436.1e-163

BJC/PAD-691/R1

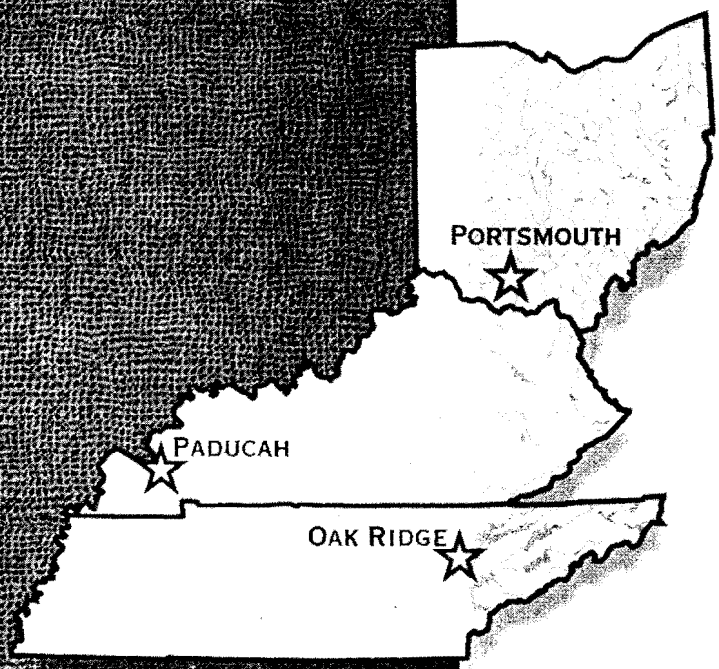
BECHTEL JACOBS

Bechtel Jacobs Company LLC

ENVIRONMENTAL MANAGEMENT

& ENRICHMENT FACILITIES

Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky



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

BJCF-8 (2-01)

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

436.1e -

BJC/PAD-691/R1

Cultural Resources Management Plan for the Paducah Gaseous Diffusion Plant Paducah, Kentucky

Date Issued—March 2006

Prepared by
CDM Federal Services Inc.
Paducah, Kentucky
under Subcontract 23900-SC-RM056F

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 Portsmouth Gaseous Diffusion Plant
Paducah, Kentucky 42001
under contract DE-AC05-03OR22980
for the
U.S. DEPARTMENT OF ENERGY

REVIEWED FOR
CLASSIFICATION
MAR 16 06
Initials Date
UNCLASSIFIED

CONTENTS

FIGURES v

ACRONYMS vii

EXECUTIVE SUMMARY ix

1. INTRODUCTION 1

2. EXISTING CONDITIONS 3
   2.1 PROGRAM DESCRIPTION 3
      2.1.1 Mission Statement 3
      2.1.2 Land Use 3
   2.2 CULTURAL AND HISTORICAL SETTING 3
      2.2.1 Previous Studies at PGDP 3
      2.2.2 Historical Context—Overview 5
   2.3 PGDP HISTORICAL PROPERTIES 24
      2.3.1 The 2004 Cultural Resources Survey and the NRHP 24
      2.3.2 Documentation of Property Types 26
      2.3.3 Historic Context Evaluation 28
   2.4 PGDP ARCHAEOLOGICAL PROPERTIES 29

3. CULTURAL RESOURCES MANAGEMENT PROCEDURES AND ADMINISTRATION 31
   3.1 FEDERAL AGENCIES AND THE NHPA 31
   3.2 SECTION 106 OF THE NHPA 31
      3.2.1 Public Participation 32
   3.3 SECTION 110 OF THE NHPA 32
   3.4 RELATED FEDERAL LAWS 33
      3.4.1 NEPA of 1969 33
      3.4.2 AHPA of 1974 33
      3.4.3 ARPA of 1979 33
      3.4.4 AIRFA of 1979 33
      3.4.5 NAGRA of 1990 34
   3.5 THE ROLE OF THE KENTUCKY SHPO 34
   3.6 THE ROLE OF THE ADVISORY COUNCIL 34
   3.7 MANAGEMENT RECOMMENDATIONS AND PROCEDURAL REVIEW 34
      3.7.1 Procedural Review 35
      3.7.2 Documentation and Monitoring 35
      3.7.3 Professional Qualifications and Training for Staff 35
      3.7.4 CRMP Updates and Endorsements 35
   3.8 PGDP CULTURAL RESOURCES SUMMARY 35

4. CULTURAL RESOURCES MANAGEMENT METHODS 37
   4.1 RECORDS AND REPORTS 37
      4.1.1 Cultural Resources Site Records 38
   4.2 INVENTORY 38
   4.3 PROGRAMMATIC EXCLUSIONS 38
   4.4 MANAGEMENT OF NRHP-ELIGIBLE ARCHAEOLOGICAL SITES 41

4.4.1 General Considerations for Prehistoric and Historic Archaeological Sites 41
4.5 MANAGEMENT OF OTHER NRHP-ELIGIBLE PROPERTIES 42
4.5.1 Mitigation Measures 43
4.5.2 Emergency Discovery Procedures 44
4.5.3 Notification Procedures 44

5. REFERENCES 45

APPENDIX A: PROPERTY INVENTORY A-1

FIGURES

1 PGDP vicinity map 4
2 U.S. Geological Survey (USGS) quadrangle map, Heath, Kentucky (1978), showing PGDP location 4
3 Site plan for the KOW TNT Production Area 8
4 Photograph of the KOW electrical plant during World War II 9
5 Aerial view of the KOW TNT Production Area in May 1950 10
6 Aerial view of the KOW Magazine Area in May 1950 11
7 The Heath USGS quadrangle map of 1954. 13
8 Schematic of gas flow in gaseous diffusion cascade 15
9 The site of PGDP is shown as farmland and woodlands in this aerial photograph taken in May 1950 18
10 Construction activity at the plant in December 1952 19
11 Construction work on the interior of Building C-335 in April 1952 20
12 Construction of the fluorine cell room electrical buss work in the C-410 Complex in December 1952 21
13 Construction of Process Building C-333 in July 1952 21
14 The lack of housing in the Paducah area led to the erection of hundreds of temporary buildings 22
15 Ca. 1955 postcard of PGDP 23
16 Proposed PGDP Historic District National Register boundary 26

ACRONYMS

AEC	Atomic Energy Commission
AHPA	Archaeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resource Protection Act
BJC	Bechtel Jacobs Company LLC
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLG	Certified Local Government
CRMP	Cultural Resources Management Plan
DOE	U.S. Department of Energy
KHC	Kentucky Heritage Council
KOW	Kentucky Ordnance Works
kW	kilowatt
MOA	Memorandum of Agreement
NAGRA	Native American Graves and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PGDP	Paducah Gaseous Diffusion Plant
SHPO	State Historic Preservation Officer
TNT	trinitrotoluene
TVA	Tennessee Valley Authority
^{235}U	uranium-235
UF_6	uranium hexafluoride
U.S.	United States
USEC	United States Enrichment Corporation
USGS	U.S. Geological Survey

EXECUTIVE SUMMARY

The Paducah Gaseous Diffusion Plant (PGDP) near Paducah, in McCracken County, Kentucky, is owned by the United States (U.S.) Department of Energy (DOE). DOE has responsibility for environmental management and leases the uranium enrichment facilities. PGDP was established in 1952 as a uranium enrichment plant to enrich uranium for commercial and defense use. It is located approximately 12 miles west of the city of Paducah, Kentucky, and contains over 150 primary buildings.

The National Historic Preservation Act (NHPA) of 1966 requires every federal agency to examine its undertakings and their effect on historic properties. As part of meeting the requirements of the NHPA, the DOE Paducah Site Office entered into a Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO) of the Kentucky Heritage Council and the Advisory Council on Historic Preservation (hereinafter referred to as "the Council") in January 2004. This PA requires that DOE complete a Cultural Resources Survey and Cultural Resources Management Plan (CRMP) in accordance with federal and state standards.

DOE completed an intensive cultural resources survey of PGDP. The results of this survey are presented in the report, *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006, incorporated by reference. The report provides detail for the buildings and sites eligible for listing on the National Register of Historic Places (NRHP) and identified as NRHP-eligible contributing properties to the PGDP Historic District. This survey did not include the archaeological components typically included in a cultural resources survey due to the fact that much of the PGDP area has been previously disturbed.

To better fulfill the requirements of the NHPA, DOE committed to the development of a CRMP for PGDP. The CRMP defines the preservation strategy for PGDP, and will direct efficient compliance with the NHPA and federal archaeological protection legislation at PGDP as DOE continues mission activities at the site.

Within the CRMP is an analysis of potential PGDP undertakings (projects and programs) that are likely to have an effect on PGDP historic properties over the next several years. Methods for the timely review of these effects, and coordination with the Kentucky SHPO, are provided.

1. INTRODUCTION

The Paducah Gaseous Diffusion Plant (PGDP) near Paducah, in McCracken County, Kentucky, is owned by the United States (U.S.) Department of Energy (DOE). DOE has responsibility for environmental management and leases the facilities used for enriching uranium to the United States Enrichment Corporation (USEC). PGDP was established in 1952 as a uranium enrichment plant to enrich uranium for commercial and defense use. It is located approximately 12 miles west of the city of Paducah, Kentucky, and contains over 150 primary buildings.

The DOE Paducah Site Office entered into a Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO) of the Kentucky Heritage Council (KHC) and the Advisory Council on Historic Preservation (hereinafter referred to as "the Council") in January 2004. The PGDP CRMP is to define the preservation strategy for PGDP, and to direct efficient compliance with the NHPA and federal archaeological protection legislation at PGDP as DOE continues mission activities at the site. The CRMP outlines the steps and procedures that will assist in meeting these objectives.

The PA requires that the DOE complete a cultural resources survey consistent with the following:

- Section 110(a)(2) of the NHPA,
- Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines, 48 Fed. Reg. 44716 (September 29, 1983),
- the SHPO's Specifications for Conducting Field Work and Preparing Cultural Resources Assessment Reports, and
- applicable DOE standards.

The PA also requires the DOE shall complete a Cultural Resources Management Plan (CRMP) for the PGDP in accordance with the following:

- DOE's Environmental Guidelines for Development of Cultural Resources Management Plans (DOE/EH-0501),
- the NHPA,
- Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines, 48 Fed. Reg. 44716 (September 29, 1983),
- the Section 110 Guidelines,
- 53 Fed. Reg. 4727 (February 17, 1988),
- the most recent Advisory Council on Historic Preservation Report to the President and Congress,
- *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities*, and
- standards or guidelines prepared by the SHPO for Preservation Planning.

The results of the cultural resources survey are presented in the report, *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006, incorporated by reference. Activities conducted under this CRMP are contingent on receiving appropriate designated funding levels from Congress.

2. EXISTING CONDITIONS

2.1 PROGRAM DESCRIPTION

DOE's mission at PGDP is environmental cleanup and waste management, including the management of depleted uranium hexafluoride (UF_6). The responsibilities of this mission are set within an historic environment.

2.1.1 Mission Statement

DOE's mission includes environmental cleanup and waste management, management of DOE's depleted UF_6 generated prior to July 1993, leasing uranium enrichment facilities at PGDP to USEC, and maintenance of nonleased buildings and grounds. The plant has produced enriched uranium continuously since November 1952.

2.1.2 Land Use

PGDP is located in western Kentucky, approximately 3.5 miles south of the Ohio River and 12 miles west of the city of Paducah (Figs. 1 and 2). The current size of the Paducah DOE reservation is 3,556 acres, of which 748 acres are within the main security fence (USEC 2001). PGDP contains 161 primary buildings. The central components of the facility are the plant's four main production buildings, which contain the cascade system critical to the uranium enrichment process. These buildings, C-331, C-333, C-335, and C-337, continue to be used to enrich uranium and are supported by various other processing and operations buildings, such as C-310 (Purge and Product Building) and C-315 (Surge and Tails Building). Additional buildings and structures associated with the gaseous diffusion process include cooling towers and electrical switchyards. The PGDP also contains administrative buildings, warehouses, and water treatment facilities.

2.2 CULTURAL AND HISTORICAL SETTING

The construction and operation of PGDP was a key element in the U.S. efforts to develop and stockpile nuclear weapons during the Cold War era. PGDP was one of three gaseous diffusion plants in the U.S. that enriched uranium for the production of nuclear weapon components. During the late twentieth century, the plant's mission shifted to the production of enriched uranium for nuclear power. In addition to its Cold War era history, the PGDP property is near the site of the World War II-era Kentucky Ordinance Works (KOW), which developed trinitrotoluene (TNT) for U.S. weapons.

2.2.1 Previous Studies at PGDP

Prior to the completion of the Cultural Resources Survey in 2004, cultural resources studies at PGDP have consisted of two archaeological studies that identified recorded historic sites and the analysis of one building complex at the plant. The archaeological resources study at the plant was documented in a 1993 report (Evans, 1993) by Archaeological Resources Consultant Services Inc. and a 1994 report by the U.S. Army Corps of Engineers. This study, *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume IV, Cultural Resources Investigation*, resulted in the survey of a number of archaeological sites and assessments to determine their eligibility for inclusion in the National Register of Historic Places (NRHP). No buildings or structures associated with the PGDP were inventoried as part of this study.

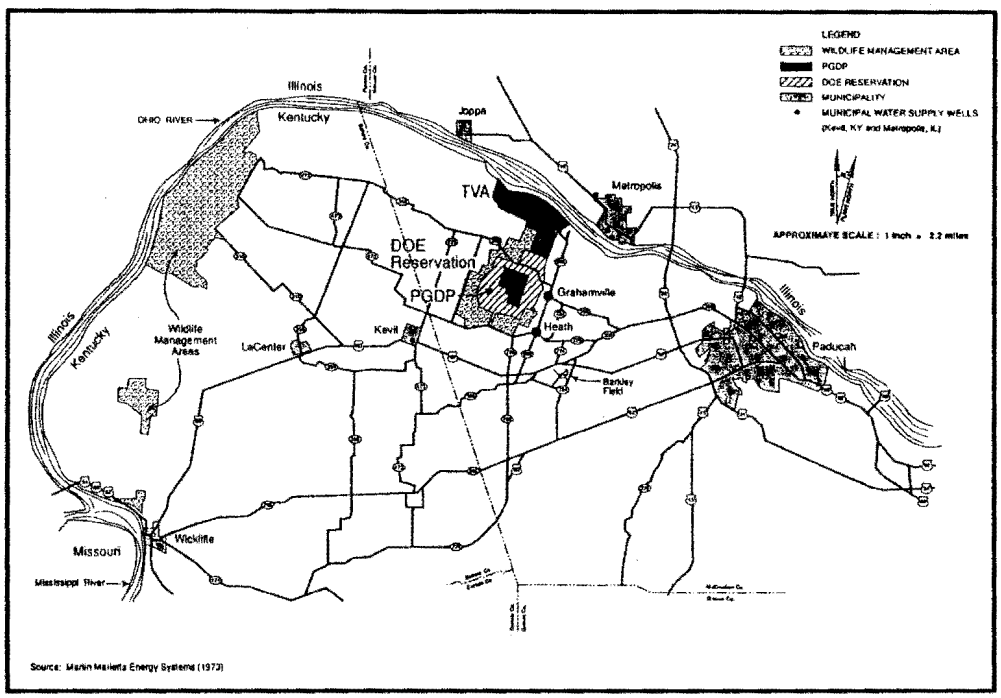


Fig. 1. PGDP vicinity map.

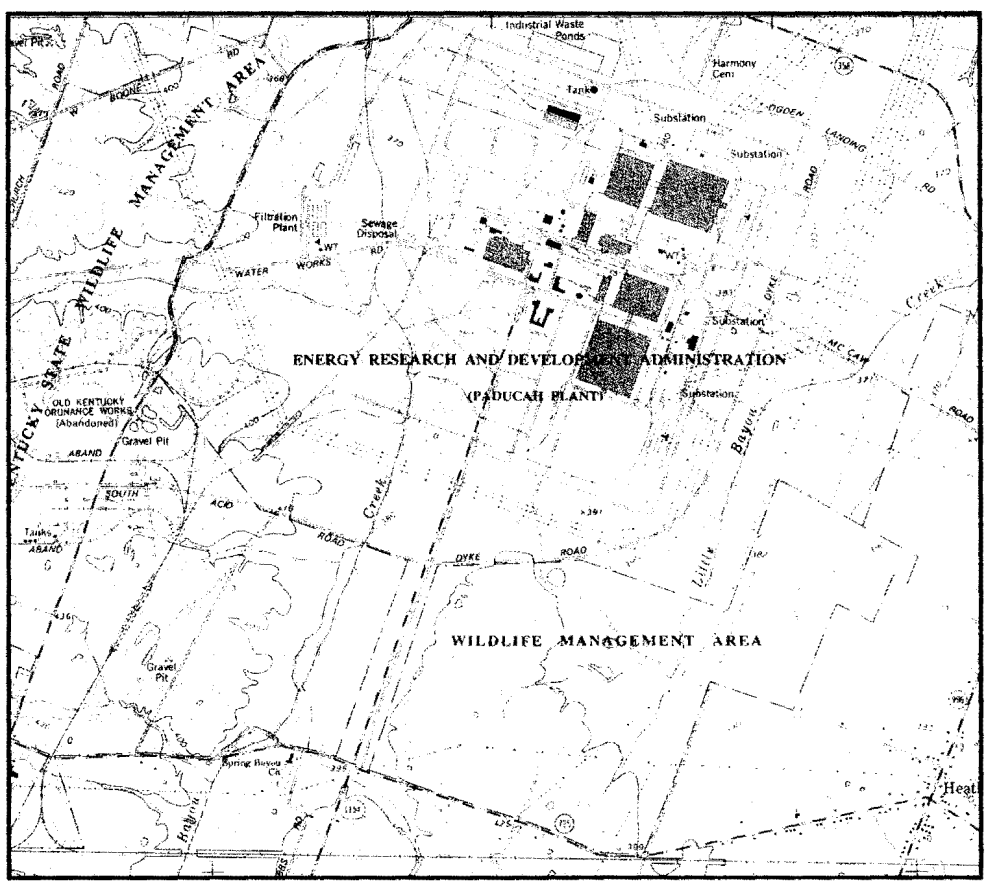


Fig. 2. U.S. Geological Survey (USGS) quadrangle map, Heath, Kentucky (1978), showing PGDP location.

In January 2003, DOE conducted an architectural and historical evaluation of the C-410 Complex within PGDP. Constructed between 1953 and 1957, the C-410 Complex served as a feed manufacturing plant for the cascade diffusion system located in the main process buildings. It consisted of the main C-410 building, as well as buildings C-411, C-420, and various support facilities, including three storage tanks and a sludge lagoon. Due to extensive contamination, DOE proposed to decontaminate and decommission the C-410 Complex at PGDP. The study of this complex concluded that the C-410 Complex was eligible for the National Register as a contributing property within the potentially eligible PGDP Historic District. This conclusion was contained in the report, *Cultural Resources Survey and National Register Assessment, C-410 Complex, Paducah Gaseous Diffusion Plant, McCracken County, Kentucky*, January 20, 2003. The KHC concurred with this report's assessment of NRHP eligibility and DOE's plans to mitigate adverse effects to this historical facility.

