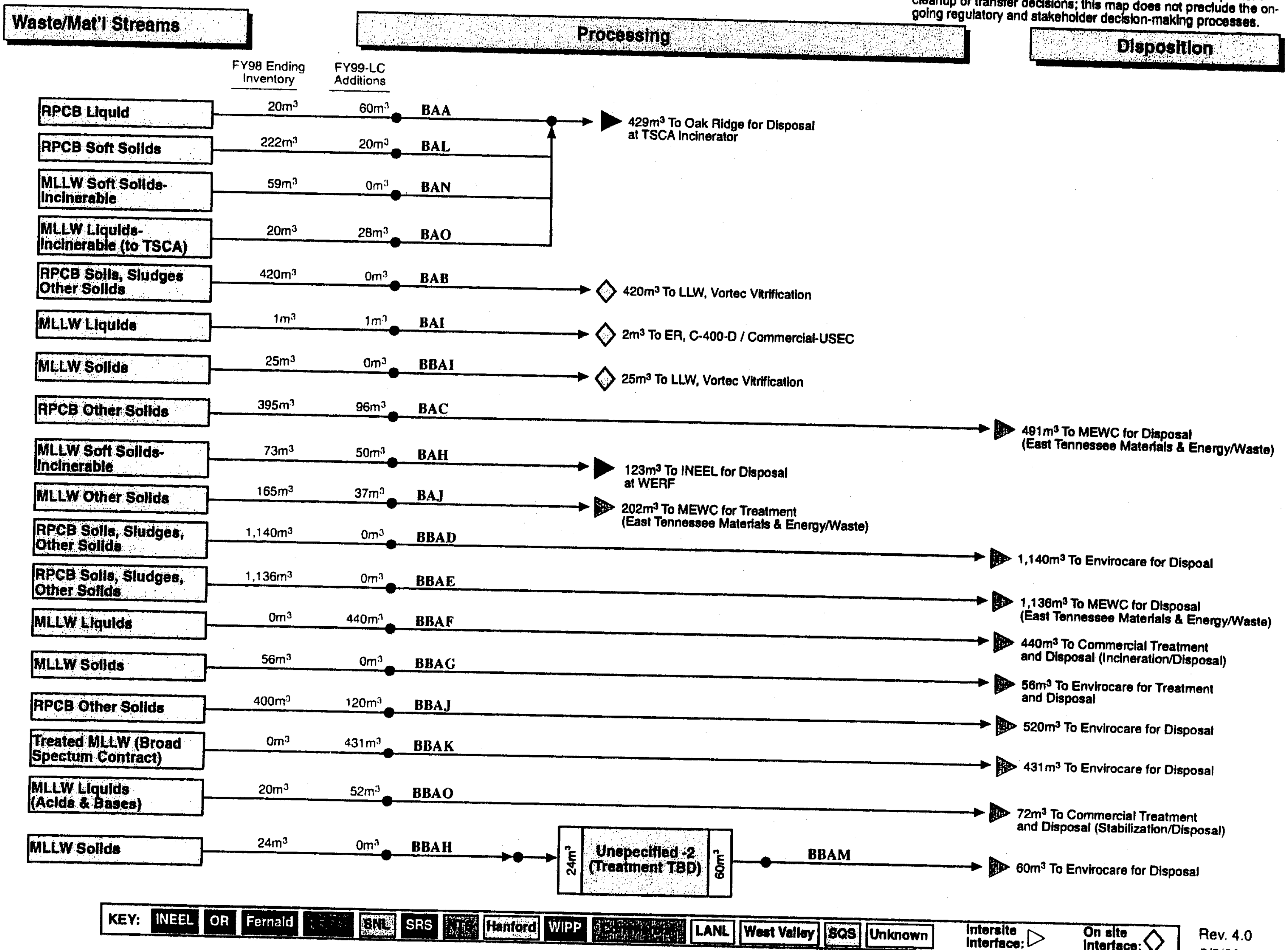
APPENDIX C

Paducah Baseline Disposition Map

Paducah MLLW Disposition Map

PREDECISIONAL DRAFT

This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.

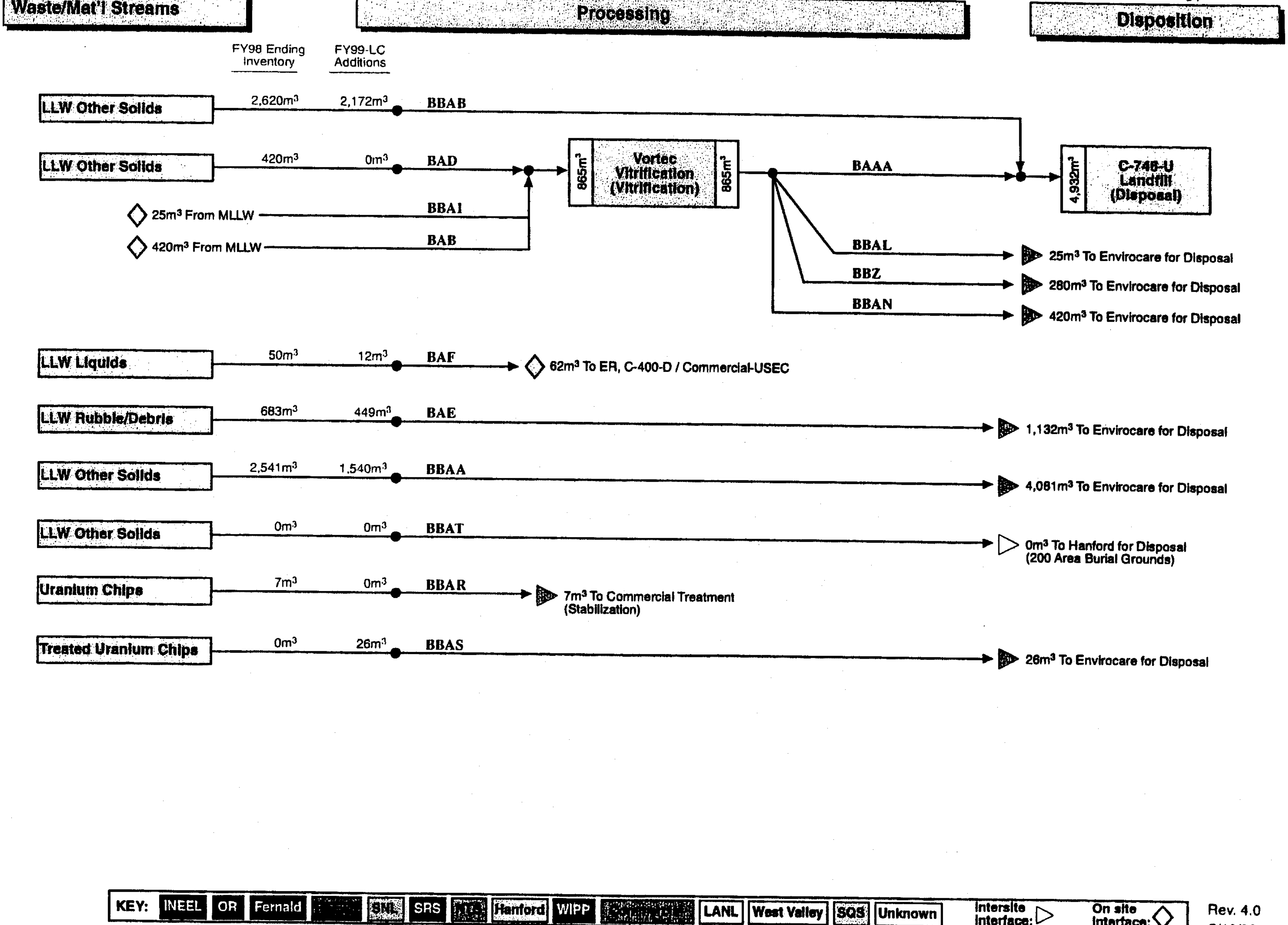


Rev. 4.0
6/2/99

Paducah LLW Disposition Map

PREDECISIONAL DRAFT

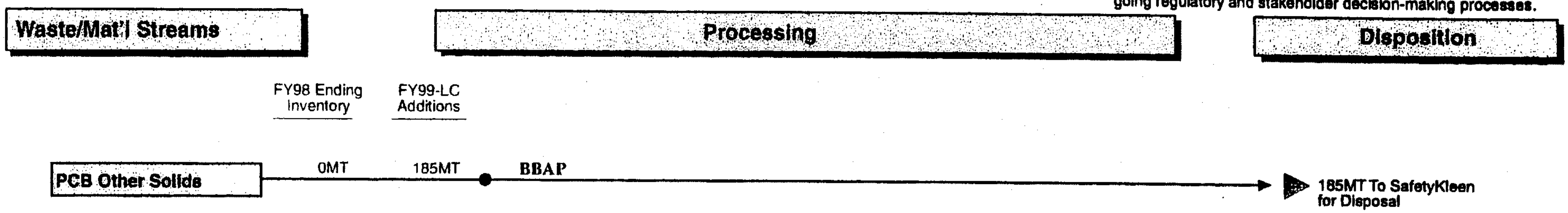
This map is conceptual and in many cases does not ...sent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.



