



DEPARTMENT OF ENERGY

PADUCAH SITE TOUR BOOK

May 17-19, 2016



Site History/Key Facts

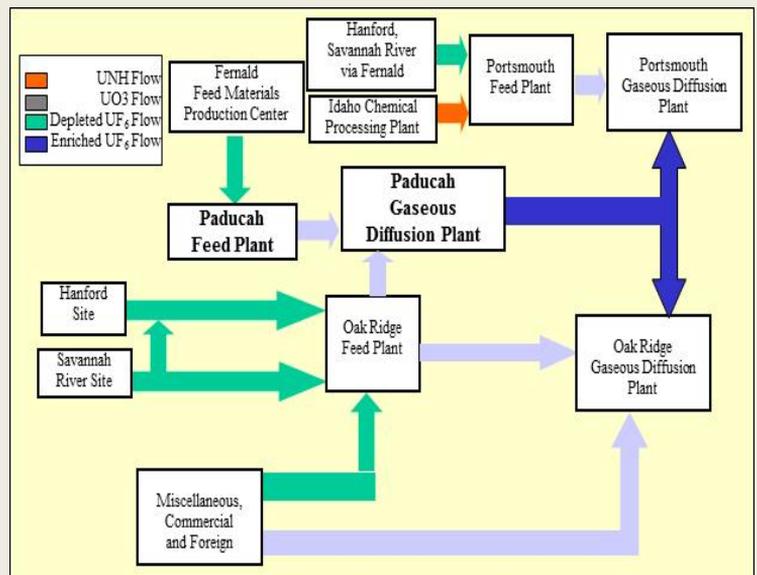
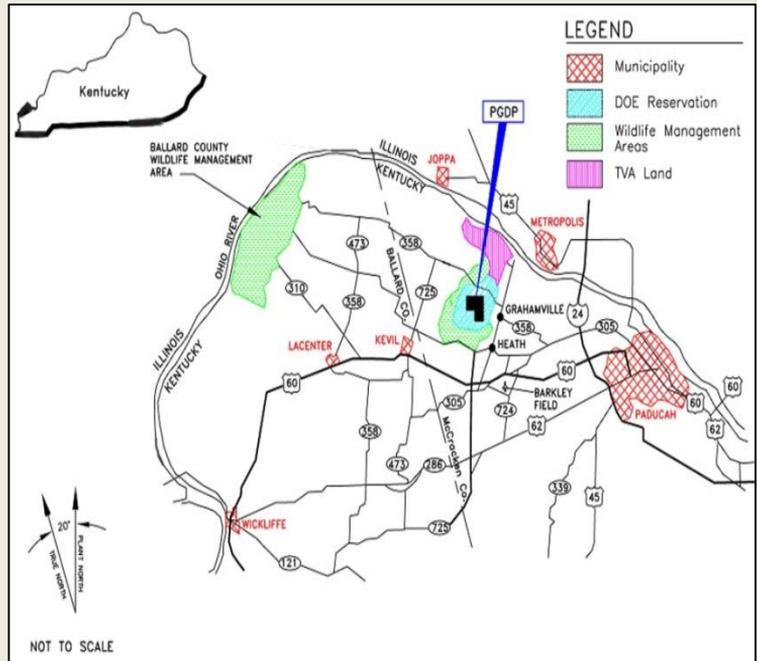


An artists rendition of 50s era workers leaving the Paducah site

- Uranium was enriched for nuclear weapons until the mid-1960s when the plant began enrichment for use as commercial nuclear power reactor fuel.
- DOE and its contractors employ ~1600.
- In its nearly 60 years of operation, the plant has pumped more than \$5 billion into the regional economy.

Site History/Location

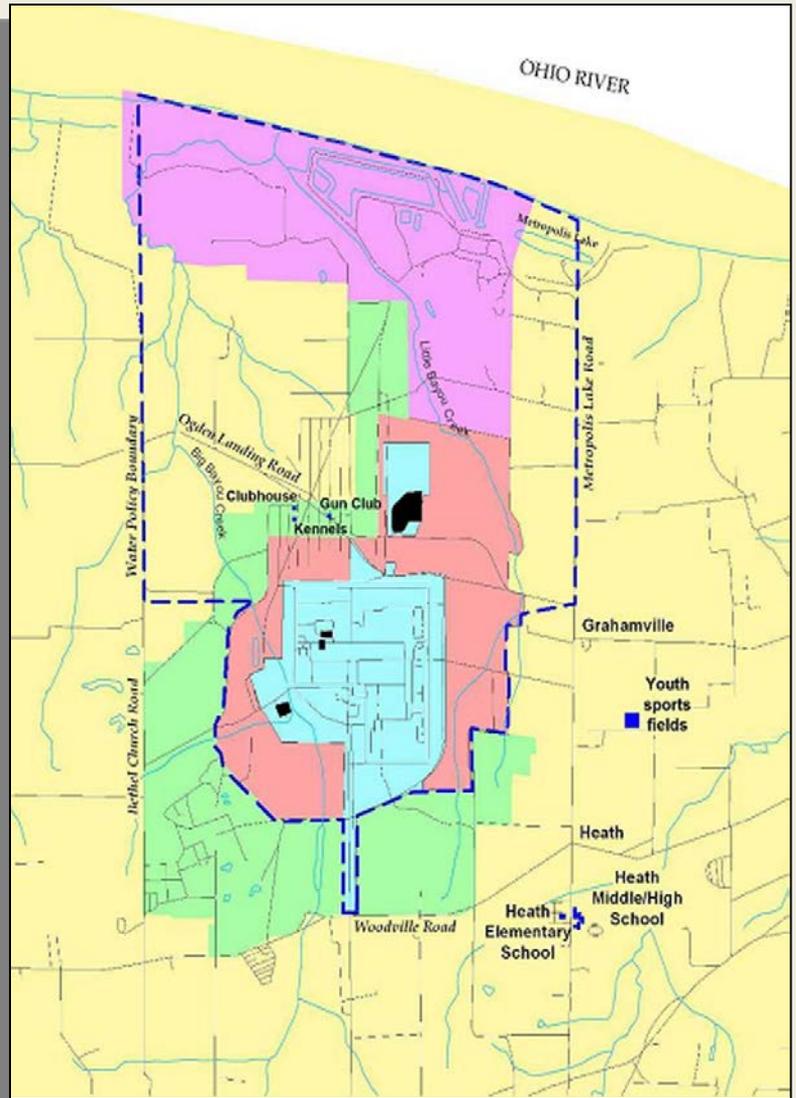
- Plant operations required various support facilities such as electrical switchyards and a chemical cleaning/ decontamination building (C-400), waste water treatment facilities, etc.
- Initial feed stock came from reprocessed material acquired from a variety of sources.
- The plant received recycled uranium from nuclear reactors (reactor returns) and converted it to uranium hexafluoride (UF_6).
- Returns declined over time as reprocessing operations ended at Hanford and Savannah River and more UF_6 is purchased from commercial plants; program ended in 1985; returns contained Plutonium, Neptunium, and Technetium-99.