2.2.2 Historical Context—Overview

2.2.2.1 Nineteenth and early twentieth-century land ownership and usage

Prior to Euro-American settlement, much of the land in western Kentucky and Tennessee was part of the Chickasaw Nation. In 1818, Andrew Jackson and Isaac Shelby negotiated a treaty with the Chickasaw to purchase this land. Known as the Jackson Purchase, this acquisition allowed for extensive white settlement into the region. Numerous settlers arrived in this section of Kentucky during the 1820s, and by 1824 the population was sufficient to establish McCracken County. Paducah emerged as the commercial and governmental center of the county and was incorporated in 1830 at the confluence of the Ohio and Tennessee rivers (Department of the Army 1994). Most of the land in the county was converted from woodlands and grasslands to cultivated fields. Corn, wheat, and tobacco were the main crops, and many farms raised livestock such as cattle and swine. A great number of settlers owned slaves, and by 1860, the population of McCracken County had risen to 10,322, of which 8554 were white and 1768 were African-American slaves (Department of the Army 1994).

Despite attempts to remain neutral, Kentucky was occupied by Union and Confederate forces early in the Civil War, and Paducah became an important military base for the Union army. No major conflicts occurred in McCracken County until March 24, 1864, when Confederate Major General Nathan Bedford Forrest led a raid on Paducah. Forrest's command quickly seized the town. After a brief skirmish with a smaller Union force, Forrest's men gathered a substantial amount of supplies and horses before moving south to Mayfield (Faust 1986). No other major actions took place in the county during the remainder of the Civil War.

Following the Civil War, McCracken County's population increased to almost 14,000 by 1870. Tobacco emerged as the primary cash crop during the mid-nineteenth century and area farmers also raised substantial amounts of corn and wheat. Post-war industries that developed in Paducah included five wagon factories, a woolen mill, three tobacco warehouses, a tobacco stemmery, and three large flour mills. The city's rail service, first established in 1853, was enlarged in the 1880s when the Paducah-Elizabeth Railroad was consolidated with the New Orleans and Ohio Railroad (Department of the Army 1994). This railroad line was later merged into the Nashville, Chattanooga, and St. Louis Railroad system.

The property now encompassed by the DOE reservation was the site of several large farms in the nineteenth century, primarily those of the Baldry, Owen, and Carneal families. One of the larger landowners was Reverend W. S. Baldry who purchased 1688 acres in this vicinity in 1859 (McCracken County, Deed Book M). His daughter, Mary Jane, married W. F. Cunningham, and the couple later inherited much of the Baldry estate. The federal government purchased a portion of the Baldry lands in 1942 for the KOW.

Edward and Harriet Owen also established a large plantation in this area in the 1850s. The Owens had several slaves and, at one time, 21 slave cabins existed on the plantation (Department of the Army 1994). At her death, Harriet Owen left the bulk of her estate to her last husband, Lafayette Harrison. The property was subdivided in the 1890s among the Harrison heirs, and in 1897 the small community of Heath grew up around a store and post office established on a portion of the property. The community grew in prominence in 1902 when the Paducah-Cairo Railroad was completed through this area and a depot was built in Heath. Part of the former Harrison estate included not only Heath, but also extended into the property now encompassed by the DOE reservation.

Another important family in the vicinity was that of Reverend Josiah Carneal, who purchased extensive acreage in this section of the county. His son, John D. Carneal, donated land in 1876 for the construction of the African-American Carneal Chapel Missionary Baptist Church, just to the north of Grahamville. A school was also built on this property in 1900, and this crossroads settlement is still known as Carneal.

Throughout the early twentieth century, agriculture continued to be the primary occupation of most McCracken County residents, with tobacco as one of the chief crops. However, by the mid-1920s, the over-production of tobacco, nationwide, led to falling prices and many farmers in the county suffered as a result. The harsh economy of the Great Depression compounded the problem, and despite efforts to improve the agricultural economy through New Deal programs, land values dropped by the late 1930s. Many farmers continued to struggle until America's entry into World War II in 1941. At this point, the landscape of this section of McCracken County was transformed when the federal government established the KOW west of Paducah.

2.2.2.2 KOW

The KOW was an explosives manufacturing facility constructed in 1942, with the sole purpose of producing TNT and concentrated sulfuric acid from six production lines. The chemical TNT was widely used for a variety of explosives in bombs, mines, torpedoes, and other munitions. DOE is not responsible for the KOW. Applicable requirements for cultural resources management will be carried out by the agency currently responsible for this area, namely the Corps of Engineers.

The KOW was one of five large government-owned plants constructed in the U.S. under a contract with DuPont de Nemours and Company of Delaware. Because of its demonstrated capacity in the production of gunpowder and munitions, DuPont was awarded a "TNT Special Contract" by the U.S. government in 1942 (Hewgley Museum manuscript). This contract called for DuPont to design the plants, procure production equipment, and consult in overall plant operations. The designs of these plants were based on DuPont's Kankakee Ordnance Works near Joliet, Illinois—a DuPont-designed-and-operated TNT plant, then in its initial operating stages (Hewgley Museum manuscript). The first three plants to be built under this contract were the West Virginia Ordnance Works at Point Pleasant, Ohio; the Longhorn Ordnance Works at Karnack, Texas; and the Lake Ontario Ordnance Works at Modeltown, New York. These three plants were commissioned on January 8, 1942. Two additional plants, the Pennsylvania Ordnance Works near Milton, Pennsylvania, and the KOW west of Paducah were commissioned in February and March 1942, respectively.

The announcement of the KOW was made on February 27, 1942, when The *Paducah Sun-Democrat* headlined "$30,000,000 Arms Plant to be Built in McCracken County" (on file at the Paducah Historical Society). The federal government condemned 16,100 acres west of the city and an estimated 250 families were forced to relocate. Most of the buildings within the condemned area were razed, although some dwellings were salvaged and moved to new locations. The federal government began purchasing property

in June and eventually acquired over 250 separate tracts for the plant (McCracken County, General Index to Deeds N to Z).

The site for the KOW was largely composed of farmland and woodlands near the small community of Heath (Fig. 3). The initial contract for the construction of this plant was for $4,128,490, and on March 10, 1942, the Rust Engineering Company was awarded the contract to build the facility. The KOW was to have six lines producing TNT, as well as sulfuric acid. The Atlas Powder Company, a subsidiary of DuPont, was contracted to operate the plant. Actual construction began on April 15, 1942, and over the next seven months some 6000 workers constructed numerous concrete and frame buildings at the site. A spur line of the Illinois Central Railroad was also built to provide rail transportation to the plant.

On December 28, 1942, the KOW went into operation when one of its lines produced its first amount of TNT. During its operations, the plant consisted of a TNT-manufacturing area, an acid production area, a water treatment plant, and a coal-fired steam plant (Fig. 4). The KOW had its own cafeteria, which could seat 248 persons at one time, a hospital, laundry, and its own box factory for making TNT packaging boxes (McCracken County, General Index to Deeds N to Z). The water system was considered one of the most modern in the state, and two of its water tanks remain in use today. To the west of the production area were administrative buildings and residences for plant managers. The last of the buildings at the plant were completed in April 1943.

The plant made TNT by adding nitric acid to toluene gas in large 2000 gal vats. The liquid TNT was then washed, hardened, and formed into flakes and was then placed into 50 pound boxes. The boxes were transported by rail and truck to the Magazine Area located to the north of the production area. A total of 92 concrete bunkers in the Magazine Area were built to provide temporary storage for the boxes of TNT. From the bunkers, the boxes of TNT were then transported to munitions plants across the country. Hundreds of workers were employed at the plant during the war years.

The plant remained in operation from December 1942 until it was placed on standby status on August 15, 1945. With the official surrender of Japan and end of hostilities, the last TNT was manufactured and packed on August 24, 1945. The KOW was declared surplus to the Surplus Property Board on September 20, 1945. During its years of production, the KOW manufactured almost 393 million pounds of TNT (U.S. Army Corps of Engineers 1992). Overall, from 1940 to 1945, DuPont produced more smokeless gunpowder and TNT than any other company in previous history (DuPont 1952).

For a number of years, most buildings at the site were secured and left standing. During the early 1950s, many of the buildings remained extant as shown in the May 1950 aerial photographs (Figs. 5 and 6) taken by the Tennessee Valley Authority (TVA). However, once construction of PGDP was initiated, most of the KOW buildings were removed. Today, the former KOW site consists largely of concrete foundations identifying the locations of the TNT and acid production areas. Two original 250,000-gal concrete water tanks (currently inactive) are designated C-611-M (MCN-194) and C-611-N (MCN-195). At the site of the steam power plant are four concrete coal storage tanks. Also extant is the shell of a concrete and brick building that was part of the East Acid Production Area.

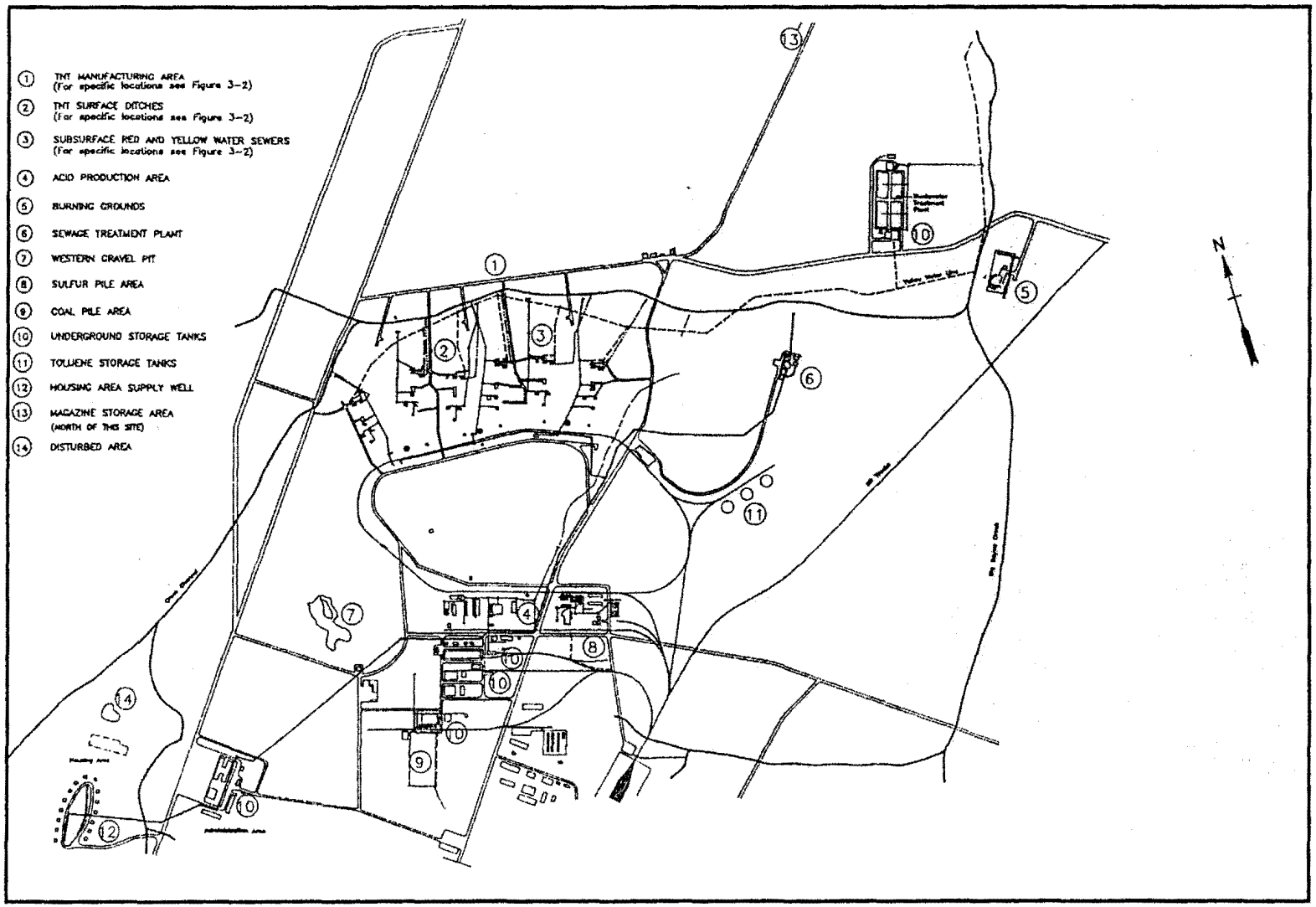


Fig. 3. Site plan for the KOW TNT Production Area.
(Plan courtesy of the U.S. Army Corps of Engineers)

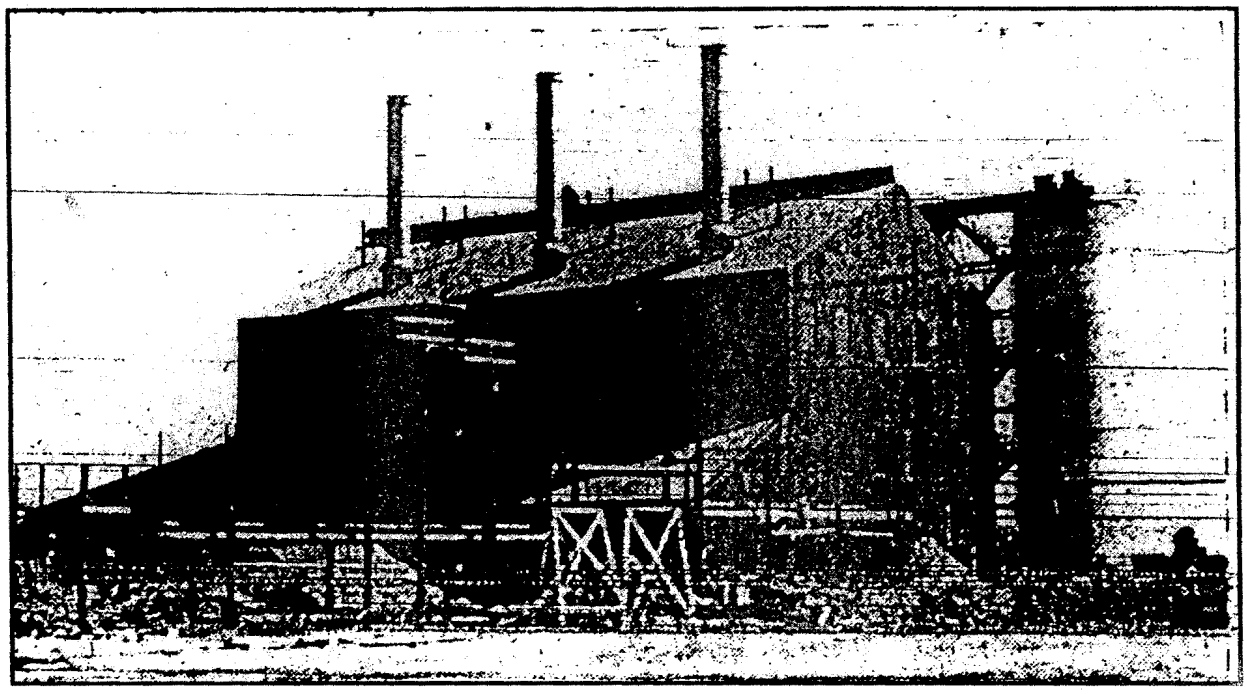


Fig. 4. Photograph of the KOW electrical plant during World War II. The four coal storage holding tanks associated with this building remain extant (*The Paducah Sun-Democrat*, December 15, 1950).

The most visible remnants of the KOW on the landscape are the remaining concrete storage bunkers located north of the main production area. Nine rows of concrete bunkers were built, arranged in a north-south axis. The bunkers were evenly spaced and were built with sloping reinforced concrete walls on three sides and with wood roofs. The walls were built 4-ft thick at the base and tapered to 18-in. thick near the roof. The roof and the exterior walls of the bunkers were covered with a foot of earth to help suppress accidental explosions and to provide camouflage in case of an aerial attack. The design of the bunkers was intended to direct any accidental explosion into the air out of the roof as opposed to exploding laterally, which could affect adjacent bunkers. Most of the bunkers are now part of the West Kentucky Wildlife Management Area; however, several are also owned by private individuals or organizations. The KOW site is part of the Defense Environmental Restoration Program due to the contaminants of TNT and its by-products. A Phase I Contamination Evaluation was performed by TCT-St. Louis in 1990, which identified numerous sources of contaminants in the TNT production line area.

In addition to the properties within the project area, the residential development associated with the KOW operations remains extant just west of Bethel Church Road (Fig. 7). Originally known as McCracken Village, this complex of 15 dwellings is located around a circular park. The federal government sold this property under the provisions of the Federal Property and Administrative Services Act of 1949 in March 1950 (McCracken County, Deed Book 286). The property was purchased by Phil and Neva Magruder, who renamed the complex Magruder Village. The dwellings are now in individual private ownership and are not within the project area for this study.

Fig. 5. Aerial view of the KOW TNT Production Area in May 1950.
(Photograph on file at the McCracken County Property Valuation Office, Paducah, Kentucky.)

Fig. 6. Aerial view of the KOW Magazine Area in May 1950.
(Photograph on file at the McCracken County Property Valuation Office, Paducah, Kentucky.)

2.2.2.3 Development of nuclear energy and the Manhattan Project

The PGDP has its origins in the development of nuclear energy and the Manhattan Project of the 1940s. The development of nuclear energy emerged from various scientific discoveries of the 1930s. During the early years of this decade, scientists discovered that the nucleus of an atom contains neutrons (particles with no charge), as well as electrons and protons (particles with negative and positive charges). Further research revealed that atoms of the same element can have different weights, depending on the number of neutrons in a particular atom's nucleus. These "different classes of atoms of the same element, but with varying numbers of neutrons, were designated isotopes" (Gosling 1994).

There are three isotopes of uranium, a naturally-occurring element found in the earth. All three of these isotopes have 92 protons and 92 electrons, but each has a different number of neutrons, and thus, a different atomic weight. Uranium-238 has 146 neutrons and is the heaviest of the three isotopes. It accounts for over 99% of natural uranium. Uranium-235 (^{235}U) has 143 neutrons in its nucleus and makes up only 0.7% of natural uranium. The third isotope, Uranium-234, has 142 neutrons and is found only in traces of the element (Gosling 1994). This slight difference in the atomic weights of uranium isotopes played a key role in the development of nuclear energy.

Additional advancements in the field of physics during the 1930s included the discovery of fission. In the early 1930s, it was known that bombarding elements with protons could split atoms. In 1934, an Italian scientist bombarded elements with neutrons instead. In 1939, Berlin radiochemists used this method with uranium and realized that "while the nuclei of most elements changed somewhat during neutron bombardment, uranium nuclei changed greatly and broke into two roughly equal pieces" (Gosling 1994). The end-products weighed less than the original uranium; therefore, using Albert Einstein's $E=mc^2$ equation, the loss of mass was converted into a form of kinetic energy. This energy, in turn, could be converted into heat. This process of splitting atoms and releasing energy is called fission.

During the fission process, neutrons are released. If they collide with other ^{235}U atoms, additional neutrons are released and, in turn, smash into more atoms, which release more neutrons to smash into more atoms, and so on. This chain reaction produces a continuous release of energy. Once discovered, scientists realized that "a controlled self-sustaining reaction could make it possible to generate a large amount of energy for heat and power, while an unchecked reaction could create an explosion of huge force" (Gosling 1994). The binding energy of the nucleus so released would be tremendous, ten million times larger than the energy released by chemical reactions (Logan 1996).

