

Preservation Versus Demolition – The Fate of the Historic K-25 Gaseous Diffusion Plant – 10492

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ABSTRACT

East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee is the site of the former K-25 gaseous diffusion complex. One hundred eleven structures in this complex comprised the K-25 Site Main Plant and Powerhouse Historic Districts. The K-25 Building—the world’s first gaseous diffusion plant—has been designated a Manhattan Project Signature Facility. The U.S. Department of Energy (DOE) is cleaning up ETTP for private-sector reuse, which necessitates the demolition of all contaminated or decrepit facilities. The effect of the planned action on the structures in the historic district triggered the National Historic Preservation Act (NHPA) Section 106 process to determine how to best preserve and/or interpret the Manhattan Project facilities. Beginning in 2002, a series of Memorandums of Agreement (MOAs) were negotiated between DOE and several consulting and signatory parties. The first of these enabled a study to determine preservation options, to inventory and retrieve historic equipment and artifacts, and to gather oral histories. Later MOAs delineated which historic-district facilities could be demolished while specifying DOE’s role regarding preservation and interpretation of the K-25 North End. A worker accident in 2006 uncovered widespread structural damage that escalated the cost of the preservation options. The Partnership for K-25 Preservation put forth a proposal to modify the MOA in order to minimize costs, but in 2008 DOE determined that the extensive damage left no credible option for preserving any of the buildings. Subsequent to that determination, preservationists proposed a manned K-25 History Center at ETTP that would provide an overview of the 44-acre K-25 footprint, interpret the facility’s role in World War II and the Cold War, and display historic gaseous diffusion equipment. Although DOE expressed its preference for this proposal, as of late 2009 the agency has not formalized its final decision. Preliminary decontamination and decommissioning (D&D) activities have been implemented on the two legs of the K-25 building, and demolition of the West Leg is in progress. The lesson learned from reviewing the impact of the NHPA Section 106 process on the D&D work at ETTP is that early engagement with stakeholders regarding their preferences for historic preservation can allow steps to be taken to prevent further deterioration of at-risk structures and can eliminate delays to D&D work that increase the total project cost.

INTRODUCTION

Decontamination and decommissioning (D&D) is the preparation of a nuclear facility for reuse or demolition. The U.S. Department of Energy (DOE) is undertaking a massive D&D effort in Oak Ridge, Tennessee, targeting the aging gaseous diffusion facilities at the K-25 site, since renamed East Tennessee Technology Park (ETTP). The vast majority of these were slated for demolition under the Accelerated Cleanup Program, although a few were preserved for private-sector reuse as office buildings or industrial facilities. ETTP is home to some of the earliest Manhattan Project structures, which meant that DOE had to comply with the provisions of Section 106 the National Historic Preservation Act (NHPA) when decisions were made to demolish the facilities in the historic district.

Congress established the NHPA to preserve the historical and cultural foundations of the United States. Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties and provide the Advisory Council on Historic Preservation (ACHP) and other interested parties an opportunity to comment on Federal projects prior to implementation [1].

MANHATTAN PROJECT SIGNATURE FACILITIES

K-25 was the wartime code name for the world's first gaseous diffusion plant designed to enrich uranium, built in the backwoods of east Tennessee to support the Manhattan Project. The mile-long U-shaped building was constructed in 18 months and the first of its 3,000 individual diffusion stages came online in January 1945 (Fig. 1). It represented an extraordinary engineering effort and deployed the first industrial-scale use of what is now called "nanotechnology" in the barrier material designed to separate isotopes of uranium. Although it made only a minor contribution of uranium-235 for the first atomic bomb, K-25 was the flagship plant for production of enriched uranium for the Cold War. Production in this building ended in 1964, but the building was put into standby mode and kept hot, dry, and ready to restart for an additional three years. In 1967 DOE shut it down forever.