Land Use

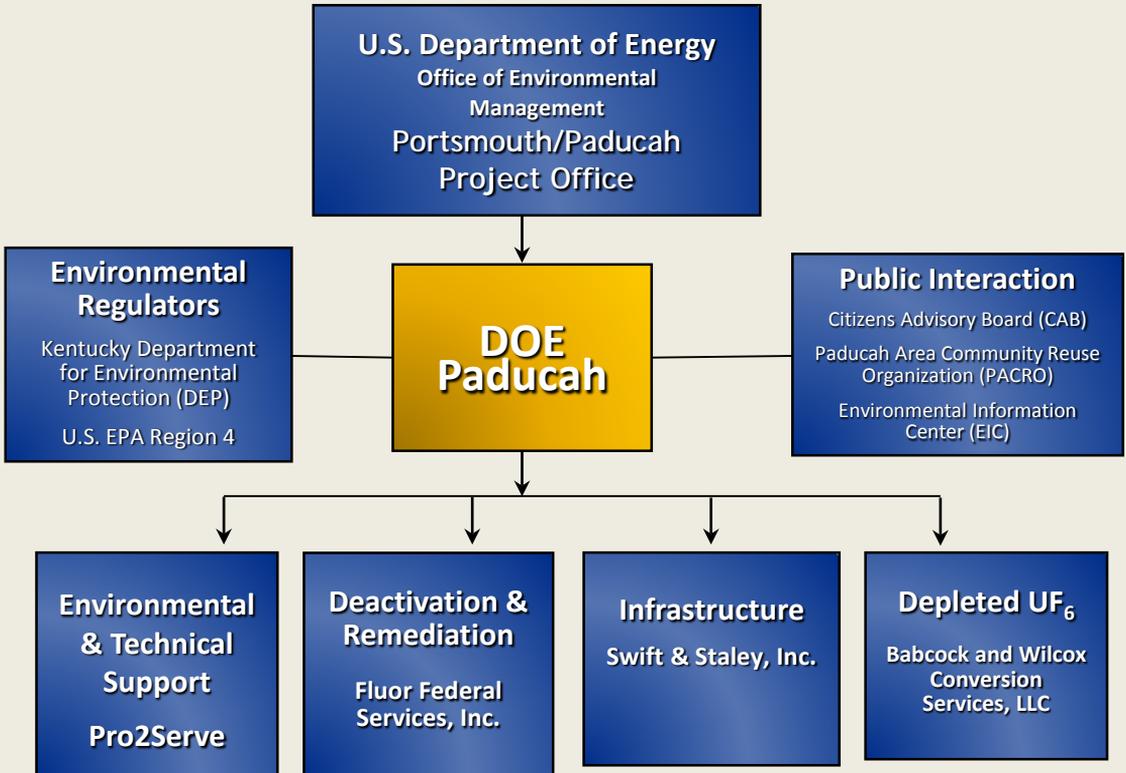
Most of the DOE-owned land is licensed to the Commonwealth of Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA).

- Blue area includes DOE facilities, former enrichment plant facilities, and the depleted uranium conversion facility.
- TVA owns a large tract of land north of the enrichment plant where Shawnee Fossil Plant is located.
- The plant patrol border or “buffer zone” is the boundary line of the DOE owned property.



Pink – TVA Shawnee Fossil Plant
Peach – DOE Land Licensed to WKWMA
Green – WKWMA Owned Land
Blue – DOE Owned Property

Current Paducah Site Contracts



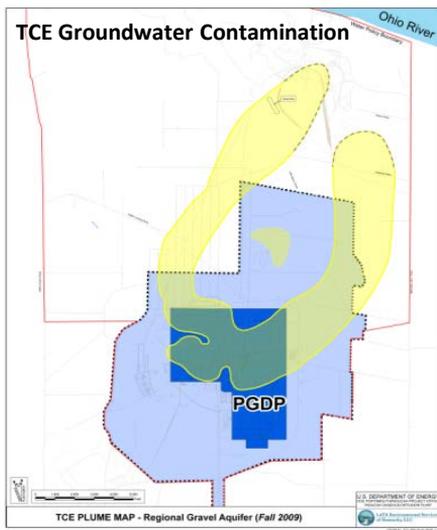
DOE Paducah Site Missions

Depleted Uranium Hexafluoride Plant (DUF₆)

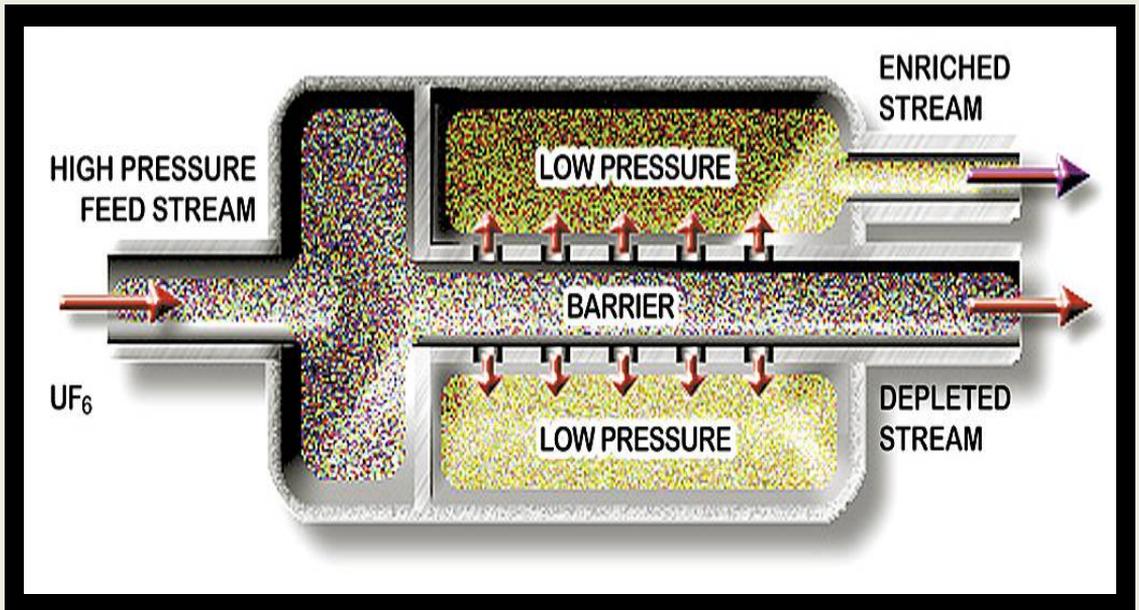


- Owner/landlord
- Environmental cleanup
- Disposal of waste
- Decontamination and Decommissioning of surplus facilities
- Storage and conversion of DUF₆

Environmental Cleanup



Gaseous Diffusion



- The enrichment process separated lighter uranium-235 isotopes from heavier uranium-238. Gas is forced through a series of porous membranes (barriers) with microscopic openings. Uranium-235 moves through the membranes more easily, increasing the concentration of uranium-235 as it moves through the process.
- A set of enrichment equipment, known as a “stage,” includes an electric motor powering a compressor that forces the gas through the barriers located in the converter.
- There were 1,760 stages in the four process buildings and 60 stages in the purge and product facility and about 400 miles of process lines. Stages were arranged in groups called cells.
- There are four process buildings with 74 acres under roof.