As these scientific discoveries emerged, war was mounting in Europe. Scientists realized uranium fission made possible the creation of a new weapon, one with a potential for mass destruction, and thus, the race to build the first atomic bomb began. Government-supported research intensified, concentrating on isotope separation. After the bombing of Pearl Harbor on December 7, 1941, which brought the U.S. into World War II, the urgency to develop atomic power intensified. The initial challenge before scientists was to create a practical demonstration of a chain reaction. Physicists working at the University of Chicago under the direction of Arthur Compton achieved this goal on December 2, 1942. The experiment, which was conducted on a squash court located beneath the university's football stadium, successfully created a controlled nuclear reaction by specially arranging tons of uranium and graphite (Allardice and Trapnell 1974).

In response to the need for atomic research, the U.S. government initiated the Manhattan Project, a top-secret effort to develop nuclear weapons. The U.S. Army Corps of Engineers was responsible for the project and established sites for uranium separation and for the production of plutonium, which also had the ability to create an explosion. Sites associated with the Manhattan Project were established in Oak Ridge, Tennessee; Los Alamos, New Mexico; and Hanford, Washington. Research to support the project

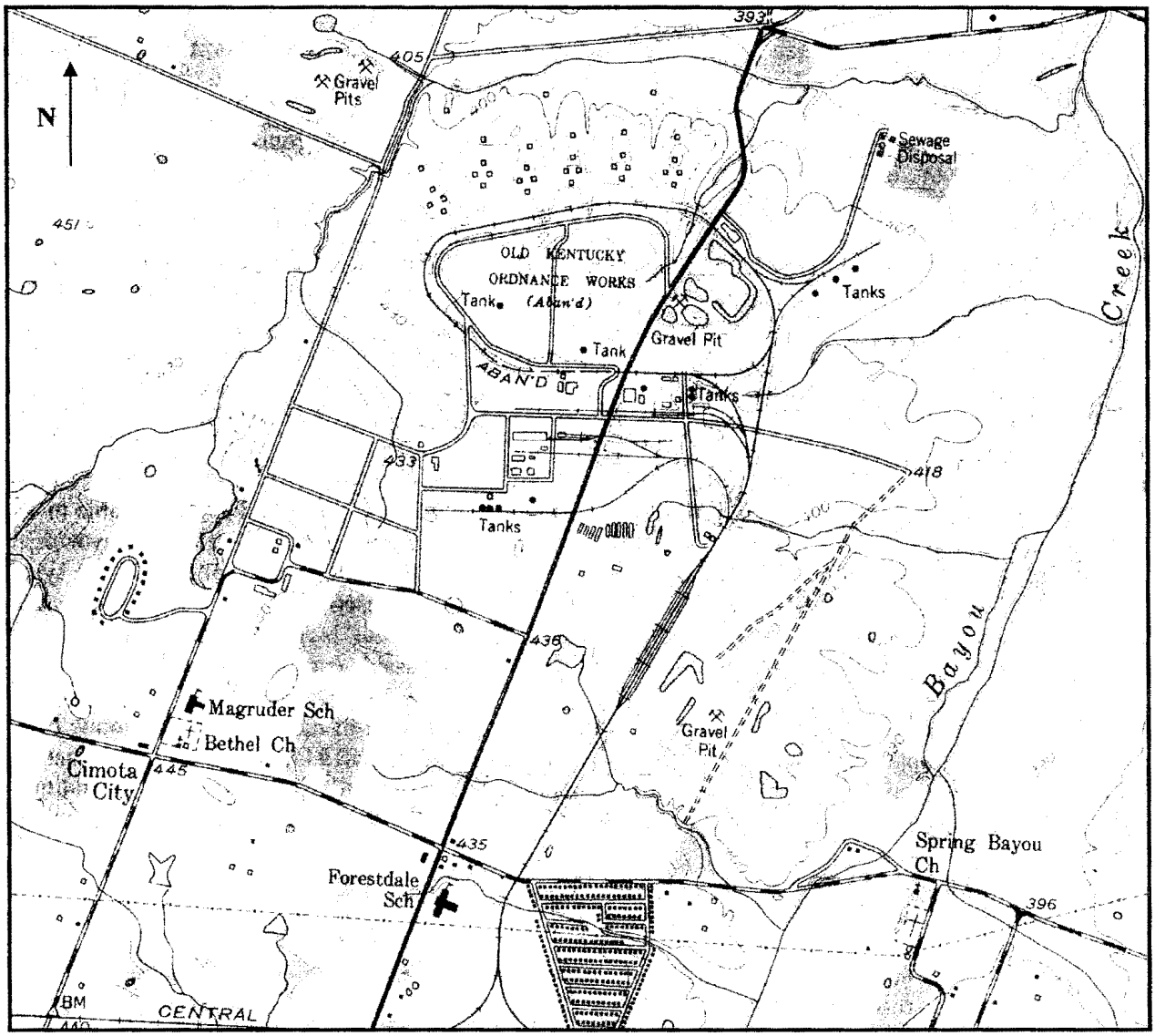


Fig. 7. The Heath USGS quadrangle map of 1954. The map continued to show the layout and plan of the KOW during its demolition. The residential area of McCracken Village is shown just northwest of Magruder School.

took place at universities, laboratories, and plants across the country. Universities as diverse as Columbia, the University of California at Berkeley, and the University of Chicago, were key contributors.

It was discovered early on that the fission in uranium occurred primarily in uranium atoms of the lighter and more rare ^{235}U isotope, which accounts for less than 1% of natural uranium. In order to create a chain reaction using ^{235}U, scientists had to separate it from the heavier Uranium-238 isotope and concentrate it into a critical mass. Scientific studies revealed various possible approaches for separating the uranium isotopes, and scientists heavily debated which process would be ultimately successful. In late 1942, the choice was narrowed to two methods, the electromagnetic process and the gaseous diffusion process. At this point no one had ever separated uranium isotopes in any but micro-lab-scale quantities, and mass quantities were required for the development of atomic weapons.

The process of gaseous diffusion is based on the principle that lighter isotopes will pass through a porous barrier more readily than the heavier isotopes. The process begins with a form of uranium called UF_6. At room temperature, UF_6 is a solid, but when heated above 135°F, it becomes a gas. The gas is then fed into a cascade system of porous membrane barriers with microscopic openings. The lighter ^{235}U isotope passes through the barriers more easily; and as the gas moves through multiple levels of the cascade system, the isotopes continue to separate to create a higher concentration of ^{235}U in the upper barriers (Fig. 8) (USEC 2001).

The Manhattan Project used both gaseous diffusion and electromagnetic diffusion to create enriched uranium for atomic weapons. During the early 1940s, two plants were established in Oak Ridge, Tennessee, for these purposes: K-25 and Y-12. K-25 was the gaseous diffusion plant for the Manhattan Project. Built in 1943, K-25's general form assumed a U-shape and was composed of 54 contiguous four-story buildings. The complex was almost a half-mile in length, averaged 400 ft in width, and stood 60 ft tall. The total area for the main building alone encompassed 44 acres (Hewlett and Anderson 1962, Robinson 1950).

The first attempts at developing a viable barrier process met with failure, and K-25 was able to only partially enrich the uranium. At this point, the gaseous diffusion process was curtailed in favor of the electromagnetic process of uranium enrichment at Y-12. The final and upper stages of the cascade system were eliminated as uranium was taken from the middle of the K-25 cascade process and used as feed for Y-12 (Hewlett and Anderson 1962). Meanwhile, research on the barrier process continued and improvements were made by 1944, and K-25 ultimately produced usable enriched product.

The efforts of the Manhattan Project resulted in the development of the world's first atomic bomb, which the U.S. dropped on the city of Hiroshima, Japan, on August 6, 1945. Its power and devastation were unlike any seen before. Approximately 100,000 people were killed instantly and an additional 100,000 were fatally injured (Gosling 1994). The bombing led to the surrender of Japan and the eventual end of World War II.

2.2.2.4 America's nuclear program and the Cold War

Following the end of World War II, the Atomic Energy Commission (AEC) was formed to lead America's nuclear research program. Management of atomic research and production facilities was transferred from the U.S. military to civilian corporations such as Union Carbide. Although some plants of the Manhattan Project were shut down, K-25 continued to produce enriched uranium to feed processes at Y-12.

The introduction of the atomic bomb brought a new challenge to international relations and introduced a power struggle between leading nations. The U.S. monopoly on atomic weapons did not last long. In 1949, Russia revealed that it too had successfully tested an atomic weapon. Unable to reach an agreement over arms control, the two superpowers locked into a relationship of mutual suspicion as each began to stockpile a nuclear arsenal. The mounting distrust between the two countries was fueled by fundamental differences in their political and social ideologies of communism and democracy, and a global struggle emerged between the two philosophies. Known as the Cold War, this period of distrust and arms development between the Soviet Union and the U.S. continued until 1989.

A trigger to the Cold War was the "failure of the World War II allies to reach agreements on international controls respecting nuclear research and atomic weapons" immediately following the war (Gosling 1994). Scientists in the U.S. broached the topic of arms control prior to the war's end. Aware that their counterparts in the Soviet Union were not far behind them in nuclear research, U.S. scientists

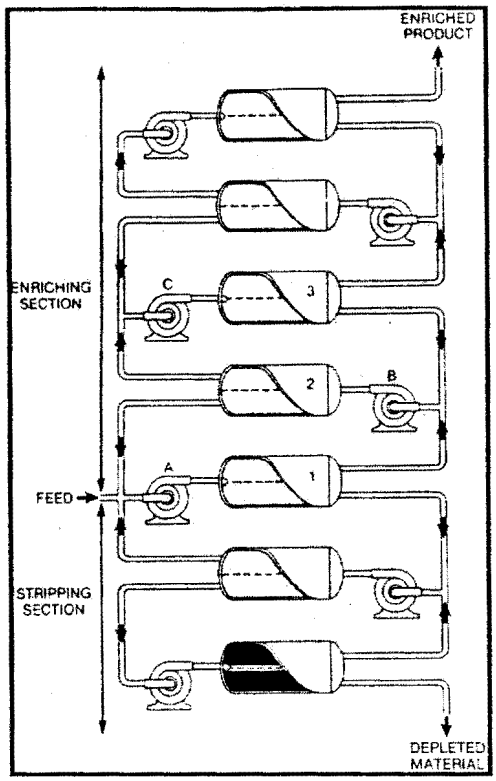


Fig. 8. Schematic of gas flow in gaseous diffusion cascade.
(Diagram from USEC web site, "The Manhattan Project: Making the Atom Bomb.")

advocated the formation of an international organization to prevent nuclear conflict as early as 1944. A peacetime policy of full publicity and cooperation was encouraged (Gosling 1994).

In June 1946, the U.S. presented a formal proposal for the international control of atomic energy to the United Nations. Presented by statesman Bernard Baruch, the proposal was known as the Baruch Plan and recommended that an international atomic development authority be created to control nuclear activities and to license and inspect nuclear projects. After the authority was established, all existing bombs were to be destroyed and no other bombs would be built. The Soviet Union quickly rejected the proposal, stating that all atomic weapons should be destroyed prior to the formation of the international authority. They maintained that the U.S. held an unfair advantage, because of its existing stockpile of nuclear weapons. The U.S., on the other hand, argued that an international agreement must precede a reduction in arms. With both sides unwilling to compromise, the debate reached a stalemate. Relations between the U.S. and the Soviet Union continued to deteriorate and the U.S. continued to develop its nuclear arsenal (Gosling 1994).

Relations between the two nations continued to be strained, and in 1949, the Soviet Union revealed that it had successfully tested its first nuclear weapon. The political situation in Asia added fuel to the fire in the global struggle between communism and democracy. In February 1950, the Soviet Union signed a treaty of alliance and mutual assistance with the People's Republic of China. During this same period, tensions between communist North Korea and independent South Korea were escalating into war. On June 25, 1950, the North Korean army invaded South Korea. Five days later, U.S. forces entered the conflict to assist South Korea (Rhodes 1995).

2.2.2.5 Establishment of the PGDP

With America's participation in the Korean War and rising tensions with the Soviet Union, President Harry Truman decided to increase research and development of the hydrogen bomb. In the fall of 1950, the AEC embarked on a vast expansion program to meet these requirements and began construction of atomic energy plants across the country. These new nuclear production facilities included a feed materials center at Fernald, Ohio; a plant to produce large quantities of lithium 6 at Oak Ridge; gaseous diffusion plants in Portsmouth, Ohio, and Paducah, Kentucky; two large reactors and a separation plant for producing plutonium at Hanford, Washington; and five heavy-water reactors at the Savannah River site in South Carolina for producing tritium from lithium 6, as well as plutonium. This three-year, three billion dollar expansion would represent one of the largest federal construction projects in peacetime history (DOE, Historical Records of the AEC).

Paducah was selected as the site for the gaseous diffusion plant for a number of reasons. First, a significant portion of the land, the 1942 KOW site, was already owned by the federal government. Second, the site offered geographical advantages with much needed electrical power nearby, as well as water from the adjacent Ohio River. Finally, the site was promoted by the vice president of the U.S., Paducah native Alben Barkley (Durfee 2003).

On October 9, 1950, President Harry Truman approved a recommendation from the National Security Council to increase the production capacity of ^{235}U. The design of the new plant was contracted to the Carbide and Carbon Chemicals Division of Union Carbide and Carbon Corporation with assistance from the firm of Giffels and Vallet, Inc. (Durfee 2003). The Council initially identified eight potential sites for the establishment of the new uranium enrichment plant. In Arkansas, two sites were identified: one on the White River in the north section of the state and another at Fort Smith on the Arkansas River. Two sites were identified in Louisiana: the Ouachita River at Sterlington and the Red River at Shreveport. In Kentucky, four sites were examined: the Green River near Bowling Green, Wolf Creek in the eastern section of the state, and sites on the Ohio River at Owensboro and Paducah.

The site selection was first limited to locations already owned by the federal government in order to maintain secrecy and avoid the unnecessary purchase of private property. The survey was also limited to areas where large quantities of coal or oil could be obtained at reasonable cost. The site criteria were refined to include a reserve power capacity of about 330,000 kilowatts (kW) available within a year and about half that capacity available for construction; that the site be located within 1000 miles of Oak Ridge, Tennessee; that approximately 1000 acres of suitable building land and 4000 acres of perimeter be available for security reasons; that it should be near an urban center capable of producing a work force of 10,000 men and 1500 operators; and that transportation facilities be available at reasonable cost (Durfee 2003).

The application of this site selection criteria resulted in the preference for two sites previously studied—the KOW at Paducah and the Louisiana Ordnance Works at Minden, Louisiana. A third site, the Longhorn Ordnance Works near Marshall, Texas, was also seriously considered. Of these three sites, the KOW at Paducah was preferred, because it was more readily available and was the most favorable government site located within the strategically preferred area of the country (Durfee 2003). The selection committee that visited the site was impressed by the amount of land owned by the federal government and by the geographical advantages for water from the Ohio River and electricity from the hydropower of the nearby Kentucky Dam. On October 19, 1950, Gordon Dean, Chairman of the AEC, wrote Frank Pace, Jr., the Secretary of the Army, and requested that the "portion of the KOW that is still owned by the Department of the Army be transferred to the Atomic Energy Commission" (Durfee 2003).

Although there was available power from the Kentucky Dam and TVA, the projected 850,000-kW daily demand of the new plant would require new generating sources. In November, the AEC determined that TVA should be responsible for supplying electric power to the new plant and that funds be appropriated to the agency for this purpose. TVA worked with five energy companies to provide interim power requirements, while the new plant was under construction. The new plant, a steam-electric plant, was planned for a site just north of the proposed gaseous diffusion plant adjacent to the Ohio River. Named the Shawnee Steam Plant, this new plant was estimated to cost $184 million.

In early December 1950, the selection of the Paducah site was announced and a contractor to build the plant was approved. An official telegram from Washington, D.C. to *The Paducah Sun-Democrat* made the official announcement on December 14, resulting in front page news. The contractor chosen to build the plant was F. H. McGraw and Company of Hartford, Connecticut. AEC chose the company because of its qualified personnel and its experience building large projects. Contractor operation of the plant was the responsibility of the Carbide and Carbon Corporation, which also operated the K-25 gaseous diffusion plant in Oak Ridge. Construction costs were estimated at $500 million. On December 16, TVA officially announced that it would build a four-unit steam plant near the Paducah installation to supply electricity.

Construction at the site began in early January 1951 with the demolition of KOW buildings and the repair of the abandoned KOW railroad line. Also in January, TVA started acquiring property just north of the plant site for the construction of the Shawnee Steam Plant. Already owning the 4000-acre KOW site, the AEC purchased an additional 3335 acres for the construction of the gaseous diffusion plant (Fig. 9). The majority of the property was purchased by the federal government from February through May 1951. Approximately 120 tracts of property were acquired during these months. In September, the federal government also purchased over 150 transmission line easements for the construction of the electrical towers (McCracken County, General Index to Deeds N to Z).

Work on PGDP began immediately with groundbreaking activities starting January 2, 1951. F. H. McGraw and Company of Hartford, Connecticut, won the contract to build the enrichment plant and Carbide and Carbon Chemicals Company (subsequently Union Carbide) was selected to manage and operate the facility. The plant cost an estimated $800 million and was in operation by September 1952. Construction continued at the plant until 1954 (Figs. 10 through 13). The size of the plant was doubled during construction, which resulted in a cost increase from $500 million to $800 million.