Rev. 4.0
5/10/99

Paducah HAZ Disposition Map

PREDECISIONAL DRAFT
This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.

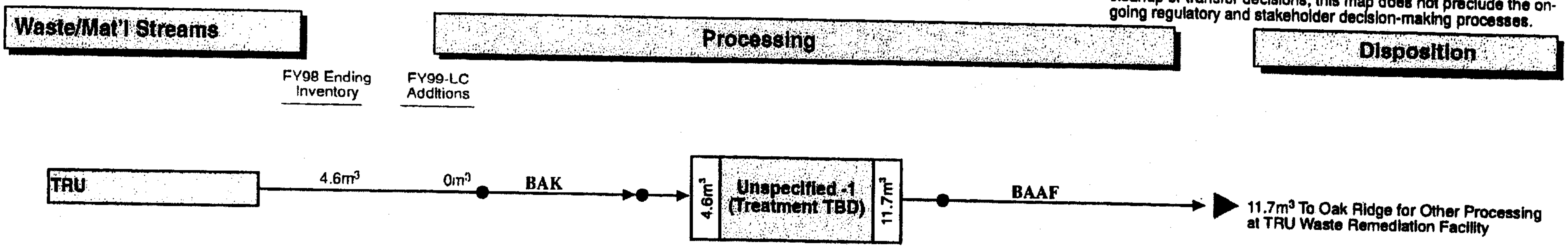


KEY: INEEL | OR | Fernald | SNL | SRS | Hanford | WIPP | LANL | West Valley | SQS | Unknown | Intersite Interface: ▷ | On site Interface: ◇

Rev. 4.0
5/10/99

Paducan TRU Disposition Map

PREDECISIONAL DRAFT
This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.



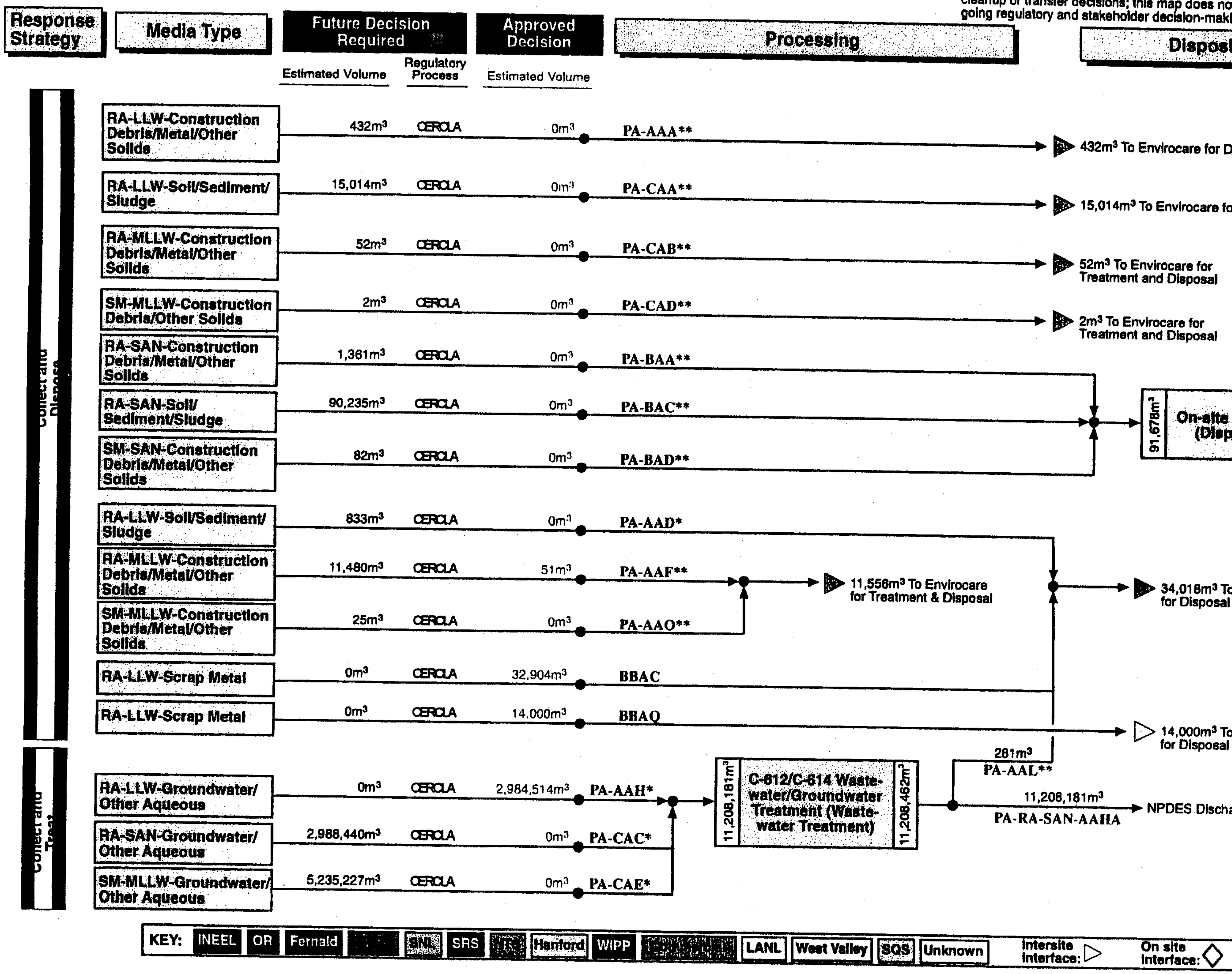
KEY: INEEL | OR | Fernald | BNL | SRS | NTS | Hanford | WIPP | LANL | West Valley | SQS | Unknown | Intersite Interface: ▷ | On site Interface: ◇

Rev. 4.0
5/17/99

Paducah ER Disposition Map (Page 1 of 2)