Key Facts

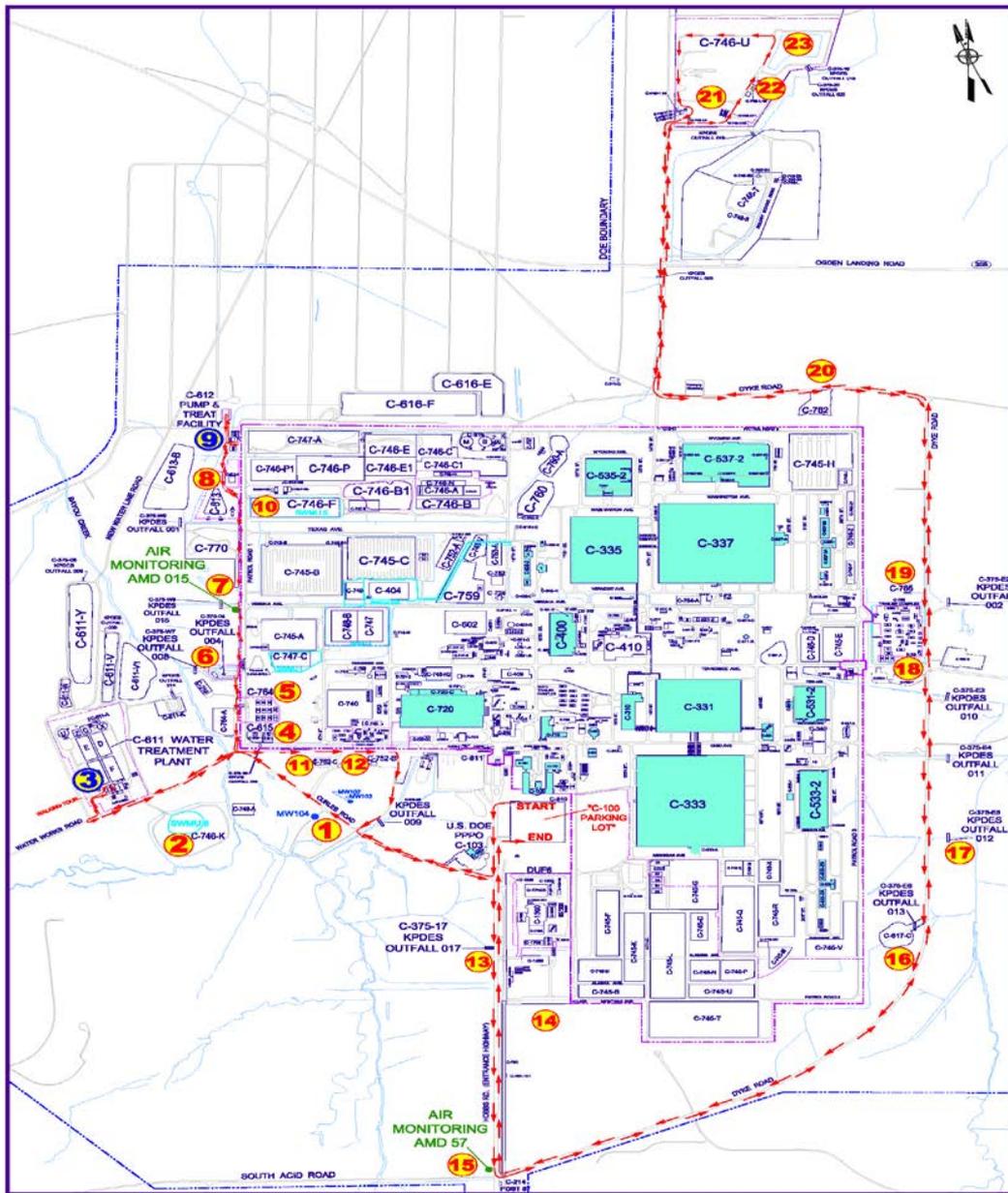
Power Usage	Approx. 10 megawatts
Power Suppliers	Shawnee Steam Plant, Electric Energy Inc.
Largest Process Motor	3,300 horsepower
Water Utilization	Approx. 3 million gal per day
R-114	Approx. 8.6 million lbs.
Raw Water	Up to 4.5 million gallons per day
Steam Plant	Replaced with natural gas package boilers
High Pressure Fire Water Tank	325 feet/320,000 gallons
Sanitary Water Tank	185 feet/250,000 gallons
Number of Enrichment Stages	1860 (1760 in process buildings)
Number of Control Instruments	85,000
Miles of Process Piping	Approx. 400
Miles of Roadway	19
Miles of Rail	9

Day 1 - Tour Route

1. Groundwater Monitoring
2. C-746-K Sanitary Landfill
3. C-611 Water Treatment Facility **(W)**
4. C-615 Sewage Treatment Facility
5. C-764 Trailer Complex
6. KPDES Outfalls 004 & 008 (see outfalls pg. 17)
7. Air Monitoring Station AMD 015
8. C-613 Scrapyard Sedimentation Lagoon
9. C-612 Northwest Pump & Treat Facility **(W)**
10. C-746-F Burial Yard, SWMU 5
11. C-752-C Decontamination Pad
12. C-752-B Fuel Station
13. KPDES Outfall 017
14. Proposed Waste Disposal Site 3A
15. Air Monitoring Station AMD 57 (see pg. 18)
16. C-617-C and KPDES Outfall 013
17. KPDES Outfalls 012, 011, & 010 (see outfalls pg. 17)
18. C-755 Trailer Complex
19. C-765 NE Treatment Trailer
20. Proposed Waste Disposal Site 5A
21. C-746-U Landfill
22. C-746-U-15 Leachate
23. C-746-U Settling Pond

(W) – Walk through

Day 1 - Tour Map



Groundwater Monitoring



There are approximately 330 groundwater monitoring wells associated with the Paducah Environmental Monitoring Program (EMP). These wells are necessary for the key program elements of the CERCLA Actions, which would include C-400 Interim Remedial Action, and Program Operations and Maintenance (O&M) Plans for both Northeast and Northwest Plumes Programs; the Landfill Groundwater Monitoring Program, and the Surveillance Monitoring Program.

C-746-K Sanitary Landfill



The C-746-K Landfill was used between approximately 1951 and 1982 for disposal of fly ash from the plant's coal combustion boilers, for uncontaminated combustible plant waste, and for potential radiologically contaminated plant waste. The site depth is approximately 20 ft. with all waste originally placed above ground. A clay cap was installed in 1982. The ground surface is vegetated and slopes in a radial fashion. Drainage ditches along the western and northern edges of the landfill flow to the south into the unnamed tributary and to the east into Bayou Creek, respectively. Current monitoring activities include groundwater monitoring wells for volatile organic compounds and metals.

C-611 Water Treatment Plant



The C-611 Water Treatment Plant has 15 acres of fenced area. The Plant provides approximately 3 million gallons per day of water to DOE and its site contractors. The water treatment process is based on conventional water treatment techniques which include softening, coagulation, flocculation, sedimentation, and chlorination.

Raw water is taken from the Ohio River at a pumping station operated by Tennessee Valley Authority (TVA) at the Shawnee Fossil Plant (north of the plant site). The pumping station consists of six vertical turbine pumps rated at approximately 150 gallons per second and are located on the same pump deck as the TVA pumps. These pumps are located in two pump wells with bar screens containing three pumps per well. Currently, two of the pumps are not operational and there are no plans to repair.

The raw water pumps discharge into one or both of two 36 inch lines that convey the water to the C-611 Water Treatment Plant. The switchgear for the raw water pumps are old and below the high flood level for the river. Jumpers are available to power the pumps from alternate sources. All work in the pump house intake area is performed under a TVA contract as it is on TVA property.

C-615 Sewage Treatment Plant



C-615 Sewage Treatment Plant provides the sewage handling and treatment for the Paducah Site. The sanitary sewage drainage system and treatment plant were built in the early 1950s and the majority of the sewage collection system is constructed of vitrified clay pipe. The drainage system consists of gravity drain lines, flush tanks and lift stations.

The drainage system is designed as gravity flow with lift stations as needed to maintain flow in the system. The design capacity of the system is 500,000 gallons per day. Currently, the system handles approximately 180,000 gallons per day without infiltration.



C-764 Trailer Complex



Trailer complexes are utilized by current DOE deactivation contractor for housing office and field personnel close to the work sites.

The C-764 Trailer Complex contains eleven trailers and houses approximately 65 people.

OUTFALL'S



The site has two Kentucky Pollutant Discharge Elimination System (KPDES) permits which specifies the specific outfalls, monitoring frequencies, analytes, and discharge limits for discharges of water effluents from the Plant. There are a number of outfalls surrounding the plant that receives effluents from different buildings and surface areas of the plant. The specifics as to which areas and buildings discharge to which outfalls is described in the KPDES permit applications. Similar information for all of the outfalls are included in the permit application and permits.

Air Monitoring



The Contractor Environmental Management Program began managing the program on July 1, 2012, using nine solar-powered air monitoring units. Eight of the units are situated on DOE property near the units that the Kentucky Cabinet for Health and Family Services owned and operated through grants from DOE. The remaining unit is located off-site and functions as a collection site to be used for background monitoring. This station is one of the 8 on-site ambient monitoring locations associated with the Paducah Environmental Monitoring Program. The specific locations, sampling frequencies (weekly and monthly), and analytical parameters are specified in the Environmental Management Program document. Data from this monitoring is included in the National Emission Standards for Hazardous Air Pollutants Annual Report and the Paducah Annual Site Environmental Report (ASER).

C-613 Scrapyard Sedimentation Lagoon



The C-613 Sedimentation Lagoon was installed during the Scrap Yard Removal Project to limit the migration of sediments from the work site. The facility design consists of three components: storm water collection and conveyance, gravity-settling lagoon, and enhanced settling by chemical treatment. The facility is designed to detain the estimated runoff volume from the scrap metal yards for a 10-year, 24-hour (hour) precipitation event of 5 inches. Extra volume is included to enhance facility operation and efficiency. The volume of the lagoon at the design maximum water level is approximately 3,750,000 gal. At the elevation of the facility spillway, the lagoon capacity is approximately 4,500,000 gal. The lagoon empties into Outfall 001. The lagoon is still in use for limiting sediment migration from the northeast corner of PGDP. The lagoon contains a layer of sediments in the bottom that contain radionuclide contamination.