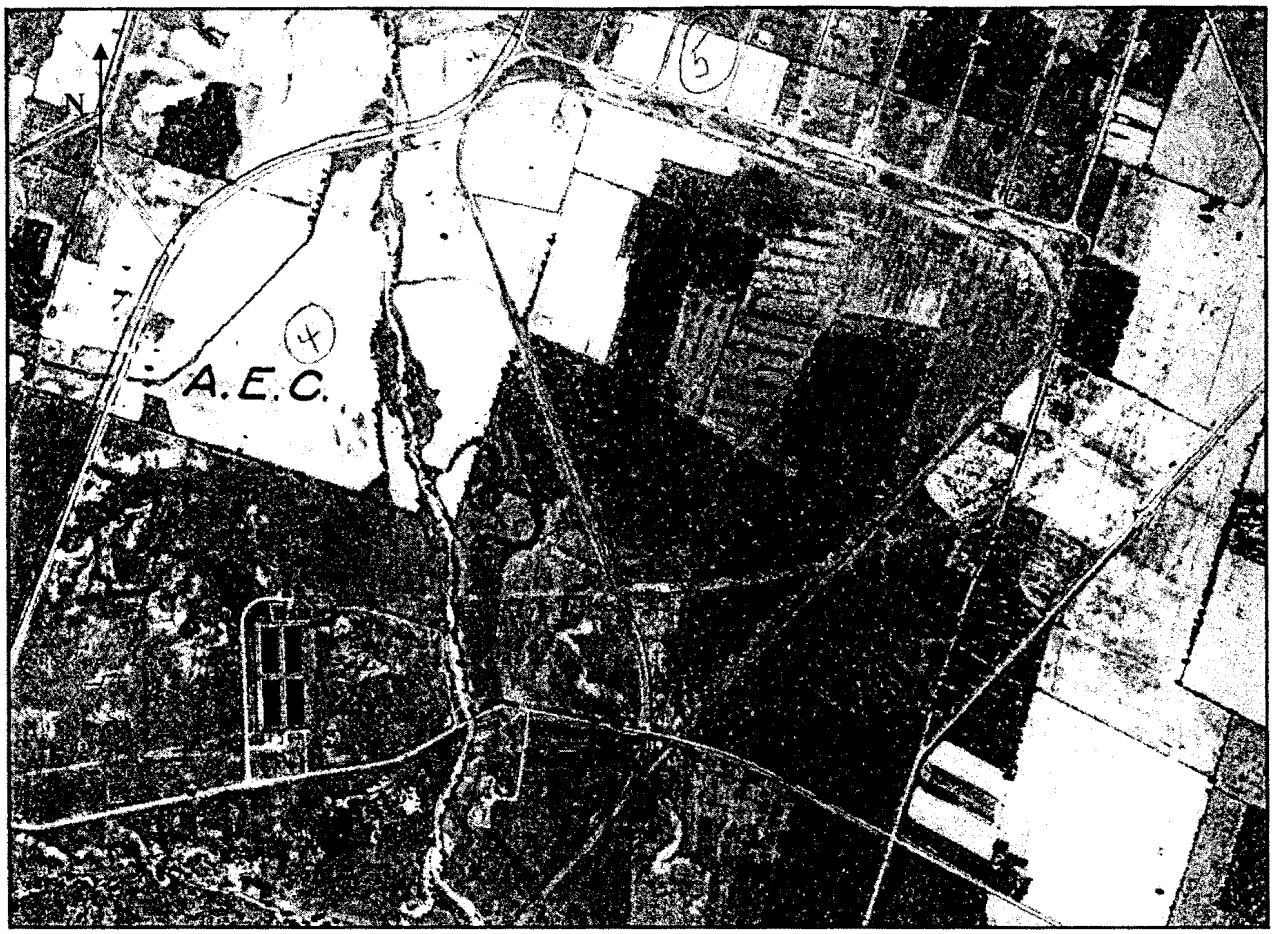


Fig. 9. The site of PGDP is shown as farmland and woodlands in this aerial photograph taken in May 1950. The four sewage lagoons of the KOW water treatment plant are shown in the lower left of the photograph. This facility was retained for use in the operations of the PGDP. (Photograph on file at the McCracken County Property Valuation Office, Paducah, Kentucky.)

Fig. 10. Construction activity at the plant in December 1952.

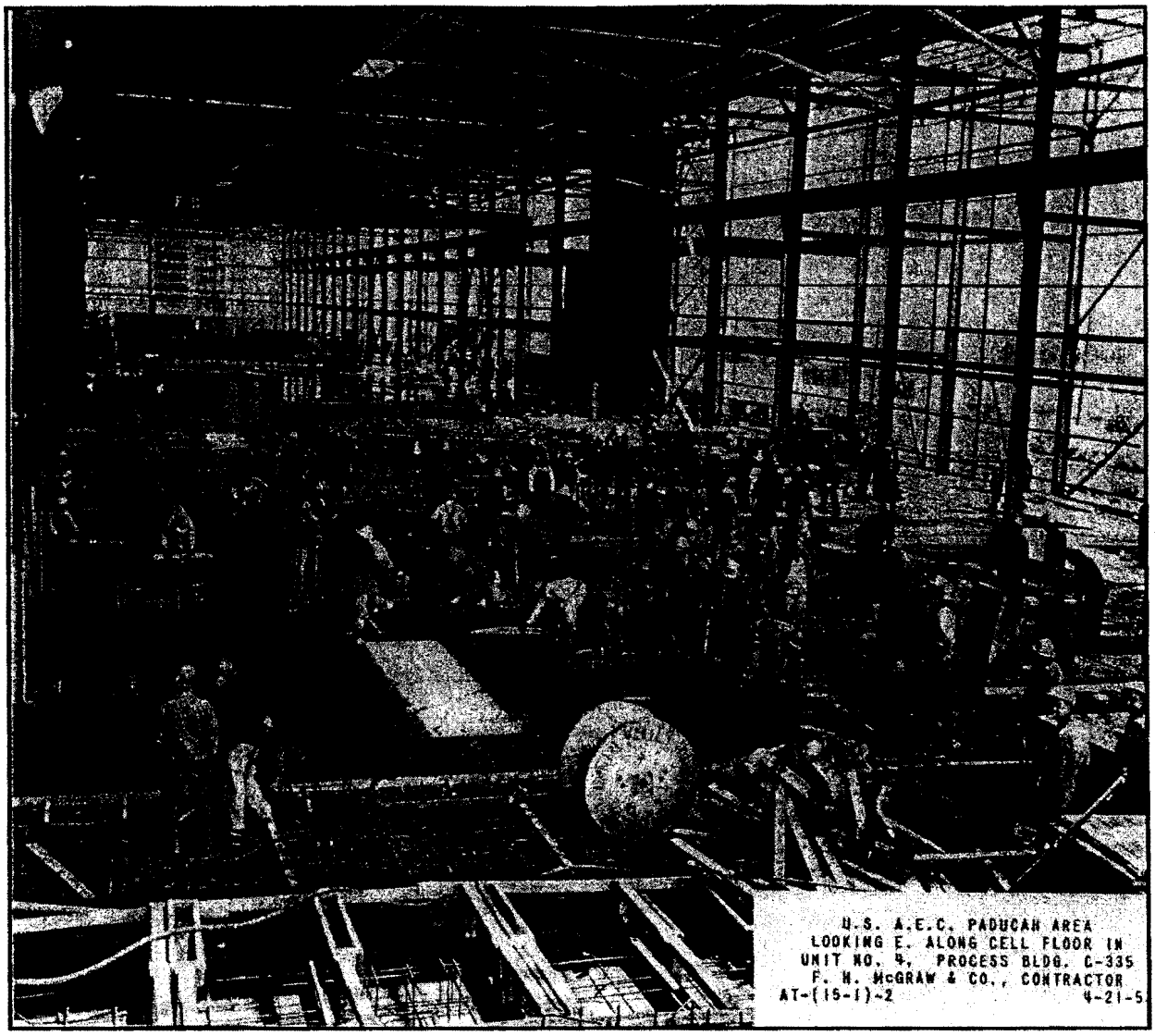


Fig. 11. Construction work on the interior of Building C-335 in April 1952.

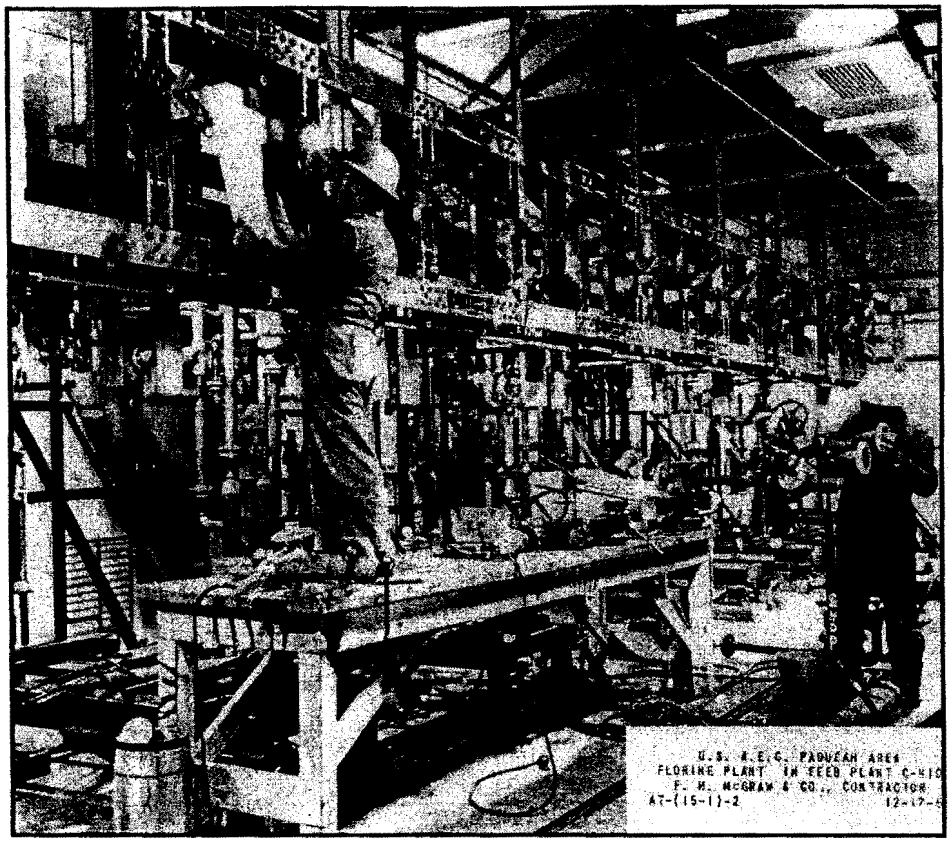


Fig. 12. Construction of the fluorine cell room electrical buss work in the C-410 Complex in December 1952.

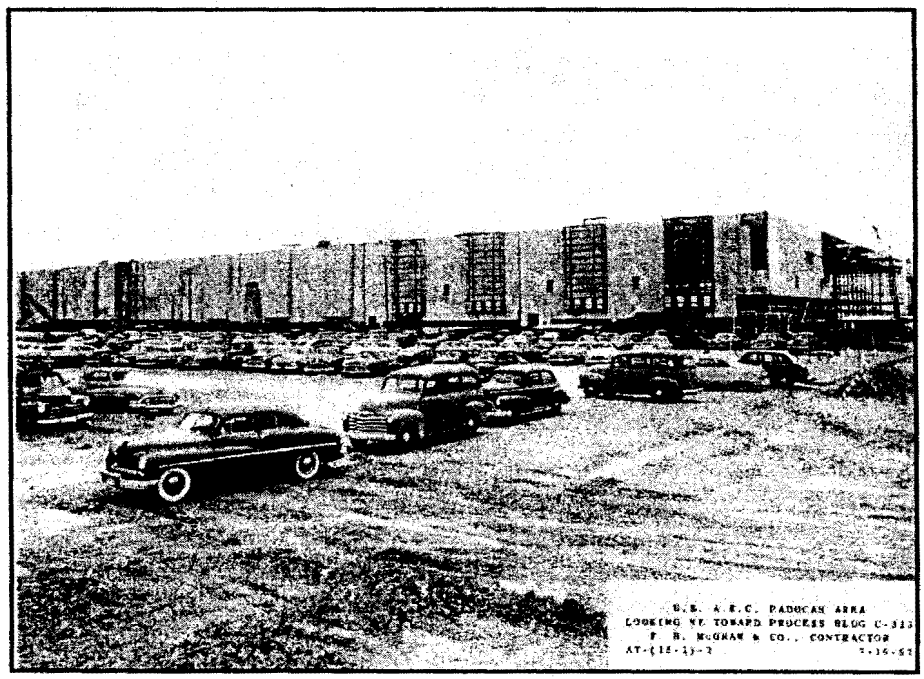


Fig. 13. Construction of Process Building C-333 in July 1952.

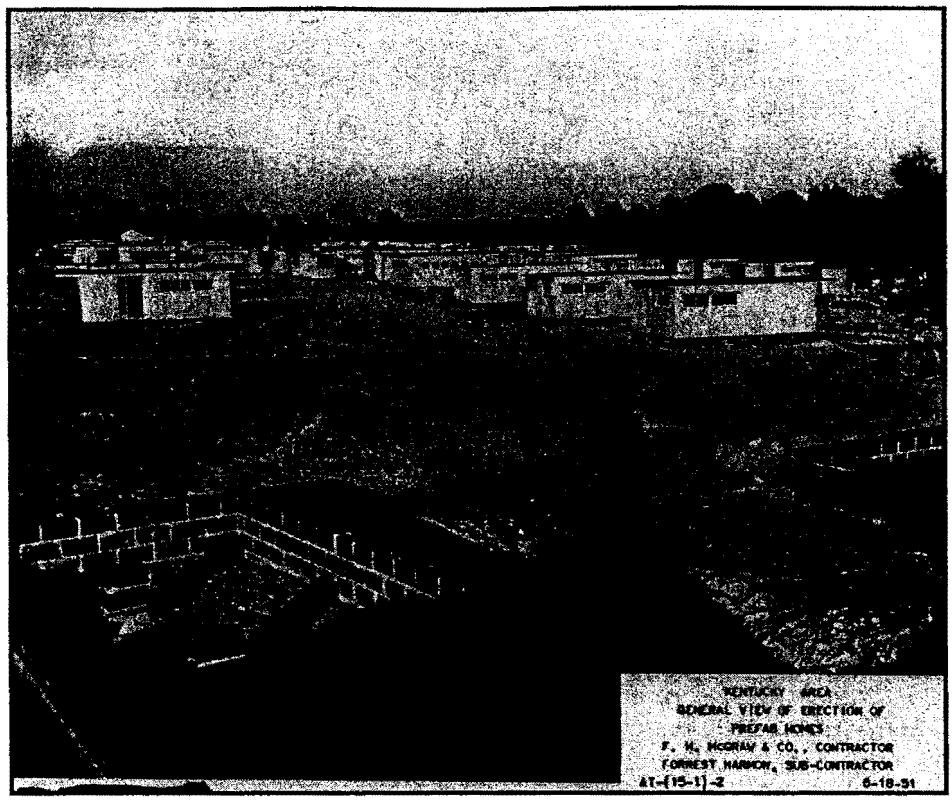


Fig. 14. The lack of housing in the Paducah area led to the erection of hundreds of temporary buildings. These flattops were transported to the Paducah area from Oak Ridge in 1951.

News of the plant spread quickly and the promise of jobs drew people to Paducah by the thousands. With a population of 33,000 in 1950, Paducah nearly doubled in size within three years. Housing was a major issue for the burgeoning town. Surplus housing was sold quickly and locals rented spare rooms, attics, and even outbuildings. Trailer courts sprang up around the town's perimeter and some people were forced to live in tents. AEC built a 1000-room temporary barracks at the plant site in 1951 to accommodate workers, and the government provided funding for hundreds of apartment buildings and at least 175 houses. Hundreds of other houses were constructed by private companies. Local entrepreneur Forrest Harman purchased 250 portable flattop houses that had originally been used at Oak Ridge, Tennessee, during the construction of that city during World War II (Fig. 14). Harman had the buildings shipped to Paducah and situated them on land near the plant site (*The Paducah Sun* 2002, Mitchell 1952). The village was first known as Flattop and later Forrestdale. At its peak, Forrestdale had a population of 1500 residents.

Initial production began at PGDP in 1952, and the facility was fully completed by 1954. Before PGDP was completed, the U.S. government began construction on a similar plant in Portsmouth, Ohio. Land was purchased for the Portsmouth plant in 1952 and initial operations began in 1954. Peter Kiewett Sons of Nebraska served as construction contractor for the plant, which was completed in 1956. Goodyear Tire and Rubber Corporation was selected to operate and manage the plant.

After the PDGP was opened, newspaper reporters with *The Paducah Sun-Democrat* were allowed to visit and describe the plant and its operations. After becoming operational, the plant had 25 acres of switchyards, which was the "largest assemblage of such equipment in the world" (*The Paducah Sun-Democrat* 1955). An estimated 161,000 volts entering the switchyards were reduced to 14,000 volts, and

this electricity was transferred to the plant buildings via 100 miles of underground cables. The electrical system contained 25,000 tons of steel and 10,000 tons of copper. The plant was reported to use 4% of all of the electrical power produced in the U.S. An estimated 10,000 miles of control cables ran through the plant. About 340 million gallons of water were circulated through the system every day to remove excess heat generated from the diffusion process.

When the plant was fully operational, it was described as operating as its own "city." A 1956 newspaper article stated, "The 'mayor' is the plant superintendent. The legislative council includes seven department heads. The 1800 employees...are the municipal workers. The atomic city maintains a police force, fire department, hospital, library, laboratory, and newspaper" (*The Paducah Sun* 2000).

Enriched uranium from the Portsmouth plant was shipped to Oak Ridge for production of nuclear weapon components. As the Cold War continued, the arms race also escalated, as both the U.S. and the Soviet Union worked to develop the hydrogen bomb. Dubbed the "H-bomb" or "super" bomb because of its potential power for massive destruction, the hydrogen bomb derives its energy from the fusion of hydrogen isotopes. Unlike the fission that uranium isotopes undergo in the development of atomic weapons, which involves the separation of lighter from heavier isotopes, fusion involves the joining together of lighter elements into heavier elements.

Throughout the late 1950s and 1960s, PGDP continued to produce enriched uranium for atomic weapons. During these years, the plant employed over 2000 workers annually and it was the largest employer in the Paducah region (Fig. 15). The enriched uranium produced by the plant continued to be used primarily for nuclear weapons until October 1973. After this date, the enriched uranium produced at the plant shifted to commercial nuclear plants as nuclear energy emerged as an important power source in the U.S.

Fig. 15. Ca. 1955 postcard of PGDP.

In 1969, enriched uranium was produced by foreign plants using a centrifugal extraction process, and the need for enriched uranium via gaseous diffusion lessened. As the centrifugal process and other technologies became more widely used, uranium enrichment from gaseous diffusion became less and less economical. Also in these decades, concerns over radioactive contamination as a by-product of the gaseous diffusion process increased.

2.2.2.6 Late twentieth century PGDP operations

In the 1960s, the mission of both PGDP and the Portsmouth Gaseous Diffusion Plant shifted to a commercial focus as nuclear energy emerged as an important power source. Civilian energy demands were increasing and nuclear energy helped meet this demand. The two "sister" plants in Ohio and Kentucky worked together to enrich uranium for use in nuclear power plants. In 1984, Martin Marietta Energy Systems, Inc. (later Lockheed Martin Utility Services), took over contractor operations of the Paducah plant, and in July 1993, USEC began leasing and operating both the uranium enrichment facilities at the Paducah and Portsmouth plants.

As the Cold War waned in the 1980s, the need for enriched uranium lessened. The K-25 plant in Oak Ridge, Tennessee, stopped uranium enrichment production in 1985 and was permanently shut down in 1987. The collapse of the Soviet Union in 1989 led to even further reductions in enriched uranium processing.

The Energy Reorganization Act of 1974 created the Nuclear Regulatory Commission (NRC), which began operations on January 19, 1975. The NRC was formed to regulate nuclear facilities for public health and safety. In 1992, Congress passed the Energy Policy Act, which established the USEC as a government-owned corporation for the purpose of operating the nation's uranium enrichment enterprises. In 1996, the President signed into law the USEC Privatization Act through which USEC became a private corporation. In May 2001, the USEC ceased enrichment activities at the Portsmouth, Ohio, plant and consolidated its operations at the Paducah site.

In 1994, PGDP was added to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List. DOE is responsible for investigating or remediating solid waste management units and other areas of concern. There is also continual monitoring of two plumes of contaminated groundwater beneath the plant, which were discovered in 1988. DOE is also responsible for the storage and disposal of scrap metal and chemical and radioactive waste.

2.3 PGDP HISTORICAL PROPERTIES

The *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006, identified a NRHP-eligible historic district at the facility. The PGDP Historic District contains 101 contributing properties and is eligible for the NRHP under National Register Criterion A for its military significance during the Cold War, and for its role in commercial nuclear power development.

