



Paducah Gaseous Diffusion Plant Overview

September 29, 2017

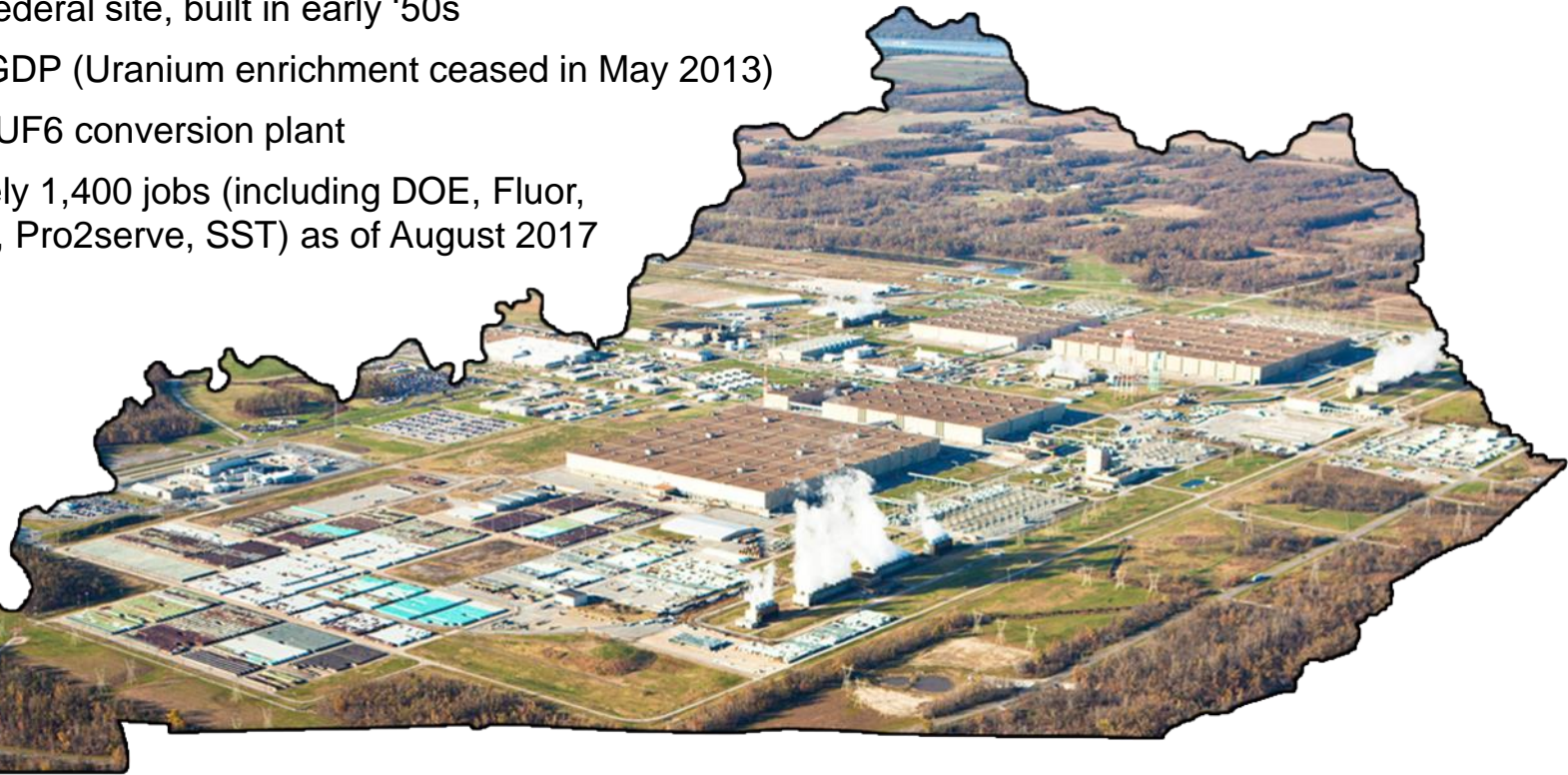


Paducah Gaseous Diffusion Plant

Paducah

- 3,500-acre federal site, built in early '50s
- Shut-down GDP (Uranium enrichment ceased in May 2013)
- Operating DUF6 conversion plant
- Approximately 1,400 jobs (including DOE, Fluor, LRSR, MCS, Pro2serve, SST) as of August 2017

PADUCAH
GASEOUS
DIFFUSION
PLANT



EM *Environmental Management*

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

Site History

- In 1950, the Atomic Energy Commission selected the former Kentucky Ordnance Works site for the second of three planned uranium enrichment plants.
- Construction began in 1951. The first product was shipped in 1952.
- Construction 1951-54
- Enrichment began 1952
- Met national defense demands until mid 1960s
- Enriching for commercial nuclear power since 1963
- Enrichment ended in 2013