C-612 Northwest Pump & Treat



The C-612 Treatment Facility began operation in August 1995. The system processes water from two extraction wells. Each well pumps at a rate of approximately 100 gallons per minute for a total treatment rate of 200 gallons per minute. The system removes TCE from the water using air-stripping and activated carbon adsorption technologies. The ^{99}Tc is removed from the water using an ion-exchange process. As of March 31, 2016, the system has processed over 2 billion gallons of contaminated groundwater and has removed almost 4,000 gallons of TCE from the water. In 2015, DOE upgraded this system to more modern equipment. The effort included replacement of the ion exchange system, process piping and valves, and the programmable electronics and controls.

C-746-F Burial Yard SWMU 5



The C-746-F Burial Yard, also known as Solid Waste Management Unit 5 (SWMU 5) covers an area of approximately 197,400 ft² and is located adjacent to SWMU 6 to the east. The burial yard was operated from 1965 to 1987 and received radionuclide-contaminated scrap metal, slag from the C-746-A nickel and aluminum smelters, and waste from the Work for Others program. Disposal pits were located on a grid system. Documentation of the size of these grids ranges from 10 ft. x 10 ft. cells to 20 ft. x 20 ft. cells excavated to a depth of 6 ft. – 15 ft. below ground surface. The burial yard currently has a soil and vegetative cover.

The remedial investigation and feasibility study for this SWMU is complete and the proposed plan is currently undergoing public review and comment. The proposed plan recommends installation of a Kentucky Subtitle D cap, land-use controls, and long-term groundwater monitoring.

C-752-C Decontamination Pad



C-752-C Decontamination Pad is an open sided structure with a curbed concrete floor pad. The facility is utilized to decontaminate equipment used on site prior to offsite release. Solutions/sprays used during decontamination activities enter the floor drains and accumulate in sumps. The accumulated water is pumped to storage tanks for further sampling and disposition.

C-752-B Fuel Station



The C-752-B Fuel Station is available 24 hours per day, 7 days per week. The fueling station utilizes a card reader and vehicle code system and provides self-service refueling of government owned/leased vehicles. The facility has two split tanks, each tank having a total capacity of 4,000 gallons. With the split tank configuration, there are four fuel pumps and four fuel compartments (tanks) with the following capacities: Diesel On-road, 1,000 gallons; Biodiesel off-road, 3,000 gallons; E-85 gasoline, 1,000 gallons; and 87 octane gasoline, 3,000 gallons. The fuel station is maintained by the infrastructure contractor.

KPDES Outfall 017



This is the only outfall for discharges from the DUF₆ Conversion facility.

Proposed Waste Disposal Site 3A



The DOE estimates a future need for disposal of approximately 3.7 million cubic yards of radioactively contaminated, non-radioactively contaminated, and hazardous material (soil and building debris), including sanitary waste through the end of deactivation and decommissioning of the PGDP. DOE has prepared a Remedial Investigation/Feasibility Study to address on-site versus off-site options for waste disposal and whether an On-Site Waste Disposal facility (OSWDF) should be selected as the preferred alternative. Site 3A is one of five candidate sites evaluated in the Remedial Investigation/Feasibility Study that passed the Threshold Screening and therefore was carried forward for further evaluation. Site 3A is located outside of the secured area of the plant and is approximately 110 acres.

C-617-C and Outfall 013



C-617-C Pond is a man-made wetland designed to control runoff from the cylinder yards. Outfall 013 receives discharge from the pond as well as other plant effluents.

C-755 Trailer Complex



This area is a 7-acre complex built in 1995 providing office trailers and change house for infrastructure and deactivation contractors just outside the security fence. It also provides trailers for construction management and safety staff. There are approximately 21 trailers, a change house, and maintenance building supporting approximately 150 people.

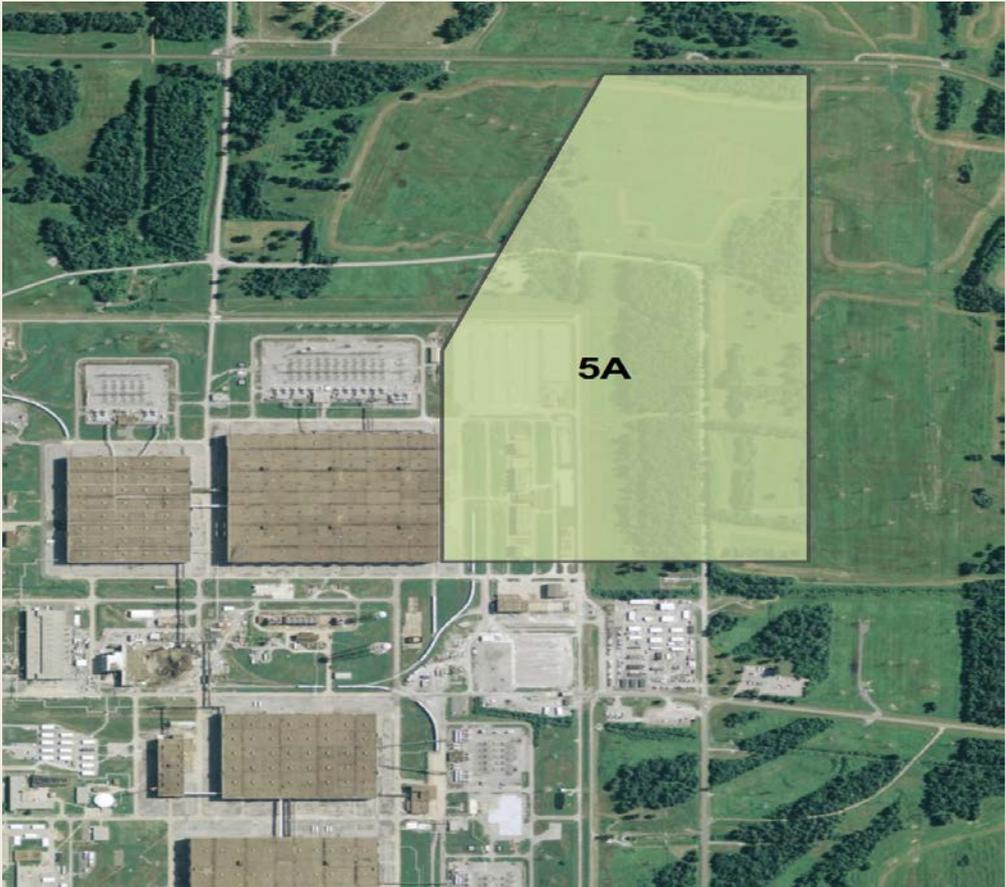
C-765 NE Treatment Trailer



The C-765 Treatment Trailer contains the treatment unit which is part of the Northeast Plume Containment System (NEPCS). The NEPCS consists of two extraction wells, an underground equalization tank, transfer piping, this treatment unit for air stripping and suspended solids removal, and monitoring well network. Operation of the NEPCS began February 28, 1997. As of March 31, 2016, the NEPCS has processed more than 1.5 billion gallons of water and has removed approximately 300 gallons of TCE.

Optimization of the NEPCS is in progress. The project is currently in the CERCLA documentation stage. When complete the optimized system will include two treatment units (including the one pictured above) processing water from two new extraction wells installed inside the limited area.

Proposed Waste Disposal Site 5A



DOE is evaluating candidate sites for the OSWDF. This is Site 5A another one of the five candidate sites evaluated in the Remediation Investigation/Feasibility Study that passed the Threshold Screening and therefore carried forward for further evaluation. Site 5A is located on an interior portion of DOE-owned property, located primarily outside of the plant secured area, with approximately 24% of the site within the secured portion of the plant. This site is approximately 135 acres. The majority of Site 5A land is designated as DOE-owned property licensed to West Kentucky Wildlife Management Area. The western portion is designated DOE-owned industrial land use.

C-746-U Landfill



This landfill is an operational RCRA Subtitle D landfill for disposal of Paducah Site solid waste and environmental media. The landfill waste acceptance criteria prohibits the disposal of classified, hazardous, or Low Level Waste. However, waste with residual radioactive material within authorized limits may be disposed. The location of the landfill is outside the security fence. The total area of the landfill site is 60 acres with approximately 22 acres permitted for disposal. The landfill has a capacity to accept an estimated 1.2 million cubic yards of waste, and currently contains an estimated 114,000 cubic yards.