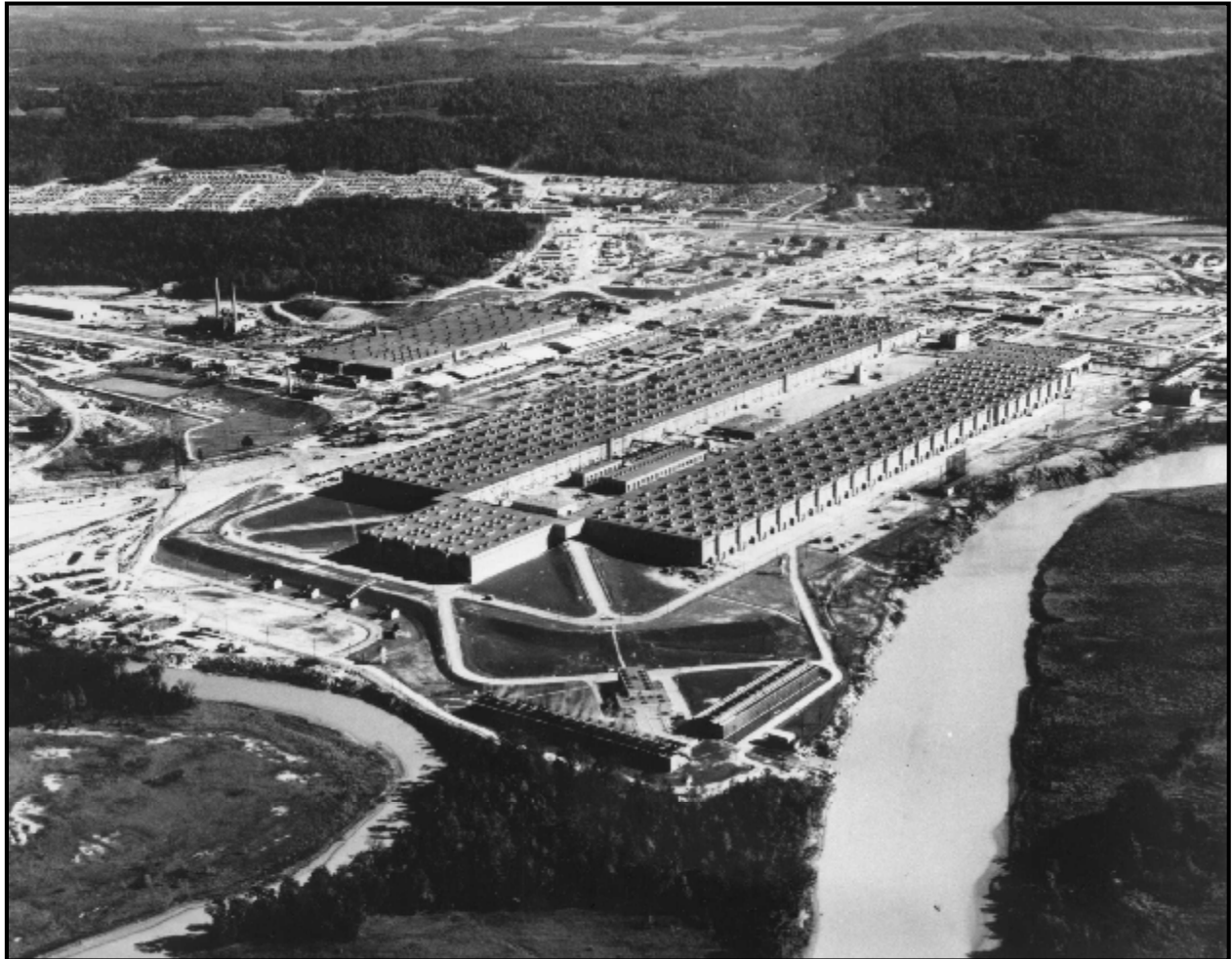


Fig. 1. The K-25 plant was completed in 1945. (Photo courtesy of DOE)

At the request of DOE, a panel of distinguished historic-preservation experts surveyed historic structures at all of the Manhattan Project sites in the 1990s. Based on the work of these experts, in 1998 DOE formally designated the K-25 Gaseous Diffusion Process Building as one of its eight Manhattan Project "Signature Facilities." Taken as a group, these nationally significant historic properties best convey and interpret the scale and importance of the Manhattan Project, and are key to DOE's ability to successfully interpret the Manhattan Project mission of developing atomic bombs during World War II.