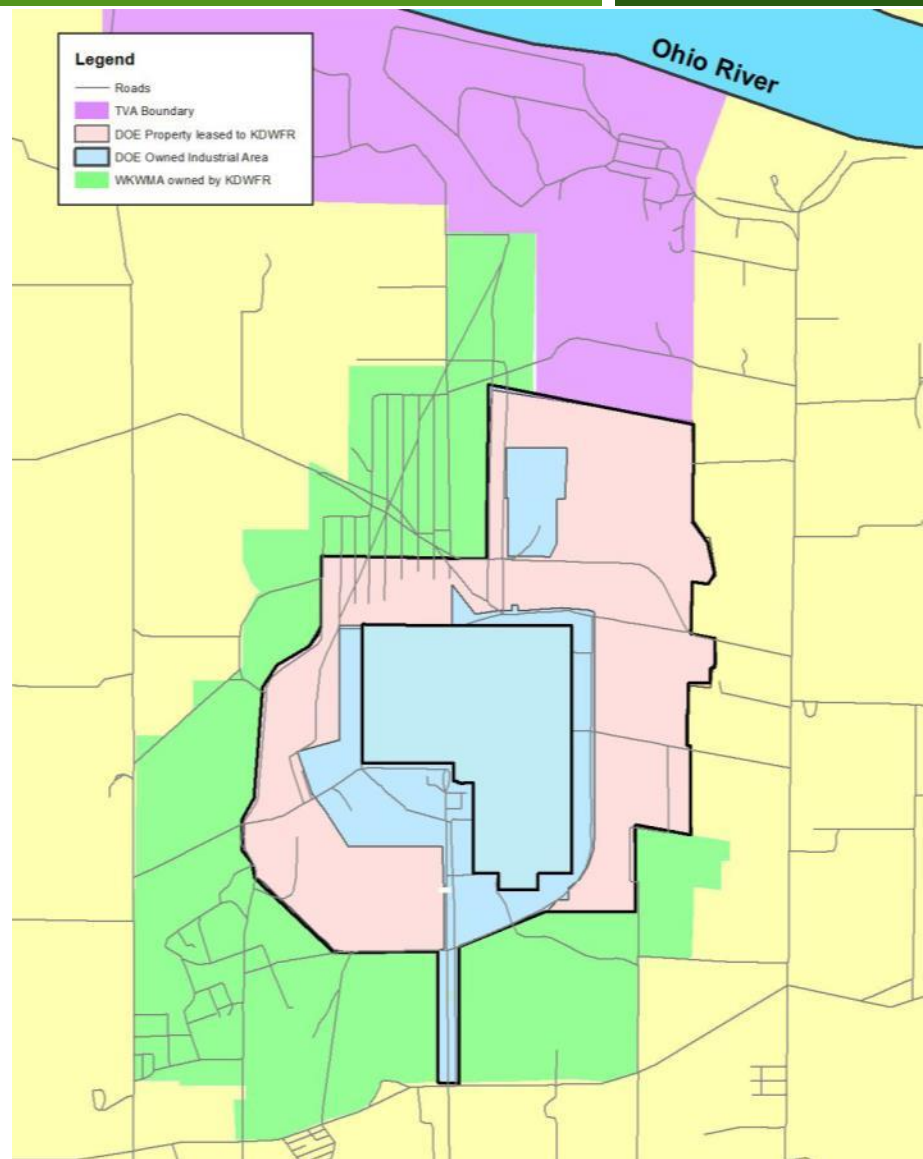


(Photo of a floodwall mural by Robert Dafford marking the plant's 50th anniversary.)