The approved landfill design has a total of 23 disposal cells. Five of 23 cells within the C-746-U landfill have been constructed and are filled or are active.

C-746-U-15 Leachate



The C-746-U leachate collection system consists of a 12-inch drainage layer utilizing an 8-inch diameter perforated pipe for the main collection lines. The leachate flows by gravity to a collection wet well where it is pumped to a series of storage tanks with a total capacity of approximately 100,000 gallons. The estimated peak daily leachate generation rate for 15 days is approximately 88,000 gallons for the operation of Cells 1–5.

Collected leachate from the C-746-U Landfill is treated through a series of treatment processes including particulate filters, activated carbon, apatite media, and ion exchange media to remove potential organic and metal contaminants before being discharged to KPDES outfall 020.

C-746-U Settling Pond



Surface water runoff from the C-746-U Landfill is diverted to the C-746-U sedimentation pond. The surface water diversion ditches, culverts, and sedimentation pond are designed to accommodate the 100-year, 24-hour storm event. The pond has approximately 4.5 acres of surface area and is treated to remove sediments and discharged to KPDES Outfall 019 two to three times per year. Outfall 019 is the same physical location as Outfall 020.

Day 2 - Tour Route

1. C-200 Guard and Fire Headquarters
2. C-100 Administration Building **(W)**
3. C-710 & C-709 Lab **(W)**
4. C-302 Operations Division Data Center
5. C-300 Central Control
6. C-304 Office Building
7. C-310 Purge & Product Withdrawal
8. C-333 Process Building **(W)**
9. R-114 Rail Cars
10. C-746-Q Hazardous and Low Level Waste Storage Facility
11. C-745-X Converter & Compressor Storage Pad
12. C-533 Switchyard
13. C-315 Tails Withdrawal Facility
14. C-531 Switchyard
15. C-611-O & -R Water Towers
16. C-360 Toll Transfer and Sampling Facility **(W)**
17. C-637 Cooling Towers & Pump House
18. C-337-A UF6 Feed Vaporization Facility
19. Proposed Waste Disposal Site 5A
20. C-537 Switchyard (refer to pg. 49)
21. C-337 Process Building **(W)**
22. C-350 Drying Agent Storage Building
23. C-410-D & -K Fluorine Facility
24. C-600 Steam Plant & Package Boilers
25. C-400 Cleaning Building **(W)**
26. C-400 Groundwater Treatment
27. C-752—A & C-753-A Storage facilities
28. C-616 Liquid Pollution Abatement Facility
29. C-757 Solid & LLW process Facility
30. SWMU 3 C-404 LLRW Burial Area
31. SWMU 2 C-749 Burial Yard (Inactive)
32. SWMU 4 C-748-B-C-747 Burial Area (Inactive)
33. C-733 Hazardous Waste Storage
34. C-720 Machine Shops **(W)**
35. C-720 – SWMU 211A
36. C-409 Stabilization Building **(W)**

(W) – Walk through

C-200 Guard and Fire Headquarters



Security operations are comprised of Protective Force members and Security staff professionals. The Protective Force operates 7 days per week/24 hours per day and is responsible for the implementation of the plant's security plans and policies.



The C-200 Guard and Fire Headquarters is where the plant's fire and security forces are housed. The Paducah Gaseous Diffusion Plant (PGDP) maintains a group of well-trained security and fire personnel to respond to plant emergencies. The PGDP fire department operates 7 days a week/24 hours per day and maintains equipment comparable to that found in larger cities in Kentucky. Emergency response equipment includes a 100-foot elevated platform ladder truck with foam-making capability, two ambulances, a 1,500 gallon per minute pumper, a Haz-Mat truck and a Heavy Rescue/Equipment truck. The plant also has mutual-aid agreements with surrounding communities if needed during an emergencies.

C-100 Administrative Complex



The C-100 Administration Building is one of the oldest structures on the site. The facility is two stories of offices and a basement used primarily for storage. It houses the site computer servers, medical facility, records vault for classified information, and a variety of office spaces and conference rooms. It is constructed of reinforced concrete with a total of 97,508 square feet of floor space. Currently this facility also serves as the primary automated access control entrance location for pedestrian traffic into the limited area. The C-100 building has office space for approximately 175 people that is currently being shared by the infrastructure and deactivation contractors.



C-710/C-709 Laboratory

These facilities house laboratories with an array of old and modern analyzers and test equipment, offices, a conference room, and vault for records retention and storage. The Laboratory maintains a suite of analytical services that are tailored to meet some of the needs of the site including deactivation activities, operations support, production of working reference material, and project activities. Offsite laboratories are still utilized by the remediation and deactivation projects.

The operation of on-site analytical facilities to provide analytical laboratory services will be at the discretion of the Contractor. In the event the Contractor performs some analytical services on-site, the services shall be available to other DOE on-site contractors.



C-302 Operations Division Data Center



The C-302 facility contains approximately 35 offices, conference rooms, training rooms, and self-contained HVAC systems.

C-300 Central Control



The Central Control Facility was constructed in 1953 to serve as the main control center for the gaseous diffusion operation. The facility monitored, coordinated, and controlled critical plant processes, power distribution, utilities, communications, plant alarm systems, and emergency operations. Cabling supplied electronic information about the plant's process systems to this building. The Central Control Facility currently houses three main functions: the plant shift superintendent, the cascade coordinator, and the emergency operations center.

C-304 Office Building



The C-304 facility contains approximately 30 offices, conference rooms, training rooms, and has self-contained HVAC systems.

C-310 Product Withdrawal



Enriched uranium was withdrawn from the cascade at the Product Withdrawal Facility. This building is equipped with withdrawal positions to accommodate either 2 ½ (30B) or 10-ton (48X) product cylinders. The large tower next to the west side of the building is a 200-foot stack used to vent gases from the enrichment process. The stack is regulated by a Title V Permit with Kentucky.

Process Buildings



The enrichment process occurred primarily in the four large process buildings referred to as C-331, C-333, C-335, and C-337. All of these facilities are HAZ/CAT 2 facilities.

These facilities enriched uranium by the gaseous diffusion process. The process consisted of approximately 1,760 stages arranged in two parallel cascades. Through different valving configurations, the plant was able to enrich uranium at higher assays up to 5.5 wt. % U^{235} .

The larger process buildings, C-333 and C-337, are approximately 1100 feet long by 970 feet wide, and 83 feet high. Each of these building has approximately 25 acres under roof.

The smaller process buildings, C-331 and C-335, are approximately 804 feet long by 640 feet wide, and 68 feet high. Each smaller process building contains approximately 12 acres under roof.

Process Buildings cont.



The enrichment, or separation process, took place on the second floor of the process buildings inside a heated housing that helped ensure the UF_6 stayed in a gaseous form. The UF_6 was pumped through many tubes installed inside a diffuser vessel called a converter. The gas was pumped through the converters by large compressors powered by electric motors. Motors for the large process equipment were rated up to 3,300 horsepower. As the UF_6 gas passed through the tubes, the molecules separated slightly. The U^{235} atoms, which made up less than one percent of the uranium in its natural state, passed through the tubes more easily. As the gas moved through the cascade, more separation occurred at each stage. At the top of the enrichment process, the uranium had been enriched so that it contained between 1 and 5 percent of the fissionable U^{235} atoms. The remaining uranium, stripped of most of its U^{235} atoms, moved to the bottom of the enrichment process and was removed and stored in cylinders as depleted uranium. The electrical equipment and instrumentation to support and control the enrichment process is located on the first floor of the building along with an Area Control Room where the buildings' processes are monitored.

R-114 Rail Cars



Of the more than 8.3 million pounds of R-114 onsite, over 2.5 million pounds of R-114 is stored in 16 railcars and 3 ISO containers. The remaining R-114 is stored in process equipment throughout the process buildings. An additional 12 ISO containers are currently available and 12 additional railcars are being procured this year for additional onsite storage. Some of these ISOs and railcars will be used by the current deactivation contractor for storing of R-114 removed from the process equipment in support of in-situ chemical treatment.