In 2000 DOE commissioned a study from the ACHP titled *Recommendations and Preservation Options for Manhattan Project Signature Facilities at Oak Ridge and Hanford Reservations*. This study was undertaken by a panel of experts and laid out options for preserving and conveying the significance of the K-25 facility. The K-25 site-specific finding states “The Panel is alarmed that DOE is moving forward with its plans for decontamination and decommissioning of the K-25 Signature Facility apparently without a full appreciation of its historic significance, and without comprehensive analyses of alternatives that would allow this facility to continue to tell its story.” [2]

NEGOTIATING THE FATE OF THE K-25 BUILDING

In 2001 DOE’s Oak Ridge Environmental Management office presented the draft Engineering Evaluation/Cost Analysis (EE/CA) for the D&D of the K-25 and K-27 Buildings as part of the Accelerated Cleanup Program for ETTP. The public meeting drew a large crowd of Oak Ridge residents concerned about preserving the building; the comments on the EE/CA reflected the interest in preserving the historic structure (Fig. 2).



Fig. 2. The K-25 Building was the centerpiece of the former gaseous diffusion complex, pictured here before extensive D&D activities at ETTP. (Photo courtesy of DOE)

A series of meetings were convened under Section 106 of the NHPA to gain input from consulting parties and attempt to come up with a satisfactory plan for interpreting the history of the K-25 site. Both the Oak Ridge Reservation Local Oversight Committee (LOC) and the Oak Ridge Heritage and Preservation Association (ORHPA) are consulting parties for historic preservation decisions on the ORR. Other consulting parties include DOE Oak Ridge Office (ORO), the Tennessee State Historic Preservation Officer (SHPO), ACHP, the Oak Ridge Site Specific Advisory Board (ORSSAB) and the City of Oak Ridge. In 2009, the National Trust for Historic Preservation was added as a consulting party. Signatory parties to the Memorandum of Agreement (MOA) are DOE ORO, the Tennessee SHPO, and ACHP; with ORHPA and the City of Oak Ridge each signing as concurring parties.

The first MOA, signed in 2002, laid out the following actions as agreed by the consulting parties and ratified by the signatory parties:

- DOE with the help of interested parties would inventory equipment and historical artifacts in the K-25 building, tagging those of interest as historic artifacts.
- An architectural and engineering (A&E) firm would be contracted to provide design proposals for historic interpretation of K-25 and K-27.
- DOE would seek funding to implement agreed-on measures.
- Professional historians would be used to record oral histories of the site and propose options for preserving memory of the K-25 Building.

In late 2003, DOE brought in an A&E contractor with experience in restoring historic properties. Ehrenkrantz, Eckstut, and Kuhn (EE&K) identified 99 structures as contributing properties to the K-25 Site Main Plant and Powerhouse Historic Districts and eleven buildings (including the K-25 and K-27 Buildings) as eligible for inclusion in the National Register of Historic Places (National Register). Nine support buildings were identified as having potential for further evaluation in development of the site-wide alternative for ETTP. EE&K presented two alternatives and a comprehensive plan for retaining and rehabilitating different “slices” of the East Leg of the K-25 “U” as being historically accurate means of preserving and interpreting the site. The cost of each option, over \$100 millions, however, made it impossible to implement considering DOE’s other financial obligations.

Local preservationists began meeting as a group on a regular basis to build on what was learned from the EE&K studies and to develop and evaluate what other possibilities might constitute an acceptable compromise. After months of exploring various options, ORHPA representatives settled on a proposal that would retain the stand-alone North End of the K-25 “U” instead of a slice of the East Leg. This portion of the building had alleyways that were one diffusion cell shorter than those of the legs of the “U”, helping to reduce costs. Also, to cut costs, the group determined that all the supporting structures that were not eligible for the National Register could be released for demolition.