Site

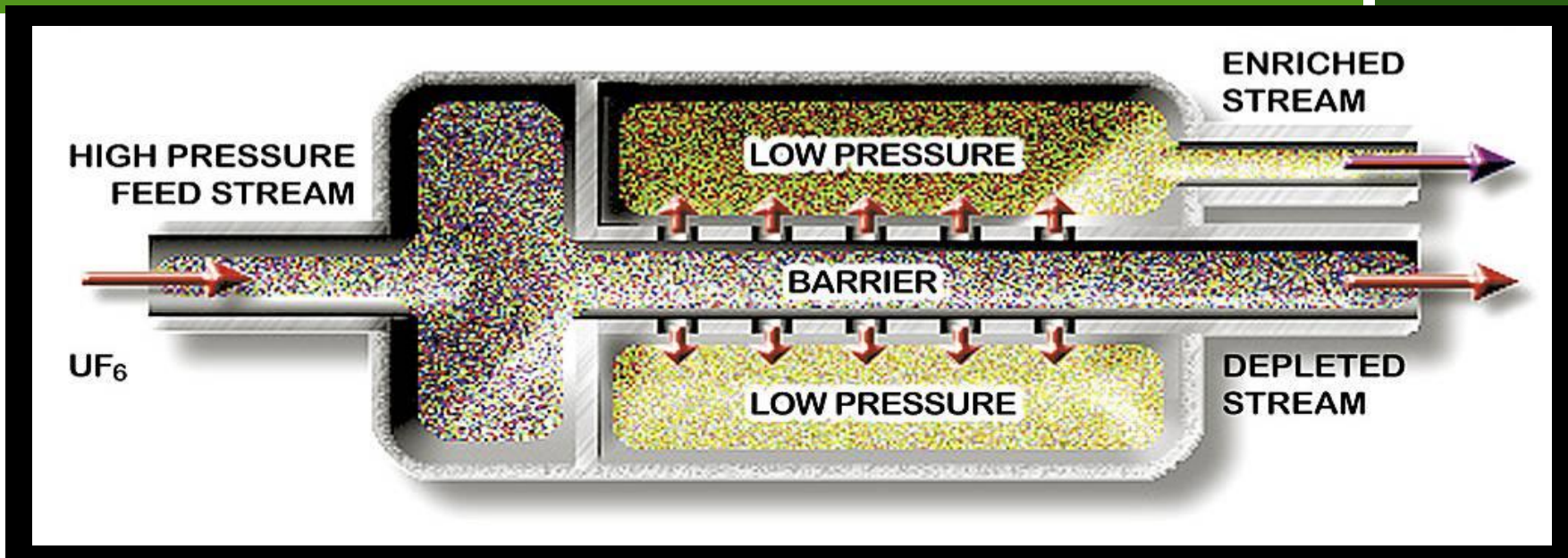
DOE-owned land consists of approximately 3,500 acres with a license agreement with West Kentucky Wildlife Management Area (WKWMA)