C-746-Q Hazardous & Low-Level Waste Storage



The C-746-Q Hazardous and Low-Level Waste Storage Facility is an approximately 33,000 ft² prefabricated metal building that stores RCRA and LLW. Material that requires nuclear criticality storage is located here. Adjacent to C-746-Q is C-746-Q1. C-746-Q1 is a 16,335 square foot unit that is part of the C-746-Q facility designed to manage both solid and liquid hazardous wastes. Wastes are stored in containers. This unit is currently permitted for the crushing of light bulbs and for chemical treatment of hazardous wastes in containers. This is a Nuclear Hazard Category 2 facility.

C-745-X Converter & Compressor Storage Pad



The C-745-X yard is one of two yards (the other is C-745-Y) where failed process converters and compressors are stored. C-745-X and C-745-Y are Nuclear Hazard Category 2 facilities. This equipment stored in these yards will require in-situ chemical treatment.

C-533 Switchyard



As originally designed, electrical power came into the plant at 161,000 volts through the overhead transmission lines from TVA's Shawnee Steam Plant and Electric Energy, Inc. (EEI) at Joppa, Illinois, and from Kentucky Utilities Systems into four switchyards. Kentucky Utilities and Jackson Purchase Electrical Corporation supply lower voltage power to a few facilities at the plant, such as the C-103 building and C-746-U landfill. The power flowed through more than 90 circuit breakers to 35 large transformers located throughout the plant. While all the power entered the plant through the TVA and EEI power lines, the plant purchased power from various utilities throughout the Midwest. Additionally, four switchyards had interconnectivity between them that allowed power to be transferred between the switchyards and between the power suppliers.

Originally the PGDP required four switchyards to provide electrical service to the plant with redundancy. The plant typically used between 700 – 2,000 megawatts of electrical power each hour, depending on the plant's production targets and availability of reasonably priced power. The plant was built and later modified to a capacity to use up to 3,000 megawatts per hour.

However, the shutdown of production operations has enabled modification of the distribution system. In 2015, the site completed the reconfiguration of the site's 14KV power distribution system, allowing the shut-down of the low-side of the C-533, C-535, and C-537 switchyards.

C-315 Withdrawal Facility



At the Depleted Uranium (Tails) Withdrawal Facility, the uranium that was depleted of most of its ^{235}U atoms was pulled from the cascade process and drained into 14-ton cylinders for storage. This facility may fill between one to four cylinders per day. Once filled, the cylinders were moved with cylinder haulers to storage yards.

Building C-315 has a poured-concrete foundation, a built-up flat roof, and an exterior of transite panels. The facility has a rail connector. The upper facade and rest of the first story has an exterior of transite panels. Extending from the upper facade of this building is an enclosed steel tie line that rests on steel piers. The north facade of the building lacks openings except for two louvered vents.

The east facade of the building also has a partial-width wall of poured-concrete. Within this wall is a pedestrian entrance with an original steel and glass door and four garage bays with steel overhead track doors. Across the width of the building is a large metal canopy with a 20-ton crane for handling the uranium cylinders.

C-531 Switchyard



As stated previously, this switchyard currently provides all power within the limited access area of the plant.

In order to Decommission and Demolish the remaining C-531 switchyard and to remove the plant from very burdensome federal regulations associated with bulk electrical power transfers through the switchyards, a new switchyard to replace the C-531 switchyard is tentatively planned to be constructed east of the C-755 Trailer Complex. The construction, along with operation and maintenance of the new switchyard, will be the responsibility of the power supplier. The Contractor, however, shall maintain and operate the 14,000 volt power distribution (low side) systems at the PGDP site.

Along with the new switchyard comes the requirement to connect it to the plant's 14,000 volt distribution system. The design and installation, except for the final routing and tie ends, will be completed by others. The Contractor shall make the final tie-ins. The tie-ins shall include the final routing and connections of approximately sixteen 14,000 volt interlocked armor cables to the 14,000 volt breakers in the new switchyard and the final routing, vault penetrations, and connections of twenty-four new 14,000 volt cables to existing paper insulated lead covered cables in six underground cable vaults.

C- 611-O & C-611-R

High-Pressure Fire Water System



The checkered tower provides water to the plant's high pressure fire water (HPFW) protection system. This tower is 325 feet tall and holds about 325,000 gallons of water. It is one of the largest water towers in the United States. The fire water tower provides water to more than 100,000 sprinkler heads installed in the plant that cover approximately 8.5 million square feet of buildings and equipment. There are also more than 3,200 portable fire extinguishers in the plant. The HPFW system covers all the process buildings.

The blue water tower provides water for the plant's sanitary water supply. This tower is 185 feet tall and holds approximately 250,000 gallons of water. The water tower also supplies water to the fire protection systems not covered by the HPFW (checkered tower) system."

C-360 Toll Transfer and Sampling

The C-360 Toll Transfer and Sampling facility provided systems for receiving, sampling, transferring and shipping cylinders containing UF_6 . All operations necessary for fulfilling enrichment service contracts for private industry were performed at this facility. Feed material, as well as the plant's enriched product, was weighed and tested here to ensure it met industry standards. Four autoclaves, similar to the ones housed in the vaporizer facilities, were used to sample and/or transfer UF_6 .



The building is constructed of structural steel with build-up roof, cement-asbestos and metal siding with concrete floor slabs and foundations. The Toll Transfer and Sampling Building is divided into a high-bay work area of about 18,000 square feet and a low-bay service area of 3,593 square feet. The service (basement) area houses the transfer station and scales, cold traps, evacuation drums, and associated piping. The laboratory area is located north of the work area on the same level and contains four sampling stations, laboratory bench, and control panels to monitor and control building operations. The east side of the building has crane doors that allow the movement of overhead cranes in and out of the building if required. Roll-up doors are provided at truck entrances, rail entrance, and entrances to maintenance areas.

Office, lounge, and kitchen areas are adjacent to the laboratory. An annunciator panel is provided in the laboratory and supervisor's office to provide alarms for critical parameters of building operation. The building also contains a rail siding on the south side that utilizes the work area as an interior loading dock with space for cylinder staging. Maintenance areas, a truck entrance, electrical equipment room, and shower and rest room facilities are also provided.

C-637 Cooling Towers & Pump House



There are four sets of cooling towers and pump house which were used to remove heat from the enrichment process. One set of cooling towers and a pump house were dedicated to each process building. Heat, generated by compression of the UF_6 gas inside the compressors, was transferred to the R-114 systems. The R-114 systems were then cooled by water. The heat from the R-114 was passed to the water as it flowed through condenser tubes. Once through the tubes, the water flowed by gravity through underground pipes and over the top of the cooling towers. As the water flowed over the towers it was cooled by exposure to air. The cooled water drained into the basins below the towers where it was pumped back to the process building to repeat the cycle. Each complex contains a pump house, cooling tower, blending cooling towers, and other support buildings.

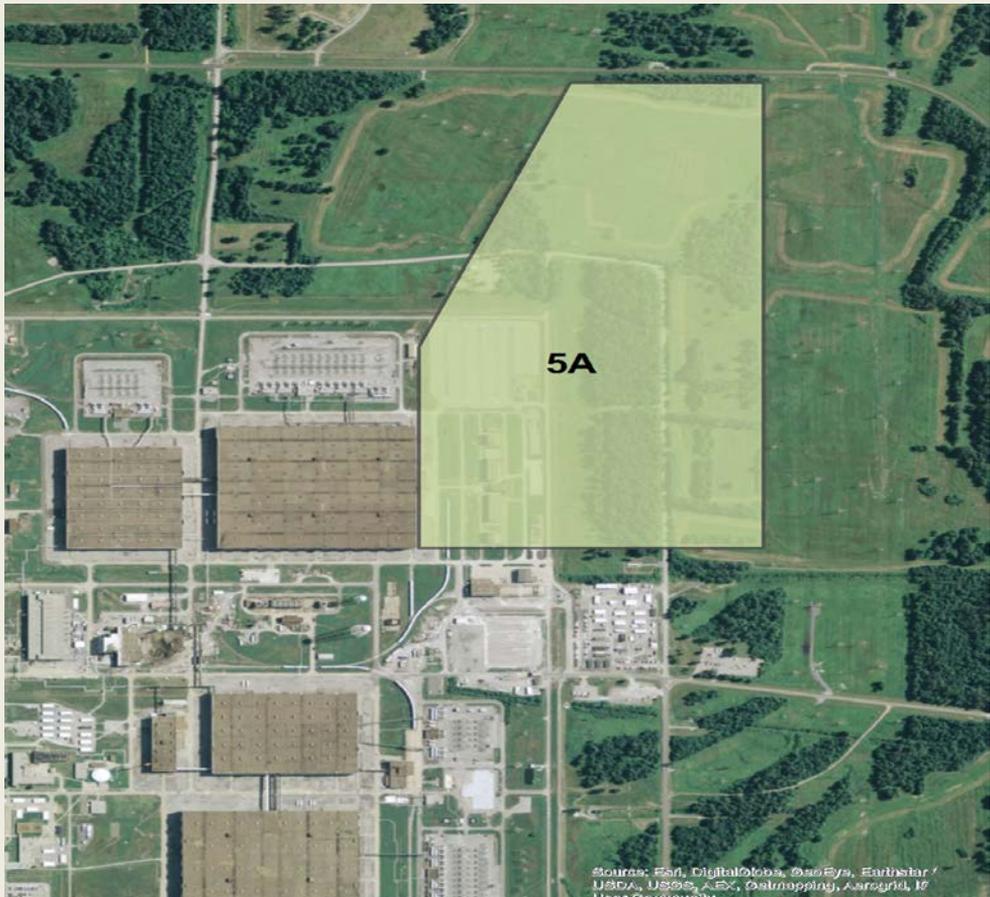
The cooling towers are no longer in service and only one pump house, C-631, is in operation to support the high pressure fire water system.