In April 2004 the consulting parties ratified an additional MOA that allowed DOE’s remediation contractor, Bechtel Jacobs Company (BJC), to begin demolition of 99 of the 108 buildings identified as contributing properties to the K-25 Site Main Plant and Power House Historic Districts. The nine support facilities eligible for inclusion in the National Register were excluded for a period of one year to allow additional evaluation as to whether any should be preserved to support interpretation of the site. These buildings were:

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| • Cafeteria | K-1002 |
| • Medical Building | K-1003 |
| • Worker’s Change House | K-1008-C |
| • A Bus Station | K-1019-5A |
| • Fire Engine Hall | K-1021 |
| • Guard Portal #4 | K-1028-45 |
| • Depleted U-235 Waste Building | K- 601 |
| • Filter Test Facility | K-1024 |
| • Nitrogen and Air Plant Building | K-1101 |

At a November 2004 consulting parties meeting in Oak Ridge, DOE presented a breakthrough proposal for preserving a portion of the K-25 building based on preservationist’s desire to retain the North End. In addition to preserving the North End, DOE would leave the inner wall from the vaults of each of K-25’s half-mile long legs. Ten feet would remain above grade as commemorative walls for murals and other displays to give visitors a sense of the magnitude of the facility and allow expanded options for interpreting the site.

Also at this meeting, the consulting parties agreed to the demolition of eight of the nine buildings listed above, all but the Guard Portal #4 to be used as a visitor entrance. With the proposed preservation of the North End of the K-25 Building and the mural wall, these eight structures were thought to be unnecessary to interpretation of the site, as well as being in such poor physical condition that rehabilitation for any new use and ongoing maintenance would have been costly.

A new MOA was signed by all parties in March 2005 that provided for preservation of the North End of the K-25 “U” and the above-mentioned demolition of eight of the nine ancillary buildings. The significant short-term stipulations included:

- Retain the North End of the K-25 building and undertake interim preservation by replacing the roof and sealing the transite siding;
- Retain a visually intact withdrawal alley (the aisle way from which compressors and converters were accessed) and a portion of the equipment for about a year and a half to evaluate the feasibility of decontamination for display;
- Inventory equipment missing from a portion of the operating floor and determine the feasibility of restoration;
- Retain the interior vault walls of the legs of the “U” for interpretative walls and landscape the area;
- Place visual indicators at the corners of the building’s footprint;
- Retain one example of each of the four sizes of diffuser/converter shells and their compressors (but not decontaminated or declassified);
- Retain the “Roosevelt Cell” and associated equipment for possible future decontamination and display;
- Retain other artifacts useful for interpretation;
- Retain Guard Portal #4, also known as K-1028-45;
- Evaluate the feasibility of retaining the chimneys as sole remnants of the S-50 thermal diffusion plant¹; and
- Collect oral histories for the ETTP site from a diverse cross-section of former employees.

The elation of preservationists over the MOA provisions was short lived. The K-25 Building stood for more than four decades without ventilation or heating; consequently its 44-acre roof had deteriorated allowing rain to pour into the building. Infiltrating water corroded internal structures, including weakening short concrete panels (slabs) making up the top (operating) floor and some of the structural pillars in the vault (basement floor). In January 2006 a BJC worker fell through the decayed operating floor. The ensuing investigations resulted in implementation of a new safety policy which dictated that no worker could enter the huge structure without stringent protective measures. This caused a substantial increase in the cost of preserving the North End. A subsequent cost analysis estimated that implementing the 2005 MOA under these conditions was \$47 million compared to the \$27 million estimated at the time of its signing. Clearly cost alone would be a deciding issue if changes were not made to the MOA.