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

Gaseous Diffusion Process

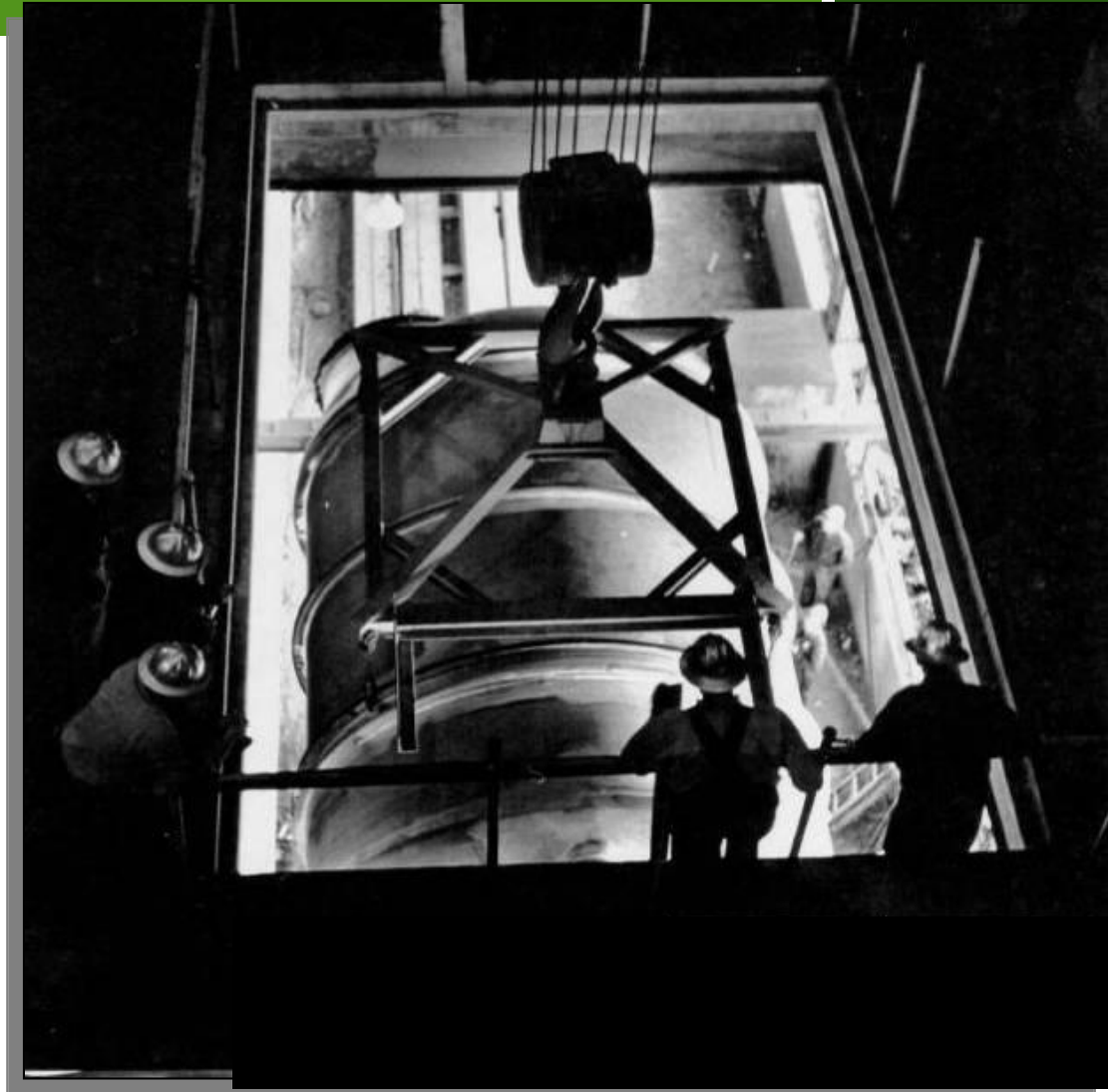


- Enrichment process separates lighter uranium-235 isotopes from heavier uranium-238. Gas is forced through a series of porous membranes (barriers) with microscopic openings. Uranium-235 moves through the membranes more easily, increasing the concentration of uranium-235 as it moves through the process.
- There are four process buildings with 74 acres under roof.



Gaseous Diffusion Process

- ✓ There are 1,760 stages in the four process buildings and 60 stages in the purge and product facility and about 400 miles of process piping. Stages are arranged in groups called cells.
- ✓ Each stage is about the same size of a semi tractor and trailer.
- ✓ A converter from the original construction is shown at right.



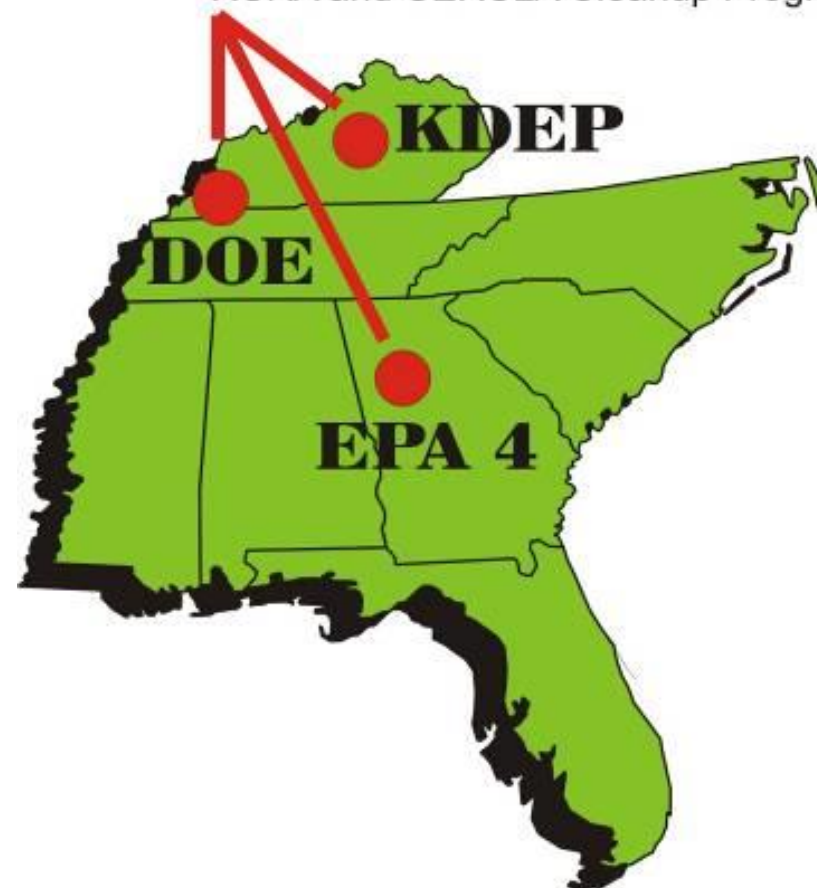
Regulatory Framework

The site is highly-regulated, and federal laws and regulations are strictly enforced. Orders and policies from DOE, EPA, and the Occupational Safety and Health Administration (OSHA) are also implemented. Among the laws are the:

- Energy Policy Act
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Resource Conservation and Recovery Act (RCRA)
- Toxic Substances Control Act (TSCA)
- Hazardous and Solid Waste Amendments (HSWA)
- National Environmental Policy Act (NEPA)
- National Historic Preservation Act (NHPA)
- Paducah site listed on National Priorities List in 1994 with Federal Facility Agreement signed by DOE, Kentucky, and EPA in 1998

Federal Facility Agreement:

Tri-Party Agreement coordinates RCRA and CERCLA Cleanup Programs



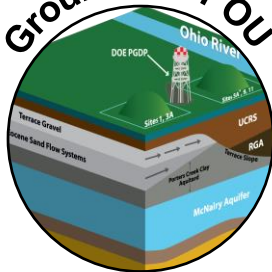
Major EM Projects

Surface Water OU



The Surface Water Operable Unit (OU) encompasses ~6 miles of contaminated creeks on and near DOE property

Groundwater OU



The Groundwater OU addresses off-site contamination risk and has removed ~7,500 gallons of TCE to date with as much as ~6,000 gallons remaining