PREDECISIONAL DRAFT

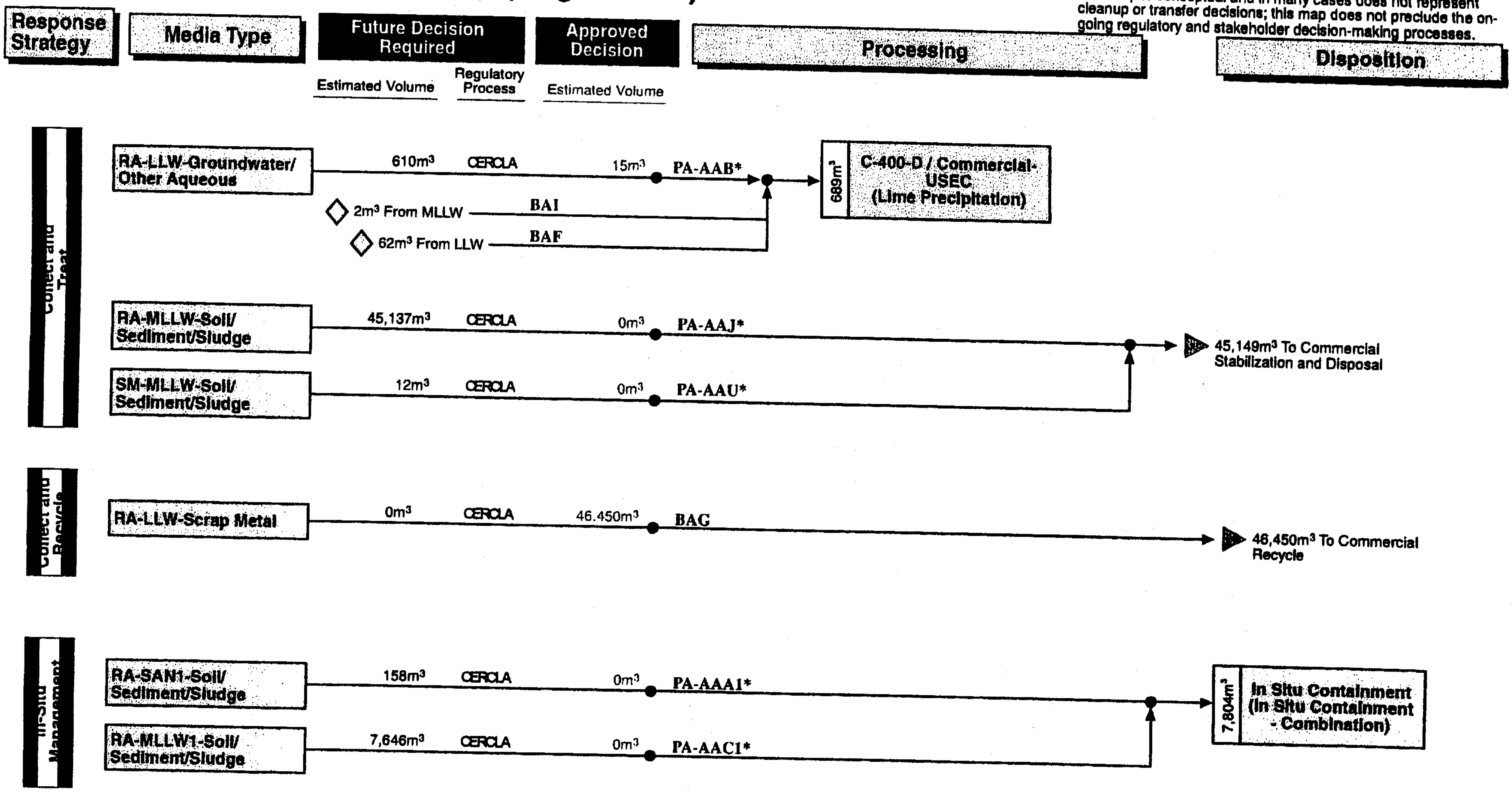
This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.



Rev. 4.0
5/19/99

Paducah ER Disposition Map (Page 2 of 2)

PREDECISIONAL DRAFT
This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.



	Future Decision	Approved
Groundwater/Surfacewater:	8,224,277m³	2.984,529m³
In Situ Response Strategy:	7,804m³	0m³
Ex-Situ Response Strategy:	164,665m³	93,405m³

KEY: INEEL | OR | Fernald | SNL | SRS | Hanford | WIPP | LANL | West Valley | SOS | Unknown | Intersite Interface: ▷ | On site Interface: ◇

Rev. 4.0
5/19/99

APPENDIX D

Environmental Compliance Overview

D1. UNITED STATES DEPARTMENT OF ENERGY ORDER 435.1

Beginning July 1999, proposed DOE Order 435.1 and its related manuals and guidance documents replaced Chapters I, II, III, IV, and VI of DOE Order 5820.2A. The requirements of the DOE Order will apply to all new and existing DOE radioactive waste management facilities, operations, and activities. DOE Order 435.1 is required to be implemented at the earliest possible date, but in any event, no later than July 2000.

DOE Order 435.1 requires a complex-wide LLW Management Program Plan to ensure that all LLW activities are systematically planned, executed, and evaluated. The LLW Management Program Plan is to include a "radioactive waste management basis" (RWMB) for all LLW generated. The RWMB is to include a performance assessment, composite analysis, and disposal authorization statement that ensures LLW can be handled and disposed of appropriately. The LLW Management Program Plan will require DOE to study the complete life cycle of LLW from waste generation to ultimate disposal.

DOE Order 435.1 states that LLW that has an identified path for disposal will only be allowed to stay in storage for one year. The Order requires the preparation of a policy for dealing with waste that has no identified path for disposal. The Order requires that DOE Headquarters (HQ) be notified and approve the intent to generate such waste.

DOE Order 435.1 also requires that treatment and storage areas be designed to confine the waste in case of leaks and spills. Monitoring and leak detection systems are required to provide rapid identification of containment failures. While covers are not explicitly required for storage facilities (they are for disposal facilities), storage areas are to be constructed or modified to maintain package integrity, prevent overflows of containment systems, etc. Thus, in practice, covers will most likely also be required for storage facilities.

United States Department of Energy Order 435.1 favors (but does not require) the disposal of LLW onsite. United States Department of Energy Order 5820.2A also has a preference for on-site disposal of LLW. However, DOE Order 435.1 indicates that its requirements may be waived or modified through accepted processes for work activities (e.g., Work Smart Standards) or through an exemption processed in accordance with the requirements of DOE Order 251.1, Directives System. The exemption process is laid out in the manual accompanying DOE Order 251.1.

Approval of an exemption may only be made if it is not prohibited by law or does not present an undue risk to facility workers and public health, safety, and the environment, and if the exemption is warranted under the circumstances. Factors DOE HQ must consider in deciding whether to grant an exemption include, but are not limited to, whether DOE Order 435.1 requirement is justified by a safety or health benefit and whether any material circumstance exists that was not considered when the requirement was adopted.

Finally, if the DOE PGDP Site Office requires Bechtel Jacobs Company to comply with DOE Order 435.1, evaluations will need to be made as to whether existing requirements for the management of LLW are "necessary and sufficient." As a result of the Work Smart Standards discussed in the *Environmental Management, Management and Integration Contract* for Oak Ridge Operations (ORO) (which includes the PGDP), the DOE and Bechtel Jacobs Company have agreed that Bechtel Jacobs Company must only comply with standards deemed necessary and sufficient.

D2. UNITED STATES DEPARTMENT OF ENERGY MORATORIUM

Pursuant to a 1991 memorandum, DOE HQ placed a moratorium on the shipment of any potential radiologically contaminated waste that also is contaminated with Resource Conservation and Recovery Act (RCRA)-hazardous or Toxic Substances Control Act (TSCA)-regulated waste to commercial facilities not licensed by the United States Nuclear Regulatory Commission or an agreement state (DOE, 1991). In a second memorandum, DOE clarified that the moratorium does not apply to the off-site shipment of any non-TSCA or nonhazardous radiologically contaminated waste, but DOE's release criteria (DOE, 1992) must be met prior to the waste's unconditional release, except for wastes for which the radioactivity is covered by another regulatory program (DOE, 1993). In 1995, DOE HQ lifted the moratorium at the PGDP for those hazardous/toxic wastes determined to be nonradioactive by virtue of process knowledge and surface smear surveys (DOE, 1995). The partial lifting did not include bulk or volume materials. In 1997 DOE issued guidance (referred to as EM-37 guidance) for establishing authorized limits for releasing and shipping hazardous wastes containing residual radioactive material to commercial waste treatment facilities not licensed to handle radioactive materials (DOE, 1997). The guidance authorizes those sites at which the moratorium was lifted or partially lifted to use the release requirements of DOE Order 5400.5 to establish authorized radionuclide limits on a case-by-case basis as long as certain requirements are met.

D3. UNITED STATES DEPARTMENT OF ENERGY PROPOSED STANDARD

DOE-STD-XXXX-YR PROPOSED, "Guide to Good Practice for Establishing Authorized Limits for the Release of Waste and Property Contaminated with Residual Radioactivity" would establish uniform DOE guidance for developing, establishing, and coordinating authorized radiological limits for the release of wastes (non-real property) to landfills and/or other TSDF not licensed to receive radioactive material. It applies to DOE-operated on-site landfills, public or off-site landfills, and hazardous waste facilities. At present, DOE Order 5400.5, "Radiation Protection of the Public and Environment," issued February 8, 1990 defines requirements under which DOE facilities may establish authorized radiological release limits for release of waste and property for off-site disposal. The order has been supplemented by guidance provided by the Office of Environment, Safety, and Health (EH) and the Office of Environmental Management (EM). The EH and EM guidance define protocols for use by DOE field elements and contractors in establishing authorized radiological release limits on a case-by-case basis, including the requirement that the appropriate DOE field and headquarters program and oversight organizations retain the prerogative to review and/or approve proposed authorized limits prior to implementation. The proposed guide would integrate the EH and EM guidance and experience gained in their application.