A group of preservationists, composed of representatives from ORHPA and other interested organizations including the Washington, DC-based Atomic Heritage Foundation (AHF), was organized and led by William J. “Bill” Wilcox, under the name Partnership for K-25 Preservation (PKP). PKP began a series of meetings with museum consultants, A&E firms, and representatives of BJC to formulate a cost-effective modification of the 2005 MOA allowing all or part of the North End to be retained. Exploration of a series of options led to cost savings proposals that cut the cost estimate to approximately \$27 million.

¹ These two chimneys were torn down as soon as a feasibility study concluded that they were structurally unsound. . It is noteworthy that they were difficult to demolish.

This included replacing the “Roosevelt Cell,” which is contaminated with enriched uranium, with an identical cell from a largely uncontaminated portion of the K-27 plant that would be painted in the same way for display as a demonstration cell. In addition, the mural wall concept was reduced to a 200-foot section when it was discovered that the inner vault walls were not structural retaining walls; rather, they were integral to the building’s structure and would likely collapse during demolition activities. In February 2008, a public meeting sponsored by the LOC and ORSSAB drew approximately 150 people, the large majority of whom filled out a post-meeting survey in support of preserving a portion of the K-25 building with the plan proposed by PKP.

Despite finding strategies that brought DOE’s costs down by about \$20 million and developing a multi-year business plan, PKP was unable to convince DOE to preserve the North End. In October 2008, DOE indicated that the overall poor condition of the building and the resulting unsafe working environment, along with concerns regarding post-D&D restoration costs and ability to meet modern building codes, would make it impossible to retain any of the original K-25 building. PKP then undertook to expand its contingency plan for an interpretative center to provide as much as the visitor’s experience as possible in the absence of the North End. Their proposal detailed an on-site history center that would display Manhattan Project and Cold War equipment and artifacts from the K-25 site with an observation tower from which the delineated 44-acre footprint of the K-25 U-shaped building could be viewed (Fig. 3).



Fig. 3. The K-25 History Center as proposed by PKP would cover 46,000 square feet, have 20-ft high display galleries, and boast an observation tower. (Artist rendering courtesy of BJC)

At the March 2009 consulting parties meeting, ORO presented its new proposal for a history center to be located at the south end of the K-25 footprint at a cost of approximately \$18 million. A competing idea had been suggested, but was rejected by DOE ORO for an unmanned display at the ETTP site with the majority of interpretive materials to be housed and displayed at the downtown American Museum of Science and Energy (AMSE).² A couple of the consulting parties continue to promote this option.

In June 2009 DOE released “Explanation of Inability to Implement Certain Memorandum of Agreement Stipulations In the March 2005 MOA” which listed three major items that DOE could no longer accomplish:

- Retention of the North End of the K-25 Building,
- Retention of the upper 10 feet of the interior vault walls, and
- Salvaging the "Roosevelt Cell" and associated equipment.

² However, AMSE Foundation leadership has endorsed PKP’s proposal for a manned history center at the K-25 site.

DOE has stated its preference to pursue a course largely based on PKP's proposal and has solicited comments from the consulting parties. In October ORO's Assistant Manager for Environmental Management—the key decision maker—left DOE for a position with the Tennessee Valley Authority. His replacement will have the opportunity to bring this difficult seven-year Section 106 process to a final and successful—though by no means preordained—conclusion. As of early 2010, a MOA is yet to be finalized outlining the siting, scope, and nature of historic interpretation of K-25.

NATIONAL PARK SERVICE SPECIAL RESOURCE STUDY

While consultations and meetings continued in Oak Ridge, the Manhattan Project National Historical Park Study Act was passed in September 2004 (a year after being introduced). This bill authorized the Department of the Interior to undertake a Special Resource Study of four Manhattan Project sites—Oak Ridge, Tennessee; Hanford, Washington; Los Alamos, New Mexico, And Dayton, Ohio. This study explored the feasibility and desirability of creating a National Historical Park of the Manhattan Project with interpretations at each of those locations, and perhaps others under the guidance and in partnership with the DOE or other entities. Public scoping meetings took place in 2006.