2.3.1 The 2004 Cultural Resources Survey and the NRHP

An intensive Cultural Resources Survey was completed for the properties at PGDP. This survey was conducted in accordance with Section 106 of the NHPA of 1966 (as amended in 2000). The survey evaluated all buildings, structures, and sites for eligibility for the NRHP. The results of the 2004 survey were presented in the report, *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant,*

Paducah, Kentucky, (BJC/PAD-688/R1), March 2006. As stated above, the report identified a NRHP-eligible historic district on the property.

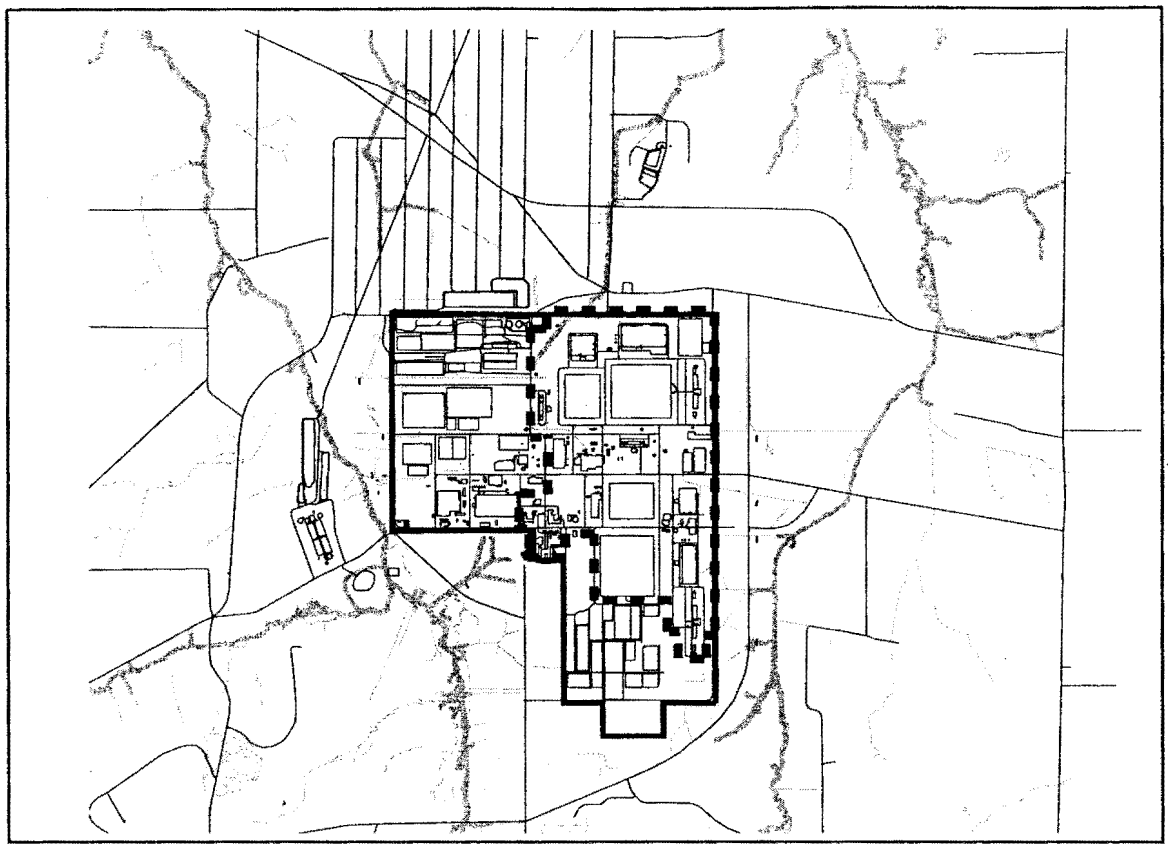
The NRHP is the nation's official list of properties significant in architecture, history, and culture. Eligible properties may be significant on a local, state, or national level. The NRHP is administered by the National Park Service (NPS) and Keeper of the Register, who makes the final decision about whether a property should be listed. Properties that are eligible for the NRHP receive the same consideration as those that are listed. In order to be listed on the NRHP, a property must possess historic significance and integrity. A property is eligible for listing on the NRHP if it meets one or more of the following criteria:

- Criterion A—Association with historic events or activities;
- Criterion B—Association with important persons;
- Criterion C—Distinctive design or physical characteristics;
- Criterion D—Properties that have yielded, or may be likely to yield, information about prehistory or history; or
- Criterion Considerations A through G— A religious property deriving primary significance from architectural or artistic distinction or historical importance; a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; a birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life. a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or a property achieving significance within the past 50 years.

In addition, the property must retain integrity or a sense of time and place. Integrity is composed of seven qualities, which are location, design, setting, materials, workmanship, feeling, and association.

The proposed PGDP Historic District contains 101 contributing properties and is eligible for the NRHP under National Register Criterion A for its military significance during the Cold War, and for its role in commercial nuclear power development (Fig. 16). PGDP was one of three U.S. facilities in operation during the Cold War, which produced enriched uranium for nuclear weapons. Nuclear weapons were the country's primary offensive and defensive weapons system of the Cold War. The main components of this district are the plant's four main production buildings, which contain the cascade system critical to the uranium enrichment process. These buildings, C-331, C-333, C-335, and C-337, continue to be used to enrich uranium and are supported by various other processing and operations buildings. The proposed district includes buildings and structures associated with the gaseous diffusion process, such as cooling towers, electrical switchyards, and switching stations.

Generally, properties that are less than 50 years old are excluded from listing on the NRHP. However, NRHP Criterion Consideration G allows the listing of a property that is less than 50 years old if it has exceptional importance. The NRHP-eligible PGDP Historic District has a period of significance to 1973. Although this date exceeds the 50-year benchmark, it reflects the initial development of PGDP, and



Proposed Historic District

Fig. 16. Proposed PGDP Historic District National Register boundary.

the shift in focus to commercial nuclear energy. The contributing buildings within the PGDP Historic District meet the requirements of NRHP Criterion Consideration G for exceptional significance for properties less than 50 years of age.

The recommended historic district boundary is drawn to include all of the uranium enrichment processing plants and adjacent support facilities including the electrical switchyards and substations and cooling towers and pump houses. The district boundary also includes the original administrative and control buildings located to the southwest of the main processing area. Within this recommended boundary are the properties of primary significance to the plant's mission and operations. Of the 101 buildings and structures within this boundary, 95 were built between 1952 and 1956 when the plant was built and placed in operation. The boundary is drawn to omit ancillary buildings and structures such as warehouses, maintenance facilities, waterworks, and sewage plants. The majority of these buildings were constructed between 1960 and 2006, are of prefabricated metal or concrete, and were not directly involved in the plant's uranium enrichment process.

2.3.2 Documentation of Property Types

The buildings and structures in the PGDP Historic District reflect eight primary property types. These building types are: 1) process buildings; 2) electrical switchyards, and switch houses; 3) cooling

towers and pump houses; 4) administrative buildings; 5) security facilities; 6) water treatment facilities; 7) storage tanks; and 8) support, maintenance, and warehouse buildings. These eight property types are defined in detail in the *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006, and are summarized as follows:

- **Process Buildings:** There are 25 process and support buildings at PGDP, all of which are within the boundaries of the NRHP-eligible PGDP Historic District. Process buildings are those that are directly involved in the gaseous diffusion process. The majority of the process buildings were constructed in rectangular plans and with concrete foundations, steel structural and support systems, flat roofs, and exterior walls of transite panels. An exception to this is the Central Control Building, C-300, which differs from the others through its concrete construction and circular design. The majority of these buildings were constructed between 1951 and 1956. These buildings reflect the establishment and growth of PGDP in the Cold War era as a component of U.S. nuclear weapon and energy efforts. Their historical significance is derived from their role in the Cold War era, especially in the development of enriched uranium.

  The process and support buildings include: C-300, C-310, C-310-331-A, C-310-331-B, C-310-410, C-310-A, C-315, C-315-331, C-331, C-331-333-A, C-331-333-B, C-331-333-C, C-331-335, C-331-410, C-333, C-333-A, C-335, C-335-337-A, C-335-337-B, C-335-337-C, C-337, C-337-A, C-340 (includes C-340-A, B, C, D, and E), C-410 (includes C-410-A, C-410-I, C-411, and C-420), and C-620. Currently, buildings C-340 and C-410 are under the decontamination and decommissioning program and are scheduled for demolition.

- **Electrical Switchyards and Switch Houses:** The PGDP Historic District contains four main switchyards and switch house complexes. These facilities supply and control the electrical power to each of the four process buildings. Each switchyard contains hundreds of electrical transformers and other equipment. Within the switchyards are a number of fire-valve houses to provide fire control in the event of fire. The electricity from the switchyards is transferred into the process buildings through both overhead metal conduits and underground ducts.

  The main switchyards and switch house complexes include: C-531, C-533, C-535, and C-537. The 26 individual components of these are: C-531-1, C-531-2, C-531-3A, C-531-3B, C-532, C-533-1, C-533-2, C-533-3A, C-533-3B, C-533-3C, C-533-3D, C-535-1, C-535-2, C-535-3A, C-535-3B, C-535-4, C-536, C-537-1, C-537-2, C-537-3A, C-537-3B, C-537-3C, C-537-3D, C-537-4, C-540-A, and C-541-A.

- **Cooling Towers and Pump Houses:** There are four cooling tower and pump house complexes that support the four main process buildings. These are: C-631-1, C-633-1, C-635-1, and C-637-1. Each complex contains a pump house, cooling tower, blending cooling towers, and other support buildings, for a total of 26 buildings or structures. These properties include: C-631-1, C-631-2, C-631-3, C-631-4, C-631-5, C-631-6, C-633-1, C-633-2A, C-633-2B, C-633-3, C-633-4, C-633-5, C-633-6, C-635-1, C-635-2, C-635-3, C-635-4, C-635-5, C-635-6, C-637-1, C-637-2A, C-637-2B, C-637-3, C-637-4, C-637-5, and C-637-6.

- **Administrative Buildings:** There are ten administrative buildings at PGDP. These properties contain offices and house the administrative functions of the facility. When PGDP was built in the 1950s, the main administrative building was Building C-100, and this building still houses many of the significant offices of the plant. Other administrative buildings include the Technical Service Building (Building C-710), and Building C-212.

- **Security Facilities:** Guard posts or portals provide controlled access into PGDP. Security Guard and Fire Headquarters is located in Building C-200. Some of the original portal buildings have been replaced by later structures, and new portal buildings have also been erected in recent years due to heightened security threats.

- **Water Treatment Facilities:** These properties include the main water treatment plant on Water Works Road (Building C-611) and the sewage treatment plant (Building C-615). These complexes include sewage lagoons, settling tanks, pump houses, and storage and support buildings. The individual components of these two complexes include: C-611, C-611-M, C-611-N, C-611-O, C-611-R, C-615, C-616-A, C-616-B, and C-616-K.

- **Storage Tanks:** Sixteen storage tanks are scattered throughout PGDP to hold various chemicals These buildings are: C-406, C-407, C-540-B, C-540-C, C-540-D, C-540-E, C-541-B, C-541-C, C-541-D, C-541-E, C-601-A, C-601-B, C-601-D, C-603-E, C-603-F, and C-603-G.

- **Support, Maintenance, and Warehouse Buildings:** There are a total of 53 warehouses, storage and support buildings, and structures at PGDP. They support the installation, refurbishment, cleaning, and daily operations of the uranium diffusers in the process buildings. There are also those that provide services to maintain other equipment, to support building maintenance, and overall plant operations. Building C-400 is one of the most important maintenance and operations buildings. Sections of the cascade equipment are often replaced and the equipment is cleaned in Building C-400, and then either reused or placed on standby.

2.3.3 Historic Context Evaluation

The PGDP was constructed in the early 1950s in response to national security demands brought on by the Cold War. The inability to reach an agreement on international nuclear arms control resulted in strained relationships between the U.S. and the Soviet Union following World War II. Distrust between the two nations mounted and both responded by accelerating the development of nuclear weapons. The method of gaseous diffusion had proven to be the most effective method of uranium enrichment, and in an effort to build up its nuclear production, the U.S. established the Paducah, Kentucky, and Portsmouth, Ohio, gaseous diffusion plants in addition to its existing K-25 plant in Oak Ridge, Tennessee.

The U.S. government established PGDP in the early 1950s to produce enriched uranium for the production of nuclear weapons, which were deemed necessary for national defense. During this period, the Paducah plant along with its sister plant in Portsmouth, Ohio, and the original K-25 plant in Oak Ridge, Tennessee, were the only sources for uranium enrichment in the U.S. These three plants played a significant role in the nation's defense efforts of the Cold War era. The plants continued to supply enriched uranium for weapons production until 1973, when the stockpile of nuclear weapons was deemed sufficient for deterrence.

The PGDP is also significant in the area of industry for its role in the growth and development of commercial nuclear power. Harnessing atoms for electric power in the U.S. dates to the Atomic Energy Act of 1954, which allowed private industry to own and operate reactors (Rhodes 1993). The first demonstration project for nuclear energy took place in September 1954 when construction began on a 60,000-watt plant in Shippingport, Pennsylvania, near Pittsburgh. Nuclear energy was widely touted as a clean and safe form of electricity in the 1950s and 1960s. This optimism was reflected by AEC Chairman Lewis Strauss who predicted that "It is not too much to expect that our children will enjoy in their homes, electrical energy too cheap to meter, will know of great periodic regional famines in the world only as matters of history, will travel effortlessly over the seas and under them and through the air with a

minimum of dangers and at great speeds, and will experience a life span longer than ours...This is the forecast for an age of peace" (Rhodes 1993).

Crucial to the commercializing of nuclear power was the Price-Anderson Act passed in 1957, which almost completely underwrote liability for nuclear accidents. Even though energy companies were required to purchase insurance, they were indemnified up to $560 million. By the early 1960s, both General Electric and Westinghouse had invested billions of dollars in reactors, which employed both pressurized-water and boiling-water technologies. Although these early reactors were not profitable, the potential for future economic gain led to utility companies ordering 100 reactors between 1965 and 1970.

The uranium enrichment process was a fundamental step in supplying power for civilian nuclear reactors. Once the uranium ore is mined and purified into uranium oxide, it is then converted to UF_6. As a gas, the UF_6 is then enriched through the gaseous diffusion process, and the enriched UF_6 is then converted into uranium dioxide, a black powder that is then pressed into ceramic pellets. The pellets are then formed into thin-walled zirconium alloy tubes, or fuel rods. The fuel rods are then employed into fuel assemblies to provide the heat and energy to power the light-water reactors (Garwin and Charpak 2001).

The Arab Oil Embargo of 1973 resulted in reduced demand for all forms of energy, and the number of orders for nuclear power plants plummeted. During the 1970s, concerns over the safety of nuclear plants increased, and several proposed plants were cancelled due to public opposition. The image of nuclear power suffered a serious blow in March 1979, when a series of malfunctions occurred at the Three Mile Island plant near Harrisburg, Pennsylvania. A "general emergency" was declared when coolant was lost at one of the reactors, resulting in a partial meltdown. An estimated 140,000 people evacuated the area around the plant; however, no substantial radioactivity leaked from the plant area itself. Cleanup at the site cost hundreds of millions of dollars and took several years. As a result of Three Mile Island, the NRC mandated modifications to nuclear plants, which averaged $20 million per plant (Rhodes 1993).

By the early 1980s, the demand for enriched uranium lessened as construction of new nuclear power plants came to a halt and foreign plants were coming on-line. In Paducah, the Contractor's operation of the plant for DOE were conveyed from Union Carbide to Martin Marietta, and there was an increasing focus on environmental remediation. With the end of the Cold War in 1989 and the dismantling of the Soviet Union, demand for enriched uranium for nuclear weapons also was reduced. In 1993, Congress transferred production of enriched uranium from DOE to USEC. DOE then assumed the role of landlord, with an environmental cleanup mission. In 1993, the U.S. contained 110 nuclear power plants, which generated one-fifth of the nation's total electricity (Rhodes 1993). Of the reactors capable of commercial operation in the U.S., one-third employ boiling-water reactors, while two-thirds utilize pressurized-water reactors (Garwin and Charpak 2001). America's nuclear power plants now increasingly utilize enriched uranium from foreign centrifugal enrichment rather than gaseous diffusion. The U.S. future production is being directed to the use of centrifuges.

2.4 PGDP ARCHAEOLOGICAL PROPERTIES

A Phase I archaeological reconnaissance was conducted in 1993 in McCracken County, Kentucky by Archaeology Resources Consultant Services Inc. of Louisville, Kentucky. The reconnaissance was part of an Environmental Assessment by Martin Marietta Energy System, Inc. which was proposing to design and construct a solid waste landfill at PGDP. The entire project area was approximately 40 acres located directly north of the C-746 S & T landfill. The reconnaissance identified two historic sites.

The results of the reconnaissance recommended that no further archaeological work be performed associated with the design and construction of a solid waste landfill at these two historic sites; 15McN92, Deep Well Site and 15McN93, Jet Black Pond Site. Concurrence with the findings and recommendations in the report was documented in a letter from David L. Morgan, Director; Kentucky Heritage Council and State Historic Preservation Officer to John Young, CDM Federal Programs Corporation; dated July 2, 1993.

Additionally, in 1993, the U.S. Army Corps of Engineers contracted with the Cultural Resources Division of Geo-Marine to conduct an Archaeological survey of PGDP and surrounding area in order to meet the legal requirements of the NHPA, Archaeological Resource Protection Act (ARPA), and other federal legislation. This study was one phase of a larger project designed to identify and document environmentally sensitive resources at the facility. No sites identified during this study were on DOE property.

3. CULTURAL RESOURCES MANAGEMENT PROCEDURES AND ADMINISTRATION

The basis of federal historic and archaeological resources protection law is the NHPA of 1966. Section 106 of the NHPA requires that every federal agency examine its undertakings and how those actions could affect historic properties. Undertakings requiring review in the Section 106 process include a broad range of activities, and when activities occur, there must be assessment of effects to cultural resources. Federal agencies also have specific responsibilities regarding the preservation of its historic properties under Section 110 of the NHPA. These responsibilities include inventory and evaluation of historic properties. The Kentucky SHPO and Council provide advice and guidance to meet federal legislative requirements.

3.1 FEDERAL AGENCIES AND THE NHPA

The NHPA was passed in response to the destruction that occurred during the 1950s and 1960s due to federal projects such as highways, dams, and urban renewal. Congress created the NHPA to help prevent further destruction of historic properties by federal agencies without prior review. Amendments in 1976, 1980, and 1998 furthered the goals of the act by providing stronger protection of historic properties. The main provisions of the act include the following:

- authorization of the Secretary of the Interior (Secretary) to expand and maintain an NRHP;
- establishment of procedures for nomination of historic and archaeological properties to the NRHP;
- direction for the Secretary to approve state preservation programs directed by a SHPO and historic preservation review board;
- establishment of the Council as an independent federal agency to advise the President, Congress, and other federal agencies on historic preservation;
- establishment of the Section 106 review process to ensure that historic and archaeological resources are properly considered and reviewed by federal agencies; and
- incorporation and further definition of Executive Order 11593 in Section 110; Executive Order 11593 is the directive to complete inventory and assessment of historic and archaeological resources on federally-owned or controlled lands.