D4. REGULATORY PERMITS

The RCRA requirements for the PGDP are contained in two separate but related permits. These include the Hazardous Waste Management Permit, which is issued and administered by the Commonwealth of Kentucky, and the Hazardous and Solid Waste Amendments (HSWA) Permit, which is issued and administered by the United States Environmental Protection Agency (EPA). Both permits were issued July 16, 1991, and they constitute the RCRA permits for the PGDP (permit number KY8-890-008-982). The EPA issued the HSWA permit because Kentucky had not yet received authorization to implement those provisions of RCRA. The Kentucky Hazardous Waste Management Permit contains provisions for treatment, storage, and disposal (TSD) units permitted under the RCRA base program, as well as corrective action requirements for solid waste management units. The EPA delegated HSWA authority to the Kentucky Department for Environmental Protection (KDEP) in April 1996 [61 Fed. Reg. 18504 (April 26, 1996)].

On February 28, 1995, the Kentucky Department for Environmental Protection, Division of Waste Management (KDWM), issued Permit 073-00045 to DOE for the construction of the C-746-U nonhazardous, solid waste, contained landfill at the PGDP. In January 1997, KDWM issued a new permit for the operation of the C-746-U Solid Waste Landfill.

The C-746-U Solid Waste Landfill is authorized by the KDWM to accept nonhazardous, nonliquid, residential, construction, demolition, and industrial wastes that may be generated by DOE at the PGDP. The landfill is currently accepting items such as construction and demolition debris, remediation waste, and asbestos-containing materials that meet the landfill's WAC established by DOE management and integration (M&I) contractor for PGDP waste management and environmental restoration activities. In the permit application for the landfill, DOE estimated that it would send 5,148 m^3 of material to the landfill per year.

The C-746-U Solid Waste Landfill permit states that no waste exhibiting radioactivity above *de minimis* levels may be disposed of in the landfill, and the landfill's WAC states that wastes exhibiting radioactivity at up to 30 pCi/g for total uranium may be disposed of there. United States Department of Energy has filed an administrative lawsuit disputing the KDWM's authority to set radioactivity limits for waste disposed of in the landfill; however, a final ruling on the matter has not been issued. The landfill's permit expires on February 28, 2005.

Effluent discharges from the PGDP to Outfalls 001, 015, 017, and 019 are subject to a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The Kentucky Department for Environmental Protection, Division of Water (KDOW), issued the current KPDES Permit to DOE in March 1998, and the permit became effective April 1, 1998.

D5. SITE TREATMENT PLAN

The HSWA of 1984 (42 U.S.C.A. § 6901 *et seq.)* prohibits the disposal of RCRA hazardous wastes that have not been pretreated to standards established by the EPA. These prohibitions are commonly referred to as the land disposal restrictions (LDRs) and apply to all hazardous waste components of RAD mixed wastes containing LDR waste. After the LDR guidelines were established, restricted wastes had to be treated to meet LDR treatment standards before land disposal could be considered. The LDR FFCA was developed to extend the effective date of the LDR prohibitions for RAD mixed wastes (EPA, 1992). As a result, DOE was to identify the treatment strategy for wastes to meet the LDR treatment standards, including a schedule for the prioritization, implementation, and completion of such treatment.

As a result of a Supreme Court ruling in 1992, Congress was compelled to affirm its real intent that federal facilities should fall under the same legal regulatory jurisdictions as others by passing the Federal Facility Compliance Act (FFC Act). The FFC Act expressly waives sovereign immunity from RCRA-based civil fines by the states and provides a three-year waiver for mixed (RCRA/RAD) waste not subject to any existing agreements. The delay may extend beyond three years if DOE enters into and complies with a state enforcement order. The FFC Act also stipulates a six-month time frame for DOE to develop plans for treatment technologies and storage and disposal capacity in each state. In addition, a mixed-waste inventory report and an inventory of treatment technologies and capacities were required from DOE for submission to the EPA and the states within 180 days. This submission was the inception of the Site Treatment Plan (STP) for the PGDP. The LDR FFCA was superseded in part by the FFC Act, which incorporates elements from the LDR FFCA. Another provision to this Act includes the requirement that the EPA or RCRA-authorized states must now conduct an annual environmental inspection of federal facilities. The FFC Act amendments to the RCRA effectively relieve the EPA of any perceived responsibility for developing and promulgating treatment standards for the radiological component of mixed wastes where the radiological constituent would otherwise be regulated under the Atomic Energy Act.

As required by Section 3021(b) of the RCRA, DOE has prepared STPs describing the development of treatment capacities and technologies for treating mixed waste. United States Department of Energy published a notice April 6, 1993, 58 Fed. Reg. 17875, describing the proposed process for developing the STPs in three phases: (1) a conceptual STP, (2) a draft STP, and (3) a proposed STP. The Kentucky Natural Resources Cabinet has reviewed the proposed STP, modified its terms, and approved the STP. The current STP was finalized in April 1997 by the Commonwealth and superseded the LDR FFC Agreement between DOE and EPA. A Unilateral Order issued to DOE on October 3, 1995 requires an annual update of the STP. The current update was prepared in March 1999.

D6. URANIUM ENRICHMENT TOXIC SUBSTANCES CONTROL ACT FEDERAL FACILITY COMPLIANCE AGREEMENT

The TSD of PCB waste at the PGDP is governed by the TSCA. The DOE must follow the TSCA regulations at 40 C.F.R. Part 761 pertaining to TSD of PCBs unless the UE TSCA Compliance Agreement (the UE TSCA FFCA) between DOE and EPA provides otherwise. The EPA revised its TSCA regulations (63 Fed. Reg. 35436) June 29, 1998 (effective August 28, 1998). The revisions were dubbed the "Megarule" by industry. As a result of the revisions, many of the provisions for the TSD of PCBs and PCB items have been modified. The following summarizes the major revisions to the TSCA TSD requirements, with an emphasis on how the changes might impact the waste projects at the PGDP.

D6.1 STORAGE DRIVERS

Pursuant to 40 C.F.R. § 761.65, PCBs and PCB items may be stored for disposal no longer than one year from the date they were placed in storage. The Bechtel Jacobs Company procedure on "Polychlorinated Biphenyl Management and Spill Cleanup" (PMWM1005) further specifies that PCBs and PCB items should be shipped for disposal no later than nine months after the waste is first placed in storage. The TSCA FFCA as well as EPA's concurrence to DOE's proposal relating to the one-year storage limit provide that the one-year storage limit applies to nonradioactive PCB waste and that the limit begins to run when the PCB waste is certified as nonradioactive. Like the TSCA FFCA, the revised TSCA disposal regulations now provide an exemption to the one-year storage limit for PCB waste that is also radioactive. However, the regulations add an additional requirement that is not currently part of the TSCA FFCA - the generator must document its attempts to dispose of its PCB/radioactive waste that is stored longer than one year [40 C.F.R. § 761.65(a)]. The regulation does not specify if/how the documentation must be reported to the EPA. It is possible that DOE may include the documentation in existing reports that its submits to the EPA on a regular basis. The regulation does specify that records of disposal attempts must be maintained until the waste is disposed of. The record keeping and the potential reporting likely will increase costs; however, the amount should be minimal.