C-337-A Feed Vaporization Facility



The plant has two feed vaporizer facilities, each located adjacent to the large enrichment process buildings. Feed material for the enrichment cascade was manufactured from mined uranium or partially depleted or enriched UF_6 . The C-337-A Vaporizer was one of two feed points for UF_6 for enrichment into the plant. The feed facilities were used to convert the uranium hexafluoride from a solid to a gaseous state and transfer the material into the cascade for enrichment. To accomplish this, cylinders were heated inside cylindrical pressure vessels called autoclaves which are approximately 22 feet long with an internal diameter of about 6 feet. The feed facilities provided an uninterrupted feed supply to any point in the cascade. Each feed facility was also equipped with two 20-ton cranes used to move cylinders. The scales used for weighing cylinders in the feed facilities have a capacity of 40,000 pounds and were accurate to plus or minus 2 pounds. The autoclaves were steam heated.

Proposed Waste Disposal Facility Site 5A



DOE is evaluating candidate sites for the On Site Waste Disposal Facility. This site is located on an interior portion of DOE-owned property, located primarily outside of the secured portion of the plant. The majority of Site 5A is licensed to the West Kentucky Wildlife Management Area. The western portion is designated DOE-owned industrial land use. A portion of the site will cover the area currently occupied by the C-637 cooling towers and the C-745-H yard.

C-337 Process Building



The C-337 process building is similar in dimension and contains the same size equipment as the C-333 process building. This facility is proposed to be one of the first facilities where In-situ Chemical Treatment (ICT) will take place.

C-350 Drying Agent Storage Building



The C-350 facility contains a charging station where a 160 pound chlorine trifluoride (ClF_3) cylinder is connected and fed into 2 – 2,000 ft^3 storage drums. Fluorine (F_2) is then added to the ClF_3 to create a treatment gas mixture for use during the in-situ chemical treatment process. The treatment gas can be delivered to any process building by way of a distribution system of piping and valves.

A fully enclosed and climate controlled safety shower has been installed.

C-410-D and C-410-K Fluorine Facility



The C-410-D facility contains a charging station where tube trucks containing a mixture of 80% nitrogen and 20% fluorine are connected and fed into one of three 1,000 ft³ drums located in the C-410-K facility. Through a distribution system of piping and valves, the F₂ is delivered to C-350 for mixing with the ClF₃. The C-410-D facility is also used for fluorination of piping and equipment used during the in-situ chemical treatment process.



Several upgrades are under evaluation for this facility in support of the ICT project. They include installation of relief valves on F₂ piping, leak detection and automatic shutoff valve for the F₂ tube truck, and the use of personal HF detectors for personnel operating the facility.

C-600 Steam Plant



Steam is required for heating the buildings and to keep the process piping warm so the UF_6 stays in the gaseous form. The steam plant has three shutdown boilers (two coal-fired and one oil-and/or gas-fired) with a combined capacity of about 300,000 pounds of steam per hour. The site has installed five (5) package boiler units (22,500 pounds/hour each) to meet reduced site demands resulting from termination of process operations. The new site demand, including cell treatment, of up to 100,000 pounds/hour can be provided by the installed package systems. A connection for a sixth package boiler is available should it be determined that additional steam capacity is required.

C-600 Package Boilers

- On-site coal-fired plant (C-600) was shut down March 10, 2015.
- Five package boilers were brought on-site and tied-in to the steam supply system to replace the C-600 Steam Plant.
- Reduces site costs, emissions and improves energy efficiency.



C-400 Cleaning Building

The C-400 Facility was built in 1953 and provided cleaning and decontamination services for the plant. It has a floor area of 116,140 square feet. Equipment removed from the process buildings for repair was cleaned here prior to being moved to the maintenance facility. UF_6 Cylinders were also cleaned and tested at this facility. The solvent trichloroethylene (TCE) was used extensively as a degreaser in this facility until the 1980's. TCE spills and leaks at this facility have been identified as the source of the TCE contamination in the Northwest Plume.

The facility also housed the plant's laundry which had the capability to clean and mend more than 3,000 pairs of coveralls each week."

In the event that fissile solutions are spilled onto the floor, floor drains in the C-400 building near fissile operations without secondary containment have been sealed or have engineered controls in place. This helps prevent a criticality from occurring in the drain systems and associated sumps.



Current deactivation activities include de-inventorying fissile material/equipment from the facility to allow deactivation of the Criticality Accident Alarm System (CAAS), along with isolation of all utilities from the facility. Asbestos abatement is also in progress.

C-400 Groundwater Treatment



Electrical Resistance Heating treatment was recently implemented in two phases to address Trichloroethylene (TCE) contamination in the soils area above the aquifer. This area is referred to as the “Upper Continental Recharge System” (UCRS) and is between 0 – 60 ft. below the surface. The electrical resistance heating system consisted of a network of in ground electrodes and vapor extraction wells distributed throughout zones of contamination in a three-phase heating pattern. In 2010, the Phase I system addressed two smaller areas to the west and east of the C-400 facility, removing approximately 535 gallons of TCE from the subsurface. The Phase I project was able to heat the UCRS as planned, but was unable to heat the lower Regional Gravel Aquifer (RGA) to target temperature. Phase IIa, which was a continuation of the treatment used in Phase I, was completed in fall of 2014 and addressed one larger area to the southeast of the C-400 facility, removed approximately 1,137 gallons of TCE.

C-400 Groundwater Treatment cont.



In 2015, DOE conducted a Phase IIb Steam Injection Treatability Study. The treatability study was designed to obtain data specific to understanding the behavior of steam injected into the RGA under variable injection scenarios. The steam injection technology proved to be technically implementable in the hydro geologic conditions tested. DOE is working with regulators on a plan for C-400 Phase IIb to treat TCE in the deep aquifer, 60 ft.– 100 ft. deep.

C-752-A & C-753-A Storage and Treatment

C-752-A is a permitted RCRA Waste Storage Facility. It is one of three active permitted waste storage facilities. It was completed in 1996, and is 43,600 ft² in area. It stores TSCA, RCRA, and Low-Level Waste and is permitted to treat waste by a variety of treatment methods. Ignitable waste cannot be stored in C-752-A; it has to be stored in C-733. Waste water is also stored in C-752-A and can be treated via an activated carbon filtration unit that removes PCBs and TCE from wastewater before being discharged to a KPDES permitted outfall. The facility contains a sprinkler system and an 18 foot x 40 foot waste treatment enclosure with an air filtration system for treating high-hazard wastes. There has been periodic maintenance performed to patch cracks in the floor to ensure compliance with permit requirements. C-753-A is a Toxic Substances Control Act (TSCA) Waste Storage Facility.