With the 1966 Act came several specific preservation activities, including the establishment of the NRHP, SHPOs, Certified Local Governments (CLGs), grants-in-aid, the Council and regulations, standards, and guidelines. Four sections of the 1966 Act deal directly with federal agencies. The most powerful of these areas is Section 106, which requires federal agencies to take into account the effects of their activities and programs on historic properties.

3.2 SECTION 106 OF THE NHPA

Section 106 of the NHPA is a process designed to ensure that historic properties are considered during federal project planning and execution.

Section 106 requires that every federal agency examine its undertakings and how those actions could affect historic properties. Undertakings requiring review in the Section 106 process are those that present a type of activity that has the potential to affect historic properties. These include a broad range of activities, including construction, rehabilitation and repair projects, neglect, demolition, licenses, permits, loans, loan guarantees, grants, and federal property transfers. An historic property is any property listed in or eligible for the NRHP.

Section 106 cannot prevent a federal agency from proceeding with desired projects, but it does require analysis of the project and allows for identification of historic properties. In many cases, alternatives are suggested that satisfy all interested parties. It is the responsibility of DOE, as a federal agency, to comply with this important tool of preservation law.

3.2.1 Public Participation

The Council is greatly concerned with the participation of all interested persons in the Section 106 process. Such interested parties include, but are not limited to, CLGs; applicants for federal assistance, permits, and licenses; Native American Indian tribes; cultural leaders; landowners and private groups; and organizations.

In 1989, the Council issued its own guidelines about public participation in *Public Participation in Section 106 Review: A Guide for Agency Officials*. This publication informs agencies about how to include public participation in the review process. The Council also advises the public about how to participate in the review process. Part of the Council's mission is to assure that there is direct communication between the agency and the public, offering assistance to both parties during the Section 106 process. The Council seeks public views during the agency's steps in historic property identification, evaluation of effects, and development of alternatives.

3.3 SECTION 110 OF THE NHPA

The intent of NHPA Section 110 is to ensure that historic preservation is fully integrated into the ongoing programs and missions of federal agencies. Section 110(a) requires federal agencies to assume responsibility for the preservation of historic properties.

The National Parks Service, in consultation with the Advisory Council on Historic Preservation, has developed *The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act(Section 110 Guidelines)*. The guidelines [initially published in 1988 (53 *FR* 4727, February 17)] were revised in 1998 (63 *FR* 20495, April 24) to take into account the 1992 amendments to the NHPA. The guidelines have no regulatory authority; they are simply formal suggestions from the Secretary of the Interior on how federal agencies can meet the requirements of Section 110 of the NHPA. For agencies, like DOE, which manage large tracts of land or administer programs that often affect historic properties, the guidelines can serve as a model for the development of agency-specific historic preservation programs. DOE's policy on *Management of Cultural Resources* is consistent with the Section 110 guidelines.

3.4 RELATED FEDERAL LAWS

The NHPA and Section 106 interrelate with a number of federal laws. These laws include:

- National Environmental Policy Act (NEPA) of 1969;
- Archaeological and Historic Preservation Act (AHPA) of 1974;
- ARPA of 1979;
- American Indian Religious Freedom Act (AIRFA) of 1979;
- Native American Graves and Repatriation Act (NAGRA) of 1990; and
- Agency-specific legislation, including Department of Transportation Act of 1966 [Section 4(f)], Federal Land Policy and Management Act of 1977, National Forest Management Act of 1976, and Public Buildings Cooperative Use Act of 1976.

3.4.1 NEPA of 1969

Under NEPA, federal agencies are responsible for the environmental impact of their activities. Historic properties are considered to be part of this environment. NEPA and Section 106 of the NHPA require many of the same actions, but should not be confused with one another. They cannot be substituted for each other; however, activities involving each can be coordinated. For example, completion of Steps 1 and 2 of Section 106 can be done as the NEPA documents are prepared, because they address many of the same questions. During the consultation process (Step 3) of Section 106, an environmental impact statement or environmental assessment may be used as a basis for consultation.

3.4.2 AHPA of 1974

When a federal project involves archaeological sites, the AHPA demands certain actions that may or may not be covered by Section 106. Notification to the Department of the Interior that an agency is involved in an undertaking covered by the AHPA does not cover Section 106 compliance. Again, procedures for compliance with Section 106 and the AHPA are similar, and some steps may be completed for both at the same time. However, satisfying requirements for one is not sufficient. These are separate laws and must be treated as such.

3.4.3 ARPA of 1979

When a project involves federal or Native American Indian lands, the ARPA may demand additional action. Again, acquiring an ARPA permit does not constitute compliance with Section 106.

3.4.4 AIRFA of 1979

Any site of religious importance to American Indians is subject to consultation with tribal religious leaders. Although the process is separate, it may be coordinated with Section 106.

3.4.5 NAGRA of 1990

This law addresses when museums and federal agencies must return human remains and related grave goods to Native Americans. The law sets forth a process for returning human remains and associated funerary objects to Native American tribes.

3.5 THE ROLE OF THE KENTUCKY SHPO

One of the most important participants in the Section 106 process is the KHC SHPO. The Kentucky SHPO performs a wide variety of functions under the NHPA, state law, and other authorities. These functions include the nomination of properties to the NRHP, the conduct of statewide historic preservation planning, and a statewide inventory of historic properties; provision of technical assistance to federal and state agencies, local governments, and others; and the certification of local governments to participate in the national program. During the Section 106 process, identification of historic properties is the basic step in determining the effects of an undertaking on those properties.

It may happen that a historic property is discovered only after the project begins. In this case, it is the Kentucky SHPO's responsibility to provide a special review process within an expedited period of time. It is also DOE's and its contractor's responsibility to provide information on the NRHP eligibility of any affected properties. If the discovered resource is principally of archaeological value, officials may decide to comply with the AHPA rather than Council regulations.

3.6 THE ROLE OF THE ADVISORY COUNCIL

The Council is an independent federal agency, established under the NHPA that carries out the following duties:

- Advises the President and Congress on historic preservation matters, including annual reports, special reports and policy recommendations on preservation topics, as well as technical assistance and testimony on legislative proposals;
- Carries out Section 106 reviews; and
- Reviews federal agency historic preservation programs and policies.

Members of the Council consist of four persons from the general public (one of whom serves as the chairperson), four historic preservation experts, the Secretary of the Interior, the Secretary of Agriculture, the Architect of the Capitol, four federal agency heads, one governor, one mayor, the President of the National Conference of SHPOs, and the Chairman of the National Trust for Historic Preservation.

3.7 MANAGEMENT RECOMMENDATIONS AND PROCEDURAL REVIEW

DOE activities at PGDP will follow the CRMP. The PGDP NHPA coordinator is to monitor cultural resources compliance efforts at the installation.

3.7.1 Procedural Review

This review process will be incorporated into the site work control procedures within six months of approval of the CRMP.

3.7.2 Documentation and Monitoring

DOE will maintain documentation relative to the procedural review process. The documents will be available to the Kentucky SHPO upon request.

3.7.3 Professional Qualifications and Training for Staff

The PGDP NHPA coordinator will be trained or have adequate experience in the interpretation and application of cultural resource laws and regulations.

3.7.4 CRMP Updates and Endorsements

DOE will review and update (if necessary) the CRMP in consultation with the Kentucky SHPO and Council. Of particular importance is a review of the procedures for historic property management, to ensure that the process is working effectively and efficiently. When goals have been achieved, new goals or priorities may be adopted. Any changes or major rehabilitation work to historic resources should also be noted. These updates do not have to result in a comprehensive rewrite of the existing CRMP. Instead, these updates can consist of attachments or appendices to the original plan. DOE will submit this CRMP and later updates to the Kentucky SHPO for its concurrence.

3.8 PGDP CULTURAL RESOURCES SUMMARY

The PGDP is a federally-owned installation. DOE has legal responsibilities for the identification, evaluation, and treatment of historic and archaeological properties under its jurisdiction. The PGDP was placed in operation in 1952 as a uranium enrichment plant for the production of nuclear weapons. It is located approximately 12 miles west of the city of Paducah and contains over 150 primary buildings.

DOE completed an intensive cultural resources survey of PGDP. The results of this survey were presented in the report, *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006. The report details buildings and sites with the potential for listing on the NRHP and identified the PGDP Historic District.

The CRMP defines the preservation strategy for the plant and is directed at all historic properties at the installation. The plan also directs compliance with the NHPA and federal archaeological protection. The plan ensures that historic preservation is an integral part of the comprehensive planning process and that this strategy will be implemented through the combined application of historic preservation interpretive initiatives and the physical preservation of historic properties.

4. CULTURAL RESOURCES MANAGEMENT METHODS

DOE has specific responsibilities regarding the cultural resources at PGDP. Section 106 of the NHPA makes historic preservation a part of all federal agencies' planning, decision-making, and project execution. It requires federal agencies to "take into account" the effect of their projects on historical and archaeological resources. Thus, agencies must consider the effect of the undertaking on any district, site, building, structure, or object that is included in, or eligible for inclusion in, the National Register. (Note that the "take into account" standard sets up a process; it does not ordain a particular outcome.)

In recent years, DOE and the Kentucky SHPO have consulted on the demolition of two facilities at PGDP: the C-410 Complex and the C-340 Complex. These two complexes contain numerous buildings and structures that are considered contributing to the character of the proposed PGDP Historic District. Due to the contamination of these facilities, adaptive reuse was not a possibility and the complexes are scheduled for demolition in coming years. In June 2004, the Kentucky SHPO and DOE also consulted regarding the construction of the Depleted UF_6 Conversion Facility at the plant would not require an archaeological survey. Located outside the boundary of the proposed PGDP Historic District, this site had already been the subject of ground disturbance in the 1950s.

Over the next ten or more years, it is likely that the enrichment of uranium at PGDP will cease and the historic function of the plant will come to an end. Additional facilities may become inactive during and/or after shut-down of the facility. These facilities may be scheduled for demolition before the plant operations are discontinued. The adaptive reuse, stabilization, or preservation of many of these buildings will be problematic due to the presence of contaminants, asbestos-embedded building materials, and other concerns. Buildings that have been identified as potentially hazardous include the main process buildings: C-331, C-333, C-335, and C-337. Other hazardous buildings and structures include C-310, C-315, C-710, C-720, C-724, and C-725. Both water treatment and sewage facilities, C-611 and C-615, have also been identified as locations for contaminated material.

The missions and responsibilities of DOE at PGDP can affect NRHP-eligible properties in a variety of ways. These effects can range from the total demolition of a property, removal of a site, or simple maintenance of a building. DOE, the Kentucky SHPO, and the Council will ensure that the measures set forth in this Chapter are carried out in order to fulfill NHPA and related requirements, and in lieu of the "Interim Criteria" in the PA.

- DOE will consult the PGDP cultural resources surveys referenced herein to determine if an activity has the potential to affect properties eligible or included in the NRHP.

- If the activity will not impact NRHP-eligible primary scientific facilities or equipment and will not result in ground disturbance, then the activity is excluded from further Section 106 review and the requirements of this Chapter.

4.1 RECORDS AND REPORTS

DOE generates a variety of records and reports. Many records pertain to cultural resources sites and site conditions. Other records pertain to the administration of the cultural resources work conducted at PGDP.

4.1.1 Cultural Resources Site Records

Cultural resources site records required by the CRMP will be maintained in accordance with DOE procedures for records management and kept in a secure, climate controlled environment to protect the records during long-term storage.

4.2 INVENTORY

DOE completed an intensive cultural resources survey of PGDP. The results of this survey were presented in the report, *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (BJC/PAD-688/R1), March 2006. The report details buildings and sites with the potential for listing on the NRHP and identified the PGDP Historic District. Appendix A provides a detailed property inventory for PGDP.

4.3 PROGRAMMATIC EXCLUSIONS

The following routine activities performed by DOE or designated parties are excluded from further action under the CRMP and NHPA, and do not require, Kentucky SHPO or Council review:

- **CERCLA Actions:** Actions conducted under CERCLA (when not otherwise excluded by the programmatic exclusions set forth below). The substantive requirements of the NRHP (and similar requirements) will be addressed in the CERCLA process during the identification and selection of Applicable, Relevant and Appropriate Requirements (ARARs).

- **Communications and Computer Systems:** Siting, installation, maintenance, repair, removal, or replacement of communications and computer systems, including public address systems, facsimile systems, microwave/radio systems, aboveground fiber-optic cables, phone systems, and computers and peripheral systems, including transmitters.

- **Decontamination and Decommissioning for Ancillary Facilities:** Dismantling and removal of ancillary facilities such as storage buildings, non-process buildings, lime house, piping, storage tanks, electrical systems, ventilation systems, etc. The cultural resources survey serves to meet the requirements for NRHP compliance, and no further actions are required.

- **Electrical Systems:** Installation, maintenance, repair, removal, or replacement of plant and building electrical systems including, but not limited to, switchyards, building conduit, wiring and lighting, emergency lighting, circuits and wiring, meters, transformers, utility poles, crossarms, insulators, and downed transmission lines.

- **Emergency Situations:** Activities required by emergency situations (i.e., health and safety-related emergencies) as determined on a case-by-case basis, that include those emergency activities in compliance with federal, state, or local regulatory requirements including, but not limited to, the state Environmental Protection Agency, Federal Facilities Agreements, CERCLA, Occupational Safety and Health Administration (OSHA), force majeure situations, etc. Activities related to emergency conditions including natural disasters and threats as to need security. DOE will respond to the emergency as necessary and notify the Kentucky SHPO of actions taken as a result of the emergency condition. Emergency activities that will affect historic property shall be handled in accordance with 36 CFR Part 800.12.

- **Energy Conservation:** Actions to conserve energy.

- **Environmental Monitoring:** Installation, operation, maintenance, repair, replacement, or abandonment of environmental monitoring devices/stations including, but not limited to, groundwater monitoring wells, well monitoring devices, monitoring weirs, flow meters, rain gauges, sampling devices, meteorological towers, instrumentation/equipment buggies, geochemical/ geophysical monitoring and survey devices, and actions necessary for conducting site monitoring and characterization activities including, but not limited to, sampling and collection of water, soil, rock, fauna, and air samples.

- **Environmental Restoration of Contaminated Land Areas Previously Disturbed:** This includes all areas within the boundaries of the perimeter road that were disturbed during construction of facility buildings, access tunnels, cables, conduit, and plumbing lines.

- **Fire Protection System:** Routine upgrades and modifications to fire protection systems, including fire alarm systems, smoke detectors, and sprinkler systems.

- **General Equipment:** Direct replacement or removal of equipment or facility components.

- **Habitat Protection:** Actions in researching, protecting, restoring, or improving fish and wildlife habitat, provided they do not involve deep or chisel plowing (disking or shallow plowing is permissible) or other land-disturbing activities, such as the construction of levees.

- **Hazard Prevention:** Installation and maintenance required for hazard prevention, including fabrication, removal, installation, and repair of safety railings, machine guards, hand rails, guard rails, ladders, frames, and fences; installation of nonskid surfaces and anchoring floor mats; and grounding of structure and equipment.

- **Heating and Air Conditioning Systems:** Installation, maintenance, removal, repair or replacement of heating, ventilating, air conditioning systems, and high-efficiency particulate air filters.

- **KOW:** Another federal agency, the Army Corps of Engineers has jurisdiction over the KOW and activities conducted in that area.

- **New Construction:** It is anticipated that the majority of the buildings within the PGDP will be demolished in coming years. As the plant is shutdown, it is possible that some temporary buildings or structures will be constructed as part of plant operations or to support the demolition process. This new construction will not require review.

- **OSHA Regulations and Permit Compliance:** Installation, maintenance, repair, or replacement of equipment used in current operations designed to maintain compliance with regulatory permits, compliance agreements, and OSHA regulations.

- **Personnel Safety:** Installation or modification of personnel safety systems and devices including, but not limited to, safety showers, eye washes, emergency exit lighting systems, and emergency ingress/egress routes; protective additions to electrical equipment; personnel accountability/assembly systems and stations; improvements to walking and working surfaces or areas; fabrication and installation of platforms, rails, shields, and guards; and stairway modifications and installations.

- **Process and Lab Equipment:** Installation, maintenance, repair, storage, relocation, removal, or replacement of process or lab equipment and associated systems such as presses, rolling mills,

foundry equipment, cranes, glove boxes and hoods, fans, tanks, ultrasonic cleaners, machine shop equipment, heat exchangers, ovens and furnaces, slat baths, centrifuges, bag houses and scrubbers, conveyors, motors, piping, valves, autoclaves, compressors, pumps, hydroforms, recovery equipment, metal-forming equipment, inspection equipment, motor-control centers, and cyclone separators.

- **Regulatory and DOE Order Compliance:** Installation, maintenance, repair, or replacement of equipment used in current operations designed to meet requirements outlined in regulatory statutes (e.g. CERCLA, RCRA, NEPA, etc.) and pertinent DOE Orders.

- **Removal of Asbestos:** Asbestos removal and renovation activities including cleanup, encapsulation, and removal and/or disposal of asbestos-containing materials from existing buildings and structures. Asbestos-related activities should be conducted in accordance with applicable regulations (e.g., 29 CFR 1910.1001, "General Industry"; 29 CFR 1910.134, "Use of Respirators"; 29 CFR 1926.1101, "Construction Industry"; and all applicable regulations).

- **Removal of Polychlorinated Biphenyl-Contaminated Items:** Removal of polychlorinated biphenyl-contaminated items, such as electrical transformers and capacitors possibly requiring temporary removal of walls, ceilings, fences, power lines, or other obstacles, that would prevent forklift or crane access to the item targeted for removal. Some transformers may have contaminated pads and/or soil around the base. The surrounding substrate will be sampled, and if it is determined to be contaminated, it will be excavated and removed.

- **Routine Activities:** Routine administrative contractual, security, financial, or personnel activities.

- **Routine Plant Service Activities:** Mowing, trimming, and open burning of grass, shrubs, or trees; moving and assembling of furniture and equipment; snow removal; routine revegetation and erosion controls; janitorial and housekeeping services; small-scale use of pesticides; small-scale road, railroad, sidewalk, and parking lot repair; preventive maintenance; maintenance and repair of plant vehicles and heavy equipment; maintenance of plant safes, vaults, and locks; busing and plant transportation; minor relocation of access roads; maintenance or repair of industrial machinery; maintenance, repair, or installation of fencing; maintenance, repair, or installation of indoor or outdoor signs; construction of scaffolding; calibration, testing, repair, and maintenance of laboratory and/or electronic equipment; corrective and preventive actions to maintain and preserve buildings, structures, and equipment in a suitable condition; and routine decontamination of tools, surfaces, and equipment.

- **Routine Repair and Maintenance of Buildings:** Routine maintenance and repair including, but not limited to, mounting/hanging wall items, cabinet/shelf fabrication and installation, and elevator repair; repair or replacement of non-original paint, siding, or roofing; and repair or replacement of non-original doors, walls, and windows.

- **Sale or Transfer of Property:** Sale or transfer of historical properties when the sale or transfer includes deed stipulation requirements that management of the properties is conducted in compliance with the NHPA and undertakings involving modification, alteration, or destruction of the properties is coordinated with the Kentucky SHPO and the Council.

- **Security Systems:** Installation, maintenance, removal, and repair of security systems, including computer security, detection, monitoring, surveillance, and alarm systems.