Temporary storage of bulk PCB remediation waste and PCB bulk product waste (defined at 40 C.F.R. § 761.3 and further discussed in the disposal section below) may occur at the cleanup site or site of generation for up to 180 days pursuant to 40 C.F.R. § 761.65(c)(9). The maximum duration of temporary storage under the original regulatory provisions was 30 days. To qualify for the temporary storage under 40 C.F.R. § 761.65(c)(a), the following conditions must be met: the waste must be placed in a pile designed and operated to control dispersal of the waste by wind by a means other than wetting, and the waste must not generate leachate through decomposition or other reactions. The storage site must have the following: a liner that prevents migration of wastes into the subsurface soil, groundwater, or surface water and that meets the conditions of 40 C.F.R. § 761.65(c)(9)(iii)(A)(1)-(3); a cover that meets the requirements of 40 C.F.R. § 761.65(c)(9)(iii)(A)(1)-(3), that is installed to cover all of the stored waste likely to come into contact with precipitation, and that is secured so as not to be functionally disabled by winds; and a run-on control system designed, constructed, operated, and maintained under the conditions of 40 C.F.R. § 761.65(c)(9)(iii)(c)(1)-(3). Any of these conditions may be modified as long as risk-based approval is obtained from the EPA pursuant to 40 C.F.R. § 761.61(c) prior to the initiation of storage.

D6.2 DISPOSAL DRIVERS

Specific TSCA waste disposition requirements are delineated in Attachment 1 of the TSCA FFCA, the "Portsmouth and Paducah Gaseous Diffusion Plants Remedial Implementation Plan." The Implementation Plan specifies that the disposal of nonradioactive PCBs and PCB items will be on-going (disposal of PCBs must occur one year after the waste is certified as nonradioactive because the PCBs cannot be stored at the PGDP after that point). Co-contaminated radioactive PCBs and PCB items stored for disposal must be disposed of as soon as possible following the establishment of an EPA-approved operating incinerator or EPA-approved alternate disposal method. The disposal must be completed within 10 years of the work initiation date for materials already in storage and by 2016, or within ten years of storage, whichever is earlier, for materials placed into storage after February 20, 1992 (the effective date of the TSCA FFCA). Ventilation gaskets, ductwork and flanges, electrical cable, associated equipment, and historic spill material must be disposed of upon demolition of the facility from which they are derived. The work must be completed by 2016 or within 10 years of the work initiation date, whichever is earlier.

Specific disposal requirements for PCBs are contained in the TSCA regulations at 40 C.F.R. § 761.60. The recently promulgated revisions to the TSCA regulations provide new disposal options for several waste streams that will change the way these wastes are disposed of at the PGDP (those waste streams not subject to the regulatory revisions must follow 40 C.F.R. § 761.60 as before). The changes pertain to EPA's relaxation of the antidilution rule in specific applications. Previously, the EPA considered waste "PCB waste" if it contained PCBs in concentrations of 50 ppm or greater or if it was contaminated by a source that contained PCBs at 50 ppm or greater regardless of its actual concentration. For specific categories of waste, the EPA has opted not to apply the antidilution rule; consequently, some waste streams that previously were considered PCB waste and were subject to PCB disposal requirements will no longer be subject to those requirements.

D6.2.1 Laboratory Waste

The regulation pertaining to disposal of waste generated as a result of research and development activities specifically covers wastes generated during sample analysis. The regulation [40 C.F.R. § 761.64(a)] provides that samples (of a size designated in a chemical extraction and analysis method for PCBs) extracted for purposes of determining the presence or concentration of PCBs are no longer regulated for disposal under TSCA; consequently, they can be disposed of as non-PCB waste. The EPA is not explicit about whether this provision applies if the sample contains PCBs but is not being analyzed specifically for purposes of determining the presence and concentration of PCBs. If a waste is known to be PCB contaminated due to process knowledge, and the sample is only analyzed for purposes of determining the presence or concentration of radionuclides, metals, or any other constituent, then this provision may not be applicable, depending on EPA's intent.

The regulation further provides that all other wastes generated during chemical analysis of samples containing PCBs, such as personal protective equipment (PPE) or lab equipment, may be disposed of based on their concentrations at the time of disposal [40 C.F.R. § 761.64(b)(1)]. If the waste does not contain PCBs greater than or equal to 50 ppm, then it would be disposed of like any other non-PCB waste. If the waste otherwise meets the C-746-U Solid Waste Landfill's WAC, then it could be disposed of in the C-746-U Solid Waste Landfill. If the waste does contain PCBs greater than or equal to 50 ppm, it must be decontaminated or disposed of in accordance with TSCA as follows: liquid waste must be decontaminated pursuant to 40 C.F.R. § 761.79(b)(1) or (b)(2) or disposed of in accordance with 40 C.F.R. § 761.60(a) or (e); nonliquid waste must be disposed of in a state permitted, licensed or registered facility that can accept municipal solid waste or nonmunicipal nonhazardous waste, a RCRA Subtitle C landfill that can accept PCB waste, or a PCB disposal facility approved under 40 C.F.R § 761.61(c)[40 C.F.R. § 761.64(b)(2)]. The implementation of waste management practices (such as segregation of PCB and non-PCB laboratory waste) based on these regulatory provisions likely would result in a considerable cost savings to DOE waste projects.

D6.2.2 Polychlorinated Biphenyl Remediation Waste

Under the revised TSCA regulations, the EPA defines PCB remediation waste as waste containing PCBs as a result of a spill, release, or other unauthorized disposal. This category includes soils, sediments, dredged materials, muds, PCB sewage sludge, and industrial sludge to name a few. The self-implementing disposal provisions of the new regulations specify that disposal of PCB remediation wastes with PCB concentrations less than 50 ppm or nonliquid cleaning material and PPE at any concentration may occur either in a facility permitted, licensed, or registered by a state to manage municipal solid waste or nonmunicipal nonhazardous waste; a RCRA Subtitle C landfill permitted by a state to accept PCB waste; or an approved PCB disposal facility [40 C.F.R. § 761.61(a)(5)(i)(B)(2)(ii) and 40 C.F.R. § 761.61(a)(5)(v)(A)]. Personal protective equipment and cleaning solvents may be reused in lieu of disposal if they are decontaminated in accordance with 40 C.F.R. § 761.61(b) or (c) [40 C.F.R. § 761.61(a)(5)(v)(B)]. For remediation waste that is greater than or equal to 50 ppm, disposal must occur in a RCRA-permitted hazardous waste landfill or an approved PCB disposal facility. While these self-implementing provisions can be applied to the disposal of CERCLA/RCRA waste, any such disposal must be coordinated with the EPA's CERCLA Program Manager and the appropriate KDEP representatives to ensure that under the CERCLA/RCRA programs at the PGDP, the EPA or KDEP will not impose additional disposal requirements above and beyond what TSCA requires. This coordination should occur throughout the CERCLA/RCRA process, and the path forward should be specified in a record of decision. For non-CERCLA remediation waste, EPA/KDEP's approval would not be required to follow the self-implementing disposal provisions. Disposing of remediation waste pursuant to this regulatory provision likely would result in a significant cost savings for DOE waste projects.

D6.2.3 Polychlorinated Biphenyl Bulk Product Waste

This waste includes wastes derived from manufactured products containing PCBs in a nonliquid state at concentrations at the time of designation for disposal greater than or equal to 50 ppm, regardless of their current concentrations. Examples include demolition debris, felt or fabric products such as gaskets, and fluorescent light ballasts. Such wastes may be decontaminated; disposed of in an incinerator, in a chemical waste landfill, in a RCRA-permitted hazardous waste landfill, in an alternate disposal facility approved under 40 C.F.R. § 761.60(e); or disposed of pursuant to the TSCA PCB coordinated approval process [40 C.F.R. § 761.62(a)]. Certain bulk product wastes specified in 40 C.F.R. § 761.62(b)(i) and (b)(ii) may be disposed of in a solid waste landfill; additionally other PCB bulk product waste such as paper or felt gaskets contaminated by liquid PCBs may be disposed of in a solid waste landfill provided the conditions of 40 C.F.R. § 761.62(b)(2)-(4) are met.

D6.2.4 Polychlorinated Biphenyl/Radioactive Waste

Disposal of PCB/radioactive waste must take into account the PCB concentration as well as the radioactive properties of the waste. If the waste meets the requirements for disposal in a municipal or nonmunicipal nonhazardous waste landfill, then the waste may be disposed of based on its radioactive properties. It is not clear whether EPA has relaxed its antidilution provision with regards to PCB/radioactive waste (i.e., for purposes of disposal the PCB concentration is the actual concentration found in the waste regardless of the concentration of the source). The EPA's clarification should be obtained with respect to this issue. If the EPA clarifies that it intended to relax the antidilution rule with regards to PCB/radioactive waste, then disposition of PCB/radioactive waste pursuant to this regulatory interpretation likely would result in a significant cost savings for DOE waste projects.