C-616 Liquid Pollution Abatement Facility



The plant Recirculating Cooling Water (RCW) systems were treated for corrosion control with a phosphate-based inhibitor for steel, a copper corrosion inhibitor, and a dispersant. Because a large quantity of RCW was lost through evaporation in the cooling towers, the concentration of soluble salts and non-dissolved impurities will increase unless some means is used to control it. To control this at PGDP, a blowdown system was used. The corrosion inhibitors and other contaminants in the blowdown prohibited direct discharge of this water to the receiving stream. The purpose of the C-616 waste water treatment plant was to treat this waste water to lower the contaminant concentrations below the discharge limits.

The facility is currently used to reduce the phosphate levels in the four cooling tower water basins to below 50% of the permitted discharge limits. At transition, it is expected that this facility will be shut down. If needed to support the Contractors activities, this facility will require restarting.

C-757 Solid & LLW Process Facility



The C-757 Solid and Low Level Waste Processing Facility has 10,000 ft² used for waste management staging and processing.



Burial Grounds



In the plant's early years of operation, material and equipment removed from the facility were buried in a series of on-site disposal areas. These burial grounds include both classified and non-classified material. There are more than 60 acres of old waste burial grounds inside the security fence. They contain materials from household/commercial waste to radioactive, hazardous and ignitable waste.

Releases from these burial grounds may have affected, or have the potential to affect, groundwater underneath the areas. Remediation of these burial grounds has been broken into five subprojects, with decisions pending on the various cleanup remedies.

SWMU 4 (C-747 Contaminated Burial Ground and the C-748-B Burial Area) is currently being characterized to better delineate areas of higher contamination to determine the appropriate remedial actions in the future as part of the CERCLA process.

SWMU 2 (C-749 Uranium Burial Ground) contains primarily buried uranium that was immersed in oils to address ignitability concerns. There has been an Interim Record of Decision in place to monitor the unit for releases.

SWMU 3 (C-404 Landfill) is a closed hazardous waste landfill managed through a post-closure RCRA permit.

C-733 Hazardous Waste Storage Facility

The C-733 Waste Oil and Chemical Storage Facility is a 4,224 ft² covered structure. This building is RCRA permitted and holds flammable/ignitable hazardous material. Four 3,000-gal. carbon steel aboveground storage tanks and associated piping formerly used for batching/transfer operations were removed in March 2016 under a RCRA closure activity.



All containers stored in C-733 are elevated to protect them from contact with standing liquids. All containers are stored on pallets or elevated platforms. Smaller containers may be stored on shelves or in flammable storage cabinets. The means of secondary containment in the storage area at C-733 is a diked concrete pad, which is sloped to drain to a sump. The sump dimensions are 6 ft. by 5 ft. by 16 ft. The maximum volume that could be contained inside the diked area is the dike volume (3,265 ft³) plus the sump volume (480 ft³) for a total of 3,745 ft³ (28,000 gal).



The maximum number of containers that can be stored at C-733 at one time is 700, 55-gal drums. Wastes may be stored in containers that are under or above 55-gal in volume.

C-720 Maintenance Shop

C-720 Maintenance Shop is larger than five football fields and contains the fabrication and maintenance shops that supported plant operations. Shipping and receiving is also located at this facility. Almost every industrial craft was represented here, including painters, carpenters, sheet metal workers, plumbers, electricians, instrument and maintenance mechanics, machinists, laborers and heavy equipment operators. The crafts housed in this building had the capability to fabricate, repair, maintain, and calibrate almost every piece of equipment essential to the operation of the plant.



The high bay portion of the facility contains metal fabrication and machining equipment; overhead crane bays; electrical motor facilities which include support equipment necessary to completely rebuild and test electrical motors, electrical protective equipment, and electrical insulating gloves; climate controlled shop areas for precision work; electronic repair facilities; and paint spraying facilities.

There are 72 milling machines, both horizontal and vertical ranging in size from a 9 inch by 36 inch table to a 20 foot table with a 72 inch vertical head travel. They are also equipped with nine tape controlled and computerized numerical controlled milling machines, 14 radial drills ranging from the small table and floor models up to a 24-inch diameter column and a 10-foot arm model.



C-720 SWMU 211A



Solid Waste Management Unit 211A is one of two potential TCE source areas near the C-720 Maintenance and Storage Building. The other potential source area, SWMU 211B, is south of the C-720 Building and is upgradient to SWMU 211A. DOE is currently working with regulators to evaluate results from soil testing performed in 2012 and 2015. The results indicate that dense non-aqueous phase liquid or DNAPL may be present at SWMU 211B and the Conceptual Site Model for this site may be invalid. Further discussions are warranted among the FFA parties with regard to the TCE source located upgradient of SWMU 211A, the possibility that anaerobic degradation is affecting this source, and on the timing of the SWMU 211A remedial action.

C-409 Stabilization Building



The C-409 building was built in the late 1960s to condition the process converters against corrosion by the UF_6 prior to installing in the cascade cells. C-409 is a Nuclear Hazard Category 2 facility. In the most recent past, the building was used to process waste water from C-400 deconning operations that contained dissolved uranium compounds with greater than 1.00 wt. % U^{235} . Current activities include removal of all fissile material and equipment, along with all combustible material, with the goal being to deactivate the sprinkler and the criticality accident alarm systems.

DOE Facility Operations Agreements & Permits

Permit Type	Issued By	Permit Number	Issued To
Stated Agency Interest ID# 3059			
Clean Water Act			
Kentucky Pollutant Discharge Elimination System	KDOW	KY0004049	DOE/FFS//BWCS
Kentucky Pollutant Discharge Elimination System	KDOW	KY0102083	DOE/FFS
Permit to Withdraw Public Water	KDOW	0900	FFS
Water Treatment Registration (Public Water System)	KDOW	PWS No. 0732457	FFS
Clean Air Act			
Conditional Major Operating Air Permit	KDAQ	F-10-035R1	BWCS
Title V Air Permit	KDAQ	V-07-031	FFS
RCRA – Solid Waste			
Residential Landfill (closed)	KDWM	SW07300014	DOE/FFS
Inert Landfill (closed)	KDWM	SW07300015	DOE/FFS
Solid Waste Contained Landfill (construction/operation)	KDWM	SW07300045	DOE/FFS
RCRA – Hazardous Waste			
Hazardous Waste Facility Permit	KDWM	KY8-890-008-982	DOE/FFS
Hazardous and Solid Waste Amendments Permit	EPA	KY8-890-008-982	DOE/FFS

Paducah Site Environmental Permits

BWCS – Babcock & Wilcox Conversion Services, LLC

DOE – U.S. Department of Energy

FFS – Fluor Federal Services, Inc.

KDAQ – Kentucky Division for Air Quality

KDOW – Kentucky Division of Water

Outfalls

Location	Discharge Sources
KPDES PERMIT# KY0004049	
001	The treated waste streams from C-752A Waste Storage and Treatment Facility, C-752-C Decontamination Pad, C-600 Steam Plant, C-616 Wastewater Treatment Facility, North-South Conversion Ditch, C-612 Northwest Plume Groundwater System, C-613 Northwest Corner Storm water Collection Basin, miscellaneous process waters, blowdown and runoff.
015	Runoff and miscellaneous process waters
017	Co-Permitted with DUF6 Conversion Facility. Cooling water/boiler blowdown and condensate from DUF6 Conversion Facility. In addition, untreated runoff from cylinder yard area.
019	Runoff from C-746-U Landfill Area
020	C-746-U Landfill Leachate Treatment System
KPDES PERMIT# KY0102083	
002	Cooling water, roof and floor drains, sink drains and miscellaneous wastewaters and runoff.
004	Combined wastewaters from domestic sewage, sink drains, motor cleaning, garage drains, laundry, machine coolant treatment, condensate blowdown and cooling waters.
006	C-611 Water treatment plant sludge, sand-filter backwash, and sink drains.
008	Surface drainage, roof and floor drains, cooling water, paint shop discharge, condensate, sink drains, and treated wastewaters and untreated storm water runoff from outfalls 004 and 016.
009	Storm water, roof and floor drains, condensate, cooling waters and sink drains.
010	Switchyard runoff, roof and floor drains, condensate and sink drains.
011	Cooling water, roof, sink, and floor drains, switchyard runoff, condensate, and storm water runoff.
012	Roof, floor, and sink drains, condensate, and storm water runoff
013	Storm water runoff from southeast corner of the plant
016	Fire protection water and storm water runoff from southwest corner of the plant.