- **Steam Condensate/Chemical Treatment Systems:** Modification to steam/condensate systems including, but not limited to, repair or replacement of associated piping, pumps, and condensers to maintain system integrity (excluding aboveground steam lines); extension of systems to accommodate new construction or building modification; and repair of any associated chemical treatment systems.

- **Storage Tanks:** Repair, replacement, and modification to existing steel oil and chemical storage tanks.

- **Training, Planning, and Tests:** Training exercises; emergency preparedness planning; various tests and demonstrations including, but not limited to, transport packaging tests for radioactive/hazardous material tank-car tests, research and development demonstrations, and small-scale pilot demonstrations.

- **USEC Activities:** Activities of the United States Enrichment Corporation, including activities conducted under the Lease Agreement between USEC and DOE. The activities of USEC fall under the jurisdiction of the United States Nuclear Regulatory Commission (NRC) and NRC-issued licenses/approvals.

- **Waste Treatment, Storage, and Disposal Activities:** Operation and maintenance of waste treatment, storage, and disposal facilities; maintenance of landfills; spill cleanup activities; maintenance, repair, or replacement of liquid retention tanks, dikes, and piping; and maintenance or repair of lagoons and small basins.

- **Water Systems:** Siting, installation, maintenance, repair, removal, and contractor operation of plant water systems including, but not limited to, water wells, cooling-water systems, potable-water systems, storm sewers, wastewater treatment systems, plant drainage, and plumbing.

4.4 MANAGEMENT OF NRHP-ELIGIBLE ARCHAEOLOGICAL SITES

A total of seven prehistoric and six historic archaeological sites have been documented at or near PGDP. Two of the prehistoric sites have been identified as NRHP-eligible. Future archaeological surveys will follow guidelines set forth in this plan and the *SHPO's Specifications for Conducting Field Work and Preparing Cultural Resources Assessment Reports*.

4.4.1 General Considerations for Prehistoric and Historic Archaeological Sites

Two prehistoric archaeological sites at PGDP, 15McN37 and 15McN99, have been identified as eligible for the NRHP. Additional archaeological investigations may be undertaken at the site and could reveal further archaeological resources as described below.

If projects are undertaken in any area that has not been previously surveyed for archaeological resources or evaluated, the following actions are required.

- When a ground disturbance activity is proposed in a previously undisturbed area, and an archaeological survey (that has been reviewed and accepted by the Kentucky SHPO) has determined that no NRHP-listed or eligible properties will be affected by the proposed activity, DOE may proceed with the project with no further review by either the Kentucky SHPO or the Council.

- When a ground disturbance activity is proposed in a previously undisturbed area where there has been no archaeological survey reviewed and accepted by the SHPO, DOE will either initiate the survey activity or determine, in consultation with the Kentucky SHPO, that a survey is not necessary prior to initiation of the activity. If DOE determines, in consultation with the SHPO, that a survey is not warranted, DOE shall document the consultation with the SHPO and proceed with the undertaking with no review by the Counsel. If the Kentucky SHPO does not substantively respond to a request for consultation in 30 days, DOE may proceed to initiate the proposed activity.

- When a ground disturbance activity is proposed in an area where previous ground disturbance activities have occurred, DOE may proceed with the activity without consulting the Kentucky SHPO or the Council regarding the need for an archaeological survey, so long as the estimated depth and the extent of new disturbance does not significantly exceed the depth and extent of previous disturbances.

- If archaeological properties are located by a survey and DOE determines that the proposed activity will adversely effect such properties, DOE shall consult with the Kentucky SHPO to determine the property's NRHP eligibility; if found to be eligible, DOE shall further consult with the Kentucky SHPO to determine appropriate measures that might avoid, reduce, or mitigate the activity's effects to the site.

- If archaeological properties are located by a survey and DOE determines, that the proposed activity will not adversely effect such properties, DOE shall proceed with the undertaking with no review by the Counsel or the SHPO. If the Kentucky SHPO does not substantively respond to a request for consultation in 30 days, DOE may proceed to initiate the proposed activity.

- If the Kentucky SHPO and DOE agree to measures that will mitigate an adverse effect to an NRHP-eligible archaeological property [as determined by applying the criteria of adverse effect, 36 CFR Part 800.5(a)], an archaeological mitigation plan, consistent with the Council's handbook, "Treatment of Archaeological Properties," and the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* (NPS 1983) will be approved by the Kentucky SHPO and DOE will ensure that the plan is implemented. The SHPO will have 30 days to review the plan and provide comments. If comments are not submitted within 30 days, the plan shall be deemed approved. If DOE and the Kentucky SHPO cannot agree concerning the treatment of eligible archaeological properties, DOE will request the comments of the Council. The DOE shall retain all project documentation for possible review by the Council. The Council will provide written comments within 30 days. If comments are not received in 30 days, DOE will determine how to proceed.

4.5 MANAGEMENT OF OTHER NRHP-ELIGIBLE PROPERTIES

The following procedures will apply to Section 106 compliance for management of other NRHP-eligible properties.

- DOE will consult the PGDP cultural resources surveys referenced herein to determine if an activity has the potential to affect properties eligible for listing in the NRHP.

- If DOE determines that no NRHP-eligible properties are located within the area of potential effect or that no NRHP-eligible properties will be adversely effected by the undertaking, DOE shall proceed with the undertaking with no review by either the SHPO or the Council.

- If DOE determines that the undertaking will have an adverse effect on a NRHP-eligible property, DOE will either implement the mitigation measures set forth in 4.4.1 for the affected area or propose and seek SHPO concurrence on alternative mitigation measures. The SHPO will respond to any proposed alternative mitigation measures in 30 days. If comments are not received in 30 days, DOE may proceed to initiate the undertaking. If the SHPO and DOE agree on measures to be implemented by DOE, such activities need not be reviewed by the Council. If the SHPO and DOE cannot agree on mitigation measures in 30 days, DOE will request the comments of the Council. If an agreement is not reached, DOE will consider Council comments and make a decision at that point. Once the Council's comments have been reviewed, DOE will notify the Council of its final decision and proceed with that decision.

It should be noted that DOE undertakings will be implemented to meet programmatic needs (or other missions) regardless of whether or not the undertakings would affect NRHP-eligible properties. However, DOE will consider measures to mitigate impacts to NRHP-eligible properties whenever possible.

4.5.1 Mitigation Measures

The following mitigation measures will apply to undertakings (including building demolitions) that DOE determines will have an adverse effect on NRHP-eligible properties, unless an alternative plan is implemented in accordance with Section 4.5.

In 2004, Kentucky Individual Historic Resource Inventory Forms were completed for each contributing building in the NRHP-eligible PGDP Historic District as part of the *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* (BJC/PAD-688/R1), March 2006. Each property was inventoried in accordance with Kentucky SHPO standards and photographically documented. These inventory forms will constitute a part of the mitigation for proposed undertakings.

The following additional recordation will take place prior to implementing the undertaking:

— Buildings or their impacted areas will be documented with a series of 35-mm color slides and black-and-white photographs showing all exterior elevations, including close-ups of specific architectural details, interior woodwork and architectural elements, and any other significant character-defining details. A selection of photographs will be printed on 5 in. by 7 in. archival-quality, acid-free paper. Each photograph or slide will be labeled with the date, site number, direction, and subject. All negatives will be included with the documentation, and will be submitted in acid-free sleeves accompanied by a list describing each frame. If an alternate recordation technology is identified and the SHPO agrees, DOE will use the new technology in lieu of those listed above.

— Measured drawings may be prepared at DOE's discretion. Existing drawings will be used whenever possible. If drawings are prepared, they will be at a scale of ¼ in. per foot. The drawings shall be in pencil on archival-quality, acid-free vellum. Each drawing shall be labeled with the title of the building, survey number, view, dimension, name(s) of the field worker and drawing preparer, date of the drawing, scale bar, north arrow for plans, and explanatory notes. The drawings will be accompanied by a written description of the building and an explanation of construction details.

— Three copies of this documentation will be prepared by DOE. One copy will be submitted to the Kentucky SHPO for review and approval. Upon acceptance of the documentation by the Kentucky SHPO, DOE will provide the second copy to a local preservation organization or

archive (as determined by DOE) for placement in a permanent local archive of its choice. The third copy will be retained by DOE.

These measures will satisfy the agency's obligation under the NRHA. No additional consultation with the SHPO or Council is required. This recordation is not required for NHRP-eligible facilities that have similar facilities previously recorded.

4.5.2 Emergency Discovery Procedures

There are situations where historic or prehistoric sites are discovered only after a project has begun. In most instances, these sites are archaeological in nature and are discovered during ground-breaking activities. Sometimes, late discoveries stem from effects on a historic property not identified until after a project has begun or is finished. If such a discovery occurs, DOE has three options:

- **Compliance with Section 800.6.** Under this option, DOE either enters into consultation with the Kentucky SHPO and Council to develop a Memorandum of Agreement (MOA) or requests Council comment without an MOA. In either case, the Council must provide an expedited review (5 days). In lieu of Section 800.6 procedures, DOE may implement applicable requirements of this CRMP.

- **Development of a Plan.** DOE may develop a plan to handle the discovery itself. Under this option DOE notifies the Kentucky SHPO and Council of its plans as soon as possible. The Council and SHPO provide initial comments within 2 days and final comments within 15 days. If DOE receives comments within 15 days, DOE will respond to comments and proceed to implement the plan. If final comments are not forthcoming in 15 days, the plan shall be deemed approved and DOE shall implement the plan.

- **AHPA Compliance.** If the discovered property is primarily of archaeological value, DOE can comply with AHPA instead of Section 106. After the work is finished, DOE must provide the Kentucky SHPO an opportunity to comment and submit a report to the Council.

4.5.3 Notification Procedures

Any time that a historic property is discovered after project work has begun, DOE must notify the Council. If PGDP chooses its option to follow AHPA guidelines rather than Section 106, Council notification takes place after AHPA standards have been met and satisfied.

A letter to the Council should include information about when the site was discovered, where it is located, Kentucky SHPO comments, whether the discovery is NRHP-eligible, if the project will have an adverse effect on the site, and what DOE plans to do about the discovery. As in any situation requiring agency action, it is best to consult with the Kentucky SHPO about what actions to take. If DOE complies with Section 106, rather than AHPA, the Council must comment within an expedited period of time, and provide its final comments within 30 days. Discovery procedures for consultation and creation of an MOA are the same as those described under Section 106.

5. REFERENCES

Advisory Council on Historic Preservation 1989. *Public Participation in Section 106 Review: A Guide for Agency Officials.*

Advisory Council on Historic Preservation 1991. *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities.*

Advisory Council on Historic Preservation 2001. *Caring for the Past, Managing for the Future: Federal Stewardship and America's Historic Legacy*

Allardice, C., and E. R. Trapnell 1974. *The Atomic Energy Commission*, Praeger Publishers: New York, NY, pp. 6–7.

Bechtel Jacobs Company LLC 2006. *Cultural Resources Survey for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, BJC/PAD-688, prepared by Thomason and Associates, March.

Department of the Army 1994. *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume IV, Cultural Resources Investigation*, Department of the Army, Vicksburg, Mississippi, and Nashville, Tennessee, pp. 24–25 and 28–29.

DuPont 1952. *DuPont, The Autobiography of an American Enterprise*, E. I. DuPont De Nemours & Company, Inc., Wilmington, DE, Charles Scribner's Sons: New York, NY, p. 114.

Durfee, Kristopher 2003. *Why Paducah?: An analysis of the Selection Site for the Gaseous Diffusion Plant in Paducah, KY*, manuscript on file at the McCracken County Public Library, Paducah, Kentucky, pp. 2 and 5–8.

Evans, Martin C. 1993. *A Phase I Archaeological Reconnaissance on the Solid Waste Landfill (ESO-18007) at the Paducah Gaseous diffusion Plant in McCracken County, Kentucky*. Louisville, KY, April 1993 (revised June 1993).

Faust, Patricia ed. 1986. *Historical Times Illustrated Encyclopedia of the Civil War.* Harper & Row: New York, NY, p. 552.

Garrison, Joe 2003. Section 106 Coordinator, Tennessee Historical Commission (SHPO), telephone interview. January 15.

Garwin, Richard L., and Georges Charpak 2001. *Megawatts and Megatons.* Alfred A. Knopf: New York, NY, pp. 111 and 119.

Gosling, F. G. 1994. *The Manhattan Project: Making the Atomic Bomb.* U.S. DOE, September, pp. 1–2, 51, and 55–57.

Gosling, F. G. 2003. DOE Historic Preservation Officer, Washington, D.C., telephone interview, January 14.

Hewgley Museum. Manuscript on file, Wilmington, DE: "U.S. TNT Special Contract," dated 1942, pp. I-1 and I-2.

Hewlett, R. G., and O. E. Anderson 1962. *The New World, 1939/1946: Volume I, A History of the United States Atomic Energy Commission*, Pennsylvania State University: University Park, PA, pp. 123 and 129.

Letter from David L. Morgan, Director; Kentucky Heritage Council and State Historic Preservation Officer to John Young, CDM Federal Programs Corporation; dated July 2, 1993; Re: *A Phase I Archaeological Reconnaissance on the Solid Waste Landfill (ESO-18007) at the Paducah Gaseous Diffusion Plant in McCracken County, Kentucky* by Martin C. Evans.

Logan, Jonathan 1996. "The Critical Mass," *American Scientist,* May–June, p. 264.

McCracken County. *McCracken County Deed Book M*, McCracken County Courthouse, Paducah, Kentucky, p. 175.

McCracken County. *McCracken County General Index to Deeds, Grantees, N to Z, 1939–1961*, McCracken County Courthouse, Paducah, Kentucky.

McCracken County. *McCracken County Deed Book 286*, McCracken County Courthouse, Paducah, Kentucky, March 15, 1950, p. 483.

Mitchell, J. A. 1952. "Paducah Changes Its Way of Life," *Life,* **33**(2), July 14, published by Time, Inc.: New York, NY, pp. 21–24.

National Park Service 1983. *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines*, Vols. I, II, and III, 48 Federal Register 44716, NPS Preservation Assistance Division, Washington, D.C., codified in 36 CFR 67 pp. 353–371 and 36 CFR 68 pp. 372–374, September 29.

National Park Service 1992. *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*, NPS Cultural Resources, Preservation Assistance Division, Washington, D.C.

The Paducah Sun-Democrat 1942. "$30,000,000 Arms Plant to be Built in McCracken County," on file at the Paducah Historical Society, February 27, p. 18.

The Paducah Sun-Democrat 1955. "Inside the A-Plant," April 17.

The Paducah Sun 2000. "Atomic plant made Paducah double," September 15, p. 5.

The Paducah Sun 2002. "The Growing Pains and Successes of a Real Boomtown," October 19, p. 6.

Programmatic Agreement Among the Department of Energy Paducah Site Office, The Kentucky State Historic Preservation Officer, and The Advisory Council on Historic Preservation Concerning Management of Historical Properties at the Paducah Gaseous Diffusion Plant. January 2004. Copy on file at the Department of Energy, Oak Ridge Operations, Paducah Site Office, Paducah, KY.

Rhodes, Richard 1993. *Nuclear Renewal, Common Sense About Energy.* New York: Penguin Books, pp. 1, 35, 37, and 84.

Rhodes, Richard 1995. *Dark Sun, The Making of the Hydrogen Bomb.* Simon and Schuster: New York, NY, pp. 434–437.

Robinson, G. O. 1950. *The Oak Ridge Story*, Southern Publishers: Kingsport, TN, p. 81.

Snyder, David 2004. Section 106 Coordinator, Ohio Historic Preservation Office, telephone interview, September 2.

Thomason and Associates 2003. *Cultural Resources Survey and National Register Assessment, C-410 Complex, Paducah Gaseous Diffusion Plant, McCracken County, Kentucky*, January 20.

U.S. Army Corps of Engineers 1992. *Final Phase I Engineering Report, Volume I of IV, Executive Summary, Phase I Remedial Investigation at the Former Kentucky Ordnance Works, McCracken County, Kentucky.* U.S. Army Corps of Engineers, Nashville District, TCT-St. Louis, p. 1-6.

U.S. Army Corps of Engineers 1994. *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume IV, Cultural Resources Investigation.*

U.S. Department of Energy. *Management of Cultural Resources at Department of Energy Facilities,* February 23, 1990 Memorandum.

U.S. Department of Energy. *Historical Records of the Atomic Energy Commission,* Office of Scientific and Technical Information, Washington, D.C., p. 1.

U.S. Enrichment Corporation (USEC) 2001. USEC Facilities website, *http://www.usec.com/v2001_02/HTML/facilities.asp*, Paducah Plant: Key Facts and Plant History.