D6.2.5 Multi-Phasic Polychlorinated Biphenyls

If multi-phasic PCBs are separated into distinct phases prior to disposal, then the concentration of each phase can be used to determine the applicable disposal requirements [40 C.F.R. § 761.1(b)(4)(iv)]. This provision of the revised regulations represents a specific relaxation of the antidilution rule. The liquid phase of many sludges may be able to be disposed of as non-PCB contaminated waste, as long as laboratory analysis verifies that the PCB concentration is < 50 ppm. During separation of multi phasic PCBs, non-PCB-dedicated hoses and equipment would be used, so the non-PCB contaminated phase would not become PCB contaminated through contact with PCB dedicated equipment.

D6.2.6 Decontamination Wastes

Certain wastes that are generated as a result of the decontamination of PCB items are no longer subject to the antidilution rule. In general, decontamination waste and residues will be disposed of at their existing PCB concentration. For specific exceptions, refer to 40 C.F.R. § 761.79(g).

Nonliquid cleaning materials and PPE at any concentration resulting from decontamination may be disposed of in a facility permitted, licensed, or registered by a state to manage municipal solid waste or nonmunicipal nonhazardous waste, a RCRA Subtitle C landfill permitted by a state to accept PCB waste, or an approved PCB disposal facility (note that the antidilution rule has been relaxed in this instance) [40 C.F.R. § 761.79(g)(6) and 40 C.F.R. § 761.61(a)(5)(v)(A)]. These wastes potentially could be disposed of in the PGDP's solid waste landfill, as long as the landfill's WAC is met.

D6.3 MISCELLANEOUS DRIVERS

United States Department of Energy, as the owner of the PCB transformers at the PGDP, must register its transformers with the EPA by December 28, 1998 (the registration is a one-time requirement, as opposed to an annual requirement) [40 C.F.R. § 761.30 (a)(1)(vi)]. The registration requirement applies to both PCB transformers in use and PCB transformers in storage for reuse. The United States Enrichment Corporation will be responsible for verification and revision (if needed) of the list of PCB transformers it uses and has stored for reuse, and Bechtel Jacobs Company will be responsible for field validation of the list. If the registration requirement is not met for a particular transformer, it would no longer be authorized for continued use under TSCA. The transformer registration requirement will result in a one-time cost increase.

Waste storage inspection and related PCB spill cleanup records must now be included in the PCB Annual Document pursuant to 40 C.F.R. § 761.180(a)(1)(iii). These records are currently maintained, but previously have not been included in the Annual Document. The inclusion of these records in the Annual Document would result in a minimal cost increase.

D7. TOXICITY CHARACTERISTIC LEACHING PROCEDURE FEDERAL FACILITIES COMPLIANCE ACT

In March 1990, the EPA promulgated the Toxicity Characteristics Revisions, which replaced the Extraction Procedure Toxicity leachate test with the Toxicity Characteristic Leaching Procedure (TCLP) [55 Fed. Reg. 11798 (March 29, 1990) and 40 C.F.R. § 261.24]. The TCLP test added 25 organic chemicals to the list of toxic constituents of concern and established regulatory levels for these organic chemicals based on health-based concentration thresholds and a dilution and attenuation factor that was developed using a fate and transport model. After the effective date of the Toxicity Characteristics Revisions, September 25, 1990, any waste that exhibited a toxicity characteristic pursuant to the TCLP became a RCRA-characteristic hazardous waste.

The RCRA TCLP FFCA for the PGDP became effective on March 26, 1992. The TCLP FFCA is an agreement between DOE and EPA that generally requires DOE to use the TCLP of the RCRA as one of the methods for determining whether waste stored at the PGDP is hazardous. The TCLP FFCA generally applies only to waste that was not stored in a RCRA-permitted facility at the time of the agreement. Pursuant to an implementation plan for the TCLP FFCA, the wastes subject to the TCLP FFCA are referred to as accumulated wastes (AW). The implementation plan, completed in April 1992 (updated in January 1994), estimated that pursuant to the TCLP FFCA, between 2,500 and 5,000 containers at the PGDP are required to undergo a TCLP analysis.

The TCLP FFCA requires that within five business days of obtaining analytical results of TCLP analyses, DOE must notify the EPA of AW that exhibits the TCLP characteristic. The implementation plan adds that the notification must be made by facsimile. Further, the implementation plan adds that the notice must be made for waste that is determined to be hazardous, regardless of whether that determination is made through the TCLP, waste knowledge, process knowledge, or testing for ignitability, corrosivity, or reactivity. Finally, the TCLP FFCA requires DOE to develop a schedule for conducting the TCLP analyses. The latest schedule developed by DOE and approved by the EPA requires DOE to complete the TCLP analyses of AW by December 31, 2000.

D8. REFERENCES

DOE, 1991. "Shipment of Waste Originating in Radiation Control Areas," memorandum, United States Department of Energy, Washington, DC, May 17, 1991.

DOE, 1992. "Update: Moratorium on Shipment of Potentially Radioactive Hazardous and Toxic Wastes," memorandum, United States Department of Energy, Washington, DC, February 4, 1992.

DOE, 1993. "Clarification of Applicability and Responsibility under the Moratorium on Offsite Shipment of Potentially Radioactive Waste," memorandum, United States Department of Energy, Washington, DC, July 6, 1993.

DOE, 1995. "Authorization to Resume Shipments of Resource Conservation and Recovery Act Hazardous or Toxic Substances Control Act-Regulated Waste from the Paducah Gaseous Diffusion Plant," memorandum, United States Department of Energy, Washington, DC, June 30, 1995.

DOE, 1997. "Establishment and Coordination of Authorized Limits for Release of Hazardous Waste Containing Residual Radioactive Material," memorandum, United States Department of Energy, EM-37, Washington, DC, January 7, 1997.

DOE, 1998. "Status of Concurrence on Departmental Draft DOE Order 435.1," memorandum, United States Department of Energy, Argonne, IL, July 16, 1998.

EPA, 1992. *Federal Compliance Agreement for the Storage of Radioactive Mixed Waste Subject to Land Disposal Restrictions for the Paducah Gaseous Diffusion Plant,* Docket No. 92-03-FFR, United States Environmental Protection Agency, Atlanta, GA, July 10, 1992.