Soils OU



The Soils OU addresses the remediation of 66 areas totaling ~110 acres sitewide

D&D OU



The Decontamination & Decommissioning (D&D) OU consists of facilities

Burial Grounds OU



The Burial Grounds OU focuses on 10 areas spanning ~66 acres, some of which date back to the beginning of the plant



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

Paducah Cleanup Accomplishments

Since 1990, DOE has invested \$2.3 billion in successful site cleanup projects

- Mitigated exposure to residents by providing municipal drinking water.
- Reduced migration of off-site groundwater contamination using pump and treat systems.
- Treated more than 3.7 billion gallons of contaminated water; removed more than ~7,500 gallons of solvent from groundwater and source areas.
- Removed 33,000 tons of contaminated scrap metal.



GWOU – Northwest and Northeast Pump and Treat

Pump and Treat systems designed to recover and treat contaminated groundwater

Northwest Pump and Treat System

- Began operation in August 1995
- Pumped ~ 2 billion gallons of water and removed ~ 3,400 gallons of TCE*



Northeast Pump and Treat System

- Began operation in February 1997
- Pumped ~ 1.7 billion gallons of water and removed ~ 300 gallons of TCE*



*as of December 2016



EM *Environmental Management*

safety ❖ performance ❖ cleanup ❖ closure

Major Projects

Long-term facilities removal

- >500 structures with a footprint of nearly 200 acres to be razed
- Underlying soils to be investigated, cleaned up as needed

Surface Water

- Remediation of ~6 miles contaminated creeks, ditches, etc.

Deactivation

- Infrastructure optimization, e.g., switchyard consolidation
- Facility modifications incl. repairs for ~3mil. s.f. of roofs
- Deactivation activities incl. oils and refrigerant removal from process buildings
- Uranium deposit removal from process buildings

Depleted uranium

- About 46,000 cylinders

Burial grounds

- 10 burial grounds, ~100 acres
- Some contain radioactive, pyrophoric and RCRA waste

Major TCE source

- Primary source of off-site contamination
- Heavy concentrations present; >500,000 ppb of TCE in groundwater

Inactive facilities

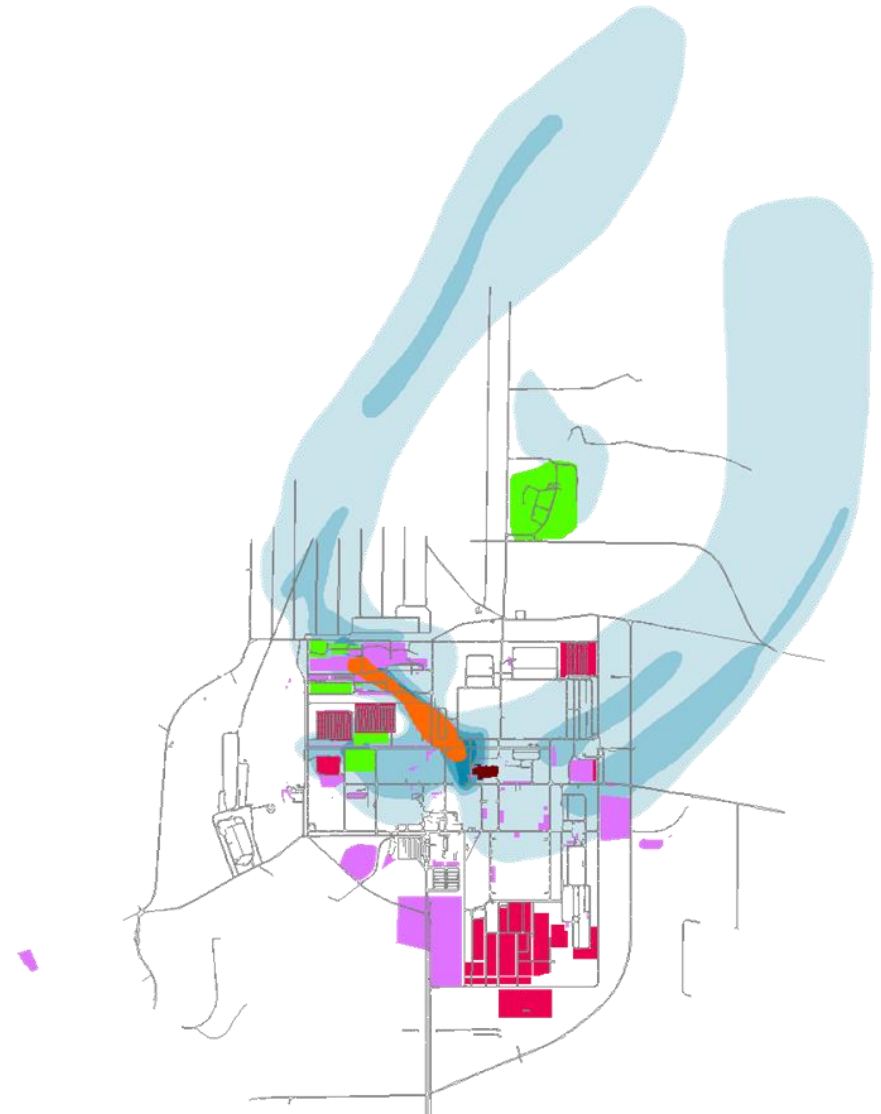
- Demolished 32 buildings prior to transition. 12 additional facilities to be completed in 2016.