The results of the Special Resource Study were finally released to the public in December 2009. The National Park Service (NPS) chose a preferred alternative not previously discussed, to designate an area at Los Alamos, New Mexico, as the Manhattan Project National Historical Park. The other sites under consideration could be associated with the park, although they would not formally be a part of it [3]. This alternative is expected to generate opposition in Oak Ridge, where preservationists had hoped to strengthen their efforts to preserve and interpret Manhattan Project facilities as part of a NPS unit. Public hearings were scheduled in the four cities and Washington, DC, in January and February. The comment period is to close in mid-March 2010.

D&D ACTIVITIES AT K-25

Federal agencies are required to finish Section 106 review before project funds are approved or permits issued. They must not take any actions that would preclude consideration of the full range of alternatives to avoid or minimize harm to historic properties before Section 106 review is complete [1]. DOE has followed this guidance, carefully walling off any unauthorized modification or demolition action on the North End, because the Section 106 review is still in progress.

Work on K-25 preliminary to D&D began soon after approval of the 2005 MOA. This included actions to improve worker safety, such as stripping the “cosmetic” transite siding off of the building, which permitted air to circulate and reduced worker exposure to mold and mildew. In preparation for final disposition, the processing equipment was injected with foam to stabilize the remnant deposits of enriched uranium within the pipes and converters and eliminate the possibility of a criticality accident during demolition activities. No pre-demolition work (such as transite removal) was done on the North End that would not otherwise have been undertaken as part of preservation activities.

As the Section 106 consultation process dragged on, BJC began to pressure DOE to allow demolition work to begin on K-25. The other D&D and demolition projects on site were largely complete, and K-25 stood as the highest priority of the remaining gaseous diffusion facilities. It was determined that the West Leg could be demolished, as allowed by the signed 2005 MOA. Uncertainty about the structural stability of the building as a whole necessitated that it be severed from the North End if preservation was to remain an option. Needing to prepare for the scheduled start of demolition on the West Leg, BJC put forth a proposal to surgically cut the bridge linking the West Leg and the North End in order to provide access. This would allow the North End to be severed from the leg undergoing demolition work while historic preservation negotiations continued. However, due to the complexity of the structure and degree of

specialized dismantlement, the price tag was significantly more costly than it would have been for demolishing the bridge using standard methods. Demolition on the West Leg began in December 2008 (Fig. 4).



Fig. 4. Demolition of the West Leg exposes a cross-section of the K-25 Building. From bottom: vault, enrichment-cell level, pipe gallery and operating floor. (Photo courtesy of BJC)

LESSONS LEARNED

The process of navigating the consultation for historic preservation and interpretation of the K-25 Building has been instructive. It has taken significantly more time and resources than imagined at the outset. Delayed implementation of the NHPA Section 106 process impacted the timing and cost of the demolition work, as exemplified by the additional expense to separate the North End from the West Leg.

Had DOE convened a panel of interested and knowledgeable stakeholders to evaluate K-25 during initial consideration of D&D, then public opinion could have been engaged and the desire to retain a portion of the building supported with measures to prevent further deterioration of the building. In fact, this deterioration—which accelerated appreciably in the last decade—not only eliminated the possibility of preserving for posterity any portion of an engineering marvel that contributed to arguably the most significant event of the 20th century, but it also created a huge safety challenge for the D&D project and escalated the original D&D cost estimate for the K-25/K-27 project to over \$800 million.

REFERENCES

1. Advisory Council on Historic Preservation, "Protecting Historic Properties: A Citizen's Guide to Section 106 Review" (2002).
2. Advisory Council on Historic Preservation, "Recommendations and Preservation Options for Manhattan Project Signature Facilities on Oak Ridge and Hanford Reservations", Final Report, (2001).
3. National Park Service, "Manhattan Project Sites", Draft Special Resource Study/Environmental Assessment (2009)