APPENDIX E

Risk-Based Methodology Scoring Table

Risk-Based Methodology Scoring Table

Risk-Based Methodology Scoring Table

		Quantity	Public S&H		Site Personnel S&H		Enviro. Protection		Compliance		Mission		Mortgage Reduction		Total
		# Containers	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likehood	Score	Score
1	AC1 Miscellaneous Acids & Bases	113	3C	156	6B	188	10B	188	11B	500	14B	750	18C	250	2032
2	TRU2 TRU Liquids	6	3C	156	6B	188	10C	94	11B	500	14B	750	18C	250	1938
3	LLW U Chips	20	3B	313	5B	375	9B	375	13B	125	14B	750	18D	0	1938
4	TRU1 TRU Solids	9	3C	156	7B	94	10C	94	11B	500	14B	750	18C	250	1844
5	HR1 High Rad Solids	18	3C	156	7C	47	10C	94	11B	500	14B	750	18C	250	1797
6	HU1 Hydrolyzed UF_6	14	3C	156	7C	47	10C	94	11B	500	14B	750	18C	250	1797
7	AR Ash Receivers (Ash)	6	3C	156	7C	47	10C	94	11B	500	14B	750	18C	250	1797
8	MF1 MgF2 Pellets	12	3C	156	7A	188	10C	94	11B	500	14B	375	18C	250	1563
9	TC1 Tc-99 Waste (4,000 gal cont.)	1	3C	156	7C	47	10C	94	11B	500	14B	750	18D	0	1547
10	LLW Radioactive Chemicals	1	3C	156	7B	94	10C	94	13D	0	14B	750	18C	250	1344
11	NS1 Nickel Stripper Sludge	14	3D	0	6B	188	10C	94	11B	500	15C	188	18C	250	1220
12	SA1 Sodium Azide	1	3C	156	6B	188	10B	188	11B	500	16C	84	18D	0	1116
13	R3 Organic Peroxide	1	3C	156	6B	188	10B	188	11B	500	16C	94	18D	0	1126
14	TSCAICS TSCAI Combustible Solids	177	3D	0	7C	47	10D	0	11B	500	16D	0	18B	500	1047
15	INEELICS INEEL WERF Comb Solids	148	3D	0	7C	47	10D	0	11B	500	16D	0	18B	500	1047
16	INEELICS1 INEEL WERF Comb Solids	173	3D	0	7C	47	10D	0	11B	500	16D	0	18B	500	1047
17	INEELPW Paint Waste	28	3D	0	7C	47	10D	0	11B	500	16D	0	18B	500	1047
18	TSCAICS1 TSCAI Comb Solids	95	3D	0	7C	47	10D	0	11B	500	16D	0	18B	500	1047
19	PCB Water/C-404 Liquid*	34	3D	0	7D	0	10D	0	11A	1000	16D	0	18D	0	1000
20	CCS1 Cr Contaminated Solids	25	3D	0	7C	47	10D	0	11B	500	15B	375	18D	0	922
21	BAT1 Batteries	38	3D	0	7C	47	10D	0	11B	500	14C	375	18D	0	922
22	SSS1 Spent Solvent Solids	17	3D	0	7C	47	10D	0	11B	500	16C	84	18C	250	881
23	HWRTS1 Hot Water Rinse Tank Sludge	24	3D	0	7C	47	10D	0	11B	500	16C	94	18C	250	891
24	SP1 Spill Cleanup Materials	15	3D	0	6C	94	10C	94	11B	500	15C	188	18D	0	876
25	PA-M001 Misc Oxidizers	2	3D	0	6C	94	10C	94	11B	500	15C	188	18D	0	876
26	TW1 Tc Waste	4	3D	0	7C	47	10C	94	11B	500	15C	188	18D	0	829
27	PCB Soil	4238	3D	0	7D	0	10D	0	11C	250	16D	0	18B	500	750
28	DEV1 Developer Solution	13	3D	0	7C	47	10C	94	11B	500	16C	94	18D	0	735
29	FL1 Misc. Flammable Materials	11	3D	0	7C	47	10C	94	11B	500	16C	94	18D	0	735
30	LPFL Labpack With Flammable Mat.	36	3D	0	7C	47	10C	94	11B	500	16C	94	18D	0	735
31	R2 Hydrogen Peroxide	1	3D	0	7C	47	10D	0	11B	500	16C	94	18D	0	641
32	R1 Miscellaneous Reactives	1	3D	0	6D	47	10D	0	11B	500	16C	94	18D	0	641
33	MSL1 Misc. Sludge	72	3D	0	7C	47	10D	0	11B	500	16C	94	18D	0	641
34	MS1 Miscellaneous Inorganic Solids	16	3D	0	7C	47	10D	0	11B	500	16D	0	18D	0	547
35	MSL2 Miscellaneous Sludges	5	3D	0	7C	47	10D	0	11B	500	16D	0	18D	0	547
36	WP1 Wooden Pallets	43	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
37	CARB1 Activated Carbon	99	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
38	CYL1 Compressed Gas Cylinder	3	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
39	GB1 Glass Bead & Sandblasting	36	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
40	CAP1 Mixed Waste Capacitors	65	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
41	MD1 Metal & Miscellaneous Debris	65	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
42	VD1 Vacuum Dust	14	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
43	CWS1 Cyl Wash & Hand Table Sludge	17	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
44	FC1 F2 Cell & Electrolyte	12	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
45	WW1 Misc. Waste Water	6	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
46	SSS2 Spent Solvent Solids	12	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
47	MCD1 Mercury Cont. Debris	28	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
48	LP2 Miscellaneous Labpack	87	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
49	PCB/Asbestos	805	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
50	PCB/Concrete	1414	3D	0	7D	0	10D	0	11C	250	16D	0	18C	250	500
51	PCB Zorball/Floor Sweep	974	3D	0	7D	0	10D	0	11C	250	16D	0	18C	250	500
52	PCB Sludges	915	3D	0	7D	0	10D	0	11C	250	16D	0	18C	250	500
53	PCB Misc. Oil	50	3D	0	7D	0	10D	0	11C	250	16D	0	18C	250	500
54	LLW Radium Source/Lead Plate/Lead	1	3D	0	7D	0	10D	0	11B	500	16D	0	18D	0	500
55	LLW Asbestos	1513	3D	0	7C	47	10C	94	11C	250	16C	94	18D	0	485
56	LLW Pure Thorium Fluoride	1	3D	0	6C	94	10D	0	13C	63	16D	0	18C	250	407
57	LLW Metal (Ash Receivers)	1708	3D	0	7C	47	10D	0	11C	250	16C	94	18D	0	391
58	LLW Miscellaneous Batteries	27	3D	0	7D	0	10D	0	13B	125	16D	0	18C	250	375
59	LLW Tc-99/Grout Tiles	1	3D	0	7B	94	10B	188	13C	63	16D	0	18D	0	345
60	Soil/Trash/Zorball/Rock/Gravel	13963	3D	0	7C	47	10C	94	13D	0	15C	188	18D	0	329
61	PPE/Plastic/Rags/Pads/Absorbents	1793	3D	0	7C	47	10D	0	13D	0	16D	0	18C	250	297
62	Misc. PCB Absorbents	659	3D	0	7C	47	10D	0	13D	0	16D	0	18C	250	297
63	PCB Scrap Metal Alum/Steel/Iron	410	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
64	PCB/Asphalt	1	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
65	PCB Ballasts/Capacitors	169	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
66	PCB Glass/Bottles	66	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
67	PCB Bushings	6	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
68	PCB Carbon	15	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
69	PCB/Coolant Sludge	3	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
70	PCB Uranium Precipitate	16	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
71	PCB Trash	1438	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
72	PCB Equipment	146	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
73	PCB Lab Residue/Waste	21	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
74	PCB Plastic/PPE	247	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
75	PCB Empty Drums	155	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
76	PCB Sodium Sulfate	1	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
77	PCB Wood	135	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
78	PCB Filters	4	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
79	PCB Vacuum Dust	3	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
80	PCB PVC Pipe	125	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
81	PCB Misc./Unknown	30	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
82	PCB Samples	48	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
83	PCB Grease	1	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
84	LLW Bird Poison	1	3D	0	7D	0	10D	0	11C	250	16D	0	18D	0	250
85	LLW Alkali Tank Sludge	166	3D	0	6C	94	10D	94	13D	0	16D	0	18D	0	188
86	LLW Hydrolyzed UF6	7	3D	0	7B	94	10D	94	13D	0	16D	0	18D	0	188
87	LLW Water	247	3D	0	7C	47	10D	0	13C	63	16D	0	18D	0	110
88	LLW Drilling Mud	827	3D	0	7D	0	10D	0	13D	0	16C	94	18D	0	94
89	LLW Propylene Glycol	2	3D	0	7D	0	10D	0	13D	0	16C	94	18D	0	94
90	LLW Elemental Powders/Oxides	1	3D	0	7D	0	10D	0	13D	0	16C	94	18D	0	94
91	LLW Metal Oxides/Chlorides	1	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94
92	LLW Wood	92	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94