Tc-99 plume

- Radionuclide releases have migrated off-site, but not above Drinking Water Standards.

Contaminated soils

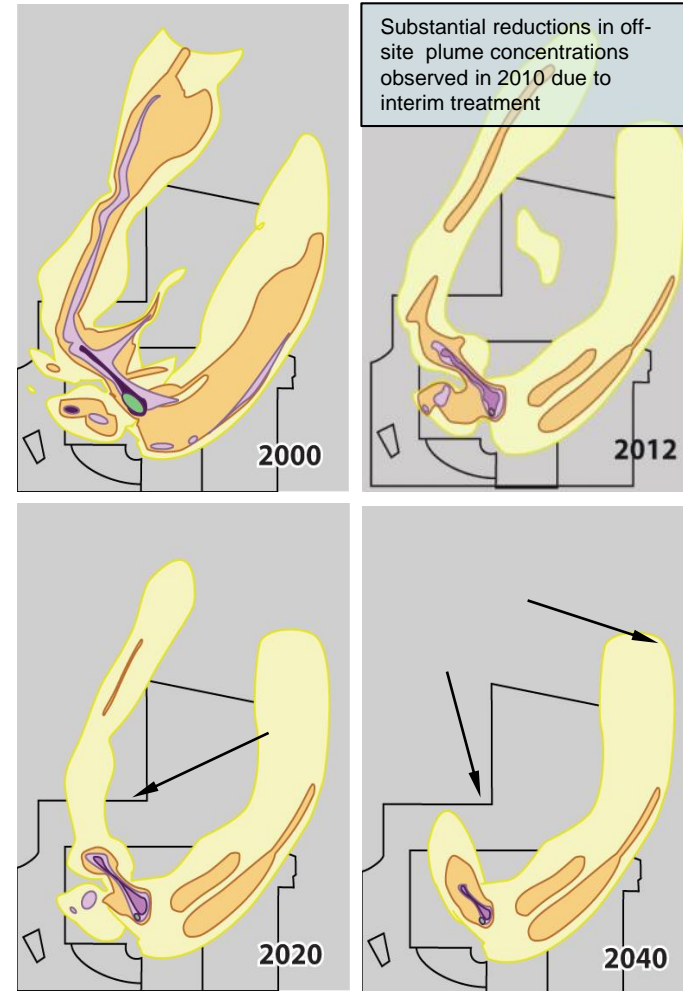
- PCBs and uranium
- 66 areas totaling ~ 115 acres



EM Significant Events

1986

During repairs to a storm sewer at the southeast corner of C-400, workers discovered evidence that the degreaser, trichloroethene (TCE), for an undetermined number of years had been flowing directly into the sewer; investigation showed the chemical was overflowing from an improperly designed sump pump.



EM Significant Events

1971-2007

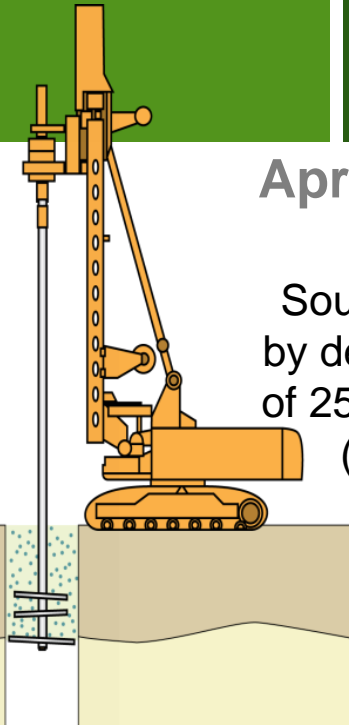
- Plant cascade upgrades and emptied UF₄ drums resulted in thousands of tons of scrap metal being removed to the northwest corner of the plant, creating “drum mountain,” a pile of crushed drums 35 feet high.
- In 2007, removal of the largest collection of scrap metal in the DOE Complex was completed with more than 30,500 tons eliminated, enough to build a World War II aircraft carrier.