APPENDIX A

PROPERTY INVENTORY

Historic property inventory

Facility number	Kentucky survey number	Function	Floor area (1)	Construction date
		Process buildings		
C-300	MCN-106	Central Control Building	16,022	1953
C-310	MCN-111	Purge and Product Building	112,240	1952
C-310-331-A	MCN-112	Enclosed Bridge	200 linear feet	1952
C-310-331-B	MCN-113	Tie Lines	200 linear feet	1952
C-310-410	MCN-114	Tie Lines	520 linear feet	1952
C-310-A	MCN-115	Product Withdrawal Building	3,276	1952
C-315	MCN-116	Surge and Tails Building	16,040	1952
C-315-331	MCN-117	Tie Lines	10,240; 5,800	1952
C-331	MCN-119	Process Building	1,029,120	1952
C-331-333-A	MCN-120	Enclosed Bridge	300 linear feet	1952
C-331-333-B	MCN-121	Tie Line (East)	300 linear feet	1952
C-331-333-C	MCN-122	Tie Line (West)	300 linear feet	1952
C-331-335	MCN-123	Tie Line	1,350 linear feet	1952
C-331-410	MCN-124	Tie Line	629 linear feet	1952
C-333	MCN-125	Process Building	2,130,120	1952
C-333-A	MCN-126	Feed Vaporization Facility	8,305	1952
C-335	MCN-127	Process Building	1,029,120	1954
C-335-337-A	MCN-128	Enclosed Bridge	200 linear feet	1954
C-335-337-B	MCN-129	Tie Line (North)	200 linear feet	1954
C-335-337-C	MCN-130	Tie Line (South)	200 linear feet	1954
C-337	MCN-131	Process Building	2,130,120	1954
C-337-A	MCN-132	Feed Vaporization Facility	8,556	1960
C-340	MCN-133	Powder Building/Decontamination and Decommissioning	67,428	1955
C-410	MCN-148	Feed Plant Complex	128,869	1953–57
C-620	MCN-202	Air Compressor Room	10,000	1953
		Electrical switchyards and switch houses		
C-531-1	MCN-150	Switch House	31,400	1952
C-531-2	MCN-151	Switchyard	135,160	1952
C-531-3A	MCN-152	Fire Valve House No. 1	144	1952
C-531-3B	MCN-153	Fire Valve House No. 2	144	1952
C-532	MCN-154	Relay House	7,784	1952
C-533-1	MCN-155	Switch House	37,360	1953
C-533-2	MCN-156	Switchyard	218,860	1953
C-533-3A	MCN-157	Fire Valve House No. 1	144	1953
C-533-3B	MCN-158	Fire Valve House No. 2	144	1953
C-533-3C	MCN-159	Fire Valve House No. 3	144	1953
C-533-3D	MCN-160	Fire Valve House No. 4	144	1953
C-535-1	MCN-161	Switch House	28,000	1954
C-535-2	MCN-162	Switchyard	165,680	1954
C-535-3A	MCN-163	Fire Valve House No. 1	144	1954
C-535-3B	MCN-163	Fire Valve House No. 2	144	1954
C-535-4	MCN-164	Test Shop	480	1954
C-537-1	MCN-166	Switch House	42,140	1954
C-536	MCN-165	Relay House	7,784	1954

Historic property inventory (continued)

Facility number	Kentucky survey number	Function	Floor area (1)	Construction date
		Electrical switchyards and switch houses (continued)		
C-537-2	MCN-167	Switchyard	284,200	1954
C-537-3A	MCN-168	Fire Valve House No. 1	144	1954
C-537-3B	MCN-168	Fire Valve House No. 2	144	1954
C-537-3C	MCN-168	Fire Valve House No. 3	144	1954
C-537-3D	MCN-168	Fire Valve House No. 4	144	1954
C-537-4	MCN-169	Test Shop	480	1954
C-540-A	MCN-170	Oil Pump House	312	1952
C-541-A	MCN-175	Oil Pump House	312	1952
		Cooling towers and pump houses		
C-631-1	MCN-203	Pump House	9,700	1952
C-631-2	MCN-204	Cooling Tower	15,248	1953
C-631-3	MCN-205	Pump House (Firewater)	1,196	1959
C-631-5	MCN-207	Blending Cooling Tower (West)	3,024	1953
C-631-6	MCN-208	Blending Cooling Tower (East)	3,024	1953
C-633-1	MCN-209	Pump House	10,245	1953
C-633-2A	MCN-210	Cooling Tower (South)	16,085	1953
C-633-2B	MCN-211	Cooling Tower (North)	16,085	1953
C-633-4	MCN-213	Blending Cooling Tower (North)	4,536	1953
C-633-5	MCN-214	Blending Cooling Tower (South)	4,536	1953
C-635-1	MCN-216	Pump House and Piping	8,505	1954
C-635-2	MCN-217	Cooling Tower	15,428	1954
C-635-4	MCN-219	Blending Cooling Tower (North)	2,520	1954
C-635-5	MCN-220	Blending Cooling Tower (South)	3,024	1954
C-637-1	MCN-222	Pump House	10,245	1954
C-637-2A	MCN-223	Cooling Tower (South)	22,100	1954
C-637-2B	MCN-224	Cooling Tower (North)	22,011	1954
C-637-4	MCN-226	Blending Cooling Tower (North)	3,528	1954
C-637-5	MCN-227	Blending Cooling Tower (South)	3,528	1954
		Administrative buildings		
C-100	MCN-95	Administration Building	67,516	1953
C-212	MCN-101	Office Building	3,471	1952
C-320	MCN-118	Communication Building	1,116	1952
C-710	MCN-230	Technical Service Building	84,333	1953
		Security facilities		
C-200/201/ 202/203/204	MCN-98	Guard and Fire Headquarters (2)	19,490	1953–1986
C-215	MCN-103	Portals 18 and 19	1,045	1957
		Water treatment facilities		
C-611-O	MCN-196	Sanitary Water Storage Tank	250,000 gal	1953
C-611-R	MCN-197	Water Tank	300,000 gal	1953

Historic property inventory (continued)

Facility number	Kentucky survey number	Function	Floor area (1)	Construction date
		Storage tanks		
C-406	MCN-144	Trichloroethylene Storage Tank	6,015 gal	1953
C-407	MCN-145	Nitric Acid Storage Tank	11,000 gal	1953
C-540-B	MCN-171	Oil Storage Tank (Northwest)	15,000 gal	1953
C-540-C	MCN-172	Oil Storage Tank (Southwest)	15,000 gal	1953
C-540-D	MCN-173	Oil Storage Tank (Northeast)	7,500 gal	1953
C-540-E	MCN-174	Oil Storage Tank (Southeast)	15,000 gal	1953
C-541-B	MCN-176	Oil Storage Tank (Northwest)	7,500 gal	1953
C-541-C	MCN-177	Oil Storage Tank (Southwest)	15,000 gal	1953
C-541-D	MCN-178	Oil Storage Tank (Northeast)	7,500 gal	1953
C-541-E	MCN-179	Oil Storage Tank (Southeast)	15,000 gal	1953
		Warehouses, storage, and support buildings		
C-101	MCN-96	Cafeteria	18,326	1953
C-102	MCN-97	Hospital	11,666	1953
C-301	MCN-107	Low-Level Waste Storage	2,802	1959
C-342 and C-342-A	MCN-134	Ammonia Dissociator Building (2)	1,242	1953
C-400	MCN-140	Cleaning Building	116,140	1954
C-402	MCN-141	Lime House	1,742	1950
C-403	MCN-142	Neutralizing Pit	900	1953
C-408	MCN-146	50-Ton Truck Scale	130	1963
C-415	MCN-149	Feed Plant Storage Building	3,666	1960
C-710-A	MCN-231	Gas Cylinder Storage Building	400	1953
C-711	MCN-232	Gas Manifold	962	1953
C-727	MCN-243	90-Day Mixed Waste Accumulation	4,428	1954
C-750	MCN-262	Garage	11,866	1952

Notes
NA = Not applicable
(1) = Units in square feet unless noted otherwise
(2) = Counted as one property

The following property was designated as non-historic property and is not included under this management plan.

Non-Historic property inventory

Facility number	Function	Description	Floor area (1)
C-100-T04	Temp. Trailer	Double-wide Trailer	1440
C-100-T05	Temp. Office	Double-wide Trailer	1440
C-100-T06	Temp. Office	Double-wide Trailer	1440
C-100-T07	Temp. Changehouse	Trailer	244
C-102-B-01	Storage Trailer	Trailer	224
C-102-T01	Temp. Office	Double-wide Trailer	1440
C-102-T02	Temp. Office	Double-wide Trailer	1440
C-102-T03	Temp. Office	Double-wide Trailer	1440
C-102-T04	Temp. Office	Double-wide Trailer	1440
C-102-T05	Temp. Office	Double-wide Trailer	1440
C-102-T07	Temp. Office	Double-wide Trailer	1960
C-102-T08	Temp. Office	Modular Office	64
C-102-T09	Temp. Office	Modular Office	144
C-205	Respirator Issue Facility	Pre-Fab Metal	1998
C-207	Fire Training Facility	Steel Frame Building	1993
C-212-U	Utility Operations Office	1,715	1953
C-216	Post 47	Concrete Guard Post	1983
C-217	Post 43	Concrete Guard Post	1985
C-302	Operations Division Data Center	Steel and Concrete Building	1981
C-303	Supervisory Control and Data Acquisition Systems Building	Concrete Building	1984
C-304	Training and Cascade Office Building	Brick Veneer Building	1991
C-342-B	Ammonia Dissociator Tank Shelter	Steel Building	1978
C-350	Drying Agent Storage Building	Concrete Building	1973
C-360 and C-360-A	Toll Transfer and Sampling Building	Pre-Fab Steel	1982
C-405	Contaminated Items Incinerator	Concrete and Steel Building	1952
C-409	Stabilization Building	Pre-Fab Building	1976
C-412	DMSA/D&D Trailer Complex	Gravel Pad	1.5 Acres
C-412-T02	Office Trailer	Trailer	1440
C-412-T03	Office Trailer	Trailer	1440
C-412-T04	Office Trailer	Trailer	1440
C-412-T05	Office Trailer	Trailer	1440
C-412-T06	Office Trailer	Trailer	1440
C-412-T07	Men and Women's Change House	Trailer	1440
C-412-T08	Office Trailer	Trailer	1440
C-412-T09	Office Trailer	Trailer	1440
C-412-T10	Office Trailer	Trailer	1440
C-412-T11	Men's Change House	Trailer	1440
C-412-T12	Office Trailer	Trailer	1440
C-412-T14	Office Trailer	Trailer	1440
C-600	Steam Plant	Concrete and Steel Building	1952
C-601	Nitrogen Generator Building Addition	1,128 / 1,122	1952
C-601-A	Steam Plant Fuel-Storage Tank (Center)	Storage Tank	1953
C-601-B	Steam Plant Fuel-Storage Tank (South)	Storage Tank	1953
C-601-C	Steam Plant Fuel Oil Pump House	Pump House	1952

Non-Historic property inventory (Continued)

Facility number	Function	Description	Floor area (1)
C-601-D	Fuel Oil Storage Tank (North)	Storage Tank	1974
C-604	Utilities Maintenance Building	Pre-Fab Steel Building	1979
C-605	Substation Building	Pre-Fab Steel Building	1979
C-606	Coal Crusher Building	Metal Coal Crusher	1980
C-607	Emergency Air Compressor Generator Building	Pre-Fab Steel Building	1984
C-611	Water Treatment Plant	15 acres	1942
C-611-M	North Concrete Sanitary Water Tank	250,000 gal	1942
C-611-N	South Concrete Sanitary Water Tank	250,000 gal	1942
C-612	Pilot Pump and Treatment	Concrete w/Fabric Structure	4480
C-612-A	Pump and Treat Decontamination Pad	Concrete w/Fabric Structure	4720
C-612-B	Storm Shelter	Steel Underground Shelter	50
C-612-T01	Pump & Treat Office	Trailer	600
C-612-T02	Pump & Treat Office	Trailer	600
C-612-T03	Pump & Treat Storage/Change house	Trailer	600
C-612-T04	Pump & Treat Lab	Trailer	120
C-612-T05	Storage Trailer	Trailer	160
C-612-T05	Sealand Storage Trailer	Trailer	320
C-612-T06	Sealand Storage Trailer	Trailer	320
C-612-T07	Sealand Storage Trailer	Trailer	320
C-612-T08	Sealand Storage Trailer	Trailer	320
C-612-T09	Sealand Storage Trailer	Trailer	320
C-612-T10	Sealand Storage Trailer	Trailer	320
C-612-T11	Sealand Storage Trailer	Trailer	320
C-612-T12	Sealand Storage Trailer	Trailer	320
C-613	Scrap Yard Sedimentation Basin	Liner Basin	2 Acres
C-613-A	Process & Office Trailer	Trailer	500
C-614-A	Northeast Plume Equipment Pad	Reinforced Concrete Pad w/Security Fence	2520
C-614-B	Northeast Plume Extraction Well 331/w equipment vault	Gravel Area w/ Security Fence	1344
C-614-C	Northeast Plume Extraction Well 332/w/equipment vault	Gravel Area w/ Security Fence	1344
C-615	Sewage Disposal Plant	806	1952
C-615-T01	Storage Trailer	Trailer	160
C-615-T02	Storage Trailer	Trailer	160
C-615-T03	Storage Trailer	Trailer	160
C-616-A	Chemical Feed Building	Pre-Fab Steel Building	1978
C-616-B	Clarifier-East	Clarifier	1977
	Clarifier-West	Clarifier	
C-631-4	Blending Pump House	Pump House	1982
C-633-3	Blending Pump House	Pump House	1953
C-633-6	Sand Filter Building	Pre-Fab Steel Building	1983
C-635-3	Blending Pump House	Pump House	1982
C-635-6	Process Waste Heat Utilization Pump House	Pump House	1983
C-637-3	Blending Pump House	Pump House	1982
C-637-6	Sand Filter Building	Pre-Fab Steel Building	1982
C-709	Plant Laboratory Annex	Concrete and Steel Building	1998

Non-Historic property inventory (Continued)

Facility number	Function	Description	Floor area (1)
C-720	Maintenance and Stores Building	Concrete and Steel Building	1952
C-720-G	90-Day Storage Recycling/Stores Storage	Steel Building	1976
C-720-H	Warehouse	Pre-Fab Steel Building	1978
C-721	Gas Manifold Storage	Steel Building	1952
C-724-A	Carpenter Shop Annex	Concrete Block Building	1954
C-724-B	Carpenter Shop	Steel Building	1954
C-724-C	Paint Shop	Steel Building	1954
C-724-D	Lumber Storage Building	Steel Building	1954
C-726	Sandblast Building	Steel Building	1973
C-728	Motor Cleaning Facility	Steel Building	1958
C-729	Acetylene Building	Steel Building	1956
C-730	Maintenance Service	Concrete Block Building	1955
C-730-A	Storm Shelter	Steel Underground Shelter	50
C-730-T01	Office Trailer	Trailer	720
C-730-T02	Office Trailer	Trailer	700
C-730-T05	Office Trailer	Double-Wide Trailer	1340
C-730-T06	Office Trailer	Trailer	1440
C-730-T08	Office Trailer	Trailer	220
C-731	Railroad Repair Equipment Storage Building	Storage Area	1981
C-732	Maintenance Materials Storage Building	Storage Area	1981
C-733	Waste Oil and Chemical Storage Facility	Storage Area	1985
C-740-B	Oil Drum Storage Shelter	Pre-Fab Steel Building	1975
C-741	Mobile Equipment Building	Steel Building	1952
C-742	Cylinder Storage Building	Concrete and Steel Building	1952
C-742-T16	Office Trailer	Double-Wide Trailer	1600
C-743	Office Building	Steel Building	1971
C-743-T01	Environmental Restoration Office	Double-Wide Trailer	1440
C-743-T02	Environmental Restoration Office	Double-Wide Trailer	1440
C-743-T03	Environmental Restoration Office	Double-Wide Trailer	1200
C-743-T04	Office Trailer	Double-Wide Trailer	1440
C-743-T07	Office Trailer	Trailer	360
C-743-T09	Environmental Restoration Office	Double-Wide Trailer	1440
C-743-T11	Office Trailer	Double-Wide Trailer	1600
C-743-T12	Office Trailer	Double-Wide Trailer	1600
C-743-T13	Office Trailer	Double-Wide Trailer	1600
C-743-T14	Office Trailer	Double-Wide Trailer	1600
C-743-T15	Office Trailer	Double-Wide Trailer	1600
C-743-T17	Field Support Lab Trailer	Double-Wide Trailer	1670
C-744	Material Handling	Concrete and Steel Building	1952
C-746-A	North Warehouse	Warehouse	1954
C-746-B	South Warehouse	Warehouse	1959
C-746-G	Electrical Equipment Storage	Storage Area	1974
C-746-L	Tractor Storage	Storage Area	1985
C-746-M	Waste Uranium Chip Storage Facility	Storage Area	1976
C-746-Q	Hazardous and LLW Storage	Storage Area	1965
C-746-Q1	High-Assay Waste Storage Facility	Storage Area	1965
C-746-T	Inert Landfill	Fenced Area	10 Acres

Non-Historic property inventory (Continued)

Facility number	Function	Description	Floor area (1)
C-746-U	Solid Waste Landfill	Fenced Area	38 Acres
C-746-U1	Office Building	Metal Building	600
C-746-U10	Storage Facility	Wood Frame	144
C-746-U11	Storage Facility	Wood Frame	144
C-746-U12	Storage Facility	Wood Frame	144
C-746-U13	Shower Trailer	Trailer	160
C-746-U2	Equipment Building	Metal Building	3600
C-746-U3	Leachate Facility	Two 30,000 Gallon Tanks	3200
C-746-U4	Storm Shelter	Steel Underground Shelter	50
C-746-U5	Storage Facility	Sealand Box	160
C-746-U6	Storage Facility	Sealand Box	160
C-746-U7	Storage Facility	Sealand Box	160
C-746-U8	Storage Facility	Sealand Box	160
C-746-U9	Storage Facility	Sealand Box	160
C-746-V	ER Waste Staging Area	Gravel Pad	10000
C-746-X	Electrical Equipment Storage	Wood Frame	5670
C-751	Fuel Dispensing Facility	Pre-Fab Steel Building	1991
C-752-B	Decontamination Pad	Concrete Pad	4200
C-752-C	Off-Site Decontamination Pad	Concrete Slab with Pre-Fab Building	9600
C-752-D	ER Clam Shell	Steel Cols. with fabric covering	4220
C-752-T01	ER Warehouse	Trailer	160
C-752-T02	ER Warehouse	Trailer	160
C-752-T03	ER Warehouse	Trailer	160
C-752-T04	ER Warehouse	Trailer	160
C-752-T05	ER Warehouse	Trailer	160
C-752-T06	ER Warehouse	Trailer	160
C-752-T07	ER Warehouse	Trailer	160
C-752-T08	ER Warehouse	Trailer	160
C-752-T09	ER Warehouse	Trailer	450
C-752-T10	ER Trailer	Trailer	500
C-753A-T9	ER Trailer	Trailer	500
C-754	Low-Level Waste Storage	Steel Cols. w/fabric covering	10000
C-754-A	Low-Level Waste Storage	Steel Cols. w/fabric covering	5000
C-755	ER Trailer Complex	Trailers	
C-755-A	ER Construction Staging Area Equipment Decontamination Building	Pre-Fab Metal Building	3500
C-755-B	ER Construction Staging Area Shower/Changeroom	Pre-Fab Metal Building	2400
C-755-C	ER Construction Staging Area Storage Building	Pre-Fab Metal Building	600
C-755-D	ER Construction Staging Area Portal Inspection Facility	Pre-Fab Metal Building	100
C-755-E	Storm Shelter	Steel Underground Shelter	50
C-755-F	Storm Shelter	Steel Underground Shelter	50
C-755-G	Storm Shelter	Steel Underground Shelter	50
C-755-H	Storm Shelter	Steel Underground Shelter	50
C-757	Solid & Low-Level Waste Processing Facility	Reinforced Concrete & Prefabricated Metal	10103

Non-Historic property inventory (Continued)

Facility number	Function	Description	Floor area (1)
C-757-T01	Health Physics Office	Trailer	160
C-759	Scrap Metal Staging Area	Gravel Area	NA
C-760	NSDD Gravel Laydown Area	Gravel Area	10000
C-761	Scrap Metal Staging/Shipping Area	Gravel Area	NA
C-770	Vortec Demonstration Plant	Concrete	NA
C-800	Motorcycle Parking Area	Structural Steel and Corrugated Siding	1620
C-801	Ohio Avenue Bus Shelter	Structural Steel and Corrugated Siding	1080
C-802	Meteorological Tower	Structural Steel	60-Meter Tower
C-810	Parking Area (C-100)	Asphalt	243500
C-811	Parking Area (C-720)	Gravel Area	NA
SC-745-G2	Temp. Cylinder Paint Facility	Pre-Fab Metal Building	4500
SC-745-G3	Temp. Cylinder Paint Facility	Pre-Fab Metal Building	4500
SC-745-G4	Temp. Cylinder Paint Facility	Pre-Fab Metal Building	4500
SC-745-G5	Temp. Cylinder Paint Facility	Pre-Fab Metal Building	4500

Notes
NA = Not applicable
(1) = Units in square feet unless noted otherwise

DISTRIBUTION

Bechtel Jacobs Company LLC
D. R. Guminski
D. M. Ulrich
J. D. Young
File-EMEFDMCPAD-RC

CDM Federal Services Inc.
T. L. Brindley

Swift and Staley Infrastructure Team
S. Polston

Uranium Disposition Services
R. R. Veazey

U.S. Department of Energy
R. H. Blumenfeld
R. M. Knerr
W. E. Murphie
K. L. Wiehle

U.S. Enrichment Corporation
S. Penrod

Environmental Information Center
File