	Risk-Based Methodology Scoring Table																
		Quantity	Public S&H		Site Personnel S&H		Enviro. Protection		Compliance		Mission		Mortgage Reduction		Total
		# Containers	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likelihood	Score	Likehood	Score	Score
93	LLW Nickel Stripper Sludge	12	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94
94	LLW Vacuum Dust	195	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94
95	LLW Nickel Dust	1	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94
96	LLW Nickel Arsenate (Sulfate)	69	3D	0	7B	94	10D	0	13D	0	16D	0	18D	0	94
97	LLW Filter Cake	660	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
98	LLW Uranium Compounds	84	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
99	LLW Glass	80	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
100	LLW Trap Mix	557	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
101	LLW Floor Sweep	566	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
102	LLW Blasting Media	324	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
103	LLW Nickel Compounds	5	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
104	LLW Sodium Hydrogen Sulfate	1	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
105	LLW Oxalic Acid	15	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
106	LLW Diesel Sludge	3	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
107	LLW Trioxide Sludge	1	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
108	LLW Dye/Chemicals	4	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
109	LLW Cresol	1	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
110	LLW Oakite 62	2	3D	0	7C	47	10D	0	13D	0	16D	0	18D	0	47
111	LLW Misc. Compounds	2	3D	0	7C	0	10D	0	13D	0	16D	0	18D	0	0
112	LLW Soda Ash	4	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
113	LLW Weld-Kleen	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
114	LLW Red Alumina Powder	2	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
115	LLW Ammonia Sulfate	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
116	LLW Epoxy	16	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
117	LLW Ferrous Sulfate	5	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
118	LLW Calcium Fluoride	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
119	LLW Zinc Chloride	3	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
120	LLW Ion Exchange Resin	17	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
121	LLW 1,4 Butanediol	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
122	LLW Chem-Calk	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
123	LLW Magnesium	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
124	LLW Protein Firefighting Foam	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
125	LLW Lithium Carbonate	2	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
126	LLW Cerium Hydrate	6	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
127	LLW Sludges	267	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
128	LLW Misc. Equipments	62	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
129	LLW Insulation/Fiberglass Sheets	264	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
130	LLW Paint Wastes	24	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
131	LLW Oil Filters	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
132	LLW Activated Carbon/Wicks	48	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
133	LLW Lab Samples/Residuals	40	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
134	LLW Rust	26	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
135	LLW Sewer Sludge	210	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
136	LLW Sodium Orthosilicate	5	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
137	LLW Petroleum Jelly	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
138	LLW Contact Cement	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
139	LLW Non-Regulated Materials	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
140	LLW Pure Gold Gel	5	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
141	LLW Lab Waste (Liquid)	6	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
142	LLW Grease	7	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
143	LLW Graphite	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
144	LLW Flux	1	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
145	LLW Film	5	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
146	LLW Collection Drum	4	3D	0	7D	0	10D	0	13D	0	16D	0	18D	0	0
	TOTAL	37707													

Management Evaluation Matrix

IMPACTS	Likelihood of Occurrence			
	A	B	C	D
	very high (0-1 yr)	high (1-10 yr)	medium (10-100 yr)	low (>100 yr)
PUBLIC SAFETY & HEALTH				
(1) Immediate or eventual loss of life/permanent disability	2500	1250	625	313
(2) Excessive exposure and/or injury	1250	625	313	156
(3) Moderate- to low- level exposure	625	313	156	0
SITE PERSONNEL SAFETY & HEALTH				
(4) Catastrophic – Injuries / illness	1500	750	375	188
(5) Critical – Injuries / illness	750	375	188	94
(6) Marginal – Injuries / illness	375	188	94	47
(7) Negligible – Injuries / illness	188	94	47	0
ENVIRONMENTAL PROTECTION				
(8) Catastrophic damage	1500	750	375	188
(9) Significant damage	750	375	188	94
(10) Minor to moderate damage	375	188	94	0
COMPLIANCE				
(11) Noncompliance with federal, state or local laws	1000	500	250	125
(12) Noncompliance with Orders or Directives	500	250	125	63
(13) Significant deviation from good management practices	250	125	63	0
MISSION				
(14) Significant negative impact at the program level	1500	750	375	188
(15) Significant negative impact on multiple projects (>2)	750	375	188	94
(16) Significant negative impact on one other project	375	188	94	0
MORTGAGE REDUCTION				
(17) Significant avoidable cost (total savings =>$15M)	2000	1000	500	0
(18) Moderate avoidable cost (total saving of >$1M<$15M)	1000	500	250	0

C.8. SITE-SPECIFIC SEISMIC DATA

PGDP is located near the northeastern end of the New Madrid fault (Reelfoot rift) zone. The Reelfoot rift zone is characterized as a deep, seismically active fault system. The Reelfoot rift zone extends beneath and beyond Paducah along the Shawneetown fault and terminates against the Cottage Grove-Rough Creek fault zone. The seismically active New Madrid fault zone (Mitchell et al. In press) has been mapped in the subsurface of the Reelfoot rift zone, but evidence of surface rupture along this fault has not been confirmed. Nuttli (1981, p. 40) states that strong-motion earthquakes seldom, if ever, produce surface ruptures in the central or eastern United States. Current knowledge of the New Madrid fault zone indicates that no significant potential exists for a surface rupture to occur at PGDP during an earthquake.

Although several strong-motion earthquakes have occurred near the St. Genevieve, Cottage Grove, and Wabash Valley fault zones, these zones differ from the New Madrid fault zone in that no spatial correlation between them and historical seismicity has been substantiated. Current knowledge indicates that these faults are inactive.

Seismic Source Zone 55 (Thenhaus 1983, pp. 20-23) is a northeast-trending area of seismicity coincident with the Reelfoot rift zone of northeastern Arkansas, southeastern Missouri, southern Illinois, and extreme western parts of Tennessee and Kentucky. The maximum expected earthquakes in Seismic Source Zone 55 would have a body-wave magnitude of 7.5. UCRL 15910 lists the maximum horizontal ground surface acceleration at PGDP, based on a moderate hazard annual probability of exceedance of 1×10^{-3}, as 0.45 g. Site specific seismic hazard results using the latest methodologies developed by Lawrence Livermore National Laboratory and EPRI indicate the maximum horizontal ground surface acceleration, with a moderate hazard annual probability of exceedance of 1×10^{-3}, as 0.25g.

Based upon previous studies [Johnston, A.C., and Nava, S.J. (1985), Recurrence rates and probability estimates for the New Madrid seismic zone, *J. Geophy. Res.*, 90] the probability of an earthquake of Richter Magnitude 6.0 in the New Madrid fault zone before the year 2025 is estimated to be about 30 to 50%. This probability is related to the total length of the fault (fault length > 200 miles). The probability of this occurring on the fault near Paducah would be more like 5 to 10%.

C.9. REFERENCES

Adamus, P.R., E.J. Clairain, R.D. Smith, and R.E. Young 1987. Wetland Evaluation Technique (WET). U.S. Army Corps of Engineers, Vicksburg, MS

Balding, A., 1995. *Wetland Assessment for UF6 Cylinders and Storage Yards, Phase IX at the Paducah Gaseous Diffusion Plant, Paducah, KY.* Prepared for Lockheed Martin Energy Systems, Inc, Paducah Gaseous Diffusion Plant, Paducah, KY. July 1995. KY/EM-93.

Brinson 19XX. Hydrogeomorphic Method (HGM).

CDM Federal Programs Corporation 1996. *Wetlands Delineation for Alternated Site 2 for the UF6 Cylinder Storage Yards, Phase IX.* Prepared for Lockheed Martin Energy Systems, Inc., Paducah Gaseous Diffusion Plant, Paducah, KY. April 1996. KY/EM-111.

Environmental Laboratory 1987. *Corps of Engineers Wetland Delineation Manual*, Technical Report Y-87-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS

Louisville District Corps of Engineers; U.S. Environmental Protection Agency, Region IV; U.S. Fish and Wildlife Service, Region IV; Kentucky Division of Water; Kentucky Department of Fish and Wildlife Resources 1993. *Wetland Compensatory Mitigation and Monitoring Plan Guidelines for Kentucky.*

Reed, P.B. 1988. *National List of Plant Species that Occur in Wetlands: Northeast (Region 1).*

Tetra Tech, Inc. 2000. *Sampling and Analysis Plan for the DUF6 Conversion Facility Site Characterization Study, Paducah Gaseous Diffusion Plant, Paducah, Kentucky.* Prepared for Bechtel Jacobs Company LLC. BJC/PAD-188.

U.S. Corps of Engineers – Waterways Experiment Station 1993. *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, KY.*

USDA NRCS (U.S. Department of Agriculture Natural Resources Conservation Service) 1998. *Field Indicators of Hydric Soils in the United States.* Version 4.0, March 1998. USDA, NRCS in cooperation with National Technical Committee for Hydric Soils edited by G.W. Hurt, P.M. Whited and R. F. Pringle.

USDA SCS (U.S. Department of Agriculture Soil Conservation Service) 1976. Soil Survey of Ballard and McCracken Counties, KY.

Vespraska, M. J. 1999. *Redoximorphic Features for Identifying Aquic Conditions.* North Carolina Agricultural Research Service, North Carolina State University, Raleigh, NC Technical Bulletin 301. December 1999.