EM Significant Events

1975-1979

Waste oils contaminated with uranium, polychlorinated biphenyls (PCBs) and solvents routinely land-farmed to test viability of biodegradation as a treatment option



April - October 2015

Source treatment by deep soil mixing of 258 soil columns (8-ft diameter)



Before

During

After



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

EM Significant Events



C-410 Feed Plant

1977

C-410/420 complex shut down after it was no longer needed to manufacture feed stock -- facility contaminated with radionuclides (Tc-99, Np, Pu), asbestos and chemicals



C-410 Feed Plant Demolished



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

EM Significant Events



Before



During



After

2004

- Initiated accelerated actions to cleanup and demolition several inactive facilities
- Completed removal of hot spots in sections 1 and 2 of the plants central drainage ditch which carries discharges from the C-400 Cleaning Building.



EM *Environmental Management*

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

EM Significant Events



Before



During



After Sediment Removal

2011-2012

- Completed removal of over 22,000 yds³ of contaminated sediment.
- Shipped all transuranic waste off-site, completing the last inventory of waste stored on-site under the Site Treatment Plan.
- Disposed of 40,000 yd³ of PCB/radioactive/heavy metal-contaminated sediment from plant ditches and outfalls.



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

Site Operating Landfill

- ✓ The C-746-U Solid Waste Contained Landfill is the only operating disposal site at the Paducah plant.
- ✓ It opened in 1997 and has helped DOE reduce disposal costs by accepting certain types of waste: sanitary waste, soil and debris and industrial waste.
- ✓ No hazardous is accepted; however, waste with small amounts of radioactivity within the landfill's Authorized Limits is acceptable.
- ✓ No radioactive waste above the Authorized Limits is accepted.



DOE Long-Term Strategy

Rocky Flats



Fernald



Paducah



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

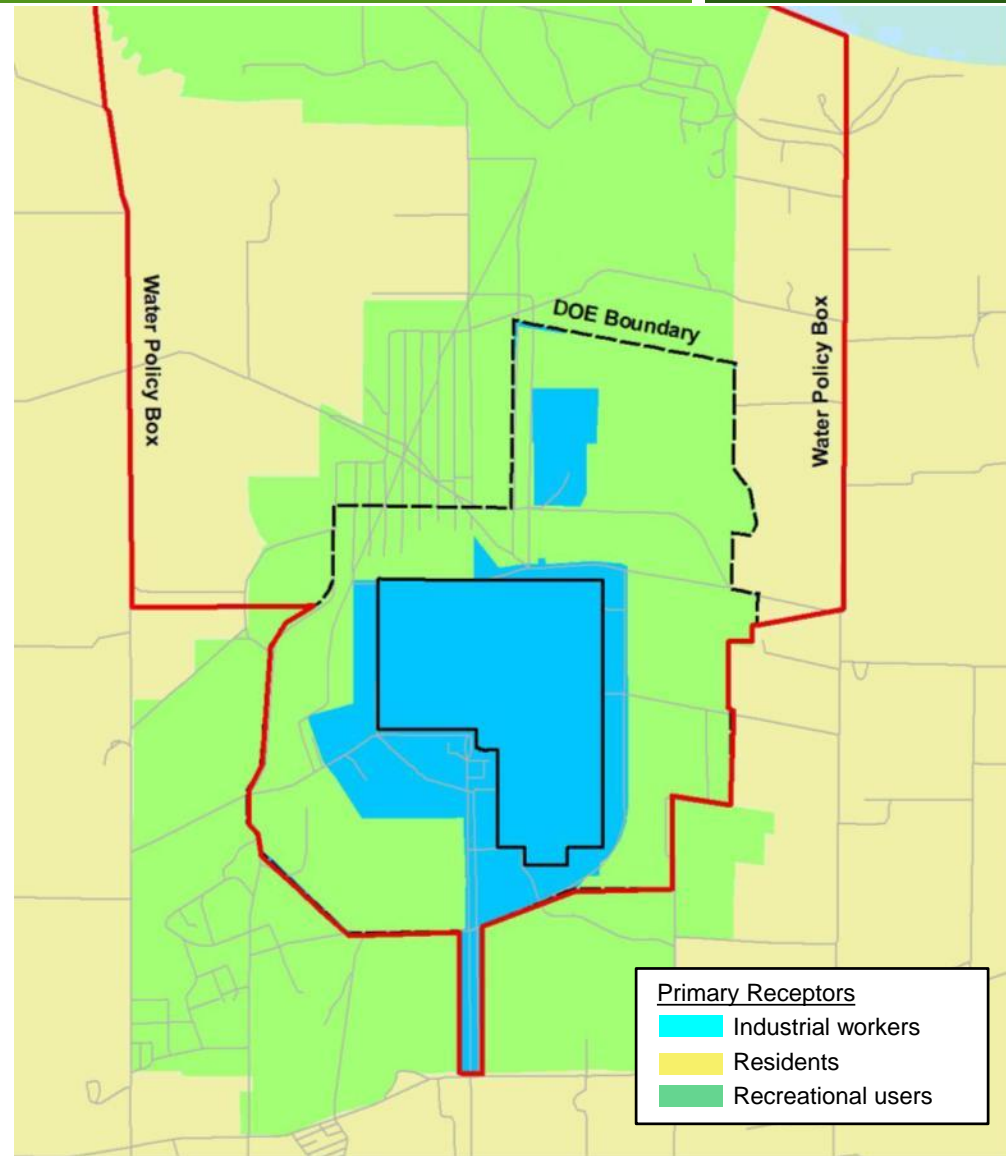
www.em.doe.gov

Long-Term Cleanup Strategy

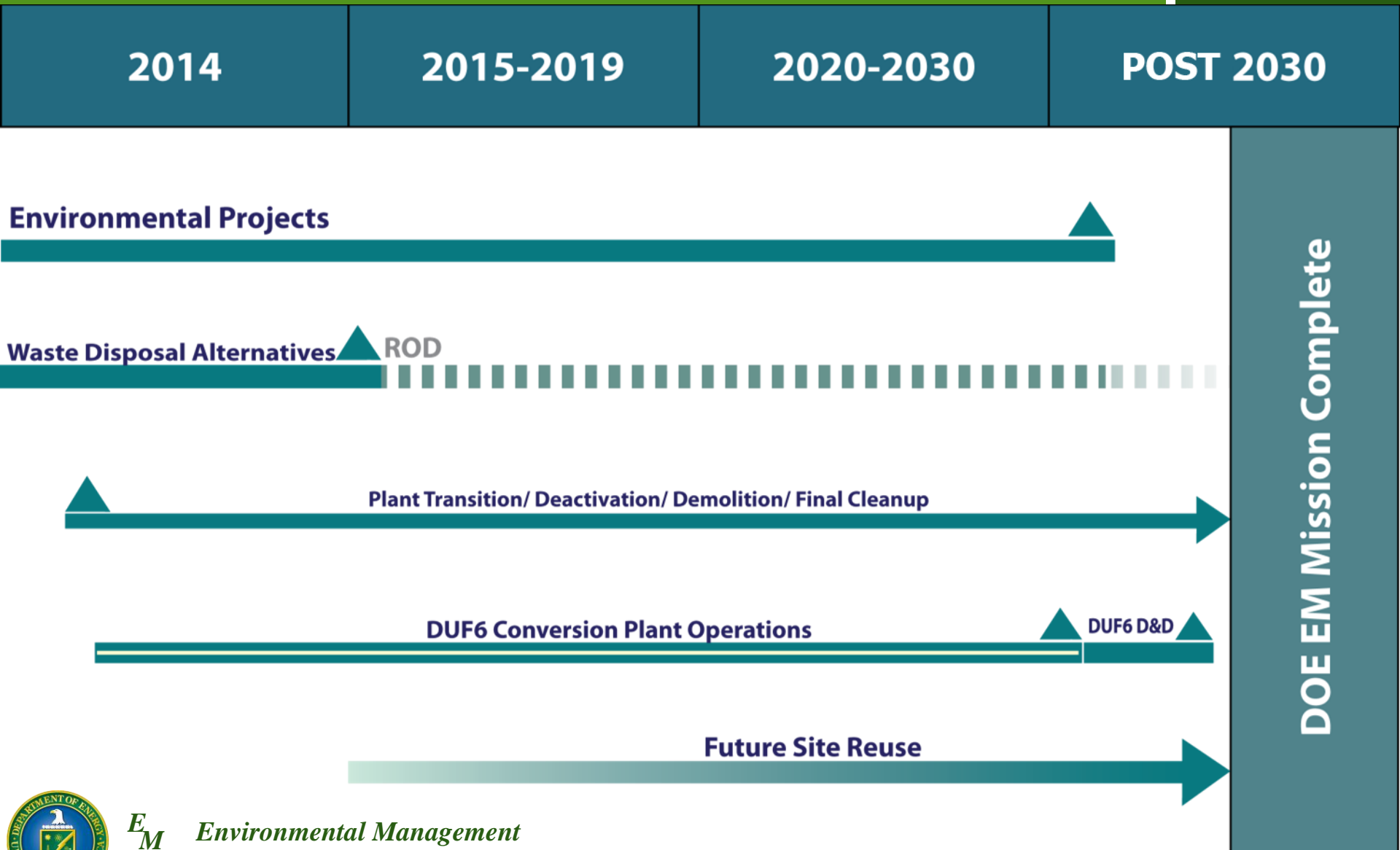
End State Vision

Planning Assumptions

- Consistent with future industrial land use:
 - ✓ Contaminated surface soils excavated to maximize plant areas available for reindustrialization
 - ✓ Major TCE sources to off-site groundwater contamination treated to extent technically practical
 - ✓ High-risk burial grounds posing groundwater threat excavated, low-risk ones capped in place
 - ✓ Institutional controls restricting access to groundwater, capped burial grounds, and subsurface soils
 - ✓ D&D of site facilities
 - ✓ Long-term monitoring



Long-Term Cleanup Strategy



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

Paducah Tenants



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov