NATIONAL HISTORIC PRESERVATION ACT
HISTORIC PRESERVATION PLAN

OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE

Prepared For

UT-Battelle, LLC

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LIST OF ACRONYMS FREQUENTLY USED IN REPORT

AEC	Atomic Energy Commission
AHPA	Archaeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
AMSE	American Museum of Science and Energy
ANP	Aircraft Nuclear Propulsion
ARE	Aircraft Reactor Experiment
ARPA	Archaeological Resource Protection Act
BJC	Bechtel Jacobs Company LLC
BSR	Bulk Shielding Reactor
CAIS	Condition Assessment Information System
CAS	Condition Assessment Survey
CC&C	Carbide & Carbon Chemicals Company
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CEW	Clinton Engineer Works
CLG	Certified Local Government
Corps	U.S. Army Corps of Engineers
Council	Advisory Council on Historic Preservation
CRMP	Cultural Resource Management Plan
CROET	Community Reuse Organization of East Tennessee
D&D	Decontamination & Decommission
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	DOE Office of Environmental Management
ERDA	Energy Research and Development Administration
ETTP	East Tennessee Technology Park
FLPMA	Federal Land Policy & Management Act
FRP	Facilities Revitalization Project
HPP	Historic Preservation Plan
LITR	Low Intensity Testing Reactor
MED	Manhattan Engineering District
MIT	Massachusetts Institute of Technology
MMES	Martin Marietta Energy Systems, Inc.
MOA	Memorandum of Agreement
MTR	Materials Testing Reactor
NAGPRA	Native American Graves and Repatriation Act
NASA	National Aeronautics Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NE	Nuclear Energy
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NNSA	National Nuclear Security Administration
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWC	Nuclear Weapons Complex

ORACLE	Oak Ridge Automatic Computer and Logical Engine
ORAU	Oak Ridge Associated Universities
ORIC	Oak Ridge Isochronous Cyclotron
ORINS	Oak Ridge Institute of Nuclear Studies
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
ORSORT	Oak Ridge School of Reactor Technology
OSHA	Occupational Safety and Health Act
PA	Programmatic Agreement
PCB	Polychlorinated Biphenyl
PBCUA	Public Buildings Cooperative Use Act of 1976
R&D	Research & Development
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision for Interim Actions
SC	DOE Office of Science and Energy
SHPO	State Historic Preservation Officer
S&M	Surveillance & Maintenance
SWSA	Solid Waste Storage Area
TSF	Tower Shielding Facility
TVA	Tennessee Valley Authority
UT-B	UT-Battelle, LLC
Y-12	Y-12 National Security Complex

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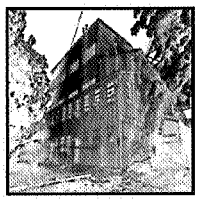


1.0. MANAGEMENT SUMMARY

Oak Ridge National Laboratory (ORNL) is one of the three major U.S. Department of Energy (DOE) research and development installations located on the Oak Ridge Reservation (ORR) in Anderson and Roane Counties, Tennessee. The other two DOE installations on the ORR are the Y-12 National Security Complex (Y-12) and the East Tennessee Technology Park (ETTP). The DOE Office of Science and Energy (SC) is the landlord agency having the responsibility for ORNL. UT-Battelle, LLC (UT-B) manages ORNL for DOE. The National Nuclear Security Administration (NNSA), a quasi-independent agency also within the DOE, is the landlord for Y-12, which is managed by BWXT Y-12, LLC. DOE Office of Environmental Management (EM) is the landlord for ETTP, which is managed by the Bechtel Jacobs Company LLC (BJC). DOE Offices of SC, EM, and Nuclear Energy (NE) have ongoing missions on the ORNL campus.

The National Historic Preservation Act (NHPA) of 1966 requires every Federal agency to examine its undertakings and their effect on historic properties. It also requires every Federal agency to assume responsibility for preserving historic properties under its jurisdiction. As part of meeting the requirements of the NHPA, an intensive architectural and historic survey of the ORNL complex was completed in December 1993 (final version, January 1994). The results of this survey were presented in the report "Architectural/Historical Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee." The report details buildings and sites with the potential for listing on the National Register of Historic Places (NRHP). The Tennessee Historical Commission State Historic Preservation Office (SHPO) reviewed the report and concurred with its findings. This report documented that seventy-seven (77) buildings and structures at ORNL were found to be NRHP-eligible. The report recommended boundaries for the ORNL Historic District. One building within the NRHP-eligible historic district, the Graphite Reactor (Building 3001), is currently listed in the NRHP. The Graphite Reactor operated between 1943 and 1963 and was designated a National Historic Landmark (NHL) by the National Park Service (NPS) in 1966. Northeast of the ORNL main facilities complex is the New Bethel Baptist Church and associated cemetery (Building 0903), which is also included in the NRHP.

To better fulfill the requirements of the NHPA, DOE Oak Ridge Operations (ORO) (including the Offices of SC, EM, and NE) has committed to the development of historic preservation plans for ORNL and Y-12. The ORNL Historic Preservation Plan (HPP) defines the preservation strategy for the ORNL and will direct efficient compliance with the NHPA and federal archaeological protection legislation at ORNL as DOE continues mission activities of the site. The HPP is directed at all historic properties at the ORNL installation. Each ORR entity that has ongoing missions at the site (DOE Offices of SC, NE, and EM) as well as the respective operating and integrating contractors, UT-B and BJC, have participated in the development of this plan and will be committed to the ORNL historic preservation program as described in the plan. The HPP seeks to find a rational approach to balance ORNL obligations for historic and archeological protection while completing site mission activities, including removal of obsolete or contaminated facilities, adaptive reuse of existing facilities whenever feasible, and construction of new facilities in order to meet site mission needs. The HPP consists of management recommendations, information

about the history of ORNL, an inventory of NRHP-eligible properties at ORNL, and procedures for their effective management.

Within the HPP is an analysis of all foreseeable DOE undertakings (projects and programs) that are likely to have an effect on ORNL historic properties over the next several years. Standard operating procedures for the timely review of these effects and coordination with the Tennessee SHPO are provided. Additionally, responsibilities and a timetable for review by DOE, the Tennessee SHPO, and the Advisory Council on Historic Preservation (Council) will be defined in a Programmatic Agreement (PA) that will be developed based on the HPP.

The ORNL historic preservation strategy is to ensure that historic preservation is an integral part of the comprehensive planning process. As a part of this preservation strategy and based on the dynamics of ORNL's planning efforts over the next five years, ORNL's existing historic properties have been categorized into the following four groups: (1) Future Mission Need, (2) Future Mission Need Uncertain, (3) Excess to Mission Need, and (4) NHL Status. Implementation of the ORNL historic preservation strategy will be accomplished through the combined application of historic preservation interpretive initiatives and the physical preservation of historic properties. Physical preservation will be evaluated in the context of, but not necessarily limited to, continuing mission need, functional use, and economic considerations. This strategy recognizes that historic preservation must go beyond the preservation of physical structures - principally due to the long-range need to modernize the installation and consolidate staff and programs. The historic preservation strategy addresses the need to preserve more global historic features. A key component of properly protecting ORNL's historic features will involve performing a set of interpretive initiatives designed to comprehensively document ORNL's historical significance. These interpretive initiatives, which will be described in detail in the forthcoming ORNL Interpretive Plan, will specifically address each of the following important elements:

- Interpretive effort to preserve the historic integrity and character of the ORNL Historic District. This effort will address the construction of the X-10 site as part of the Manhattan Project and the development of ORNL as a national laboratory.

- Interpretive effort to capture ORNL's historic missions, products, and people. The focus of this effort will not be on physical facilities but on ORNL's historic research programs and operations; its evolution as a national laboratory; and the scientists, staff, and other people associated with the site.

- Interpretive effort to document the significant features of each of the ORNL historic properties (buildings) that are to be demolished, using a graded approach consistent with the degree of historic significance:

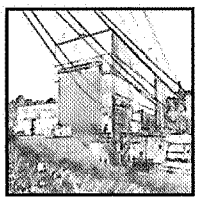
    - Facilities of Minor Historic Significance

    - Facilities of Moderate Historic Significance

    - Facilities of Major Historic Significance

For future mitigation purposes and to preserve ORNL's unique history for the public, ORNL's Interpretive Plan will also highlight its signature facility. This detailed interpretive plan will be developed and in place by the end of the year 2007.

ORNL possesses an important heritage in the history of the development of atomic weaponry and nuclear science and energy. Protection and management of this heritage requires careful planning and coordination. Recommendations from the HPP will be incorporated within future master planning documents for the installation. ORNL will complete an oral history program of current and former employees to document the site's World War II and Cold War history by the end of the year 2005. ORNL will also conduct and prepare an inventory report and assessment of its historic machinery and equipment no later than the end of the year 2007. The HPP will be reviewed and updated every five years.



2.0. PURPOSE and INTRODUCTION

2.1. Historic Preservation Plan Approach

The HPP recognizes that the ORNL is a vital and long-term component of DOE ORO. In addition to SC missions, NE and EM have properties located at ORNL that must be taken into consideration. The HPP also recognizes that the challenge for cultural resource management is incorporating the requirements of DOE Offices of SC, NE, and EM missions while preserving and protecting its historic resources. The HPP seeks to find a rational approach to balance ORNL obligations for historic and archeological protection while completing site mission activities, including removal of obsolete or contaminated facilities, adaptive reuse of existing facilities whenever feasible, and construction of new facilities in order to meet site mission needs. The ORNL HPP defines the preservation strategy for the main site of the ORNL and will direct efficient compliance with the NHPA and federal archaeological protection legislation at ORNL as DOE Offices of SC, NE, and EM continue mission activities of the site.

2.2. Historic Preservation Plan Objectives

The HPP is designed to provide the following information:

- An overview of the historic properties at ORNL;
- The legal obligations of DOE (SC, NE, and EM) to protect and manage historic and archeological properties;
- Procedures for the identification, evaluation and protection of cultural resources and assurances that such procedures are completed in a timely manner;
- Identification of all foreseeable DOE (SC, NE, and EM) undertakings over the next ten years at ORNL and their effect on historic resources;
- Determination of the level of effect(s) of ORNL activities upon historic and archaeological properties;
- Consideration of alternative actions that would avoid any adverse effects to cultural resources;
- Consideration of alternative measures to mitigate adverse effects to cultural resources such as recordation and interpretation, and;
- Outline the responsibilities of DOE (SC, NE, and EM) concerning management of historic and archaeological properties.

2.3. The Oak Ridge National Laboratory

The ORNL is one of three DOE federal facilities that comprise the 33,749-acre ORR in Anderson and Roane Counties in East Tennessee. The ORR also includes Y-12 and ETTP (formerly the K-25 site). The three installations are within the corporate limits of the city of Oak Ridge, Tennessee. The ORR is bordered on the north and east by the city and on the south and west by the Clinch River/Melton Hill Lake impoundment. The region's largest city, Knoxville, Tennessee, lies approximately fifteen miles east of the ORR.

ORNL's main site encompasses approximately 1100 acres in Bethel and Melton Valleys, with additional facilities located on the adjacent Copper Ridge. ORNL also occupies space at Y-12. The ORNL HPP is site specific to ORNL's main campus in Bethel and Melton Valleys and Copper Ridge. What is now ORNL originally developed in the early 1940s as part of the Manhattan Project, the U.S. government's top secret effort to build the world's first atomic bomb. Code-named X-10, the installation's dominant function during this period was the production of plutonium, a major component of atomic weapons. The site was chosen primarily for the area's hilly terrain. The interlocking ridge and valley system would confine the devastating results of an explosion, should one accidentally occur. The site was also located near required rail transportation and extensive water and power sources.

Following World War II, the site became a national laboratory (ORNL) and emerged as a nuclear research facility with a primary directive for research in the peaceful application of nuclear power. ORNL's mission evolved to include various energy production and conservation technologies, physical and life sciences, scientific and technological user facilities, environmental protection and waste management, science and technology transfer, and education.

A number of ORNL's buildings and structures were constructed prior to 1950 during the plant's primary role in the historic Manhattan Project. Most of the facilities have had several changes in mission over the years. Several buildings were constructed during the late 1940s and the 1950s as the site evolved as a national laboratory.

The total floor area of the main ORNL site is approximately 3.5 million square feet. SC is the landlord program office for 2,991,676 square feet of the existing ORNL floor space. The DOE EM program offices has responsibility for the remaining 482,673 square feet.

ORNL facilities are allocated building numbers using a simple geographic numbering system. Buildings are grouped within zones identified by building numbers. The main facilities complex in Bethel Valley consists of facilities in the 2000 – 5000 areas. The 900 and 1000 areas are located immediately north and west of the main complex. Immediately east of the main complex is the 6000 area, which contains the Holifield Heavy Ion Research Facility. To the east of the 6000 area is the 7000 area, which is referred to as the East Support Area.

Satellite facilities around the ORNL main complex in Bethel Valley include the White Oak Lake and Dam, which are located along State Route 95 approximately 1.5 miles southwest of the main facilities complex. The Tower Shielding Facility (7700 area) is located on the south face of Copper Ridge approximately 1.5 miles southeast of the White Oak Dam and 2.0 miles south of the ORNL main facilities complex. The Hydrofracture Facilities (7800 area) are located in Melton Valley about 0.75 mile south of the ORNL main complex. The Nuclear Safety Pilot Plant and Molten Salt Reactor Experiment Facility are both located in the 7500 area in Melton Valley along Melton Valley Drive approximately 0.5 mile south of the main ORNL complex. The High Flux Isotope Reactor Experiment Facility is located within the 7900 area in Melton Valley about

0.25 mile south of the Molten Salt Reactor Experiment Facility and about 0.75 mile south of the ORNL main complex. The Robotics and Process Systems Complex is located within the 7600 area in Melton Valley about 2.0 miles east-southeast of the ORNL main complex.

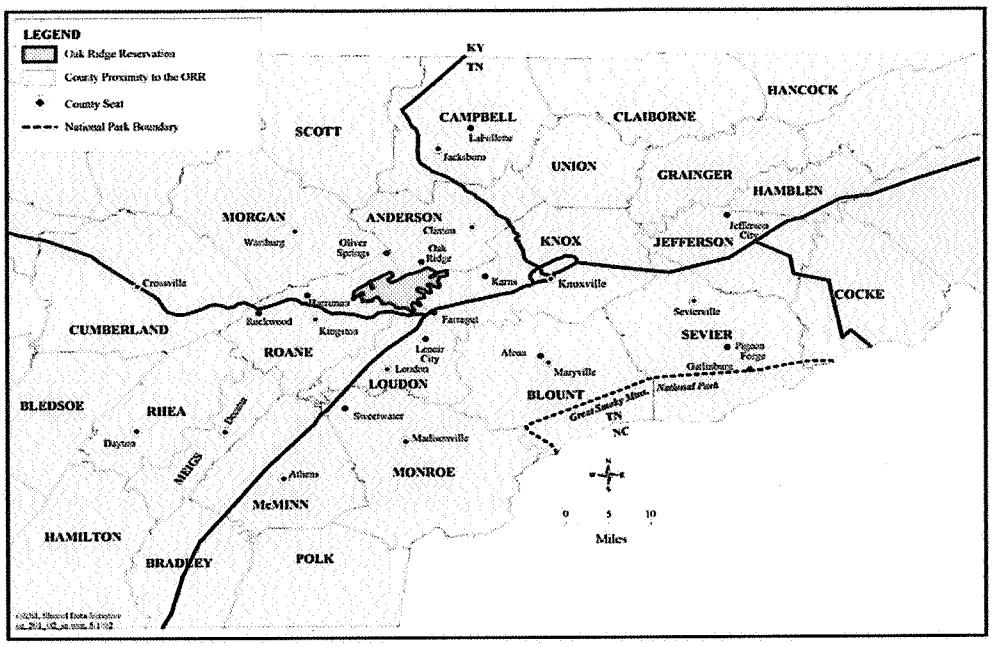


Figure 1: Location of the ORR and surrounding region.

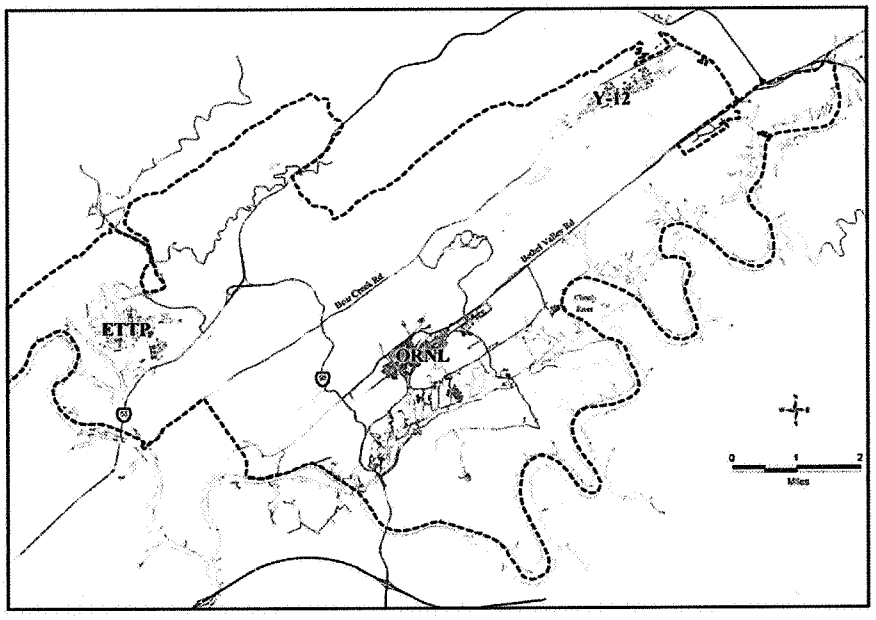


Figure 2: Location of the ORNL within the ORR.

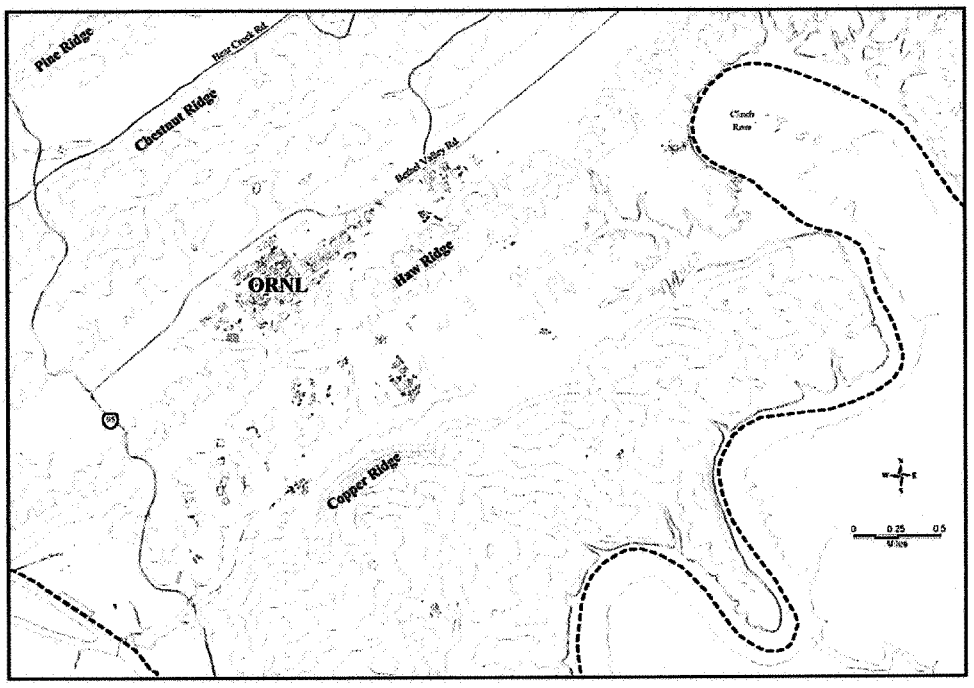


Figure 3: Location of ORNL between two ridge systems.

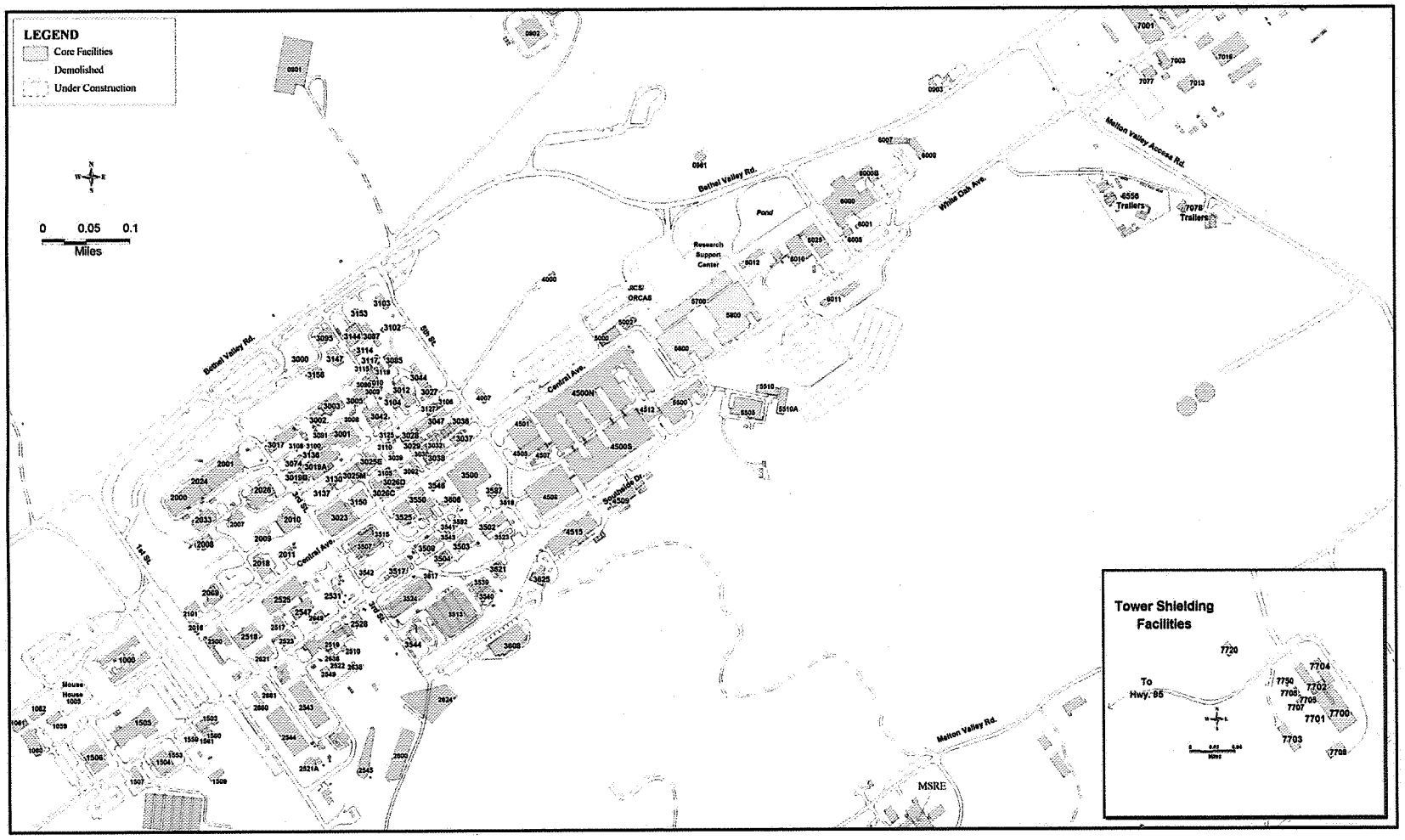


Figure 4: Site Plan of ORNL Complex

2.4. Mission Statements

Three DOE programs (SC, NE, and EM) have facility responsibilities on the ORNL site. As a Federal installation, all historic properties at ORNL must be maintained and protected regardless of which ORR entity has operational ownership of the property.

ORNL Mission: The ORNL is a multiprogram science, technology, and energy laboratory with distinctive capabilities in materials science and engineering, neutron science and technology, energy production and end-use technologies, mammalian genetics, environmental science, and scientific computing. In support of the mission of the DOE, ORNL conducts basic and applied research and development (R&D) to create scientific knowledge and technological solutions that:

*strengthen the nation's leadership in key areas of science;
*increase the availability of clean, abundant energy;
*restore and protect the environment; and
*contribute to national security

ORNL Mission Roles: As a multiprogram national laboratory, ORNL carries out R&D in support of all four of DOE's major mission areas:

1. **Science:** ORNL's R&D in science include basic energy sciences, biological and environmental research, fusion energy sciences, advanced scientific computing research, and nuclear physics.

2. **Energy Resources:** ORNL's in-house energy programs, the largest and most broadly based among the DOE national laboratories, span basic and applied research, technology development, technical assistance, and management of energy-related information.

3. **Environmental Quality:** ORNL supports the cleanup of DOE's environmental legacy through the integration of capabilities in analytical chemistry, biochemical engineering, bioremediation, biotechnology, chemical separations, earth and ecological sciences, environmental chemistry and engineering, geological sciences, instrumentation and measurement science and technology, and robotics and intelligent machines.

4. **National Nuclear Security:** ORNL contributes to DOE's mission of reducing the global nuclear danger through national nuclear security, nuclear safety, and nonproliferation efforts.

EM Mission: The Office of the Assistant Secretary for EM provides program policy development and guidance for the assessment and cleanup of inactive waste sites and facilities and waste management operations; develops and implements an aggressive applied waste research and development program to provide innovative environmental technologies to yield permanent disposal solutions at reduced costs; and oversees the transition of contaminated facilities from various Departmental programs to environmental restoration once they are determined to be surplus to their original mission. Currently, EM manages the treatment, storage, and disposal of waste generated by ORNL through the use of various facilities located on the ORNL site. EM also manages the environmental restoration of land areas and buildings under their jurisdiction located on the ORNL site.

NE Mission: The mission of the Isotope Programs in the DOE Office of NE is to maintain the infrastructure required to support the national need for a reliable supply of isotope products, services, and related technology used in medicine, industry, and research. This assures that critical isotope production infrastructure is operated in a safe, secure, environmentally compliant and cost-effective manner, thus ensuring that the facilities are available to users who need DOE-produced isotopes. This mission applies the unique expertise and capabilities of the Department to address technology issues associated with the applications, production, handling, and use of isotopes.

2.5. The National Register of Historic Places

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 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; or
Criterion D: properties that have yielded, or may be likely to yield, information about prehistory or history.

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

As a result of the 1993 Architectural and Historic Evaluation of ORNL and subsequent SHPO review, an historic district was determined eligible for listing on the NRHP. The district contained 127 buildings, of which 54 currently are considered to be contributing to the district. An additional 11 buildings located outside the historic district in outlying areas of the ORNL were found to be individually eligible for the NRHP.

Generally, properties that are less than fifty years old are excluded from listing on the NRHP. However, NRHP Criteria Consideration G allows the listing of a property that is less than fifty years old if it has exceptional importance. The NRHP-eligible ORNL Historic District has a period of significance to 1957. Although this date exceeds the fifty-year benchmark, it reflects the ending of the initial development of ORNL, the closure of the Aircraft Nuclear Propulsion Project, a significant research program at ORNL, and the end of certain national trends in scientific research. The contributing buildings within the historic district and the eleven individually NRHP-eligible buildings meet the requirements of NRHP Criteria Consideration G for exceptional significance for properties less than fifty years of age.

2.6. National Historic Landmarks

NRHP properties that hold exceptional national significance are designated as NHLs by the Secretary of the Interior. These properties represent the nation's most important historic and cultural resources. NHL designation is given to buildings, sites, structures, and objects that

possess exceptional value or quality in illustrating the history and culture of the United States. The major difference between NHLs and other NRHP properties is their level of significance. NHL properties must outstandingly represent or be associated with events that have made a significant contribution to broad national patterns or themes in American history, architecture, archaeology, engineering, or culture. The NPS commemorates NHL properties with a plaque that acknowledges their status as NHLs.

In 1966, the NPS designated the Graphite Reactor at ORNL (Building 3001) as a NHL. The building is within the boundaries of the NRHP-eligible ORNL Historic District and is considered a contributing building to the district. The Graphite Reactor was constructed in 1943 to produce plutonium for research on the production of the world's first atomic bomb. The Graphite Reactor produced the world's first gram quantities of plutonium and later was used for the highly significant radioisotope production for medical and biological research. The building received NHL status for its role in the nationally significant Manhattan Project and the pioneering efforts in the production of plutonium and stabilized isotopes for research.

2.7. The Department of Energy and Historic Preservation

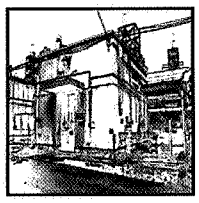
Within the past decade the DOE has worked with the Council, an independent Federal agency established under the NHPA, to identify actions to assist in the preservation of historic properties under its stewardship. The DOE worked closely with the Council to identify areas of concern and how best to integrate the responsibilities of the Agency under the NHPA. The contributions of the DOE to this process were included in the Council's report *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities* published in 1991. This report outlined the challenges facing Federal agencies such as the DOE in preserving and protecting its historic resources while at the same time meeting its missions and goals.

As a result of this report and other efforts, Federal agencies such as the DOE that operate highly scientific activities increased their communication and dialogue with state historic preservation offices and the general preservation community.

Continued focus on these efforts led to the Council's 2001 study, *Caring for the Past, Managing for the Future: Federal Stewardship and America's Historic Legacy.* This study was completed with the assistance of various Federal agencies on how the Federal Government could do a better job of preserving the historic resources it controls. The study recommended executive and legislative action to remedy many of the problems identified in the government's historic building management. One of the partners in this study was the DOE, and several of the Council's policy and program recommendations for the DOE are relevant to the ORNL HPP.

2.8. Summary

The mission of ORNL is to conduct basic and applied research and development to create scientific knowledge and technological solutions to strengthen the nation's leadership in key areas of science, increase the availability of clean, abundant energy, restore and protect the environment, and contribute to national security. The responsibilities of this mission are set within an historic environment. The need to fully assess the historic significance of this environment and conduct preservation efforts in accordance with the NHPA is recognized by the DOE. Protection and management of this heritage requires careful planning and coordination. The goals and objectives of the HPP is to provide guidelines and procedures so that the missions and goals of DOE Offices of SC, NE, and EM can be achieved without undue delay, while preserving and maintaining its historic resources.



3.0 ORNL HISTORICAL OVERVIEW

3.1. Previous Studies at ORNL

Information on the history and cultural resources of ORNL is located in various publications and reports. Repositories containing this documentation include the Tennessee State Library and Archives, the Oak Ridge Public Library, and the office of the National Environmental Policy Act (NEPA)/NHPA Coordinator at ORNL.

ORNL Division histories were prepared as part of ORNL's fiftieth anniversary (1943-1993), and Leland Johnson and Daniel Schaffer prepared a general history of ORNL in 1992. A three-volume history of the Atomic Energy Commission (AEC) (Hewlett and Anderson 1962; Hewlett and Duncan 1969; and Hewlett and Holl 1989) provides a general national context for the period 1939 through January 1961. The AEC volumes specifically address trends affecting nuclear research and the development of ORNL. In addition, the AEC and DOE have published several brief documents on various historical topics. However, the three-volume AEC series is the basic reference work for the period, and beyond this series, there has been little scholarly work done that provides a contextual overview of nuclear research or nuclear development facilities.

In December 1993 (final version-January 1994), DuVall & Associates, Inc., completed an architectural and historic evaluation of the ORNL complex. This report provides a comprehensive overview of the history and architectural resources of ORNL. For this project, a total of 608 properties were individually surveyed that included all of the buildings and structures located on the grounds of the ORNL campus.

A minimum of ten major archaeological reconnaissance-level surveys have been conducted on the ORR including a study by Fielder et al. (1977) that evaluated pre-World War II farmsteads. The ORNL complex contains no known archaeological sites. A study of the ORNL complex completed in the early 1990s reveals that due to previous ground disturbance the potential for preserved archaeological sites are minimal.

In 1991 the City of Oak Ridge (Townsite) engaged the preservation consulting firm of Thomason and Associates to prepare a NRHP nomination for all eligible properties within the Townsite. Thomason and Associates prepared a Multiple Property Nomination that contains a Cover Nomination for the area encompassed by the original 59,000-acre ORR (which would include the original Townsite and the three production facility sites – X-10, Y-12, and K-25). The Cover Nomination justifies three Historic Context Periods: I) Valley Before World War II, ca. 1840-1942; II) World War II Era, 1942-1945; and III) Post World War II Era, 1945-1959. However, post-World War II material in the Cover Nomination primarily deals with the Townsite rather than the Manhattan Project industrial complexes.

3.2. Historic Context – Overview

What is now ORNL originally developed in the early 1940s as part of the World War II Manhattan Project, the U.S. government's top secret effort to build the world's first atomic bomb. Code named X-10, the site's original mission was the production and separation of plutonium for the development of nuclear weapons. The site contained the prototype graphite reactor that produced the world's first gram quantities of plutonium. The plant and its mission were top secret and worked in concert with two other DOE facilities, K-25 and Y-12, the three of which comprised the ORR. The nation's top physicists worked at the ORR facilities. The nearby town of Oak Ridge was built to house employees of the facilities, which numbered in the thousands. The plutonium produced at X-10 was used for research on the production of the world's first atomic bomb. The U.S. dropped the atomic bomb "Fat Man" on the city of Nagasaki, Japan on August 9, 1945. The bombing led to Japan's surrender and the subsequent end of World War II.

Following World War II, the AEC was formed and management of the ORR, including the X-10 installation, was contracted to private companies. Monsanto Chemical Company assumed management of the X-10 site in 1945 as a research center. Carbide and Carbon Chemicals Corporation (C&CC), later renamed Union Carbide Corporation, operated the plant beginning March 1, 1948, and the site name was changed to the ORNL. Research focus at the site included reactor development, the production of radioactive isotopes for experimental purposes, the recovery of large amounts of uranium from the extraction wastes being held in storage, and the investigation of the effects of radiation on animals.

Management of ORNL was transferred to Martin Marietta Energy Systems, Inc. (MMES, later known as Lockheed-Martin), in 1984. Ongoing missions at ORNL include energy production and conservation technologies, physical and life sciences, scientific and technological user facilities, environmental protection and waste management, science and technology transfer, and education. UT-B assumed management of ORNL facilities in April 2000.

3.3. The Emergence of Atomic Energy

The development of atomic 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."[1]

There are three isotopes of uranium, a naturally occurring element found in the earth. All three of these isotopes have ninety-two (92) protons and ninety-two (92) electrons, but each has a different number of neutrons and thus a different atomic weight. Uranium-238 (U-238) has 146 neutrons and is the heaviest of the three isotopes. It accounts for over 99% of natural uranium. Uranium-235 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.[2] This

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[1] F.G. Gosling, "The Manhattan Project: Making the Atomic Bomb," (United States Department of Energy, September 1994), 1.

[2] Ibid.

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, Italian scientist Enrico Fermi bombarded elements with neutrons instead. In 1939, Berlin radiochemists Fritz Strassman and Otto Hahn 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."[3] The end products weighed less than the original uranium, therefore, using 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 creating energy is called fission.

During the fission process neutrons are released. If they collide with other 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."[4] The binding energy of the nucleus so released would be tremendous, ten million times larger than the energy released by chemical reactions.[5]

In the first week of January 1939, Strassman and Hahn announced that the nucleus of the uranium atom could be caused to split or fission by bombardment with neutrons. This discovery was confirmed by laboratories around the world, including four in the U.S.[6] 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 the race to build the first atomic bomb began.

By spring of 1939, scientists researching at Columbia University made advances toward creating a chain reaction. As scientists grasped possibilities, they began to seek a practical demonstration, an experiment far too costly for any team then researching the topic. The concept of forcing billions of atoms to fission in the blinking of an eye was beyond comprehension. Enrico Fermi, Leo Szilard and other leading scientists worked feverishly to stir interest from the United States government. Although they were successful in generating interest they received no funding.

Szilard sought advice, and solace, from Eugene P. Wigner, a physicist then teaching at Princeton. Finding themselves in complete agreement, Wigner and Szilard decided President Franklin D. Roosevelt should be contacted without further delay. Through mutual friends, they involved Alexander Sachs, a financier who grasped the issue at hand and could speak with confidence to the President. The men enlisted the help of Albert Einstein, who prepared a letter to the president regarding the implications of this scientific development.

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[3] Ibid., 2.

[4] Ibid.

[5] Jonathan Logan, "The Critical Mass," *American Scientist* (May-June 1996), 264.

[6] Henry D. Smyth, *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb Under the Auspices of the United States Government, 1940-1945.* (Princeton, NJ: Princeton University Press, 1945), 25.

Before this document could be composed, war broke out in Europe. Sachs finally met with Roosevelt on October 11, 1939. Sachs, who thoroughly understood theoretical science, read Einstein's letter to Roosevelt. Sachs and Roosevelt knew one another well, and Roosevelt was impressed not only with his friend's dedication but also with Einstein's endorsement. Roosevelt readily understood the letter's urgent tone and ordered Major General Edwin M. "Pa" Watson to look into the matter.[7] In October 1940, Roosevelt organized a committee charged with managing theoretical scientific experimentation, which approved $6,000 for uranium fission research. The Japanese attack on Pearl Harbor in December 1941 brought the United States into World War II, and the urgency to develop atomic power intensified.

On December 2, 1942, scientists working at the University of Chicago under the direction of Arthur Compton attempted a controlled nuclear reaction by specifically arranging tons of uranium and graphite. The experiment, which was conducted on a squash court located beneath the university's football stadium, proved successful.[8] From this experiment scientists learned precepts fundamental to understanding fission research:

Two fissionable materials, plutonium-239 and uranium-235 could create an explosion;

* In the early developmental stages, the core mechanism could be assembled and prepared for aircraft delivery;

* Plutonium could be created in a chain reaction and separated through chemical means.

3.3. The Manhattan Project

In response to the need for atomic research, the United States government initiated the Manhattan Project, a top secret effort to develop nuclear weapons. Security demands placed the atomic research program within military perimeters, and construction requirements positioned the program within the bounds of the U.S. Army Corps of Engineers (Corps).

The Corps was responsible for the project and establishing sites for uranium separation and the production of plutonium, which also had the ability to create an explosion. As scientific investigation moved forward, the Corps began seeking sites for uranium separation and plutonium production in earnest. A remote inland site with abundant water and electrical power was required. Army guidelines for location munitions facilities were specific stipulating they be located beyond reach of enemy aircraft, between the Rockies and Appalachians, and within 200 miles from U.S., Canadian, and Mexican borders.

In an attempt to aid construction and security requirements, the Army initially planned that all manufacturing facilities would be constructed in a single installation. The need for acquiring thousands of acres became readily apparent. Site requirements involved constructing a town for the thousands of workers needed for the project's construction and plant production phases. And requirements for the installation were specific. The site must be isolated and located in a moderate climate permitting year-round construction. A steady supply of workers was vital as was access to both motor and railroad transportation systems. The terrain must be composed of an

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[7]C. Allardice and E.R. Trapnell, *The Atomic Energy Commission* (New York and Washington: Praeger Publishers, 1974), 6-7.

[8]Ibid., 11.

interlocking ridge and valley system confining the devastating results of an explosion should one accidentally occur. In the best of all possible worlds, the Corps sought a remote location comprised for four isolated areas within a single, larger boundary.[9]

In April 1942, representative officials traveled to East Tennessee and identified a possible site between the rural communities of Clinton and Kingston. The area met transportation, water, and electrical criteria as this region of Tennessee bordered the Clinch River, was served by two railroads, and was within easy reach of the Tennessee Valley Authority's (TVA) electrical power. Compton perused the site, approved all he saw, and visited TVA chairman David Lilienthal.

Lilienthal was frankly dismayed. "We didn't want them to take over such vast areas of land of such fertility, and tried to get them to consider western Kentucky."[10] Compton steadfastly refused to consider Lilienthal's recommendations and suggested land could be acquired through the courts. Lilienthal's desire to press his cause was discouraged, and the military ultimately had its way.

The Army initially appointed Colonel James C. Marshall as construction and administrative head of the project, but in September, Colonel Leslie R. Groves replaced Marshall, who was reassigned as District Engineer. The Corps was responsible for site selection, plant design, construction and management of project facilities. Commanded by the army, an oversight committee comprised of scientists, named S-1, would govern research and experimental work. Within forty-eight hours of his appointment, Groves moved to acquire land in East Tennessee and obtained AAA priority ranking.[11]

The original code name assigned the effort was Laboratory for the Development of Substitute Materials, or DSM. Groves, however, did not care for the name and "demurred on the grounds of security, feeling the name was bound to arouse curiosity."[12] Ordinarily, Corps districts were named for their host city. Groves and Marshall followed this course, naming the effort "Manhattan" for the city in which Marshall originally had established headquarters.

The Manhattan Engineer District (MED) was formed on August 16, 1942. In very real terms, the MED was a nationally based district whose offices were scattered throughout the United States. The installation eventually formed by the Corps in East Tennessee was but one component of a multi-faceted "team." Research moved at a feverish pace 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 players. More than twenty firms were involved in research design and in resolving production problems for the Tennessee based plants.

As the Corps continued its search for plant site(s), scientists throughout the nation raced to establish their institution as the project's research base and to complete the American effort ahead

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[9]V.C. Jones, *Manhattan: The Army and the Atomic Bomb*, (Washington, DC: Center of Military History, United States Army, 1985), 46.

[10]D. Lilienthal, The Journals of David E. Lilienthal, (1964), 1.

[11]Jones, 603; F.G. Gosling, *The Manhattan Project: Science in the Second War* (Washington, DC: U.S. Department of Energy, 1990), 12-14; G.O. Robinson, *The Oak Ridge Story* (Kingsport, TN: Southern Publishers, 1950), 42.

[12]L.R. Groves, *Now It Can Be Told* (New York: Harper and Brothers, 1962), 13.

of Germany. Competition accelerated as scientists and engineers sought to prove their methodology the most beneficial.[13] Two routes to producing the bomb were undertaken, the uranium route and plutonium route. Neither approach had ever been tried before, both were full of tremendous uncertainties, but each offered some possibility of success. It was felt certain the Germans were working on one or both approaches and might have had a head start.

It was discovered early on that the fission in uranium was occurring primarily in uranium atoms of the light isotope, the form of the uranium atom in nature that has an atomic weight of 235 rather than 238. Unfortunately, only 7 atoms out of 1000 in nature are the U-235 form (0.7115%) and they behave identically in chemical reactions so separation can only be effected by physical means taking advantage of the very small differences in mass or in the average behavior of molecules. Scientific studies revealed various possible approaches for separating the uranium isotopes: gas centrifuge, gaseous diffusion, thermal diffusion, photochemical, and electromagnetic. Scientists and engineers debated which process would be ultimately successful and did not hesitate to request changes to process methodology or plant construction. The choice was narrowed in late 1942 to two methods, the electromagnetic process and the gaseous diffusion process. No one had ever separated uranium isotopes in any but micro-lab-scale quantities.

Ultimately, the Manhattan Project's core sites came to consist of three separate installations: the Clinton Engineer Works (CEW or ORR, Oak Ridge, Tennessee), code named "Site X"; the Hanford Site (Hanford, Washington), code named "Site W"; and the Los Alamos Laboratory (Los Alamos, New Mexico), code named "Site Y." The three sites developed simultaneously. The CEW focused on uranium enrichment and the Hanford Site produced plutonium. "Site Y," the Los Alamos Laboratory, was responsible for the design and assembling of nuclear weapons. This isolated site was the most secret of the three installations. Many of the nation's premier scientists came to live and work at Los Alamos, where the uranium based implosion device "Little Boy" and the plutonium based "Fat Man," the world's first atomic weapons, were developed.

3.4. The Oak Ridge Reservation (Clinton Engineer Works)

The proposed ORR site was located thirty-five miles west of Knoxville, Tennessee, in an area bordered by the Clinch River and a craggy mountain range known as Black Oak Ridge. The region was roughly rectangular and almost divided in half by the Roane-Anderson County line. Three distinct valleys, fixed on a northeast course were located here. Each valley was bisected by a road running through the valley floor and connected to its neighbors by narrow roads running across the mountains.[14] The reservation was first known through the code name "Kingston Demolition Range" after Kingston, Tennessee, the town located south of the reservation. The reservation was soon renamed "Clinton Engineer Works" after Clinton, Tennessee, the town located to the reservation's north. The site is now known as the ORR.

The ORR had four components: the graphite pile (reactor), code named X-10 (present day ORNL); the electromagnetic plant, code named Y-12; the gaseous diffusion plant, code named K-25; and the Townsite or residential portion along Black Oak Ridge, named Oak Ridge. In April 1943, the X-10 site was officially named the Clinton Laboratories.

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[13]Gosling, 14.

[14]Robinson, 62.

From the early settlement period of the late eighteenth century through the Depression era, the residents of East Tennessee tended to be "subsistence farmers" who survived by producing crops and livestock for their own consumption. Most farmers resided within narrow valleys along the more fertile bottom lands of streams and rivers. The adjoining mountainous terrain prevented the large scale farming of cash crops such as tobacco or cotton.

Although the project would not be officially authorized by President Franklin D. Roosevelt until December 28, 1942, on October 7th of that year, the U.S. Army filed a declaration of taking in Federal Court in Knoxville. Through the War Powers Act the Corps was granted 59,000 acres of land. Originally authorized to obtain 56,200 acres in Roane and Anderson Counties, the Corps was permitted ten additional parcels bringing total acreage to 58,900.[15] The region contained four primary communities, Elza, Robertsville, Wheat, and Scarboro, each consisting of homes, schools, farms, and churches. The valleys were inhabited by those whose families had owned and farmed the same land for generations and by families who had been previously evicted from their homes due to the development of the Great Smoky Mountains National Park in 1934 and the construction of Norris Dam in 1939.[16]

Smaller communities existed within the primary communities, often named after a nearby church or school. During site preparation for X-10, some cemeteries were transferred off the ORR and added to existing cemeteries in nearby communities. But in most cases, roads were rerouted or buildings were resited in order to avoid local cemeteries, which saved construction time. The New Bethel Baptist Church and Cemetery near the X-10 site is one example. Church services continued in the building until the late 1940s. The frame building and associated cemetery have been maintained over the years and remain extant just northeast of the present-day ORNL main facilities complex. Virtually unchanged from its early 20th appearance, it remains a testament to life in Bethel Valley prior to the era of the Manhattan Project.

Roughly 1,000 families (approximately 3,000 people) were affected by the establishment of the Oak Ridge Reservation.[17] The majority believed they were substantially underpaid for their farms and addressed grievances in federal court.[18] Although local opposition was sometimes intense, residents found little outside support. A real estate office, opened to purchase land through condemnation, secured clear title.

Crops were ripening in the fields, and hay was freshly stored when federal agents covered the region. Pounding on doors they noted the War Powers Act, notifying farming families that the government was acquiring property. Landowners were told they had thirty days to vacate, and that the price of land - an average of $56 an acre - was non-negotiable. Finding no one at home, notices were nailed directly on the dwellings. In some instances, farming families were given two weeks notice. There were cases of families who were packing household goods while crews began tearing at the roof of their homes. The Army's eviction and relocation practices did not

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[15]Jones, 320.

[16]J.A. Young, "An Historical View of Oak Ridge: The Pre-Oak Ridge Communities and Katy's Kitchen," (Oak Ridge Public Library, Oak Ridge Room, n.d.), 6.

[17]J. Overholt, ed. "These Are Our Voices, The Story of Oak Ridge 1942-1970." (Oak Ridge, TN: Children's Museum of Oak Ridge, 1987), 102.

[18]Jones, 324.

include relocation costs and required that property owners not be paid until the family vacated the premises. There were instances of compensation arriving six months after property condemnation.[19] Residents began leaving by the end of November. Numbered among them were those who hoped their loss would contribute to winning the war.

Land was quickly accrued. The Army lost no time in clearing the site, and demolished many farm related buildings. When possible, existing buildings were utilized with approximately 180 pre-Manhattan era dwellings incorporated in the Corps' overall scheme. Laboratory and processing spaces were desperately needed.

At the X-10 site, a functioning model of the Chicago graphite pile (reactor) was erected to provide design criterion for Hanford's production plant. In addition, the MED erected the following at Oak Ridge:

* An electromagnetic plant, costing $300 million to construct and $177 million to operate (Y-12). This plant would generate the first weapons grade uranium provided to the laboratory at Los Alamos.

* A thermal diffusion plant, costing $10 million in construction expense and $5 million to operate (S-50). This facility provided feed material for another plant and made successful tandem operations possible.

* A gaseous diffusion plant, costing $460 million to construct (K-25). The plant proved the most successful of the three plants despite scientific advice to the contrary.[20]

Security was tight at Oak Ridge, and with the exception of a handful of select officials, employees worked on a "need to know" basis. Information was compartmentalized within each department. Employees knew only what was necessary to complete their assigned portion of the work. While many workers held slight notions about the type work they were doing, the vast majority learned of their role from radio broadcasts following the bombing of Hiroshima.[21]

The 92 square mile reservation was fenced with barbed wire salvaged from existing homesteads.[22] Security also included mounted guards who patrolled the boundary's perimeter. Seven gates allowed monitored entry to the reservation. The gates effectively separated the outside world from the world of the reservation. Once within reservation boundaries, checking stations provided additional security marking established limits between the town and each individual plant.

Beginning in early 1942, the Boston based architectural firm of Skidmore, Owings, and Merril prepared detailed plans for the town of Oak Ridge. The community would occupy the northern edge of hilly Black Oak Ridge. Originally intended to house approximately 13,000 workers, Oak

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[19]Young, 4.

[20]Allardice and Trapnell, 17.

[21]Overholt, 91-92, 149.

[22]C.W. Johnson and C.O. Jackson, *City Behind a Fence: Oak Ridge, Tennessee, 1942-1946* (Knoxville: The University of Tennessee Press, 1981), 10.

Ridge's population peaked at 75,000.[23] In time the Townsite came to contain a post office, supermarkets, drugstores, shops, churches, nurseries, movie theaters, cafeterias, laundries, a guest house/hotel, schools, a hospital, recreational facilities, trailers, hutments, barracks, dormitories, and houses. [For more information on the buildings at the Townsite, the NRHP nomination prepared in 1991 by Thomason and Associates may be consulted].

Materials and equipment were procured through purchase orders, contracts, subcontracts, and formal modifications. Material provision involved thousands of manufacturers and vendors. These came to include Du Pont, General Electric, Allis-Chalmers, and Westinghouse, as well as a number of construction subcontractors.

Contracts for design and construction were awarded, but restricted to select companies. Upon the awarding of a contract, contractors were required to isolate that portion of their plant dedicated to Manhattan Project business. No less than one hundred and nineteen (119) field inspector-expediters, twenty-six (26) schedulers, nine (9) "priority men" and eighty-five (85) field stenographers/clerks were employed to inspect and move material. In addition, eleven branch offices were opened in principal manufacturing regions across the country. Originally located in Boston, the expediting office was eventually closed and moved to Oak Ridge.[24]

3.5. X-10 (Clinton Laboratories)

The graphite reactor at X-10 was the prototype for the huge plutonium processing plant that was later built at Hanford, Washington. X-10 was the location of the first plutonium-producing graphite reactor in the world, becoming operational November 5, 1943. The plant was originally composed of over 150 buildings, including three chemistry buildings, a technical laboratory, a pile building, a physics lab, a power house, an electrical instrument development building, machine shop and research development shops, a lead shop, a medical building and several administration buildings and warehouses. Construction of the plant cost $13,000,000. In April 1943, the X-10 site was officially named the Clinton Laboratories.

Of all the possibilities available to the Military Policy Committee in 1942 as a source of atomic energy, the pile (graphite reactor) appeared to be the smallest gamble. From a military perspective, the pile would produce fissionable material and radioactive materials that might be used in chemical warfare. Scientists hoped the pile could be a potential power source in the years following the war. Given this range of choice, the Military Policy Committee pursued pile production.[25]

Unlike the gaseous diffusion (K-25) and electromagnetic (Y-12) research efforts, the pile did not focus on isotope separation. Instead, this method employed a "transmutation-chemical separation" process to manufacture plutonium. Feed material, comprised of uranium slugs (a natural element), is altered into the man-made element plutonium by permitting carbon moderators to slow neutrons. This slowing allows neutrons to escape absorption by U-238 and remain free to "penetrate" U-235. The new element, plutonium, is then divided, or separated,

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[23]Overholt, 105.

[24]*Engineering News-Record*, 13 December 1945: 125-127.

[25] Jones, 184-185.

from the uranium slug through a chemical "separation" process.[26] As the pile generated plutonium, the process established criteria for a nuclear weapon vastly different from the weapon utilizing U-235.

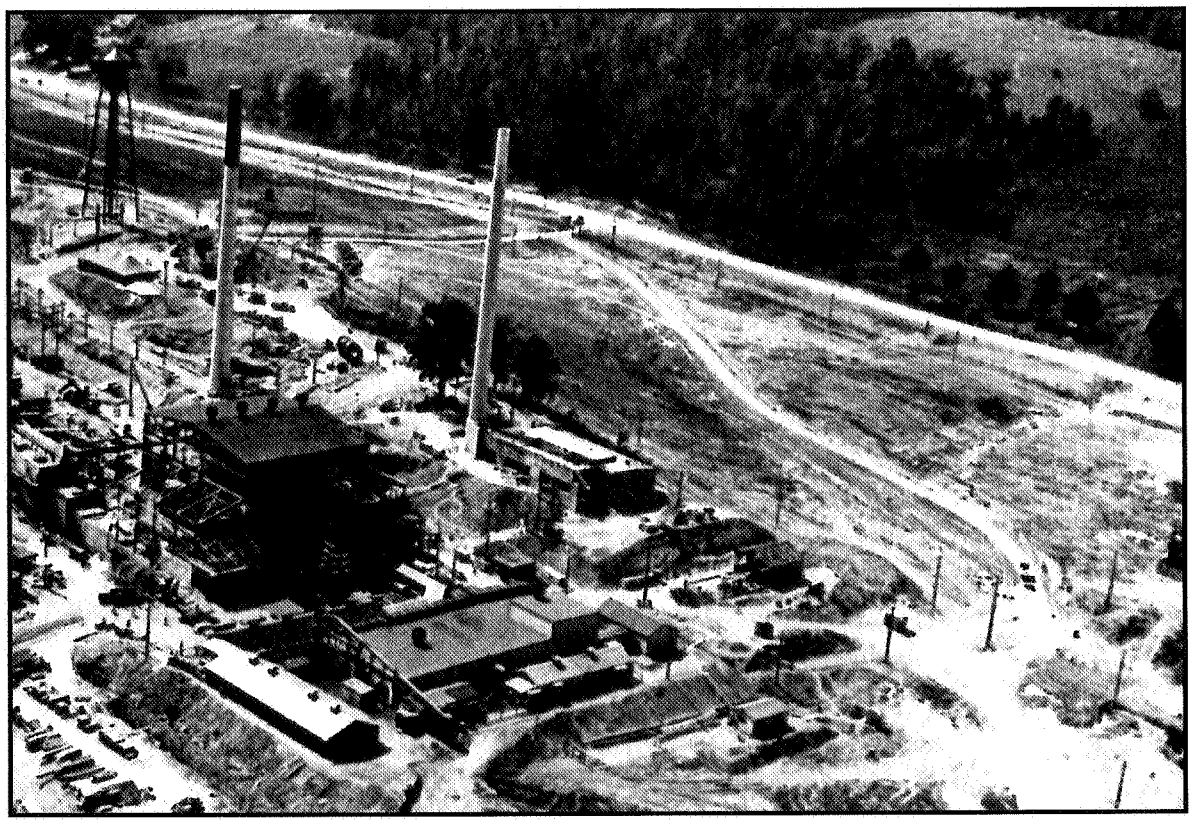

Figure 5: Construction of the X-10 site, including the Graphite Reactor, in October 1943.

The transmutation occurs in a "pile" that is a solid mass of graphite pierced at intervals by tubes that run from one side to the other. The uranium slugs are placed in these tubes in certain geometric designs. Fission in the form of a chain reaction then occurs and transmutes a small portion of the uranium into plutonium. The structure for this process was called a "pile" throughout World War II, because the structure was composed of graphite and uranium stacked or piled on top of one another in a lattice arrangement. But during the early 1950s, the term "reactor" commonly replaced the term "pile."[27]

The type of coolant used in the pile became a critical issue by 1942. "Heavy water" was a choice preferred by Compton since this form of cooling would meet moderator and cooling demands. As heavy water was not available in large quantities, scientists felt research in that direction could prove futile. Compton's desire for a "heavy water pile" prompted General Groves to promote the construction of a heavy water plant in Trail, British Columbia. Du Pont, too, encouraged Groves

[26] Robinson, 44-45.

[27] Leland Johnson and Daniel Schaffer, *Oak Ridge National Laboratory REVIEW*, (Vol. 25, No. 3 and 4), 11.

in this direction. At Du Pont's urging, General Groves complied in modifying plants for the production of heavy water. Facilities were then established at Morgantown, West Virginia, the Alabama Ordnance Works, and Wabash River, Indiana. Interest in heavy water research continued, and in 1942 the Army decided all heavy water research would be conducted at the University of Chicago. In August 1943, Groves organized a committee that reviewed the role heavy water would play in the Manhattan Project. Committee members concurred with the present course and advised continuing heavy water pile research in the event the graphite piles failed.[28]

By late 1942, the issue of coolant remained strongly undecided. Taking direction from General Groves, who was anxious to reach a decision, Compton charged Fermi with building a low-powered graphite pile. Compton hoped the pile's construction would provide badly needed data regarding the "K" factor (the minimum number of neutrons needed to maintain fission) and demonstrate the probability of a chain reaction. Fermi began construction and located the pile beneath the West Stands of Stagg Field. On December 2, 1942, Fermi's "massive lattice pile of 400 tons of graphite, six tons of uranium metal, and fifty tons of uranium oxide, achieved the first self-sustaining chain reaction" in the world.[29] Fermi's original pile had been so modest that coolant had not been needed. The information gained regarding the "K" factor proved scientist had more latitude in selecting coolant than previously known. The possibility existed that water or even air could be employed. Design work on air-cooled pile located at Oak Ridge was advanced, and Du Pont encouraged its use rather than changing to water – a process some scientists considered more promising than air.[30]

Because scientists at the University of Chicago were most closely associated with the pile process, they strongly supported locating the proposed pile production facility near Chicago at Argonne. General Groves and S-1, however, decided that while Argonne could accommodate Fermi's smaller plant, the site was too small to permit construction of the pilot facility, and Oak Ridge was selected instead. After this decision was made, Groves realized the ORR was too small to base all production facilities there. Thus, the full-scale plutonium plant was scheduled for Hanford, Washington. Consequently, the pilot-scale plutonium-producing pile, with its associated chemical separation buildings, became the primary focus of the X-10 site. Once plans for the ORR pile were finalized, Fermi's pile was moved from the University of Chicago to Argonne.[31]

The experiment conducted by Fermi in 1942 had only tested the purity and physics of the pile. The pile based at X-10 was designed for small-scale production, and intended to reveal mistakes in design. The X-10 pile was not an exact miniature of the Hanford plant. X-10's pile functioned as more a "working model" from which scientists drew data for planning the Hanford development. As a result, there were at least two fundamental differences between the piles (reactors) found at Hanford and X-10. The X-10 pile was air-cooled. The Hanford pile, over Du Pont's objections but at the direction of the University of Chicago, used a water-cooled approach. The second difference lay with the ORR's insistence in using bismuth phosphate in the chemical

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[28] Jones, 72, 190-197; Hewlett and Anderson, 193.

[29] Gosling, 10.

[30] Jones, 190.

[31] Ibid., 72.

separation process. Problems resulted with this choice and prompted Hanford researchers to select lanthanum fluoride as the chemical used for Hanford's chemical separation.[32]

The University of Chicago had assumed the pile would be located at Argonne and that their scientists would direct the facility. Groves, however, was persuaded that each facility should be directed by a proven commercial leader. He selected Du Pont to design and develop the separations pilot plant at Oak Ridge. Du Pont, in its turn, was reluctant having earned the name "Merchants of Death" for supplying munitions during World War I. Capitulating to Groves' appeals, Du Pont signed on with its participation hinging on two points – Du Pont would not earn a profit and their income would be limited to costs. Secondly, the company's employment would end with the close of World War II.[33]

Once the University of Chicago learned that Du Pont would not only design but manage the X-10 site, the staff decided to stay in Chicago and develop a water-cooled pile. However, General Groves and Du Pont officials knew University of Chicago staff were indispensable to X-10 development and requested that University scientists operate the site. Without question, Compton and his staff were angry over "losing" the pile, but they concluded that patriotism demanded they accept this offer.[34] Even with this measure of participation, the University of Chicago's influence decreased and its involvement became increasingly less important in the overall scheme of the Manhattan Project.[35]

Compton restructured his staff early in 1943, basing his decision on establishing individual laboratories of equal stature. Compton named himself director and appointed three associate directors, Robert Stone, Associate Director for Health Matters, Norman Hilberry, Associate Director for Research, and Wilbur Munnecke, Associate Director for Administration.[36] Associated research facilities included the University of Chicago's original Metallurgical Laboratory, Iowa State College in Ames, Chicago's Argonne, and the X-10 Site at Oak Ridge directed by Martin Whitaker. In April 1943, the X-10 Site was officially recognized as Clinton Laboratories. Staff grew from sixty-four employees in July 1943, to almost 1,000 by December.[37]

Construction of the X-10 site began in February 1943 with initial temporary buildings and utility installations completed by the end of March. Early in March of 1943, Du Pont began construction of the foundations for the six large underground cells for plutonium and fission product separation. These "hot cells" had thick concrete walls with removable slab tops for equipment replacement.[38] The first cell was linked to the pile building via an underground canal. Along one

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[32] Gosling, 30-35; U.S. Department of the Interior, "X-10 Reactor National Historic Landmark Nomination," 1965.

[33] Hewlett and Anderson, 91; B. C. Hacker, *The Dragon's Tail* (Berkely: University of California Press, 1987), 46-47.

[34] Hewlett and Anderson, 190-193.

[35] Gosling, 30.

[36] Jones, 200.

[37] Hewlett and Anderson, 210.

[38] Johnson and Schaffer, 17-18.

side of the row of cells, a one-story, frame building was erected to house the operating gallery and offices.

Construction on the pile building itself began on April 27, 1943. Difficulties soon arose, however, when workers struck a large bed of soft clay, which required more foundation work than had been anticipated. It was June before construction of the walls to the building began, and summer before they were completed.[39] The front face of the pile was composed of seven feet of high-density concrete, and the shield was pierced by hundreds of tubes through which the uranium slugs would be inserted. While the four-story pile building was being constructed, workers also built its auxiliary facilities, which included a control room, a small "hot" laboratory to handle radioactive materials, and a core removal area.[40] In order to expedite the production of graphite bars to be used in the pile, Du Pont constructed its own graphite fabrication plant adjacent to the pile building. The semiworks for the bismuth-phosphate plant at the University of Chicago was disassembled and shipped to the East Tennessee site where it was reassembled and operating by September 1943.[41]

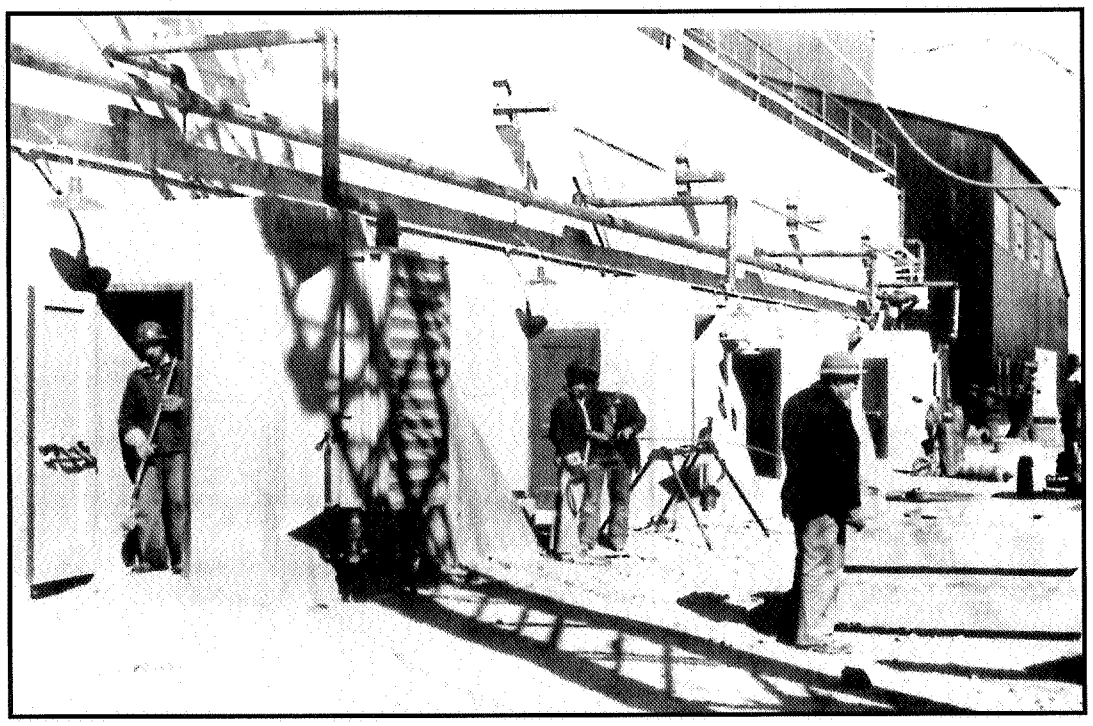

Figure 6: Construction of the concrete hot cells of the chemical separations building (Building 3019) in November 1943.

Overall, construction at the X-10 site proceeded slower than expected. Due to the isolation of the site, Du Pont had to provide the pile with its own machine shops, water supply and treatment

[39] Jones, 205.

[40] Ibid., 205-206.

[41] Hewlett and Anderson, 210.

installations, a steam plant storage areas, and classrooms and laboratories for training. The amount of construction eventually doubled from that in initial plans. The concurrent construction of the Y-12 and K-25 plants created a labor shortage, and Du Pont dispatched recruiters throughout the region to find a sufficient amount of workers.[42] Upon completion, the 112-acre X-10 site (eventually 150 acres) contained around 150 buildings that included the air-cooled experimental pile, the chemical separations pilot plant, underwater storage, an underground canal, a series of cells for chemical separation, and supporting laboratory facilities such as machine and instrument shops, warehouses, and subterranean tanks for radioactive waste.[43] The four-story pile building, which was painted black and nicknamed the "black barn," was a prominent visual feature at the site. In a building next to the pile, two of the world's largest fans were mounted that sucked outside air through the pile and then up a stack.[44]

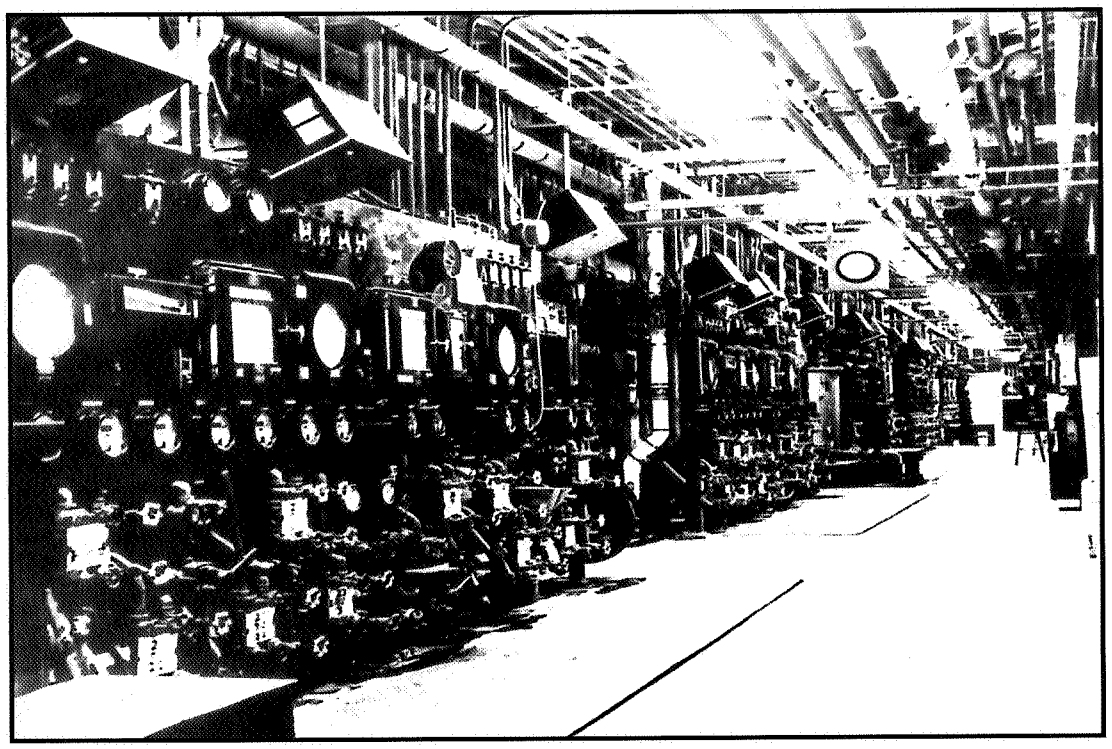

Figure 7: Remote controls for the plutonium separations process in the adjacent hot cells in 1944.

Scientists at the X-10 site continued to research the various separation processes on the chance that some aspect might contribute to the plutonium process. As important as the research was, the implementation of the pile was crucial to the primary purpose of the facility. By the end of October 1943, Du Pont had completed the final engineering of the pile, and in early November workers began to insert thousands of uranium-235 slugs into the reactor. This process involved loading a ton or two of uranium slugs, withdrawing control rods to measure the increase in

[42] Johnson and Schaffer, 18.

[43] Ibid.; Jones, 204-205; Thompson, 12-13.

[44] Johnson and Schaffer, 18.

neutron flux, then reinserting the rods into the pile, loading more uranium, and continuing to stop and assess the neutron activity to determine when the pile would become "critical" or produce a self-sustaining chain reaction. The tedious procedure continued day and night with the day shift loading nearly 10 tons of uranium slugs, and the night shift loading an additional 20 tons.[45]

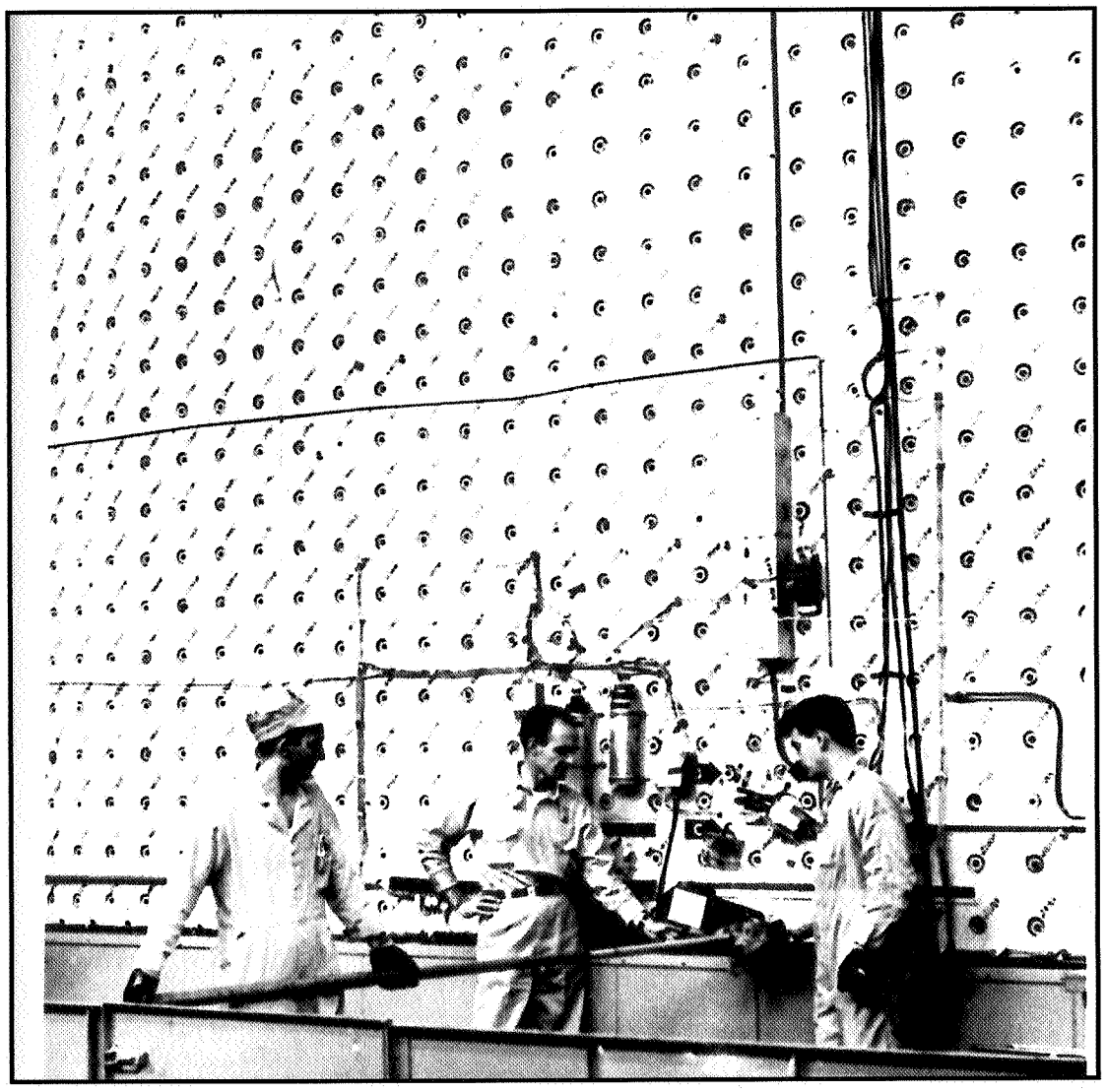

Figure 8: The concrete shield of the Graphite Reactor contains hundreds of tubes through which the uranium slugs were inserted. Workers used a long rod to push the slugs into the shield.

At 5:00 a.m. on November 4, 1943, the pile reached its goal of criticality and became the world's first power-producing pile. By early 1944, only weeks later than estimated, the semiworks was largely completed and was fully operational by March. From the first, the pile was a success and produced plutonium in significant quantities for research purposes. The quantities grew larger,

[45] Ibid., 20.

and in the spring of 1944, the ORR began shipping samples to Los Alamos. That summer, the first samples of pile-produced plutonium resulted in revolutionary changes in weapon development.[46]

By May 1944, the pile was operating at near double the power level its designers had anticipated, and by July of that same year it had doubled again. The chemical separation plant, which had not previously been tested, operated well on its first run. The staff made modifications that eventually increased the efficiency of the plant from 40 to over 90 percent. The separation plant was in operation until January 1945, at which time enough plutonium had been produced to meet the project needs. The staff then began to use the pile for experiments with other irradiated materials as fissionable fuel. The pile was also used to test materials such as aluminum, graphite, brass, neoprene, Bakelite, concrete, and masonite, which were used at Hanford.[47]

In addition to being a pilot plant, X-10 served as a training school for workers at the Hanford site. All of the experimental work and training of operators was performed at either the X-10 site or the University of Chicago. The X-10 site organized and conducted a training school for approximately 260 Du Pont employees who later worked at Hanford.

The number of employees at the Clinton Laboratories was far less than those at the other ORR sites. Between March 1944 and January 1945, an average of around 1300 people were employed at X-10, compared to 12,000 at K-25 and 22,000 at Y-12. The majority of the staff at Clinton Laboratories worked on product studies to aid the Hanford operation, and only around 12 percent were involved in product production.

In early 1945, Robert Oppenheimer, director of the Los Alamos site, urged that Los Alamos be supplied with large amounts of "RaLa", pure radioactive lanthanum, the decay product of radioactive barium-140. To provide the required amount, Clinton Laboratories erected a facility designed to produce the substance. This may well have been the first large scale production of a radioisotope.[48] Through experimentation such as this, Clinton Laboratories evolved from prototype research (Hanford technology) into an institution focused on nuclear research.

The pile, an impossibly complex and expensive research instrument, became the heart of the nuclear laboratory. The pile provided an ample supply of neutrons and radioactive isotopes which promised countless applications in industry and science. As a radiation source, the pile opened innumerable opportunities for medical and biological research. And always, the pile held the promise of the controlled power through a controlled chain reaction. Devised in the crisis of war, the pile promised a powerful instrument for peacetime applications.[49]

Though the bomb had not been completed by June 1945, Clinton Laboratories wartime goals had been met. With University of Chicago staff anxious to be done with its responsibility, General Groves agreed Monsanto Chemical Company would assume management by July 1, 1945. Martin

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[46] Hewlett and Anderson, 211-212; Jones, 208.

[47] Johnson and Schaffer, 24; Jones, 209.

[48] Johnson and Schaffer, 23-24.

[49] Hewlett and Anderson, 212.

Whitaker continued as director with the site assigned a new mission – conducting radiation research and producing "experimental materials" (radioactive isotopes).[50]

Figure 9: Clinton Laboratories after the war. Just right of center is the Graphite Reactor (Building 3001), and adjacent to it is the long, concrete separations building (Building 3019).

3.6. The Manhattan Project and the End of World War II

Following President Roosevelt's death on April 12, 1945, Harry S. Truman assumed the presidency and thus ultimate control of the Manhattan Project. Truman had little prior knowledge of the Manhattan Project. In the eighty-two days Truman served as Vice President, he had met Roosevelt privately on two occasions. Nothing of importance had been mentioned either time. Beyond a memorandum President Roosevelt had signed, the Manhattan Project had no policy statement. A portion of the document read that once the weapon was prepared, "It might perhaps, after mature consideration, be used against the Japanese, who should be warned that this bombardment will be repeated until they surrender."[51]

In the moments after Truman's inauguration, Henry Stimson, Roosevelt's Secretary of War, broached the topic of the Manhattan Project. Stimson explained "a matter of the utmost urgency" must be explained and that it involved "a new explosive of unbelievable power."[52] Twelve days

[50] Jones, 210; Thompson, 42.

[51] David McCullough, *Truman* (New York: Simon and Schuster, 1992), 379.

[52] Ibid., 348.

into his presidency, Truman learned fully of the Manhattan Project. Stimson had prepared a memorandum: "Within four months we shall in all probability have completed the most terrible weapon ever known in human history, one bomb of which could destroy a whole city."[53]

The Manhattan Project, having proved itself successful, had assumed "a life of its own." The project had effectively weathered the death of President Roosevelt and was functioning well as the Truman administration assumed control. Scientists now believed there were two possibilities for producing an atomic weapon. The first option lay with the plutonium generated at Hanford. The second option lay in using fissionable material from Oak Ridge in a gun-based device.

Meanwhile, Los Alamos scientists were not certain the "Fat Man" device, the implosion weapon designed with Hanford's plutonium, would work. A test of the device was conducted on July 16, 1945, and proved successful.[54] There was less uncertainly surrounding Oak Ridge's uranium bomb, and "Little Boy" was not tested. The Manhattan Project had achieved its goals and produced not one but two atomic weapons.[55]

As bomb development neared its end, decision makers realized these atomic weapons could be ready by August 1945. And scientists began to debate whether the weapons should ever be used. Moral and ethical questions were raised, and a petition drive began urging the weapons not be employed.[56]

S-1 met on Wednesday, May 9, 1945, to discuss the deployment of the U.S. atomic weapons. Chaired by Secretary of War Henry Stimson, the Interim Committee on the Manhattan Project included eight other members: Karl T. Compton, president of the Massachusetts Institute of Technology (MIT); Ralph A. Bard, Under Secretary of the Navy; James Bryan Conant, president of Harvard; Vannevar Bush, president of the Carnegie Institute; William L. Clayton, Assistant Secretary of State for Economic Affairs; and George L. Harrison, president of the New York Life Insurance Company.[57] Further meetings scheduled for the 14th and 18th of May followed the initial May 9th session. A meeting, spanning two days, began on May 31st. Following long and often heated arguments, committee members and their advisors hammered out three conclusions:

1) The bomb should be used against Japan as soon as possible.
2) It should be used against war plants surrounded by worker's homes or other buildings susceptible to damage, in order "to make a profound psychological impression on as many inhabitants as possible."
3) It should be used without warning.[58]

These recommendations were reported to the President by Stimson who stressed S-1's role was entirely advisory. Truman later wrote:

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[53]Ibid., 377.

[54]Gosling, 40.

[55]Hewlett & Anderson, 301 - 302.

[56]Johnson & Jackson, 159.

[57]McCoullough, 390.

[58]Ibid., 391.

> The conclusions of the Committee were similar to my own, although I reached mine independently. I felt that to extract a genuine surrender from the Emperor and his military advisers, there must be administered a tremendous shock which could carry convincing proof of our power to destroy the Empire. Such an effective shock would save many times the number of lives, both American and Japanese, than it would cost.[59]

Motivated by a desire to end the war in the fastest way possible, the Truman administration began to ponder a Japanese invasion. Given Japan's refusal to surrender, the United States forged ahead with plans to drop the bomb.

The Enola Gay departed the Marianas on August 6, 1945. On board was the "Little Boy" bomb, the uranium-gun weapon produced in the Oak Ridge plants. The bomb was dropped on the city of Hiroshima immediately killing almost 100,000 people and fatally injuring 100,000 others. Hiroshima's destruction was felt for five square miles.[60] Truman's statement followed immediately:

> Sixteen hours ago an American airplane dropped one bomb on Hiroshima . . . It is an atomic bomb. It is a harnessing of the basic power of the universe . . . We are now prepared to obliterate more rapidly and completely every productive enterprise the Japanese have above ground in any city. We shall destroy their docks, their factories, and their communications. Let there be no mistake; we shall completely destroy Japan's power to make war . . . If they do not now accept our terms they may expect a rain from the air, the like of which has never been seen on this earth . . .[61]

Within hours of the bombing President Truman released a second statement warning Japan bombing would continue if unconditional surrender did not result. On August 9, 1945, the American's second atomic weapon, the "Fat Man" device made with Hanford's plutonium, was dropped on Nagasaki.[62] While casualties were similar to Hiroshima, physical damage was limited due to the hills surrounding the city. Japan surrendered to American forces on Tuesday, August 14, 1945.

3.7. National Laboratory Development

Within weeks of Japan's surrender, Congress decided to make the Oak Ridge plants permanent facilities with a focus on peacetime applications. In August 1946, the Atomic Energy Act became law transferring management of America's nuclear research program from military to civilian direction. The act established the AEC, which assumed leadership of the Oak Ridge facilities on January 1, 1947.

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[59]Ibid., 394.

[60]Gosling, 51.

[61]Ibid., 455.

[62]Ibid., 53.

At the X-10 site, the University of Chicago had resigned as operator in 1945 and Monsanto Chemical Company had become the operating contractor. Drastic staff reductions were the norm for the entire ORR. In 1945, 82,000 people were employed on the reservation. In the three months following the bombing of Hiroshima, 51,000 workers remained on the reservation. By June 1946, reservation employment had dwindled to 34,000.

In the years leading to World War II, the United States had not pursued science as a national interest. But to achieve an Allied victory, the federal government had funded scientific research. Federal funding, in the years following the war, was continued. Indeed, science was seen as the doorway to power and success. Research centered on a wide range of topics. Among them numbered spy planes, atomic weapons, advanced computers, improved radar systems, and long range missiles. During this period, the National Science Board, the National Science Foundation, and the Science Advisory Committee were organized. The U.S. Army and U.S. Navy also continued their individual research efforts.

General Groves also recognized the importance of research and in early 1946 began to develop a research budget for fiscal year 1947. Groves appointed an Advisory Committee on Research and Development to generate research ideas. The committee supported the expansion of further research and development in the production of fissionable materials and advanced training in nuclear studies, and suggested that national laboratories be established to conduct such research. Although neither the committee or the AEC ever truly defined "national laboratory," it was generally understood that such facilities would serve the primary purpose of pursing unclassified fundamental research that required equipment too expensive for a private laboratory or university to underwrite. The Advisory Committee on Research and Development and later the AEC viewed such national laboratories as channels through which federal funds would flow to support nuclear research. Each laboratory would be assigned individual research responsibilities and have a board of directors chosen from participating universities.

General Groves also supported the establishment of national laboratories and strongly urged the formation of one at Oak Ridge. However, the Advisory Committee on Research and Development viewed the ORR more as an industrial site or an installation associated with commercial exploitation rather than as a university-affiliated laboratory, and did not originally recommend that it become a national laboratory. Instead, the committee proposed that national laboratories be established at Argonne near Chicago and at Brookhaven on Long Island.[63]

After the ORR was not selected as a national laboratory site, William G. Pollard, a University of Tennessee physics professor who had work on the gaseous diffusion process at Columbia University during World War II, led a movement to form the Oak Ridge Institute of Nuclear Studies (ORINS). ORINS consisted of fourteen universities from the southeast region and its purpose was to assist Monsanto Chemical Company in scientific staffing, gaining federal support, and to use the Clinton Laboratories of academic research. The project was approved, and the AEC provided space in existing buildings at the Townsite for ORINS.[64] In 1949, the AEC gave ORINS the responsibility of managing the Museum of Atomic Energy, and in 1965, the organization changed its name to Oak Ridge Associated Universities (ORAU).

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[63] Hewlett and Anderson, 633-645.

[64] Ibid., 636.

Immediately following World War II, the research focus at the Clinton Laboratories included reactor development, the production of radioactive isotopes for experimental purposes, the recovery of large amounts of uranium from the extraction wastes being held in storage, and the investigation of the effects of radiation on animals.[65] Research on animals was coordinated through the Agricultural Research Laboratory, which was established in 1948 as a joint project between the AEC and the University of Tennessee; in 1981, ORAU acquired responsibility for this facility.

In 1946, Whitaker resigned as director of Clinton Laboratories, and James H. Lum and Eugene Wigner replaced him as co-directors. The site then turned its research focus on the development of new piles or reactors. However, in the interim between World War II and the transfer of the facility to the AEC in 1947, clear and long-term goals for the Clinton Laboratories were slow to emerge. Many leading advisors recommended that the site be closed and merged with the facility at Brookhaven, reasoning that the site's isolation and separation form a large university community would make it ineffective. However, the Clinton Laboratories was an established and working industrial site that the AEC could not easily abandon. Thus, during its first year of existence, the AEC, while not closing the Clinton Laboratories, did not clarify the site's mission. Problems developed with Monsanto as operator of the site, and in December 1947, AEC terminated its contract with the company and hired C&CC effective March 1948. At the same time, the AEC designated Clinton Laboratories a national laboratory. Initially the site was named Clinton National Laboratory, but in 1948, the AEC changed the name to Oak Ridge National Laboratory (ORNL).[66]

The third national laboratory created in the United States, ORNL was the only one located on its World War II site. These first national laboratories were intended to be regional centers where university scientists could pursue scientific research. Of the three, Brookhaven National Laboratory came the closest to being a true regional research center, while ORNL evolved into more of an industrial complex than an academic one. As an alternative, the AEC supported ORINS as a regional research center, and in combination with ORNL facilities, the two produced a program in research, training, and education that fulfilled its mission as a national laboratory.[67]

3.8. The Cold War Era

The AEC directed the ORNL to concentrate in three fields: basic research, chemical technology, and isotope production and research. Due to the escalating hostilities with Russia and that nation's nuclear test in 1949, as well as mounting hostilities in Korea, the AEC increased its emphasis on reactor research. Argonne National Laboratory had been designated the main reactor laboratory, but its workload increased to such a degree that the site was not capable of handling all of the reactor research. As a result, AEC chose ORNL to do the overflow designs, which were some of the more unusual reactor concepts.

Education and training also remained a key focus of ORNL. In 1946, Monsanto established the Clinton Training School on the site for training technical personnel in the various fields of nuclear science. Although it lasted only one year, several prominent scientists graduated from the

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[65] Ibid., 627.

[66] Pollard, 28; Thompson, 61; Overholt, 358.

[67] Hewlett and Holl, 253-254.

program. An advanced training program known as the Oak Ridge School of Reactor Technology (ORSORT) began on the site in 1950 and continued into 1957. A variation of the program continued until 1965. These programs were crucial in the dissemination of information about nuclear reactors and nuclear power.[68]

In 1946, the Clinton Laboratories established a Metallurgical Division, which conducted intensive research into metallic elements under high temperatures and radiation stress in reactors. In 1952 a Ceramics Laboratory was also established on the site and conducted ceramics research, fabricated crucibles, insulators and fuel elements, and customized parts for reactors. The Ceramics Laboratory became a world center for metallic alloy and ceramics research.[69]

In 1949, the AEC budgeted $20 million for new construction, and Union Carbide initiated a building program named "Program H" at ORNL to replace many of the wooden wartime buildings with more permanent brick buildings. The program also included landscaping the grounds, paving streets, and renovating some older buildings. Approximately 250,000 square feet of new laboratory and office space was constructed east of or near the Graphite Reactor. The expansion included the construction of the Central Research and Administration Building North (Building 4500N), which became the center for a wide variety of research activities. Ten buildings were constructed to house research activities of the isotope program. Once scattered throughout the campus, the isotope program was now concentrated on what became known as Isotope "Alley" or Isotope Circle.

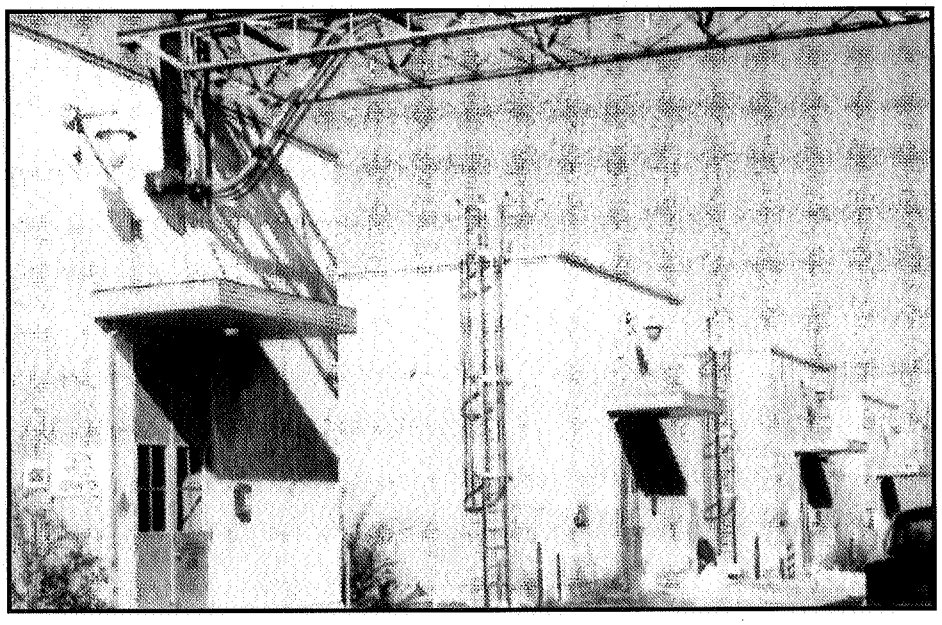

Figure 10: The Isotope "Alley" at ORNL.

In the post-World War II period, the Graphite Reactor was used extensively to produce radioactive isotopes for research. The Isotopes Section was established in 1947 and expanded into

[68] Johnson and Schaffer, 43-46; Thompson, 245-247.

[69] Johnson and Schaffer, 38-41.

the Isotopes Division. Isotopes were distributed at cost for research in the fundamental sciences, for therapeutic research for humans, and for education and training research. In addition, the isotopes were used for valuable research in the study of effects of radiation on matter. By the early 1950s, ORNL had become the prime producer for the world's supply of radioisotopes. The number of monthly shipments increased from 60 to 630 between August 1946 and January 1950.[70]

ORNL became a world center for the production and distribution of stable and radioactive isotopes, which have been called "the most valuable research tool since the invention of the microscope."[71] ORNL's isotope program brought much prestige to the laboratory and the AEC. Isotopes are used in a variety of research fields including the diagnosis and treatment of cancer, radiography, teletherapy, tracing, and measurement and control.[72]

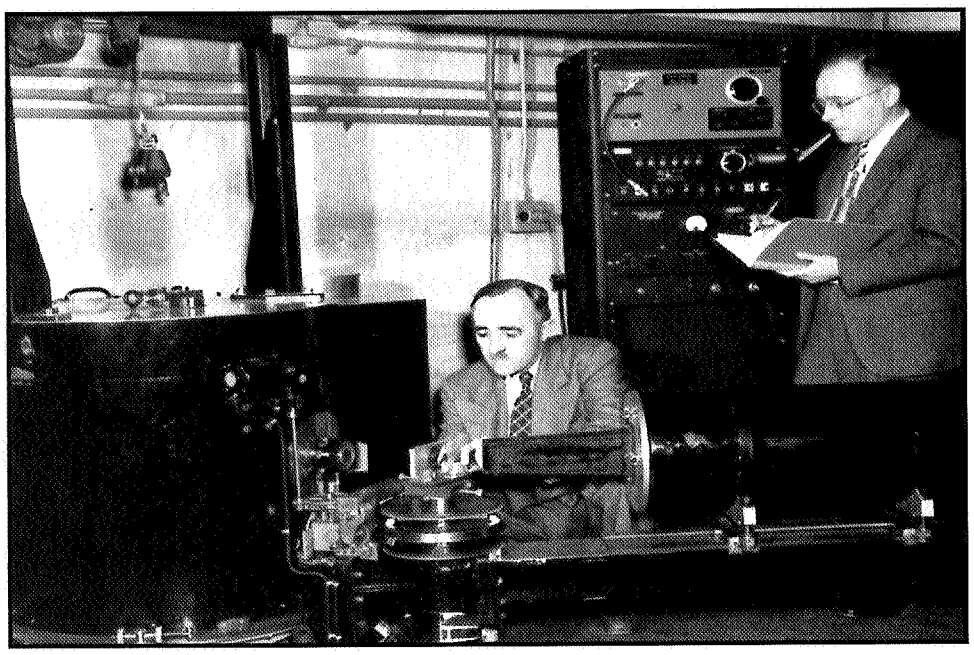

Figure 11: ORNL scientists Ernest Wolland and Clifford Shull conducted some of the world's first neutron scattering experiments using this diffractometer built at ORNL and installed at the Graphite Reactor in 1950. This work laid the foundation for a number of programs in solid state physics and materials science at ORNL and, later, throughout the world.

The Graphite Reactor was in operation for twenty years and was shut down on November 4, 1963. The Oak Ridge Research Reactor (Building 3042), completed in 1958, then produced the

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[70] Martha Carver and Margaret Slater, "Architectural/Historical Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee," Prepared for Oak Ridge National Laboratory, December 1993.

[71] Thompson, 250.

[72] Genung et al., 4-1; Little, 113.

majority of ORNL's radioisotopes. The High Flux Isotope Reactor, which began operation in 1965, later served as a major source of radioisotopes for medical and industrial uses.[73]

ORNL's Reactor Experimental Engineering Division pursued various reactor designs in the 1940s and 1950s. These included an experimental homogeneous reactor that operated from 1951 to 1954, and a second such reactor developed in 1957 as part of the AEC's Power Demonstration Reactor Program, which researched the use of nuclear energy as a power source. The Oak Ridge Research Reactor was completed in 1958 and operated until 1987. This high-performance reactor supported several scientific advances in physics and materials research, irradiations, and neutron beam studies.[74]

Chemical processing was also a major mission of ORNL beginning in the late 1940s. This research involved the process of extracting desired materials from spent natural uranium fuel. The Chemical Technology Division was formed in 1950 and experimented with a wide variety of processing methods including the Redox and Purex processes. Much of this work was carried out in the pilot-plant stage in Building 3019. A number of reprocessing facilities worldwide currently use the Purex process developed at ORNL. In 1977, a new nuclear policy of the Carter administration resulted in less emphasis on nuclear fuel reprocessing. The Chemical Technology Division then began to focus on other areas of research such as waste management and environmental studies.[75]

A centerpiece of ORNL's research in the Cold War era was the application of atomic power for nuclear-powered submarines, aircraft, and ships. The U.S. Air Force established the Nuclear Energy for Propulsion of Aircraft Project in 1946 and began research in this field. Increasing hostilities of the Cold War convinced government officials to fund the project and in 1949, the AEC ordered ORNL to pursue the research, which became known as the Aircraft Nuclear Propulsion (ANP) Program.[76] At the time this was the only nuclear-powered aircraft research program in the United States. The U.S. Air Force closed out its own research program and jointly funded ORNL's research with the AEC. The ANP Program (later named the Aircraft Reactor Engineering Division) was a pivotal feature of ORNL's existence throughout the 1950s.

ORNL constructed three unique reactors for the ANP Program, including the 2-MW Bulk Shielding Reactor (BSR, Building 3010), which was completed in December 1950. This reactor was used to study a variety of materials in bulk as shielding materials for use in aircraft. The design was relatively inexpensive, safe, and stable, and became a prototype for many research reactors around the world. It was significant in research of radiation damage processes in solids.[77]

The second reactor constructed for the program was the Tower Shielding Facility (TSF, 7700 Area). Completed in 1954 in an isolated area two miles south of the ORNL main campus, the TSF consists of four 315-foot towers that stand on the corners of a 100 x 200 foot concrete pad. The towers support a reactor core that can be suspended in the air in a spherical container. It is the

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[73] Johnson and Schafer, 36.

[74] Ibid., 100-101; Thompson, 72-74.

[75] Genung et al., 2-17, 2-27, 4-20, 4-64; Carver and Slater, 105.

[76] Thompson, 90.

[77] Ibid., 68.

only reactor facility in the United States designed and built for radiation shielding studies in which both the reactor source and shield samples are raised into the air. The research conducted at the TSF addressed questions regarding the effects of radiation from a reactor flying overhead as well as to the type and amount of shielding needed for a nuclear aircraft.[78]

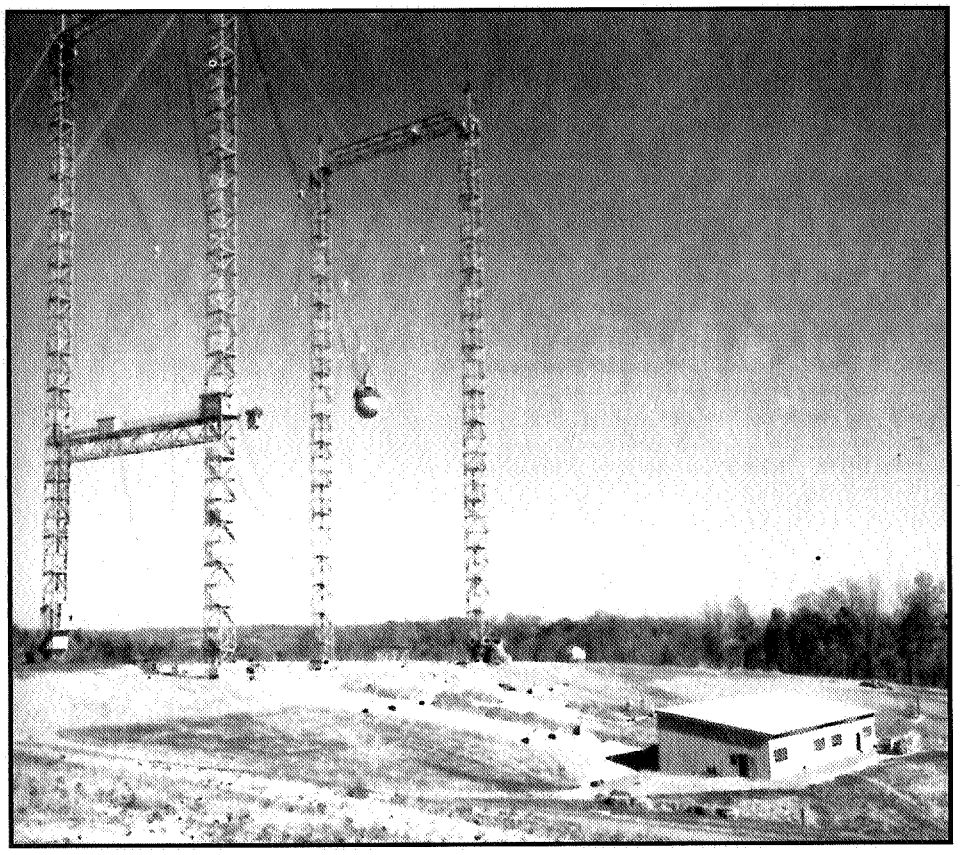

Figure 12: The TSF was completed in 1954.

The third reactor developed for the ANP Program was an experimental liquid-fueled aircraft reactor known as the Aircraft Reactor Experiment or ARE. The ARE used molten (fused) uranium fluorides (salt) as its fuel. ORNL constructed Building 7503 to house the reactor approximately one half mile south of the ORNL main campus. The reactor began operation in 1954.

In 1957, Congress cancelled the ANP Program due to its high cost and advances made in supersonic aircraft and ballistic missile development. Although the project never resulted in a nuclear-powered aircraft it did generate valuable research in numerous areas including work with nuclear particle accelerators and studies of radiation damage. An outgrowth of the project was the development of the Physics of Solids Institute, which was established in 1950 to study radiation damage and related solid-state investigations. Another consequence of the project was the development of computers large enough to handle the vast quantities of scientific data the project generated. In the early 1950s, ORNL and Argonne scientists designed and fabricated the Oak

[78] Johnson and Schaffer, 66-70.

Ridge Automatic Computer and Logical Engine (ORACLE). When it became operational in 1954, this digital computer had the largest data storage and fastest speed of any in the world.[79]

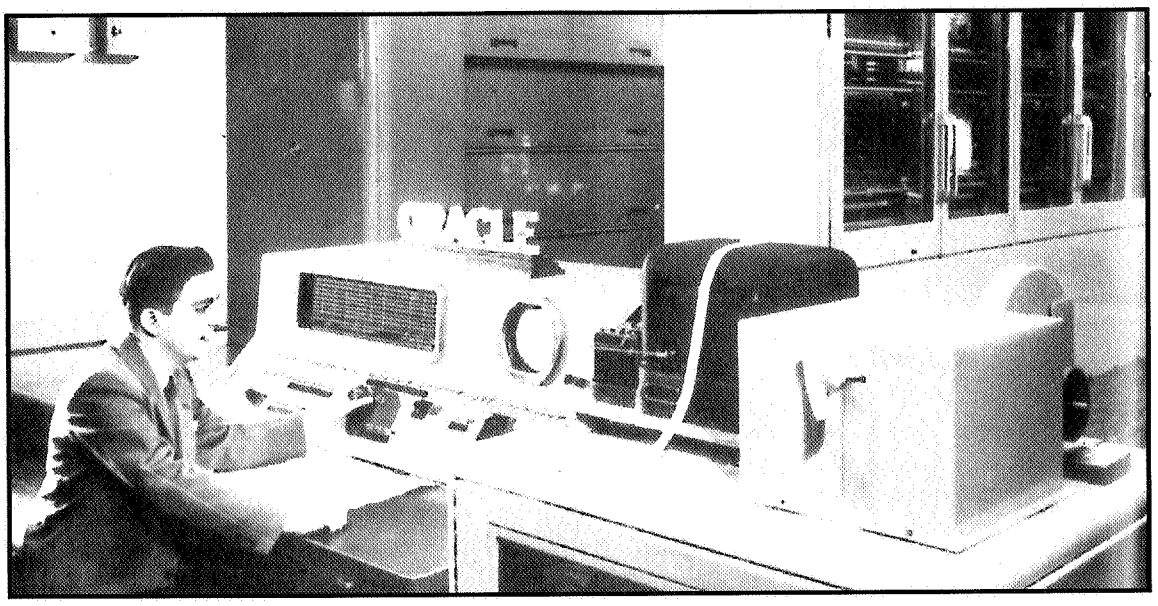

Figure 13: ORNL's ORACLE was the largest and fastest computer in the world in the mid 1950s.

ORNL scientists were also involved in the construction of nuclear-powered ships in the late 1950s and early 1960s through the Maritime Ship Reactor Program. The national laboratory provided technical support for the design and development of the *N.S. Savannah.* ORNL also provided support work such as obtaining port clearances until the ship was decommissioned in 1971 and the reactor removed.[80]

In February 1950, ORNL and Y-12's research divisions merged, placing Y-12's calutrons within easy reach of ORNL staff. Research activities by ORNL were conducted at both the X-10 site and the Y-12 Plant.[81] Between the late 1940s and early 1950s, physicists constructed three cyclotrons (later synchrotrons) to examine properties of compound nuclei and heavy particle reactions. In 1951, engineering divisions from ORNL, the Reactor Experimental Engineering Division and the ANP Division, occupied buildings at Y-12. Y-12 housed ORNL scientists who came to fill the Biology, Chemical Technology, Engineering Technology, and Fusion Energy Divisions. Y-12 support of ORNL research involved parts fabrication for the High Flux Isotope Reactor, the Molten Salt Reactor Experiment, the Oak Ridge Isochronous Cyclotron (ORIC), and the DCX

[79] Ibid., 71; 80-82; Thompson, 147-148.

[80] W.L. Greenstreet, *History of the Engineering Technology Division Oak Ridge National Laboratory 1944-1992.* (Oak Ridge, TN: Oak Ridge National Laboratory, 1992), 32-32, 44.

[81] Johnson and Schaffer, 59 - 60, 78.

fusion experiment.[82] ORNL personnel staffed in Y-12 buildings pursued initiatives whose interests diverged from plant and experimental grafting studies to cancer research.[83]

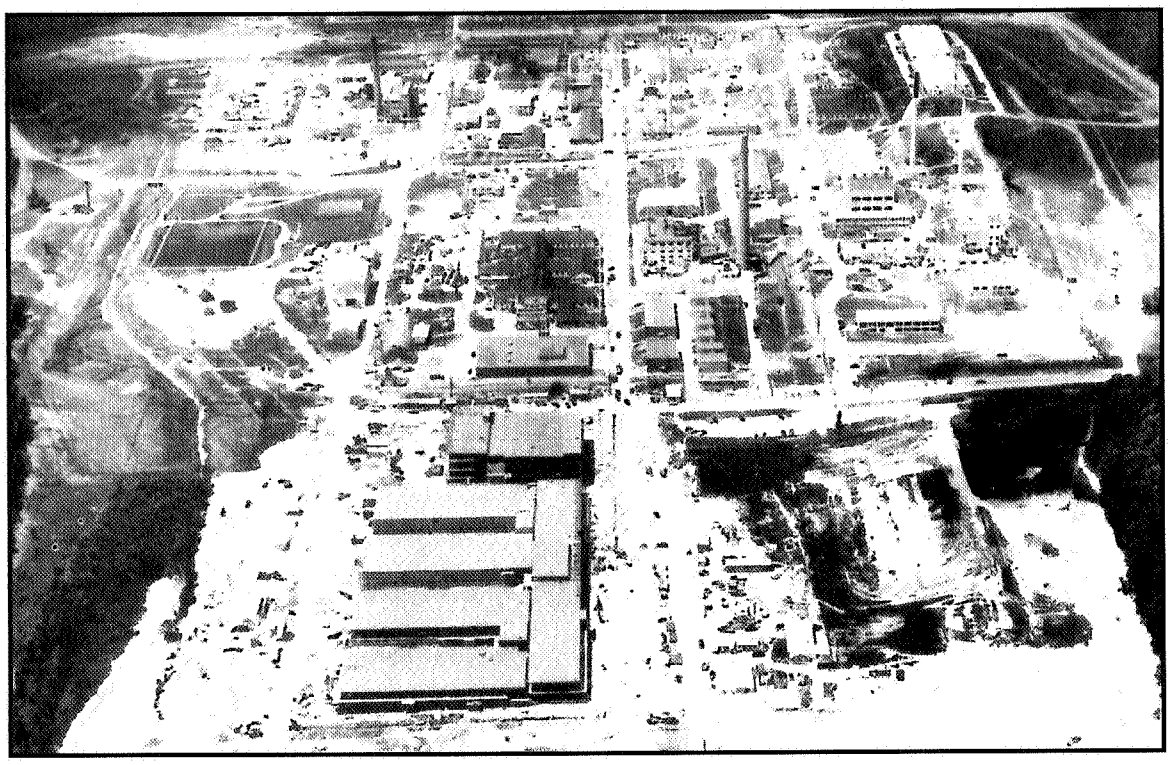

Figure 14: ORNL in the early 1950s. Building 4500N, the Central Research and Administration Facility, is in the foreground, and the Graphite Reactor (Building 3001) is in the upper right corner.

ORNL also played an important role in Project Sherwood, which researched whether or not the detonation of a thermonuclear weapon would touch off a chain reaction destroying the earth and its' atmosphere. The AEC directed ORNL to construct a cyclotron to determine if this theory were indeed fact. Housing the new unit in Beta-3 (Building 9204-3) at the Y-12 Plant, ORNL erected and tested the unit within 18 months of the original request. Testing began in 1952 and was led by Dan Scott and Harry Reynolds. The team soon discovered a hydrogen bomb would not initiate a chain reaction immolating the earth. Their focus then turned to the unit's capability to basic research. The cyclotron became the world's first source of energetic heavy ions, creating "the interactions of complex nuclei in a new field of scientific investigation," an endeavor which allowed ORNL to pursue heavy ion nuclear science.[84]

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[82]Oak Ridge National Laboratory, "Review," Vol. 25, Nos. 3 and 4, 1992: 2.

[83]*Business Week*, "AEC Unlocks Some Files For Business" 2 October 1965: 54.

[84]W.E. Thompson, "History of the Oak Ridge National Laboratory 1943-1963," (Oak Ridge: Oak Ridge National Laboratory, 1963), 145 - 146; Overholt, 362.

Health and safety issues were another important field of research at ORNL in the 1950s and 1960s. Physicists in ORNL's Health Physics Division initiated and refined safety features such as the remote handling of radioactive material, controlled access to "hot" areas, use of protective clothing, decontamination procedures, requirements for personnel monitoring, and the development of radiation surveys of buildings and the environment. The measurement of internal levels of radiation, known as internal dosimetry, became a study focus, and in 1960, the Internal Dosimetry Section was formed at ORNL, which conducted research for a variety of agencies.[85]

By the late 1950s, space exploration and the work of the National Aeronautics Space Administration (NASA) had come to overshadow nuclear research, and many were beginning to question the role of national laboratories. In response, ORNL elected to diversify its programs and developed missions outside the field of nuclear energy. During the 1960s, the large nuclear programs of the 1950s were replaced with projects or programs that were smaller in size but larger in number.[86] The nature of the research also changed. For example, the Reactor Division had focused on the design, development and construction of reactors in the 1950s, but in the 1960s it primarily worked on reactor operation and safety.

The change in direction led ORNL into a variety of new research fields. In the 1960s, ORNL began doing research projects for agencies other than the AEC, including NASA, the Department of Housing and Urban Development, the Department of the Interior, and the Department of State, although each project had to have AEC approval. By 1969, fourteen percent of ORNL's programs were related to non-nuclear work for agencies other than the AEC. ORNL was the first national laboratory to diversify its programs in such a way, and after other national laboratories followed suit, ORNL led in the amount of non-nuclear research conducted. Research included a desalination project that worked on a process to remove salt from seawater and various civil defense programs. Nuclear research continued as well and included the development of a Molten Salt Reactor and an Experimental Gas-Cooled Reactor.[87]

ORNL expanded its missions again in the 1970s. By this time, the AEC had significantly reduced ORNL's budget and staff. Funding for reactor research became unavailable and private companies were securing contracts for radioisotope and other research analysis. The number of staff at the site fell from 5500 in 1968 to 3800 in 1973. Research focuses at ORNL also began to shift as many scientists from the Manhattan Project era began to retire and the laboratory hired new employees with different research goals.[88] A growing concern about nuclear waste disposal, the environmental effects of radiation, and the possibility of accidents at nuclear power plants led to criticism of the AEC and an increasing lack of confidence in nuclear power among the general public. To address these concerns, the AEC was reorganized as the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC) in 1974.

During the 1970s, ORNL broadened its missions to encompass all forms of energy research. In 1974 it formed an Energy Division that included economists, geographers, sociologists, and other social scientists. ORNL also expanded its environmental programs and non-nuclear research areas

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[85] Johnson and Schaffer, 44-50; 120.

[86] Greenstreet, 51.

[87] Carver and Slater, 121-123.

[88] Ibid., 124.

including energy conservation, materials resources, recycling, environmental analysis, and regional modeling.[89] As a result of the NEPA of 1971, ORNL also began doing contract work on environmental impact statements.

In 1974, the Arab oil embargo brought national attention to energy issues, and ORNL became a leader in developing technical solutions to the energy crisis. At the time, ORNL was the only national laboratory to have a multi-program mission beyond nuclear science, and it received increased funding to engage in a broad range of energy-related research in conservation, coal, and nuclear energy.[90] This research led to an increase in the number of employees at ORNL, which reached 5000 by the late 1970s.

In 1977, the Department of Energy Act unified federal government energy programs, including the ERDA, under the newly-created DOE, and the nature of ORNL's work changed once more. This was in part due to President Carter's emphasis on energy conservation and "soft" energy such as solar programs as opposed to nuclear energy. The Carter administration's new focus for the national laboratories was as centers of excellence in specialized fields. DOE designated ORNL as the lead laboratory for coal technology and fuel reprocessing.

Union Carbide ended its tenure as facilities operator in 1982, and DOE awarded the operating contract to Martin Marietta in 1983, which assumed control the following year. Energy Systems, Inc., a subsidiary organization, was established to administer the reservation and associated facilities.[91] During the 1980s, ORNL expanded partnerships with industries and universities, and technology transfer of the institute's scientific and technological advances to the private sector increased its competitiveness in an international market.

3.9. Post-Cold War Missions

Although it continued to conduct nuclear research during the Cold War era, ORNL also expanded during that period to diversify in a wide range of research fields. As it entered the 1990s, the institute had become one of the top research centers in the world and "had emerged as a premier global research center for issues related to energy, environment, and basic science and technology."[92] As part of the effort to make U.S. companies more competitive, ORNL and Y-12 have been involved in technology transfer since 1984, when MMES began managing both facilities for DOE. Technology transfer was identified in the company's contract as a primary mission. As a result, both organizations offer a wide range of technology transfer options.

Today, ORNL remains one of DOE's most diverse multi-purpose research laboratories and provides research and development for both government agencies and private industries. Its primary mission continues to be centered around energy research. Areas of ongoing research include energy production and conservation technologies, physical and life sciences, scientific and technological user facilities, environmental protection and waste management, science and

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[89] Johnson and Schaffer, 143-144, 164.

[90] Genung et al., 4-74.

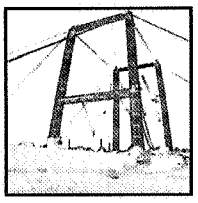
[91] Johnson and Schaffer, 207.

[92] Ibid., vi-vii.

technology transfer, and education. Technical solutions for national security programs including homeland security defense are also a continuing focus of ORNL.

3.10. Summary

The construction and operation of the X-10 site (ORNL) was a key element in the success of the Manhattan Project during World War II. The X-10 pile or Graphite Reactor and its support buildings produced plutonium that was used for research purposes at Los Alamos that led to the development of the atomic weaponry that helped end the war. Following World War II, the institution became a national laboratory with a focus on peacetime applications of nuclear energy. Significant contributions in these years include the production of radioisotopes for research, reactor design and development, and health and environmental research on the effects of radiation. Much of the existing ORNL campus reflects the legacy of its World War II and Cold War eras.



4.0. ORNL HISTORIC PROPERTIES

4.1. The 1993 Architectural/Historic Evaluation of the ORNL Complex

In December 1993 an intensive Architectural and Historic Assessment was completed for the properties at the ORNL (final version-January 1994). This survey was conducted in accordance with Section 106 of the NHPA of 1966 (as amended). The survey evaluated all buildings, structures and sites for eligibility for the NRHP.

The results of the 1993 survey were presented in the report "Architectural/Historical Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee." The report identified a large historic district within the complex. The NRHP-eligible "Oak Ridge National Laboratory Historic District" originally contained sixty-six (66) buildings and structures that would be considered contributing to the character of the district. This number includes the Graphite Reactor (Building 3001), which was designated a NHL in 1966. Since the completion of the 1993 survey, three contributing buildings to the ORNL Historic District, Buildings 3004, 3013, and 3506, have been demolished. Also, four contributing structures, the North and South Tank Farms (Buildings 3023 and 3507), and two waste settling basins (Buildings 3513 and 3524) have been remediated. The farms consisted of underground tanks used for the collection and storage of liquid low-level wastes. Since the 1993 survey, the tanks have been grouted and remediated in place. Five additional contributing buildings to the ORNL Historic District have been approved for demolition (Buildings 2000, 2001, 2019, 3550, and 5000). A Memorandum of Agreement (MOA) between the SHPO, Council and ORNL officials was prepared for each of these properties. As a stipulation of the MOAs, these buildings were documented through maps, photographs, and structural and architectural drawings. The ORNL Historic District currently contains fifty-four contributing properties.

In addition to the ORNL Historic District, the 1993 report identified eleven buildings and structures as individually eligible for the NRHP. These are buildings located near, but outside the main ORNL campus in the East Support Area (Buildings 7001 and 7002), the Molten Salt Reactor Experiment Facility (Building 7503); the TSF (Buildings 7700, 7701, 7702, 7703, 7704, and 7751); and White Oak Lake and Dam (Buildings 7813 and 7846).

These individual properties and the ORNL Historic District are eligible for listing in the NRHP under criterion A for their historical associations with the Manhattan Project, development as a nuclear energy research facility within the overall post-World War II government sponsored scientific movement, and early nuclear development activities. The district and the TSF are also eligible under Criterion C for the engineering merits of many of the properties and for their contributions to science.

The 1993 report concluded that the individually eligible properties and the NRHP-eligible district also meet NRHP Criteria Consideration G for exceptional significance for properties less than fifty years of age, with the period of significance extending to 1957. The 1957 date reflects the initial development of ORNL, the closure of the ANP Project, and the end of certain national trends in scientific research.

Another property on the ORNL site, the New Bethel Baptist Church and Cemetery (Building 0903), is currently listed on the NRHP. The church and cemetery are located approximately one mile east of the ORNL main facilities complex and are not included in the NRHP-eligible ORNL Historic District. New Bethel Baptist Church and Cemetery were listed on the NRHP in 1992 for their role in the history of Bethel Valley prior to the Manhattan Project.

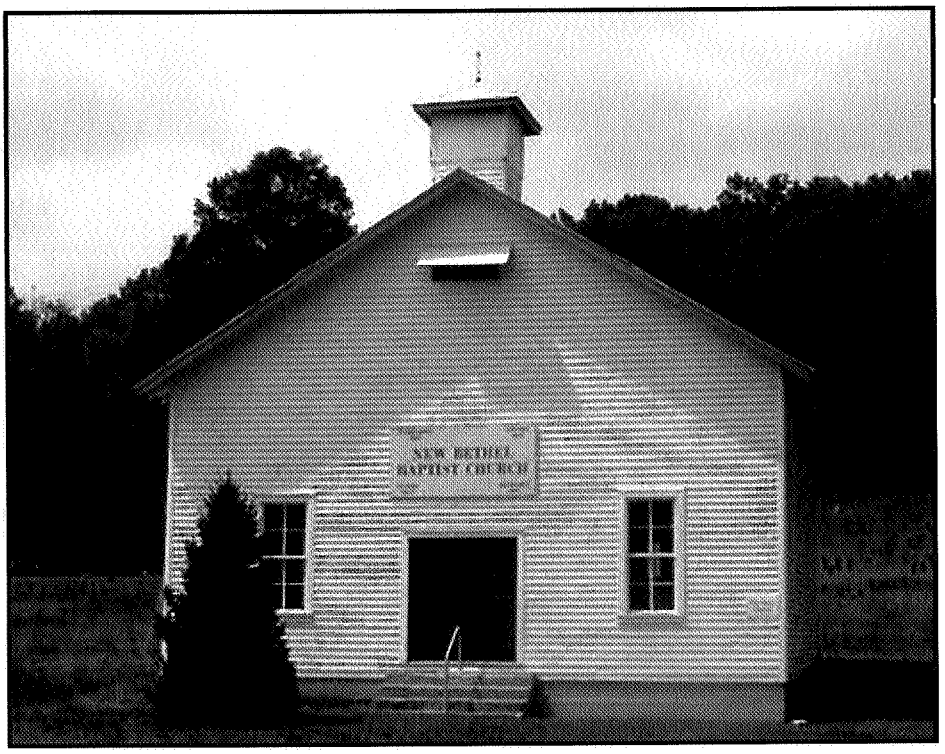


Figure 15: New Bethel Baptist Church and Cemetery reflect the pre-Manhattan Project era of the East Tennessee region. The property was listed on the NRHP in 1992.

Figure 16: The Graphite Reactor (Building 3001) was designated a NHL in 1966 for its role in the developments of nuclear science.

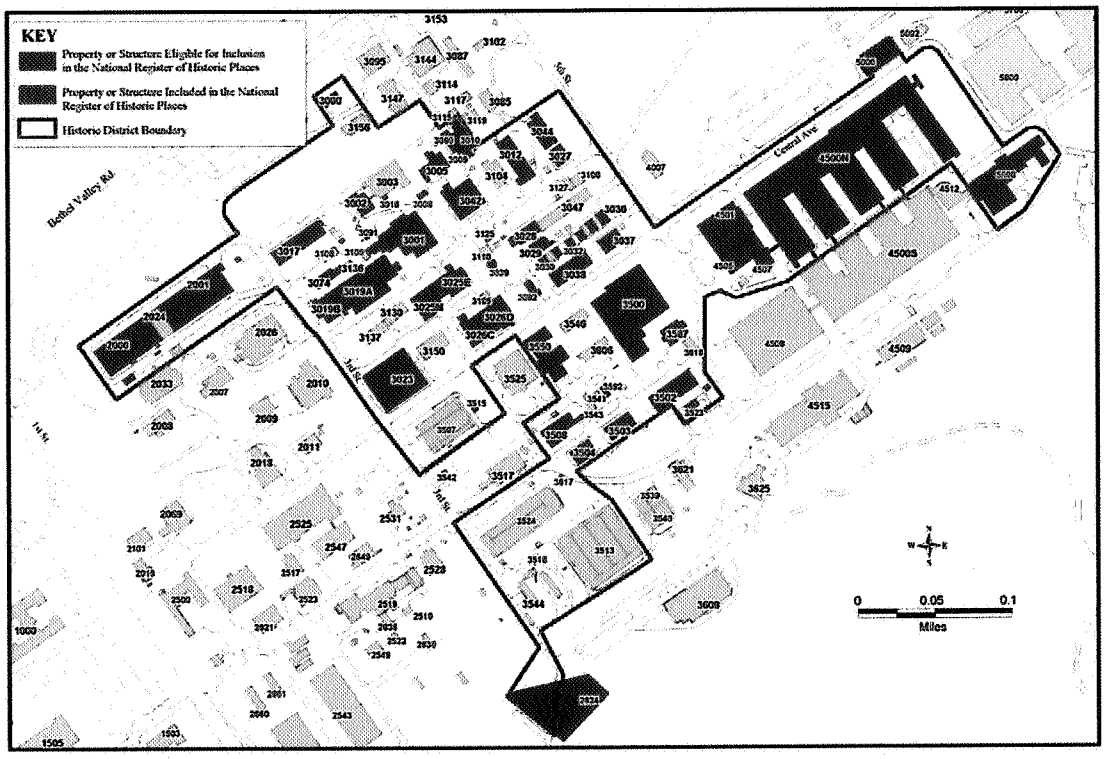


Figure 17: The ORNL main facilities complex with the NRHP-eligible ORNL Historic District outlined in green. Contributing buildings to the district are in red.

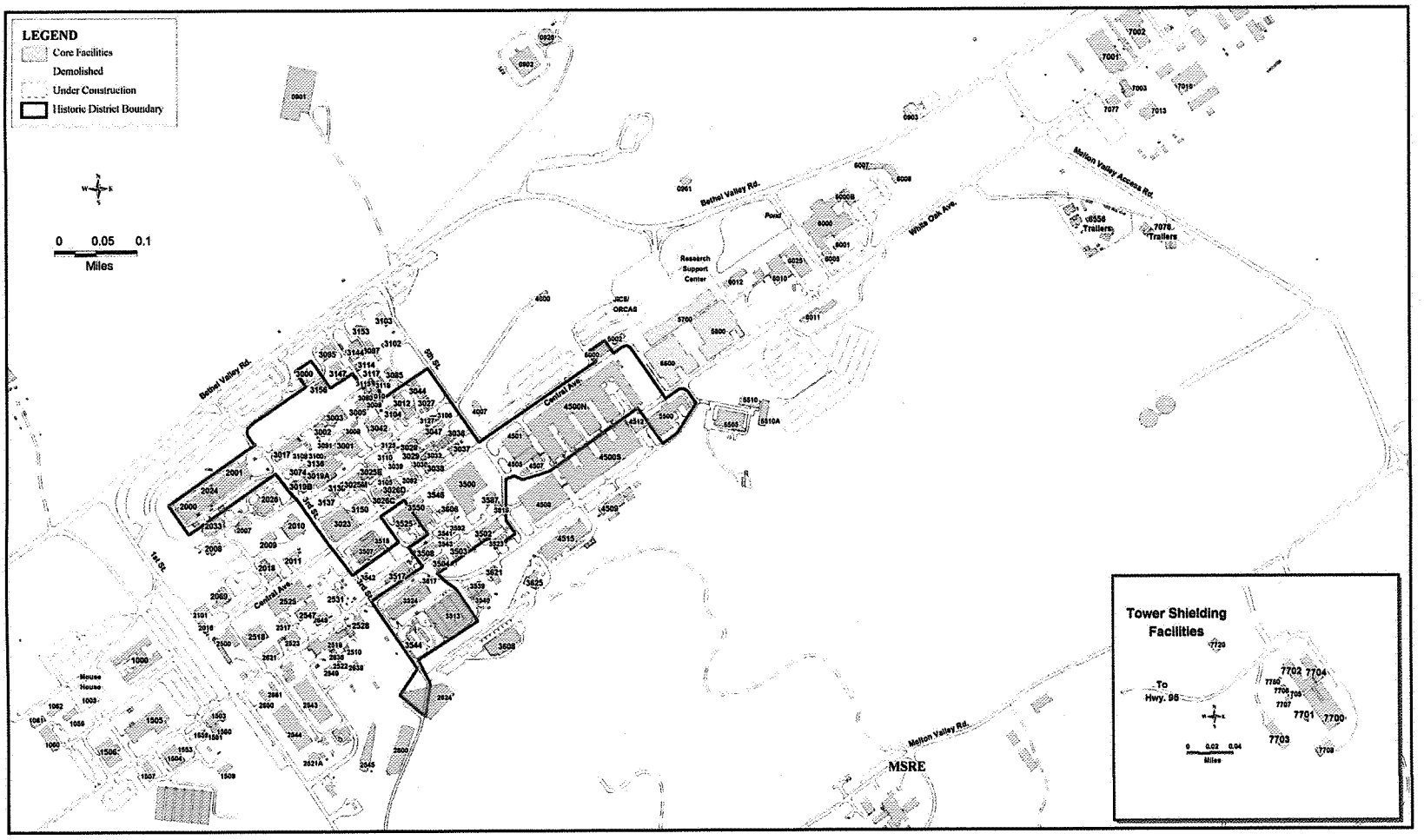


Figure 17A: Site Plan of ORNL Complex with the Historic District outlined in green.

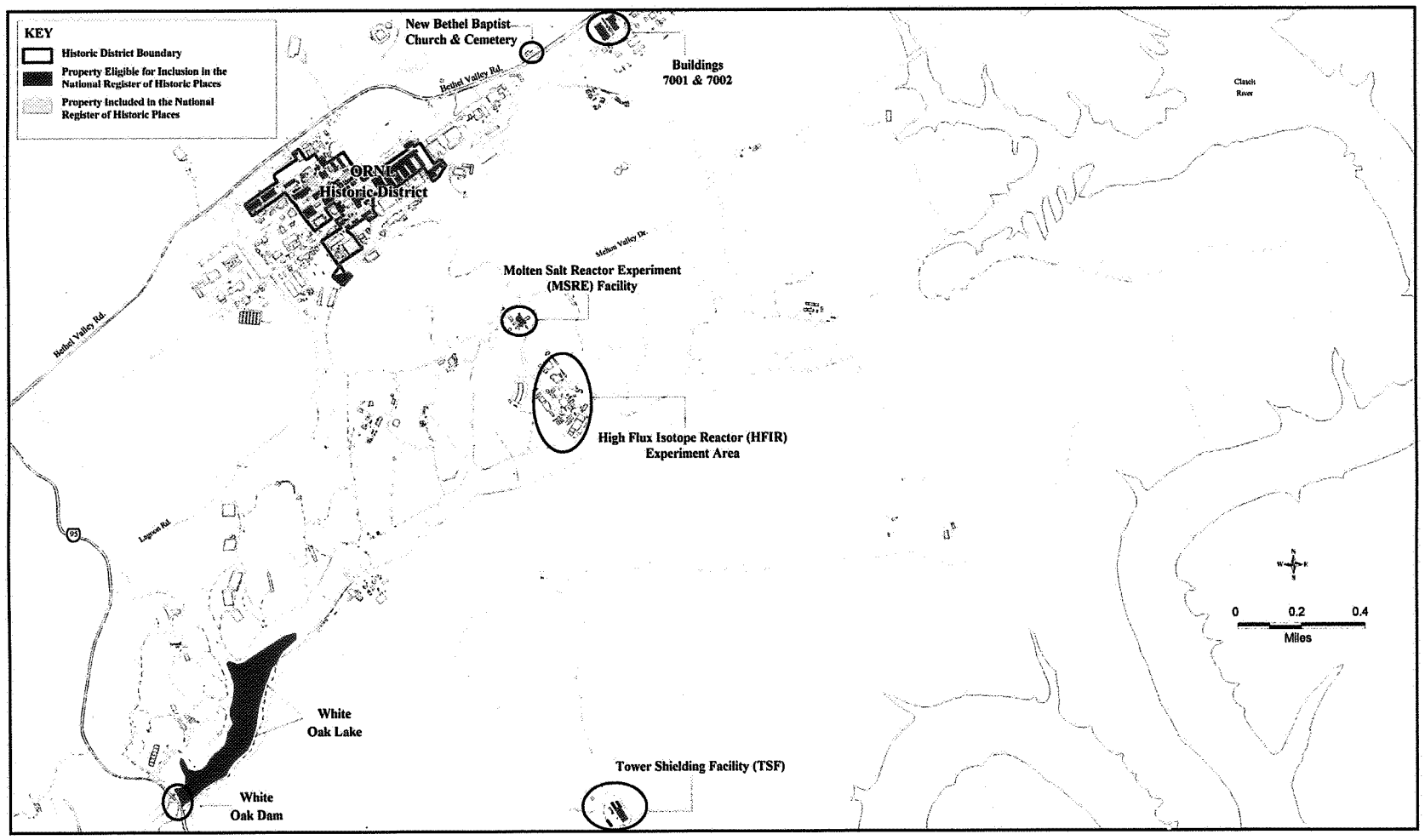


Figure 17B: Location of various ORNL facilities/structures on the Oak Ridge Reservation.

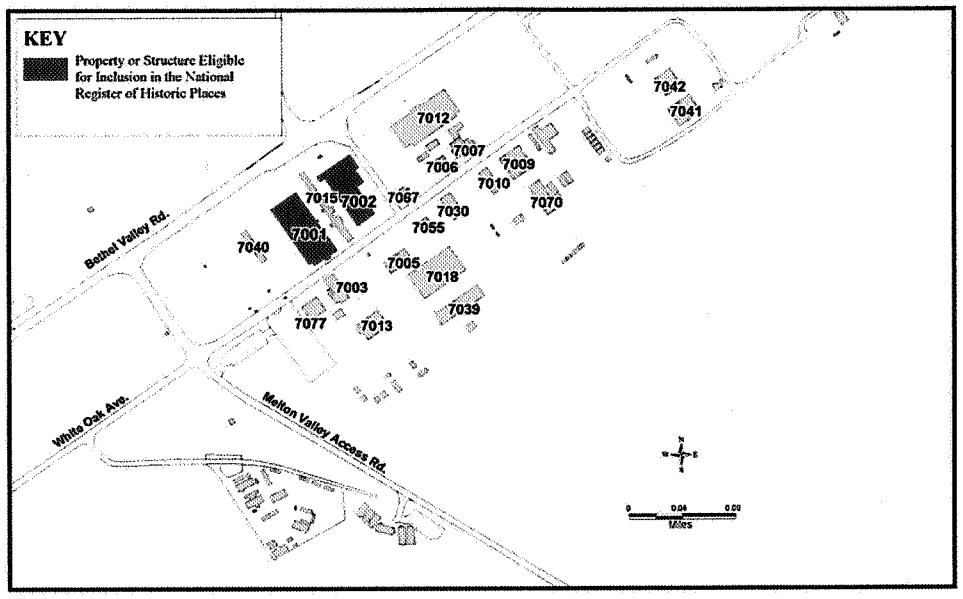


Figure 18: 7000 Area at ORNL.

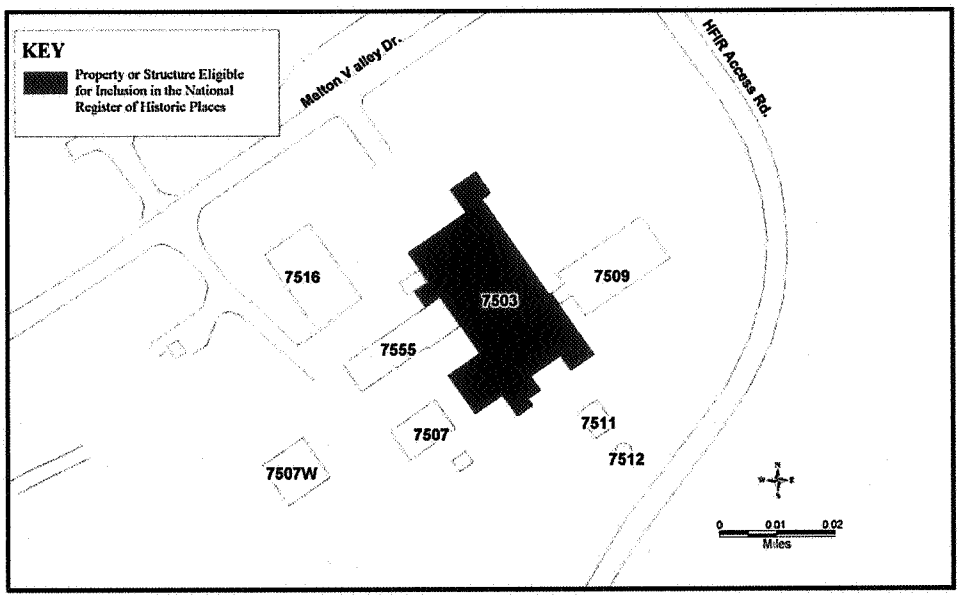


Figure 19: 7500 Area at ORNL.

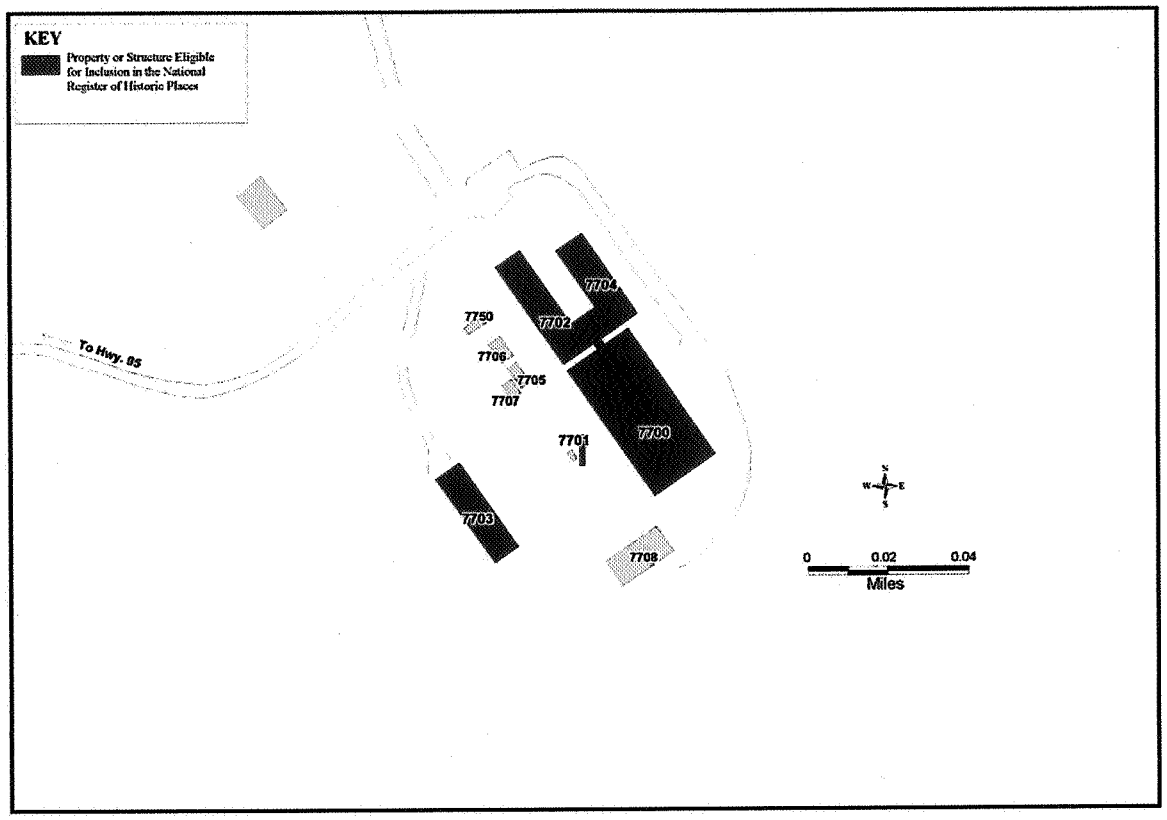


Figure 20: 7700 Area at ORNL.

Figure 21: White Oak Lake (Lake 7846) is individually eligible for the NRHP.

Figure 22: White Oak Dam (Building 7813) is individually eligible for the NRHP.

4.2. Cold War Significance

With the end of World War II in 1945, America entered into what became known as the "Cold War" with the USSR, China, and their allies. The Cold War era lasted until 1989 when the Berlin Wall was dismantled and the USSR dissolved into separate nations. The architectural and historical survey of ORNL in 1993 evaluated properties for their significance in both World War II and the Cold War. Information on the Manhattan Project and related World War II history was readily available, however, research on the role of ORNL during the Cold War was limited. Research into the significance of ORNL from 1945 to 1989 is essential to provide a comprehensive overview of the site and its contributions to the context of the Cold War.

The Cold War significance of ORNL and DOE's other operations at the ORR continue to be studied. However, some operations at ORNL are clearly notable and this historical significance must also be evaluated and assessed in future planning for the facility. The most important contributions to the Cold War based on the available information are summarized as follows:

Research and Development of Radioisotopes

Following the end of World War II, ORNL became one of three national laboratories formed by the AEC to pursue scientific research. The AEC directed the installation to concentrate in three fields: basic research, chemical technology, and isotope production and research. Because of the Graphite Reactor, ORNL became the prime producer for the world's supply of radioisotopes, as well as a source that provided the basis for valuable research to study the effects of radiation on matter. The Isotopes Section was established in 1947 and expanded into the Isotopes Division. Monthly shipments of isotopes increased from 60 to 630 between 1946 and 1950. As part of its building expansion program of the early 1950s, ORNL constructed ten buildings for use in the isotope process. Isotopes have been extremely important research tools in numerous fields of scientific research. They are used in the diagnosis and treatment of cancer, genetics research, and agricultural studies.

Buildings significant under this context:

Building 3028:	Radioisotope Processing
Building 3029:	Radioisotope Processing
Building 3030:	Radioisotope Processing
Building 3031:	Radioisotope Processing
Building 3032:	Radioisotope Processing
Building 3033:	Radioisotope Processing
Building 3034:	Radioisotope Processing
Building 3036:	Decontamination
Building 3037:	Offices
Building 3038:	Radioisotope Analysis and Packing
Building 3039:	Exhaust Stack

Ceramics and Metallurgical Research

In 1946, a Metallurgical Division was established at the installation that conducted intensive research into metallic elements under high temperatures and radiation stress in reactors. In 1952, a Ceramics Laboratory was established that conducted ceramics research, fabricated crucibles, insulators, and fuel elements, and customized parts for reactors. The Ceramics Laboratory became a world center for metallic alloy and ceramics research. Building 2011, built in 1943,

served as the main Mechanical Properties Laboratory; and in 1947, a rolling mill, Building 3012, was constructed to roll, cast, and forge reactor fuel elements and metal parts. Additional buildings were constructed for this research during the 1960s.

Buildings significant under this context:

Building 2011:	Mechanical Properties Laboratory
Building 3012:	Rolling Mill
Building 3534:	Liquid Metals Cleaning Facility
Building 3537:	Gas Storage
Building 4500S:	Research and Administration
Building 4508:	Metals and Ceramics Facility
Building 7930:	Thorium-Uranium Recycle Facility

Chemical Processing

Chemical processing, the process of extracting desired materials from spent natural uranium fuel, became an important focus of research at ORNL during the Cold War era. Building 3019 served as the Radiochemical Processing Pilot Plant during World War II and continued to be the site's central facility for chemical processing in the post-war years. ORNL's Chemical Technology Division experimented with a wide variety of processing methods including the Redox and Purex processes. The Purex process emerged as the most effective, and several reprocessing facilities worldwide now use this method. The emphasis on nuclear fuel reprocessing declined in the 1970s, and the Chemical Technology Division diversified into several other research areas such as waste management and environmental studies.

Buildings significant under this context:

Building 3017:	Chemistry Laboratory
Building 3019 (A):	Separation/Reprocessing
Building 3019(B):	Separation/Reprocessing
Building 3502:	Unit Operations
Building 3503:	Unit Operations
Building 3505:	Metal Recovery
Building 3508:	High Alpha Laboratory
Building 3550:	Chemistry Laboratory
Building 3592:	Volatility Laboratory
Building 4501:	High-Level Radiochemical Laboratory
Building 4505:	High-Level Radiochemical Laboratory
Building 4500N:	Research and Administration
Building 4500S:	Research and Administration
Building 4507:	High Radiation Level Chemical Development Laboratory
Building 7920:	Transuranium Processing Plant

Aircraft Nuclear Propulsion

In the post-war years, the potential of nuclear power for peaceful purposes became a focus of ORNL research. One of the chief programs to explore the possibilities of nuclear power was the ANP Program, which researched the possibility of nuclear-powered aircraft. The only program of its kind in the United States, the program involved the construction of three unique reactors: the BSR (Building 3010), the TSF (7700 Area), and the ARE (Building 7503), which used molten

uranium fluorides (salts) as its fuel. The ANP Program was in operation from 1946 until 1957, and although it never resulted in a nuclear-powered aircraft, data from the project resulted in spin-off research into other important fields.

Buildings significant under this context:

Building 3010:	BSR
Building 7503:	ARE

TSF:

Building 7700:	Tower
Building 7701:	Pool
Building 7702:	Control House
Building 7703:	Hoist House
Building 7704:	Control House
Building 7705:	Pump House
Building 7706:	Cooler
Building 7707:	Battery House
Building 7708:	Storage
Building 7740:	Radio Tower
Building 7750:	Septic Tank
Building 7751:	Sentry Post

Accelerator Research

Accelerator research at ORNL was an outgrowth of the ANP Program of the 1950s. The research used nuclear particle accelerators to accelerate charged particles or atoms and propel them into a target. This process fueled neutron research in the Chemistry Division. The first accelerators were installed in Building 2011, and as the program expanded, Building 5500 was constructed in 1952 to house a High Voltage Accelerator Laboratory.

Buildings significant under this context:

Building 2011:	Accelerator Process
Building 5500:	Accelerator Process & Laboratory
Building 3003:	Accelerator Process

Health Physics

The Manhattan Project established a Health Physics Section at the ORR in 1943. The Health Physics Division of the post-war years emerged from this section and was responsible for conducting radiation fall-out tests, experiments on the effects of radiation to plants, and internal dosimetry or the measurement of internal levels of radiation. The Division reorganized in 1977 as the Health and Safety Research Division and provided important information to assess radiation doses in nuclear industry and in nuclear medicine.

Buildings significant under this context:

Building 2007:	Calibration Laboratory
Building 2008:	Internal Dosimetry
Building 3504:	Waste Research Laboratory

Building 7709:	Health Physics Research Reactor
Lake 7846:	White Oak Lake

Cyclotron and Heavy Ion Research

The ORIC, 6000 Area, was built between 1960 and 1962 east of the ORNL main facilities complex. The complex was expanded in 1969 with the Oak Ridge Electron Linear Accelerator (Building 6010). The ORIC complex became one of the most versatile cyclotrons in the world. In 1972, ORNL completed the University Isotope Separator of Oak Ridge that interfaced with ORIC. This was one of only two on-line separators connected to a heavy-ion accelerator in the world. It was used for research in radioisotopes for medical and industrial purposes as well as in heavy nuclei generation. A heavy-ion research facility became operational in 1980 and changed the original function of ORIC. In addition to being able to function as a stand alone accelerator, ORIC could then be used as an intermediate-energy booster for the heavy-ion tandem accelerator. Together, these facilities function as the Holifield Heavy Ion Research Facility. In the late 1970s, DOE adopted the "user" facility approach, which opened certain research facilities to the public for scientific research. The Holifield Heavy Ion Research Facility is one of three such user facilities built in the late 1970s at ORNL.

Buildings significant under this context:

Building 6000:	Holifield Heavy Ion Research Facility
Building 6001:	Cooling Tower
Building 6003:	Office
Building 6005:	Gas Compressor House
Building 6007:	Joint Institute for Heavy Ion Research
Building 6008:	Laboratory
Building 6010:	Electron Linear Accelerator
Building 6011:	Computing and Telecommunications
Building 6025:	Office/Laboratory

4.3. Summary of ORNL's Historic Buildings by Type

The fifty-four contributing buildings in the ORNL Historic District and the eleven individual properties in outlying areas surrounding the main ORNL site represent a number of building types. The following summary of building types represents ORNL's historic resources and reflects the buildings' *historic* uses, or the original purpose that the buildings served. Current building use may differ. These building types are: Research/Laboratory Facilities, Processing Facilities, Offices, Storage Facilities, Utilities/Maintenance Facilities, and Security Facilities.

- **Research/Laboratory Facilities:** There are twenty-one NRHP-eligible research or laboratory facilities at ORNL, all of which are within the boundaries of the NRHP-eligible ORNL Historic District. The buildings are primarily of steel frame construction with either brick veneer or corrugated metal siding. They range from one- to four-stories in height and typically have flat roofs and hopper style windows. The majority of these buildings were constructed in 1951 or 1952 with two being constructed during the 1940s. Only one, Building 3026(C), dates to the era of the Manhattan Project. Built mainly during the 1950s, these buildings reflect the growth and development of ORNL in the post World War II era as a national laboratory. Their historical significance is derived from the research and development of the Cold War era, especially the production of radioisotopes, which was a major focus of the Laboratory during the Cold War era. The

most significant of ORNL's historic research and laboratory facilities are those associated with the Isotope Complex. These are Buildings 3028, 3029, 3030, 3031, 3032, 3033, and 3038. Known as the Isotope Complex or Isotope Circle, these buildings form a cohesive unit concentrated in the heart of the historic district. Additional historic research/lab facilities are Buildings 3017, 3025(E), 3025(M), 3502, 3503, 3504, 3508, 3523, 4500N, 4501, 4505, 4507, and 5500.

Of a similar design and located throughout the main ORNL central and east campuses, ORNL's research and laboratory buildings convey a strong sense of time and place within the historic district. ORNL's historic research and laboratories are major components of the district, and, along with the site's historic processing facilities, provide the fundamental essence of the installation's historic setting. Of the twenty-one contributing research facilities in the ORNL Historic District, fourteen have been identified as excess to future mission needs and are proposed for demolition. These fourteen buildings are: 3017, 3026(C), 3028, 3029, 3030, 3031, 3032, 3033, 3038, 3503, 3504, 3508, 3523, and 4507.

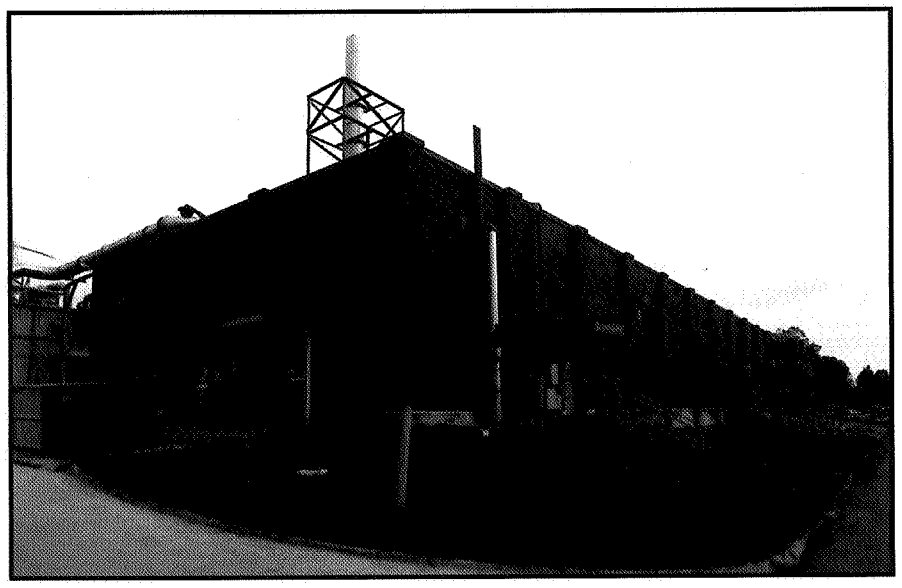


Figure 23: NRHP-eligible Building 3038 serves as a Radioisotope Laboratory.

Figure 24: NRHP-eligible Building 4500N was constructed in 1952 as the Central Research and Administration Building and is one of the largest buildings at ORNL.

- **Processing Facilities:** ORNL's sixteen historic processing facilities primarily reflect the installation's developments and achievements in nuclear science and energy. The ORNL Historic District contains ten contributing buildings that are historic processing facilities. Six of these were constructed during the 1940s, and half of those date to the Manhattan Project era. Chief among these is Building 3001, the NHL Graphite Reactor. During World War II, these buildings housed the pile or graphite reactor and other support equipment that developed the world's first gram quantities of plutonium. In the Cold War years, many of these structures housed the various reactor projects developed at ORNL. ORNL's processing facilities are typically two- to three-story buildings of steel frame and/or concrete block construction. Exteriors are commonly of corrugated metal siding. Most of the buildings have undergone alterations over the years in order to support changing missions and operations. Historic processing facilities within the boundaries of the ORNL Historic District are: 3001, 3005, 3010, 3012, 3019(A), 3019(B), 3026(D), 3042, 3515, and 3592.

  Historic processing facilities at ORNL located outside the boundaries of the ORNL Historic District are Buildings 7503, 7700, 7701, 7702, 7703, and 7704. Building 7503 initially housed the ARE, which sought to develop a reactor system for aircraft propulsion, and later the Molten Salt Reactor Experiment of the 1960s. The remaining historic processing facilities are those associated with the TSF, also associated with the ARE program of the Cold War era. NRHP-eligible buildings and structures associated with the TSF are four 315-foot tall steel towers, a reactor storage pool, a hoist house, and two control houses, which are underground bunkers.

  There are sixteen ORNL processing facilities that are either contributing buildings to the ORNL Historic District or individually eligible for the NRHP. Along with the site's

historic laboratories, these buildings and structures are major components of the district and provide the fundamental essence of the installation's historic setting. The most prominent among ORNL's production facilities is the Graphite Reactor (Building 3001), which produced plutonium for research on the world's first atomic bomb. The Graphite Reactor was designated a NHL in 1966. Another prominent ORNL processing facility is Building 3019(A). This building served as a pilot processing plant during World War II. It supplied significant amounts of plutonium for bomb research and developed the technology for the full-scale production plant at Hanford, Washington. Following World War II, the building served as a pilot plant for the development of chemical separation processes that have been used in government and commercial facilities on a worldwide basis. In 1992, the American Nuclear Society designated Building 3019(A) as a Nuclear Historic Landmark. Both the Graphite Reactor and Building 3019(A) have future mission needs.

Of the sixteen historic processing facilities at ORNL, fourteen are proposed for demolition. These buildings and structures are: Buildings 3005, 3010, 3012, 3019(B), 3026(D), 3042, 3515, 3592, 7503, 7700, 7701, 7702, 7703, and 7704.

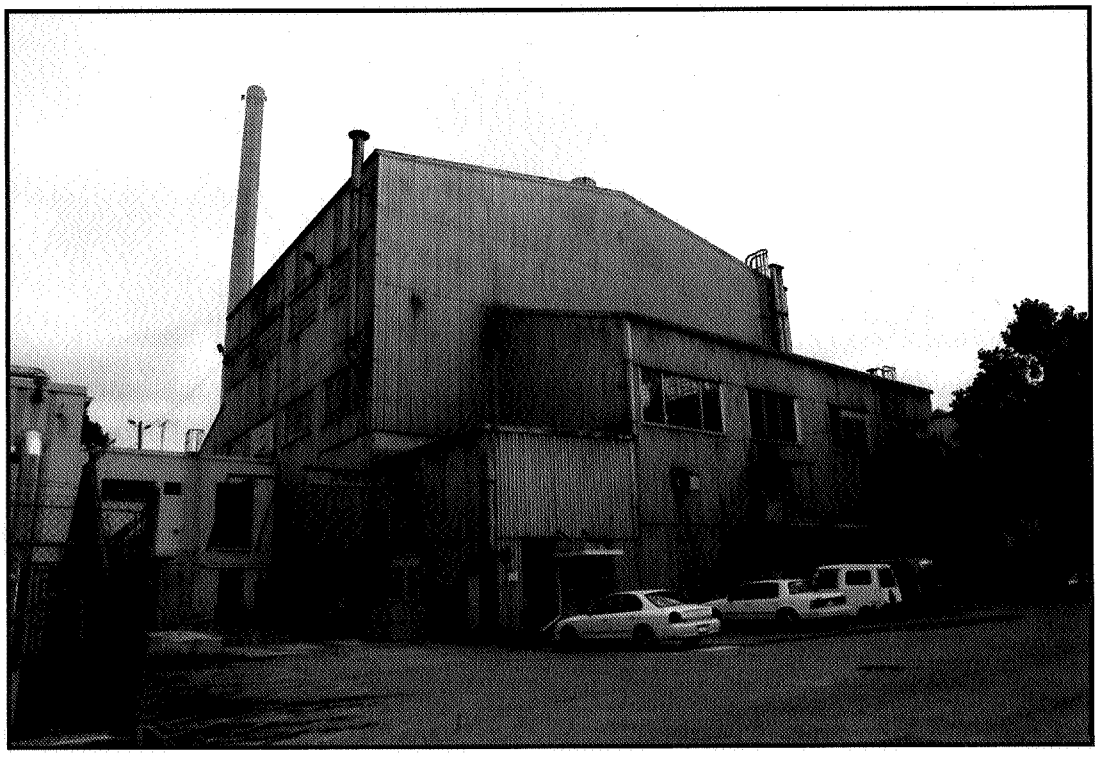


Figure 25: The Graphite Reactor (Building 3001) at ORNL is a NHL. It produced the world's first gram quantities of plutonium. The reactor was shutdown in 1963 and currently contains offices and a museum.

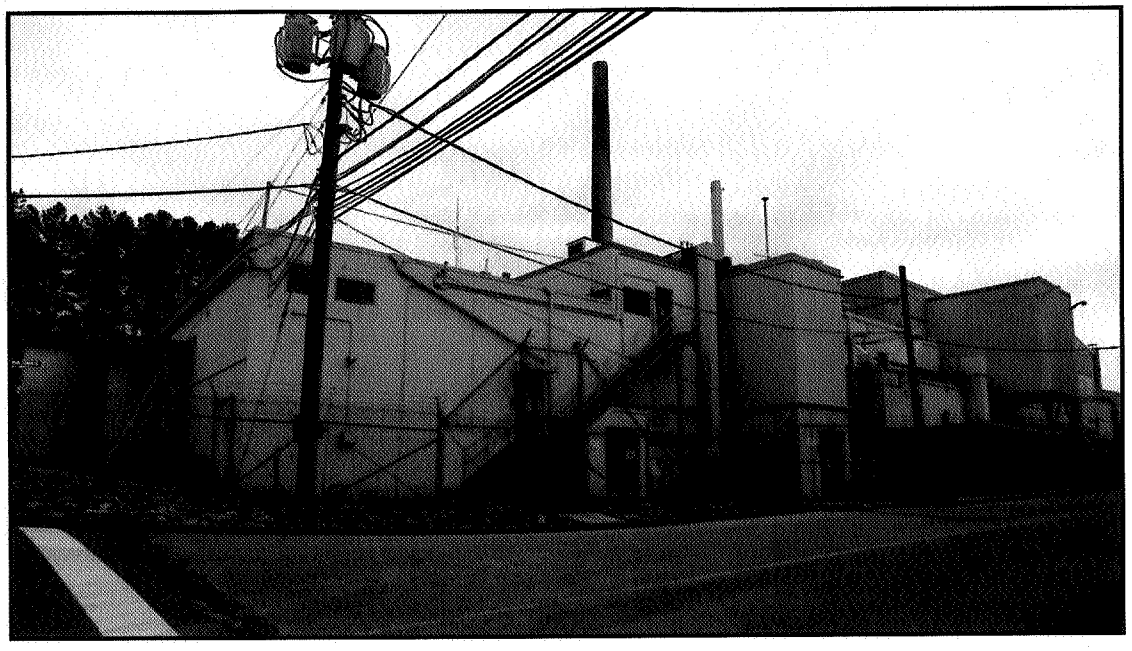


Figure 26: Building 3019(A) served as a pilot processing plant during World War II and was important in the evolution of chemical recovery processes during the Cold War era.

- **Offices:** Two contributing buildings in the ORNL Historic District are primarily office space. These are Buildings 3037 and 3500. Both are two-story, brick veneer buildings constructed in 1951. They are similar in design and have flat roofs, multi-light windows, and stone coping. Building 3037 has been determined excess to future mission needs and is proposed for demolition (Offices are also located in Building 4500N, which also serves as a primary research facility. Building 4500N is included in the Research/Laboratory category.)

- **Storage Facilities:** Storage facilities at ORNL reflect a variety of construction methods and materials and range in size from 544 to over 44,000 square feet. Most are of steel frame construction with metal panel exteriors, and others are of concrete. These buildings are used to warehouse a variety of items associated with the research and processing activities of the installation.

  The ORNL Historic District contains four contributing buildings that are storage facilities: Buildings 3008, 3027, 3036, and 3080. In the outlying areas surrounding the main ORNL complex, one storage facility, Building 7001, has been determined eligible for the NRHP. Three of these five buildings are proposed for demolition – Buildings 3008, 3036, and 3080.

Figure 27: Building 7001 is individually eligible for the NRHP. Storage buildings such as this have supported the goals and missions of ORNL as a national laboratory.

- **Utilities/Maintenance Facilities:** The ORNL Historic District contains seventeen contributing buildings that are utilities/maintenance facilities. An additional three NRHP-eligible utilities/maintenance facilities are located in outlying areas surrounding the main ORNL complex. Utilities and maintenance facilities at ORNL include pumphouses, exhaust stacks, filter houses, power and generator buildings, machine shops, and the sewage pumping station. Utilities and maintenance facilities also include various waste disposal facilities, among which are White Oak Lake and White Oak Creek Dam. Historic utilities/maintenance facilities at ORNL are: Buildings 2003, 2624, 3000, 3002, 3009, 3018, 3020, 3021, 3034, 3039, 3044, 3074, 3091, 3092, 3501, 3518, 3587, 7002, 7813, and 7846.

  These buildings and structures represent a wide variety of forms and are constructed of a range of materials including steel and masonry. Buildings range in size from 100 square feet to over 28,000 square feet. These buildings served as ancillary support facilities to the operations of ORNL's research and processing facilities. Currently six of the twenty historic utilities/maintenance facilities have been determined excess to future mission needs and are proposed for demolition. These buildings are: 2624, 3002, 3009, 3018, 3074, and 3587.

Figure 28: NRHP-eligible Building 3020 serves as an exhaust stack for Building 3019. Numerous support buildings and structures helped X-10/ORNL achieve its missions and goals during World War II and the Cold War.

- **Security Facilities:** One NRHP-eligible building at the ORNL site is a security facility – Building 7751. Building 7751 was constructed in 1947 and is a sentry post located in the TSF area approximately two miles southeast of the main ORNL complex. It is of frame construction with an exterior of shiplap siding. This building reflects the importance of the research and work done at ORNL over the years, and the need for security. There are no current plans to demolish Building 7751.

4.4. Historic Interiors

The interiors of the majority of ORNL's historic buildings have undergone significant necessary alterations over their lifetime in order to support changing missions, operations, and technology.

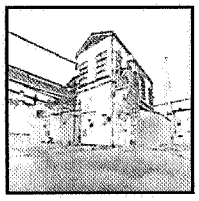
Most interiors do not reflect the buildings' historic periods of significance and do not possess historical significance in and of themselves. However, machinery and equipment associated with the historic processes that took place within ORNL facilities hold important historic value. In 2002, UT-B had an inventory completed of the World War II era machinery and artifacts in Beta-3 (Building 9204-3), a building at Y-12 for which it has responsibility. This type of inventory is also important in the future interpretation of ORNL's historic properties, and ORNL will conduct and prepare an inventory report and assessment of its historic machinery and equipment by the end of 2007.

4.5. Summary

Two properties on the ORNL site are presently listed on the NRHP, the nation's official list of properties significant in architecture, history, and culture. The Graphite Reactor (Building 3001) was designated a NHL in 1966 for its pivotal role in the development of nuclear energy and weapons, and is within the boundaries of the NRHP-eligible ORNL Historic District as a contributing building. The New Bethel Baptist Church and Cemetery are located approximately one mile east of the ORNL main facilities complex and were listed on the NRHP in 1992. The 1993 Architectural/Historical Assessment of ORNL identified a historic district within the main ORNL Campus that is eligible for the NRHP. This study also identified eleven buildings and structures located in outlying areas surrounding the main ORNL complex as individually eligible for the NRHP. The SHPO concurred with these recommendations.

Since the completion of the 1993 survey, seven contributing properties to the district have been demolished or removed, and the SHPO has approved the demolition of an additional five contributing buildings. MOAs were prepared for these properties. The NRHP-eligible ORNL Historic District presently contains fifty-four properties that would be considered contributing to the district.

The 1993 architectural and historical survey of ORNL utilized existing historical research and analysis in assessing the World War II and Cold War significance of the facility. Additional documentation and research of ORNL's Cold War history is needed. An inventory of the installation's World War II and Cold War era machinery and equipment will be completed by the end of the year 2007.



5.0. ORNL ARCHAEOLOGICAL PROPERTIES

5.1. Previous Archaeological Investigations at OR N L

A minimum of ten major archaeological reconnaissance-level surveys have been conducted on the ORR. Through these studies forty-four archaeological sites have been identified and recorded on the ORR. Of these sites, thirteen have been determined to be eligible for listing in the NRHP. None of these properties is within the boundaries of the ORNL complex. In 1993, DuVall & Associates, Inc., conducted a field review of the ORNL installation and found no preserved prehistoric or historic archaeological sites.

5.2. Potential for Archaeological Properties at the ORNL

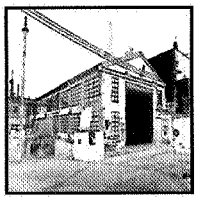
The 1993 DuVall & Associates archaeological evaluation of the ORNL concludes that the potential for archaeological properties at the ORNL main facilities complex is extremely limited. Initial and subsequent construction of the installation have caused severe disturbance of the valley floor. Bulldozing and construction of facilities and infrastructure including transmission lines and waste disposal areas have been substantial on the property since the early 1940s. As a result of the amount of previous disturbance within the valley, the potential for archaeological properties at the ORNL installation is extremely low.

5.3. National Register Assessment

There are no identified NRHP-eligible archaeological properties within the ORNL complex. The potential for archaeological sites meeting the criteria for inclusion in the NRHP is minimal.

5.4. Summary

Several archaeological surveys have been conducted at the ORR. However, no prehistoric or historic archaeological sites have been identified at the ORNL complex. Due to the amount of previous ground disturbance at the ORNL main facilities complex, the potential for preserved archaeological sites is considered minimal.



6.0. ORNL AND HISTORIC PROPERTY STEWARDSHIP

6.1. Federal Agencies and the NHPA

The basis of Federal historic and archaeological resources protection law is the NHPA. 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, 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 a 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 State Historic Preservation Officer (SHPO) and an 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;
- Incorporation and further definition of Executive Order 11593 in Section 110; 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.

6.2. 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. The review process is administered by the Council which is an independent Federal agency. Section 106 acts as the cornerstone of the 1966 Act which was created out of public concern that the Nation's historic resources were not receiving adequate attention. Section 106 was created to protect historic properties from Federal activities.

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. Even properties not yet discovered may be eligible for listing on the NRHP. Therefore, it is important that all properties be examined before proceeding with a Federal activity.

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 which satisfy all interested parties. It is the responsibility of the DOE, as a Federal agency, to comply with this important tool of preservation law.

One of the most important participants in the Section 106 process is the **SHPO**. SHPOs are appointed by state governors to carry out NHPA responsibilities. The 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 effects of an undertaking on those properties. Since the SHPO is directly responsible for conducting statewide surveys of historic properties, it is essential that officials of facilities on the ORNL Complex coordinate identification efforts with the Tennessee SHPO.

If historic properties exist within the area of a potential project, the appropriate officials should consult with the Tennessee SHPO in applying the criteria of effect set forth in Section 106. It is the SHPO's responsibility to assist DOE and its contractors in carrying out their historic preservation responsibilities, thus the SHPO helps in the determination of effects of an undertaking on historic properties. The Tennessee SHPO should be aware of ways to avoid or to reduce adverse effects on historic properties, offering this advice to the appropriate officials. As a representative of state interests, the Tennessee SHPO is often asked to provide views to the Council.

It may happen that a historic property is discovered only after the project begins. In this case, it is the 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 Archaeological and Historic Preservation Act of 1974 rather than Council regulations. The SHPO must be given an opportunity in any event to comment on the project before it continues.

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, technical assistance and testimony on legislative proposals;

- Carries out Section 106 review; 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 chair), 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.

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; 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. It is in the agency's best interest to stimulate public participation as the Council views such opinions vital to the Section 106 process. Public notice should adequately inform individuals of preservation issues, elicit views on such issues, and when possible, involve public opinion in decision making.

Council participation in Section 106 is vital. The Council regulates criteria for the assessment of effects. If the Council determines that Section 106 responsibilities are not being properly carried out by an agency or SHPO, it may choose to participate in the consultation process. In this case, the Council participates in a manner parallel to the SHPO and must be allowed to comment directly. The Council is responsible for reviewing MOAs and has the right to accept or reject such agreements. Although the agency has the right to reject Council comments, it should consider such comments seriously. If the Council fails to issue its comments within the specified period of time, the agency has the right to proceed with its project.

6.2.1. Assessing Effects to Historic and Archaeological Properties

The missions and responsibilities of the ORNL Complex can affect historic and archaeological resources 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. In order to determine the "effects" a project may have on historic properties, the appropriate officials must consider not only direct effects, but also those that may come indirectly as a result of the project.

Assessing the effects of a project can result in three possible findings:

1. **NO EFFECT** - where historic properties are not altered or affected;

2. **NO ADVERSE EFFECT** - where there may be an effect but it will not harm characteristics that qualify properties for inclusion on the NRHP.

3. **ADVERSE EFFECT** - where the effect will possibly damage the integrity of a historic property.

Any Federal undertaking must make a determination of "effect" or "no effect." During this stage of the Section 106 process, it must be determined whether there is any effect, and if so if the effect is adverse. Any time a project directly or indirectly alters a historic property or activities associated with that property, there is an effect. Any undertaking that has the possibility to alter a property's significance is considered to be an effect. When determining whether a project has an effect on properties, it is important to remember that the effect does not have to be negative to qualify as an effect. Long range as well as immediate changes from the project also need to be considered.

If the appropriate officials determine that there is no effect from an undertaking, it must notify the SHPO and any other interested parties of this decision. The SHPO has a fifteen-day period to object to the decision. If the SHPO disagrees, an effect is determined and the agency must reassess the project in consultation with the SHPO.

Once an effect is determined, then it must be decided whether the effect is adverse. Any undertaking is adverse if it degrades a property or results in loss of characteristics that make the property eligible for listing on the NRHP. Detrimental changes from vandalism or from natural forces may also result in an adverse effect.

Any effect is adverse if it results in at least one of the following:

- Destruction or alteration of the historic property or its surrounding landscape;
- Isolation from or alteration of the historic property's environment;
- Intruding elements such as visible, audible or atmospheric changes;
- Neglect of the historic property or its surroundings; and
- Transfer, lease or sale of the historic property or its significant surroundings.

Undertakings with the potential to have an adverse effect include:

- Demolition of historic buildings or structures;
- Additions to historic buildings or structures;
- Alterations to historic properties such as exterior material replacement, window or door replacement, and removal of historic fabric; and
- New building construction within or adjacent to the NRHP-eligible Historic District.

If the appropriate officials determine that the effect is not adverse, it must obtain the SHPO's agreement and notify the Council with written documentation so that the decision is available for public inspection. Documentation must be submitted with the decision, and the Council is given thirty days in which to comment.

Once all parties agree upon a course of action, the appropriate contractor may proceed with the proposed project. If no agreement is reached, DOE and contractor management must consider Council comments and make a decision at that point. Once the Council's comments have been reviewed, the appropriate officials notify the Council of its final decision and proceed with that decision.

If the Council believes that an agency or an applicant for the agency's assistance has foreclosed on Council comments, the Council will notify the agency of the foreclosure and allow for an agency response. Foreclosure usually occurs if the review process is ignored, if the project has already harmed a historic property beyond repair, or if the project is beyond a stage that allows alternative measures. ***If foreclosure is confirmed, the agency breaks the law and opens itself to litigation. Early planning and consultation with the SHPO will avoid this situation.***

6.2.2. Prepare and Implement Programmatic Agreements/Memoranda of Agreement

PAs and MOAs are legal documents that provide evidence that DOE and its contractors have completed its responsibilities as specified under Section 106. A PA defines historic properties and the roles and responsibilities of an agency in meeting its legal obligations for cultural resource protection. In addition to the stipulations outlined in a PA, DOE might also find it necessary to prepare a MOA for specific projects or undertakings. Council acceptance of a PA and/or MOA serves as its comment, which completes the process. The PA/MOA provides the appropriate DOE program official and contractor with legal support to fight challenges to its project. However, if these entities fail to carry out its responsibilities as outlined in the PA/MOA, it has to request Council comment before continuing with its undertaking.

A publication detailing the various steps in preparing agreement documents is available from the Council and reference to this document is recommended. This publication, *Preparing Agreement Documents: How to Write Determinations of No Adverse Effect, Memoranda of Agreement, and Programmatic Agreements under 36 CFR Part 800*, provides extensive information on the preparation of such documents.

A PA has been prepared for ORNL that describes overall types of installation actions and activities that require SHPO and Council review. The PA was developed to clarify effects requiring review and to make the review process more efficient. For some activities that do not require review or will have no adverse effects, the PA will provide all of the guidance necessary for activity completion. However, if the undertaking results in adverse effects then a separate MOA will be required for that specific undertaking.

6.2.3. Emergency Conditions

Emergency conditions include natural disasters and threats to national security. Such conditions may threaten public health or safety and are declared by a Federal agency head, the President, the state's governor or a local government official. In case of an emergency situation, ORNL should notify the SHPO and Council of proposed actions.

6.3. Section 110 of the NHPA

A Federal agency's responsibilities to stewardship of a historic property are outlined in Section 110 of the NHPA. A Federal agency must, under the 1966 law, assume responsibility for preserving historic properties that it owns. Major responsibilities are as follows:

- Designate a qualified preservation officer who will be responsible for coordinating the agency's preservation activities.
- Inventory and evaluate all historic properties owned by the agency and nominate them to the NRHP.
- Do not allow NRHP eligible properties to deteriorate or to be sold, demolished, altered or transferred until all possible alternative actions have been considered.
- Assume responsibility for preservation of historic properties.
- Use historic properties to their maximum extent.

- Undertake preservation activities including protection, management, rehabilitation, restoration, stabilization, maintenance, and reconstruction.

- If a historic property must be altered, damaged or destroyed, record the property in accordance with established guidelines and deposit the record with the Library of Congress with copies to DOE echelons. All expenditures involving a preservation activity are authorized and may include compensation to SHPOs.

It is the responsibility of DOE, as a Federal agency, to comply with Section 110.

6.4. Related Federal Laws

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

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

Compliance with any of the above laws does not substitute for compliance with Section 106 unless the Council agrees that it does and there is a PA or approval of counterpart regulations.

6.4.1. NEPA of 1969

Under the NEPA, Federal agencies are responsible for the environmental impact of their activities. Historic properties are considered to be part of this environment. The 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, activities involving each can be coordinated. For example, completion of steps one and two of Section 106 can be done as NEPA documents are prepared as they address many of the same questions. During the consultation process (Step 3) of Section 106, an environmental impact statement (EIS) or environmental assessment (EA) may be used as a basis for consultation. The MOA, if required, would be prepared during Step 4 of the 106 process and may be included as part of a final NEPA report. If the MOA is not included, its terms should at least be outlined in the final NEPA report.

6.4.2. 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 your 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 you may complete some steps for both at the same time. However, satisfying requirements for one is not sufficient. These are separate laws and must be treated as such.

6.4.3. ARPA of 1979

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

6.4.4. 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.

6.4.5. NAGPRA 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.

6.5. Identification of Historic and Archaeological Properties at ORNL

The responsibilities of the DOE regarding cultural resources at ORNL are varied and require specific actions. These actions follow the provisions of Section 106 as well as the ORR Cultural Resource Management Plan (CRMP). DOE officials must review available information concerning historic and archaeological properties within a project or program area for potential effect. The 1993 survey of ORNL identified and inventoried 608 individual buildings and structures. These include buildings constructed from the initial establishment of the plant in 1943 through 1993. This survey effort resulted in the completion of the report entitled the "Architectural/Historic Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee." This report provides extensive information regarding the historic properties of ORNL and should be referenced in future planning efforts or project development at ORNL. Results of this report and previous archaeological studies are detailed in Sections 4.0 and 5.0 of the HPP.

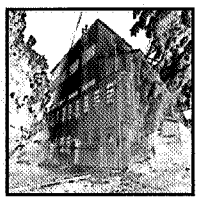
6.6. Future Cultural Resource Investigations

The fifty-year benchmark for assessing historic properties will continue to require ORNL to update its survey efforts in the future. The 1993 architectural and historical survey of ORNL focused on the installation's historic Manhattan Project era. ORNL also possesses a compelling history associated with the Cold War. A future study is needed that will assess the installation's role and significance during this era (1945-1989). Any future surveys will follow established Federal standards for cultural resource identification and include historical and architectural documentation of ORNL's significance in a given historical context.

Additional archaeological investigations may be justified when there are ground disturbance activities planned for areas with medium to high archaeological potential. These types of projects could include new building construction, extensive grading or landscaping, or the construction or rerouting of roadways. Archaeological investigations should be included within the scopes of work for these types of activities and the investigations coordinated with the Tennessee SHPO.

6.7. Summary

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 SHPO is responsible for assisting ORNL in carrying out its historic preservation responsibilities.



7.0. ORNL MISSION AND COMPREHENSIVE PLANNING – HOW IT AFFECTS HISTORIC PROPERTIES

7.1. ORNL Mission and Comprehensive Planning

ORNL faces significant challenges with respect to its facilities and infrastructure. The historic district overlays a large portion of the main ORNL facilities complex and its infrastructure base. DOE SC is the site landlord and will have a long-term national security presence. Some of the key challenges facing the SC landlord with respect to historic preservation are:

- To accomplish its mission of scientific research, ORNL staff are dependent upon the availability of a wide variety of buildings and equipment, including specialized experimental laboratories, user facilities, hot cells and nuclear reactors, and a large complement of office space and associated utility systems.

- A number of ORNL's physical facilities have reached the end of their safe operating life. The poor condition of facilities is a key environmental, safety and health concern.

- Facility inefficiencies prompt the need for consolidation of ORNL functions and operations. This consolidation is of paramount importance to improving the efficiency and effectiveness of DOE SC missions.

- While maintenance and capital expenditures have increased recently, the upgrade and retention of some ORNL facilities may not be viable. As consolidation plans progress, economic considerations must be considered along with preservation strategies.

- DOE EM is conducting decontamination and decommission (D&D) activities at ORNL. Buildings transferred to the Office of EM are those determined to be excess to any current or projected mission need and ultimately will be disposed.

Excellence in Laboratory operations is one of the key goals of the ORNL agenda. It is vital to ORNL's mission to ensure that its scientists and engineers conduct first-rate scientific research in modern and efficient facilities with state-of-the-art equipment and instrumentation. ORNL intends to meet that goal through a comprehensive upgrade of facility conditions and operational approaches over the next few years. Trends in ORNL's site and facilities management and planning are driven by the need to develop an integrated research campus for the 21st century.

There are various planning documents that have been created to direct needed changes on the ORNL site. The principal planning document for the installation is the *ORNL Institutional Plan,* which establishes the direction for ORNL in terms of its long-range vision, objectives, and goals. One of the high-priority initiatives outlined in this document is the Facilities Revitalization Project (FRP), which seeks to modernize and consolidate the site in order to provide world-class

facilities at ORNL. With respect to facilities and infrastructure, the foremost planning documents are the *ORNL Strategic Facilities Plan* and the *ORNL Land and Facilities Plan*. The *ORNL Strategic Facilities Plan* reviews the current inventory and condition of existing ORNL facilities, as well as the programmatic mission drivers that are the basis for future facilities needs, and outlines the specific facilities consolidation, upgrade, and new construction needs that lead to an overall Master Plan for ORNL development. The *ORNL Land and Facilities Plan* provides current information concerning DOE-ORO reservation land use development, integrated strategic facilities planning, cost and schedules for planned projects, and conclusions and recommendations. Within the *ORNL Land and Facilities Plan* is the ORNL Integrated Facilities Plan, which summarizes the critical components of the facilities upgrade process.

The objective of these plans is to express the results of a comprehensive planning process that evaluates mission requirements and facility and infrastructure needs. The results take the form of a Master Plan for the development of the ORNL Laboratory, which involves capital projects and other investments (i.e., maintenance and repair) required to ensure the safe and secure performance of the assigned missions. Projects proposed within the plan are required to be evaluated for NEPA and NHPA requirements prior to implementation. DOE SC participates in ORNL's strategic planning process to ensure compatibility with DOE's Strategic Plan.

Comprehensive planning is a dynamic process and occurs continuously. The *ORNL Strategic Facilities Plan* and *Land and Facilities Plan* are updated and approved by DOE annually. As ORNL continues to address the challenges described above, additional facility and infrastructure alternatives will be developed and analyzed. These alternatives will no doubt involve historical facilities and the historical district.

7.1.1. Determination of Strategic and Nonstrategic Facilities

The strategy of ORNL's Facilities Revitalization Plan is to consolidate laboratory research and support operations into a set of strategic facilities located at the main ORNL site and transfer excess facilities that are nonstrategic, uneconomical, and/or underutilized and no longer support ORNL's current and future programmatic missions to other parties.

Strategic facilities are those facilities located within the main ORNL site that are essential for ORNL to enable world-class scientists to deliver world-class research. These facilities typically are flexible in use, have unique capabilities that are difficult and/or too costly to duplicate, and are critical to the research mission. Nonstrategic facilities are identified as those that are greater than 30 to 40 years old, are of high maintenance and operation cost, have a high backlog of deferred maintenance, and pose a potential risk to the health and safety of staff and the environment.

7.1.2. Office of Environmental Management Records of Decision

For inactive buildings and other facilities that are designated for D&D, the Office of EM produces Records of Decision for Interim Actions (RODs). These documents present selected remedies for various contaminated areas. Actions are chosen to suit the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300]. In addition, NEPA values are incorporated in the documents. Inactive buildings and facilities are to be removed to grade level following decontamination and stabilization. EM prepared RODs for facilities in Bethel Valley and Melton Valley Watershed at

ORNL in May 2002 and September 2000 respectively. These RODs have been approved by all the parties and are the planning documents for the EM program at ORNL.

7.2. Historic Preservation Strategy

The ORNL Historic Preservation Strategy is to ensure that preservation is an integral part of the annual comprehensive planning process. Implementation of the ORNL historic preservation strategy will be accomplished through the combined application of historic preservation interpretive initiatives, and the physical preservation of historic properties. Physical preservation will be evaluated in the context of, but not necessarily limited to, continuing mission need, functional use, and economic considerations. This strategy recognizes that historic significance must go beyond the preservation of physical structures – principally due to the long-range need for efficient space to perform the site's missions and due to the fact that most of ORNL's historic properties are historically significant due to the historic missions that took place within them over the years. The ORNL historic preservation strategy also addresses the need to preserve more global historic features, such as ORNL's part in the Manhattan Project, the historic character of ORNL during the war effort, and the historic significance of ORNL's products and research programs (which are of particular importance to the Cold War era), historic documents, artifacts, and people.

Interpretive historic preservation initiatives developed as part of the ORNL historic preservation strategy are discussed in Section 7.3. An important component of the ORNL historic preservation strategy will also be the physical preservation of historic structures. Physical preservation must be based on sound comprehensive planning and DOE SC mission directives. As a part of this preservation strategy and based on the dynamics of planning efforts, ORNL's existing sixty-five historic properties have been categorized into the following four groups:

(1) Future Mission Need
(2) Future Mission Needs Uncertain
(3) Excess to Mission Need
(4) NHL Status

The groupings reflect the current understanding of comprehensive plans to date, including the most recent *ORNL Land and Facilities Plan* dated August 2002, and EM RODs for Melton Valley Watershed (September 2000) and Bethel Valley (May 2002). The ORNL HPP provides an assessment of all NRHP-eligible properties at ORNL. For buildings within the historic district, this assessment categorizes each property's contribution to the historical and architectural character of the district as either minor, moderate, or major. For individually-eligible buildings outside the district, the minor, moderate, or major rating refers to the overall degree of historical significance and architectural integrity of the individual property. These determinations were based on each building's:

- **Historical Significance** – historical significance reflects the building's role in the historic operations at ORNL, the importance of the activities that took place in the building in the context of the facility's history, especially World War II and the Cold War.
- **Architectural Significance and Integrity** – the importance of a building's design and construction as a representative example of a particular property type or design, and/or its significance in engineering. Integrity refers to the retention of original materials, form, and design from the building's period of significance.
- **Location in District and Contribution to Historic Streetscape** – the size, scale, and placement of a building within the district have a great bearing on whether or not the

building is a strong focal point of the district. Buildings in the center of the district, especially large research or process facilities or a collection of associated buildings (such as those in the Isotope Complex), will have a greater visual importance to the district than smaller, ancillary buildings (such as a pumphouse) that are on the edge of the district.

The 1993 intensive architectural and historic survey of the ORNL complex was referenced in making these assessments. The results of this survey were presented in the report "Architectural/Historical Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee." This report identified NRHP-eligible buildings, determined the boundaries for the NRHP-eligible ORNL Historic District, and made recommendations for contributing/non-contributing status of individual buildings. The Tennessee Historical Commission SHPO reviewed the report and concurred with its findings. The authors of the 1993 report, Martha Carver and Margaret Slater, also participated in the determinations of minor, moderate, or major status for the ORNL HPP.

- Group 1 Buildings: These ten ORNL historic properties have an identified mission need for the foreseeable future. The physical preservation of historically significant features of these properties will be ensured through an active facility maintenance program (See Section 8.0); and alterations to these properties will be reviewed for potential adverse effect to historic properties as described in Section 11.0.

TABLE 1: Group 1 – Historic Properties Projected to Have Future Mission.

	Building Number	Building Name	Responsible Entity	In ORNL Historic District?	Contribution to District's Visual Appearance	Contribution to District's Historic Integrity (or Individual Significance)
1	3039	Cent. Rad. Waste Gas Disposal Facility	BJC	Yes	Major	Major
2	3092	Off-gas Facility	BJC	Yes	Major	Major
3	3500	Instrumentation & Controls Division	UT-B	Yes	Major	Major
4	3518	Process Waste Treatment Plant	BJC	Yes	Minor	Minor
5	4500N	Central Research & Administration	UT-B	Yes	Major	Major
6	4501	High Level Radiochemical Lab	UT-B	Yes	Major	Major
7	4505	Experimental Engineering	UT-B	Yes	Major	Major
8	5500	High Voltage Accelerator Lab	UT-B	Yes	Major	Major
9	7813	White Oak Creek Dam	BJC	No	N/A	Major
10	7846	White Oak Lake	BJC	No	N/A	Major

- Group 2 Buildings: These sixteen ORNL historic properties' future mission needs are uncertain at this time, albeit most are at least partially active today. Physical preservation of historically significant features of these historic properties will be ensured through an active surveillance and maintenance (S&M) program (see Section 8.0). The objective of

the S&M program is to prevent the inadvertent loss of historically significant features through neglect. Restoration and/or upgrade to these structures will be deferred until future mission needs have been determined. At such time as future mission needs have been determined, the facility will be reclassified as a Group 1 or Group 3 building, in accordance with the process described in Section 7.3. Alterations to Group 2 properties will be reviewed for potential adverse affect using the same process as established for Group 1 buildings (as described in Section 11.0).

TABLE 2: Group 2 – Historic Properties with Future Mission Needs Uncertain.

	Building Number	Building Name	Responsible Entity	In ORNL Historic District?	Contribution to District's Visual Appearance	Contribution to District's Historic Integrity (or Individual Significance)
1	2003	Process Water Control System	UT-B	Yes	Minor	Minor
2	3000	13.8 kV Substation	UT-B	Yes	Minor	Minor
3	3019(A)	Radiochemical Processing Pilot Plant	UT-B	Yes	Major	Major
4	3020	Exhaust Stack for Bldg 3019	UT-B	Yes	Major	Major
5	3021	Turbine House for Bldg 3019	UT-B	Yes	Major	Major
6	3025(E)	Physical Exam-Hot Cells A	UT-B	Yes	Major	Moderate
7	3025(M)	Solid State Division Lab	UT-B	Yes	Major	Moderate
8	3027	Safeguard Nuclear Materials Vault	UT-B	Yes	Moderate	Moderate
9	3034	Radioisotope Area Services	UT-B	Yes	Major	Major
10	3044	Special Materials Machine Shop	UT-B	Yes	Moderate	Moderate
11	3091	Filters for Bldg 3019	UT-B	Yes	Minor	Minor
12	3501	Sewage Pumping Station	UT-B	Yes	Minor	Minor
13	3502	East Research Service Center	UT-B	Yes	Moderate	Moderate
14	7001	General Stores	UT-B	No	N/A	Moderate
15	7002	Garage & Iron Working Shop	UT-B	No	N/A	Moderate
16	7751	Sentry Post No. 22	UT-B	No	N/A	Moderate

- Group 3 Buildings: These thirty-eight ORNL historic properties have been determined to be excess to future mission needs. Thirty-two of these properties are contributing buildings or structures to the NRHP-eligible ORNL Historic District. The remaining six properties are individually NRHP-eligible buildings or structures, five of which are associated with the TSF. Historically significant features of these facilities will be preserved through interpretive initiatives, and the facilities will be demolished (in some cases after completing required D&D work or placed in "safe storage" standby condition). Interpretive initiatives that will be performed prior to demolition to capture and preserve the historically significant features of these facilities are described in Section 7.3.

TABLE 3: Group 3 – Historic Properties Excess to ORNL Missions.

	Building Number	Building Name	Responsible Entity	In ORNL Historic District?	Contribution to District's Visual Appearance	Contribution to District's Historic Integrity (or Individual Significance)
1	2624	Solid Waste Storage Area 1	BJC	Yes	Minor	Minor
2	3002	Filter House	BJC	Yes	Major	Major
3	3005	Low Intensity Testing Reactor	BJC	Yes	Major	Major
4	3008	Source & Materials – Spec. Vault	UT-B	Yes	Moderate	Moderate
5	3009	Pump House	BJC	Yes	Minor	Minor
6	3010	Bulk Shielding Reactor Facility	BJC	Yes	Major	Major
7	3012	Rolling Mill	UT-B	Yes	Major	Moderate
8	3017	Chemical Technology Division Annex	UT-B	Yes	Moderate	Moderate
9	3018	Original Exhaust Stack for Graphite Reactor	BJC	Yes	Major	Major
10	3019(B)	High Level Radiation Analytical Lab	BJC	Yes	Major	Major
11	3026(C)	Radioisotope Dev. Lab	BJC	Yes	Moderate	Moderate
12	3026(D)	Dismantling & Exam Hot Cells	BJC	Yes	Moderate	Moderate
13	3028	Radioisotope Production Lab A	BJC	Yes	Major	Major
14	3029	Radioisotope Production Lab B	BJC	Yes	Major	Major
15	3030	Radioisotope Production Lab C	BJC	Yes	Major	Major
16	3031	Radioisotope Production Lab D	BJC	Yes	Major	Major
17	3032	Radioisotope Production Lab E	BJC	Yes	Major	Major
18	3033	Radioisotope Production Lab F	BJC	Yes	Major	Major

	Building Number	Building Name	Responsible Entity	In ORNL Historic District?	Contribution to District's Visual Appearance	Contribution to District's Historic Integrity (or Individual Significance)
19	3036	Isotope Area Storage & Service	UT-B	Yes	Major	Major
20	3037	Operations Division Offices	UT-B	Yes	Major	Major
21	3038	Radioisotope Laboratory	BJC	Yes	Major	Major
22	3042	Oak Ridge Research Reactor	BJC	Yes	Major	Major
23	3074	Interim Manipulator Repair Facility	UT-B	Yes	Moderate	Moderate
24	3080	Reactor Experiment Control Room	UT-B	Yes	Moderate	Moderate
25	3503	High Radiation Level Engineering	UT-B	Yes	Moderate	Moderate
26	3504	Geosciences Lab	UT-B	Yes	Moderate	Moderate
27	3508	Chemical Evaporator Building	UT-B	Yes	Moderate	Moderate
28	3515	Fission Product Pilot Plant	BJC	Yes	Minor	Minor
29	3523	Storage	UT-B	Yes	Minor	Minor
30	3587	Instrument Lab Annex	UT-B	Yes	Minor	Minor
31	3592	Coal Conversion Facility	UT-B	Yes	Moderate	Moderate
32	4507	High Rad. Level Chem Dev. Lab	BJC	Yes	Major	Major
33	7503	Molten Salt Reactor Exper. Facility/ARE	BJC	No	N/A	Major
34	7700	Tower, Tower Shielding Facility	BJC	No	N/A	Major
35	7701	Pool, Tower Shielding Facility	BJC	No	N/A	Major
36	7702	Control House, Tower Shielding Facility	BJC	No	N/A	Major
37	7703	Hoist House, Tower Shielding Facility	BJC	No	N/A	Major
38	7704	Control House No. 2, Tower Shielding Facility	BJC	No	N/A	Major

- Group 4 Buildings: In 1966, this ORNL building received NHL status. Operations in the Graphite Reactor were discontinued in 1963. The building now houses office space and a museum. The physical preservation of historically significant features of this property will be ensured through an active facility maintenance program (see Section 8.0); and alterations to these properties will be reviewed for potential adverse effect to historic properties as described in Section 11.0.

TABLE 4: Group 4 – Historic Properties with NHL Status.

	Building Number	Building Name	Responsible Entity	In ORNL Historic District?	Contribution to District's Visual Appearance	Contribution to District's Historical Integrity
1	3001	Graphite Reactor	BJC	Yes	Major	Major

7.3. ORNL Interpretive Approach

Preservation of historically significant features will be accomplished through the combined application of historic preservation interpretative initiatives and the physical preservation of historic properties where physical preservation is consistent with site mission needs. This strategy recognizes that effective preservation of features of historic significance to ORNL goes beyond simply preserving physical structures. Effective preservation of ORNL's historic features should also address more global features, such as the construction of ORNL as part of the Manhattan Project, the historic character of ORNL's historic district, and the historic significance of ORNL's products and research programs (particularly important to Cold War era), artifacts, and people.

The history and significance of ORNL has been recorded in numerous ways. Various books and publications detailing the history of the facility during World War II have been published. In addition, the American Museum of Science and Energy (AMSE) at Oak Ridge contains some exhibits pertaining to the World War II operations of the site and offers limited bus tours of the facility. At the facility itself, a small museum exhibit on the site's role in the Manhattan Project is located in the Graphite Reactor (Building 3001). However, at present, the existing documentation, exhibits, tours, and other methods of interpretation are not comprehensive enough to adequately convey the historical importance of ORNL during World War II and the Cold War. In order to address this need, ORNL will develop an Interpretive Plan by the end of 2007.

A key component of properly protecting ORNL's historic features will involve performing a set of interpretive initiatives designed to comprehensively document ORNL's historical significance. These interpretive initiatives, which will be described in detail in the ORNL Interpretive Plan, will specifically address each of the following important elements:

- Interpretive effort to preserve the historic character and integrity of the NRHP-eligible ORNL Historic District. This effort will address the construction of the X-10 site as part of the Manhattan Project and the development of ORNL as a national laboratory and its expanding missions in later years. This effort will also address the look of the NRHP-eligible ORNL Historic District over the years as missions changed and the site underwent significant changes.

- Interpretive effort to capture ORNL's historic missions, products, and people. The focus of this effort will not be on physical facilities, but on ORNL's historic operations, research programs, and contributions to science, as well as the scientists, staff and employees associated with the facility.

- Interpretive effort to preserve each of the ORNL historic properties (buildings and structures) that are to be demolished, using a graded approach consistent with the degree

of historic significance. (The basis for the determination of each property's historic significance as minor, moderate, or major is discussed in Section 7.2.)

- Facilities of Minor Historic Significance: Facilities of low relative historic significance will have record files developed containing facility photos, facility construction drawings (if available), and a brief written physical description of the facility's historic missions.

- Facilities of Moderate Historic Significance: Facilities of moderate relative historic significance will have a more detailed interpretive record developed, and a final report issued for documentation purposes. The interpretive report will include a collection of available facility photos to document the life cycle of the facility (construction through demolition, if available), a collection of facility maps and drawings (if available), and a more detailed account of historic missions and activities.

- Facilities of Major Historic Significance: Facilities of major relative historic significance will have an extensive interpretive effort prepared, suitable for preservation using video and/or CD-ROM technology, as appropriate. The more detailed interpretive effort will include an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), a detailed account of historic missions and activities (including interviews with former workers if available).

- Consistent with the above-noted graded approach, the level of interpretation to be performed on each of the 38 historic properties that are excess to mission need and, therefore, scheduled for demolition (Group 3 properties) is described in Section 7.4.

ORNL's historical significance may be documented through a variety of interpretive measures. An especially worthwhile measure is the development of an oral history program of current and former ORNL employees. Oral histories can provide valuable information concerning day-to-day operations of the plant, the use and operations of significant components and machinery, and how technological innovations occurred over time. Those who worked at ORNL during World War II are now reaching the end of their life spans and their stories should be recorded before they are gone. Employees associated with the Cold War can provide similar information on the significance of ORNL during those years. In order to document ORNL's history during World War II and the Cold War, ORNL will conduct an oral history program of current and former employees by the end of the year 2005.

Other potential interpretive efforts, which will be described in detail in the forthcoming ORNL Interpretive Plan, might include, but are not limited to, the following:

- **Development or enhancement of an interpretive center readily available to the public.**

- **Provide a vantage point and wayside exhibits for tour buses and the general public.**

- **Prepare exhibits and markers at building locations for the general public and ORNL employees.**

Some of these issues will also be addressed in an upcoming special study and analysis of the entire ORR reflecting its role during the Manhattan Project. Currently, DOE ORO has contracted with Museums + More to develop an ORR Manhattan Project Strategic Plan, which will include Manhattan Project interpretation.

7.4. Proposed Demolition and Assessment of Impact

There are currently thirty-eight buildings classified as Group 3 and proposed for demolition. These historic properties have been determined to be excess to future mission needs. They include research and laboratory facilities, process buildings, storage buildings, offices, and utility and maintenance facilities. Table 5 identifies these buildings and their year of construction.

TABLE 5: Historic Properties Determined to be Excess Facilities (Group 3).

	Building Number	Historic Building Type	Current Building Use	Year Built
1	2624	Utilities/Maintenance	SWSA 1	1943
2	3002	Utilities/Maintenance	Filter House	1948
3	3005	Process	Low Intensity Testing Reactor	1948
4	3008	Storage	Source & Materials Vault	1943
5	3009	Utilities/Maintenance	Pumphouse	1950
6	3010	Process	BSR	1950
7	3012	Process	Rolling Mill	1947
8	3017	Research/Lab	Chemical Tech Division Annex	1952
9	3018	Utilities/Maintenance	Exhaust Stack	1943
10	3019(B)	Process	High Level Rad. Analytical Lab	1954
11	3026(C)	Research/Lab	Radioisotope Dev; Lab B	1943
12	3026(D)	Process	Dismantling & Exam Hot Cells	1945
13	3028	Research/Lab	Radioisotope Prod Lab A	1951
14	3029	Research/Lab	Radioisotope Prod Lab B	1951
15	3030	Research/Lab	Radioisotope Prod Lab C	1951
16	3031	Research/Lab	Radioisotope Prod Lab D	1951
17	3032	Research/Lab	Radioisotope Prod Lab E	1951
18	3033	Research/Lab	Radioisotope Prod Lab F	1951
19	3036	Storage	Isotope Area Storage & Services	1951
20	3037	Office	Operations Division Offices	1951
21	3038	Research/Lab	Radioisotope Lab	1951
22	3042	Process	Oak Ridge Research Reactor	1955
23	3074	Utilities/Maintenance	Interim Manipulator Repair Facility	1951
24	3080	Storage	Reactor Experiment/ Control Room	1953
25	3503	Research/Lab	High Radiation Level Engineering	1948
26	3504	Research/Lab	Geosciences Lab	1951

	Building Number	Historic Building Type	Current Building Use	Year Built
27	3508	Research/Lab	Chemical Evaporator	1951
28	3515	Process	Fission Product Pilot Plant	1948
29	3523	Research/Lab	Expensed Bench Stock Bldg	1954
30	3587	Utilities/Maintenance	Mail Services	1950
31	3592	Process	Coal Conversion Facility	1952
32	4507	Research/Lab	High Rad. Level Chem Dev. Lab	1957
33	7503	Process	Molten Salt Reactor Exper. Facility/ARE	1951
34	7700	Process	TSF	1953
35	7701	Process	Pool, TSF	1953
36	7702	Process	Control House, TSF	1954
37	7703	Process	Hoist House, TSF	1954
38	7704	Process	Control House No. 2, TSF	1954

Demolition of any contributing building in the NRHP-eligible historic district qualifies as an adverse effect on the district. In some instances, demolition of historic buildings may be justified based on building condition, limited integrity, and contamination. Facility managers may also be able to justify demolition based on obsolescence, incompatible reuse potential, and prohibitive cost. When considering the demolition of a historic building, these factors should be presented along with an analysis of the building's size and scale, its placement within the historic district, and its overall significance regarding the site's historic operations.

On the following pages are assessments of the thirty-eight historic properties listed in Group 3 currently proposed for demolition at ORNL. These assessments include a brief architectural description and history of each building, a summation of its historical significance, and the recommended interpretive effort to protect the historical significance of the building prior to demolition. Brief historical summaries of each property often refer to a division of ORNL that was historically associated with the property. Currently, all UT-B facilities are part of the Facilities and Operations Directorate and are no longer assigned to divisions.

BUILDING 2624

ARCHITECTURAL DESCRIPTION:

Building 2624 is an underground waste burial. It is located twenty-five feet south of White Oak Creek and is bisected by Third Street. It is a trapezoidal area approximately one acre in size. The burials remain in place and the site is grassed and surrounded by a barbed wire fence.

HISTORY:

Building 2624 is known as Solid Waste Storage Area (SWSA) 1. It was the first in a series of SWSAs at ORNL. The facility served as a burial ground for solid radioactive wastes with the earliest recorded burial being in the Spring of 1943. Auger holes and trenches were purportedly the burial methods utilized. Records do not indicate what was buried or where within the area. No burials occurred at SWSA 1 after SWSA 2 was placed in service in 1944.

SIGNIFICANCE:

Building 2624 functioned as an underground waste burial area during World War II. It was the first such storage area at the ORNL site. Storage sites for radioactive wastes were important components of the development of nuclear power.

Building 2624 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with the site's development during World War II and with early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 2624 played a minor role in ORNL's history during the World War II era. The removal of this underground waste burial area would have a minor visual effect on the ORNL Historic District.

RECOMMENDED INTERPRETIVE EFFORT:

Building 2624 is of minor historic significance. Prior to its demolition, a record file will be prepared for the building. This file will contain any available photographs or construction drawings of the facility as well as a brief written physical description of the building and its historic missions.

Figure 29: Building 2624 is a burial ground.

BUILDING 3002

ARCHITECTURAL DESCRIPTION:

This 3,450 square-foot building is of concrete construction and has a flat roof. A metal rail and a metal staircase lead to the roof. A small, concrete block, flat roof addition is attached to the north elevation.

HISTORY:

Building 3002 was constructed in 1948 as a filter house for the Graphite Reactor (Building 3001). It filtered air from the air-cooled reactor prior to exhaust through the fan house (Building 3003) and adjacent stack (Building 3018).

SIGNIFICANCE:

As a filter house for the Graphite Reactor (Building 3001), Building 3002 served a primary function in the processes associated with the Reactor. In the years following World War II, the Graphite Reactor was used for numerous experiments and the production of radioisotopes for medical and biological research. The production of radioisotopes was one of the key missions of ORNL in the post-war era. The reactor also was used in shielding studies that involved testing various materials for their capacity to prevent escape of radiation from a reactor. Building 3002 played an essential role in these operations.

Building 3002 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the post-World War II government sponsored scientific movement and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3002 is associated with the Graphite Reactor and is a key component of its historical processes. Building 3002 is located near the Graphite Reactor in a complex of buildings including the fan house and exhaust stack that worked in tandem to complete the operations of the reactor. Building 3002 is important to conveying the district's history and its sense of time and place. Removal of this building would have a major effect on the district's visual appearance and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3002 is of major historic significance. If the demolition of Building 3002 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 30: Building 3002 is a filter house for the Graphite Reactor.

BUILDING 3005

ARCHITECTURAL DESCRIPTION:

Building 3005 was built in several phases between 1948 and 1953 and is of concrete and steel frame construction. It has a central three-story, flat roof tower surrounded by one-story, frame and a concrete sections with flat roofs. The frame sections, including the tower, are sheathed in corrugated metal siding. Windows in the tower are single-light fixed sash design. The concrete block section to the northwest of the tower contains a door and two shed-roof additions.

The building was originally comprised of the mock-up reactor and a two-room control house on the north side of the reactor. In 1951 the mock-up was converted to an operational research reactor and additional shielding was added around the reactor. This shielding was comprised of borated plastic surrounded by loose stacked concrete blocks and river sand. Around this same time rooms were constructed on the east, south, and west elevations. These additions have multi-light hopper windows that have since been either removed or covered. In 1953, another addition was constructed on the west elevation of the building. This addition contains a roll-up door.

HISTORY:

In 1948, ORNL's reactor development efforts were concentrated on the design of the Materials Testing Reactor (MTR). As part of the development process, a full-scale mock-up of the reactor tank and major components were constructed and housed in Building 3005. The purpose of this mock-up was for performance and hydraulic tests to assure that cooling was adequate for the reactor core. Once these tests were completed, ORNL brought the mock-up reactor to criticality. Once its performance was proven, shield was added around the mock-up and necessary modifications were made to operate the reactor. The Low Intensity Testing Reactor (LITR), as it was known, began operation in 1951.

The LITR design also served as a prototype for the MTR built at Arco in Idaho. It was also a design prototype for commercial power plants and of reactor-propelled naval craft. The LITR was permanently shut down in 1968 and the fuel removed in 1970. The beryllium reflector and other reactor components remain. In recent years, the east and west rooms of the building have been used as shops for the Instrument and Controls Division and the Plant and Equipment Division.

SIGNIFICANCE:

Building 3005 is significant for its role in ORNL's experimental reactor program of the Cold War era. The Low Intensity Reactor that operated in the building was an important development in the field of nuclear science. As one of the installation's most successful designs, it served as a prototype for commercial and military use.

Building 3005 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the post-World War II government-sponsored scientific movement and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3005 housed the mock-up of the MTR, which led to the completion of the LITR, and is significant for its role in the development of nuclear science in the post-World War II era. The building is located in the heart of the ORNL Historic District near the Graphite Reactor and is important in conveying the district's history and its sense of time and place. Removal of this building would have a major impact on the district's visual appearance and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3005 is of major historic significance. If the demolition of Building 3005 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 31: Building 3005, the LITR.

BUILDING 3008

ARCHITECTURAL DESCRIPTION:

This is a one-story, concrete block building with a flat roof. The building contains 544 square feet. The south elevation contains two vault-type doors. The building has no windows.

HISTORY:

This building was constructed adjacent to the Graphite Reactor (Building 3001) in 1943 as a vault for materials storage.

SIGNIFICANCE:

Building 3008 was one of the original buildings constructed at ORNL as part of the Manhattan Project. Built in 1943, it served as a materials storage vault for the Graphite Reactor and supported the site's World War II missions and goals of plutonium production. It continued this function in the post-war era. Ancillary facilities such as this were vital to the success of missions identified for X-10/ORNL throughout the Manhattan Project era and on into the Cold War.

Building 3008 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the Manhattan Project, the evolution of ORNL as a national laboratory, the post World War II government-sponsored scientific movement, and early nuclear development.

PROPOSED DEMOLITION: 2004

ASSESSMENT OF IMPACT:

Building 3008 is one of the few Manhattan Project era buildings remaining on the ORNL complex. The building is associated with the NHL Graphite Reactor and is used as a support building to this major significant building by helping to convey the history of the Graphite Reactor's operations and contributing to the streetscape of the historic district. Removal of Building 3008 would have a moderate effect on the visual appearance and integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3008 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

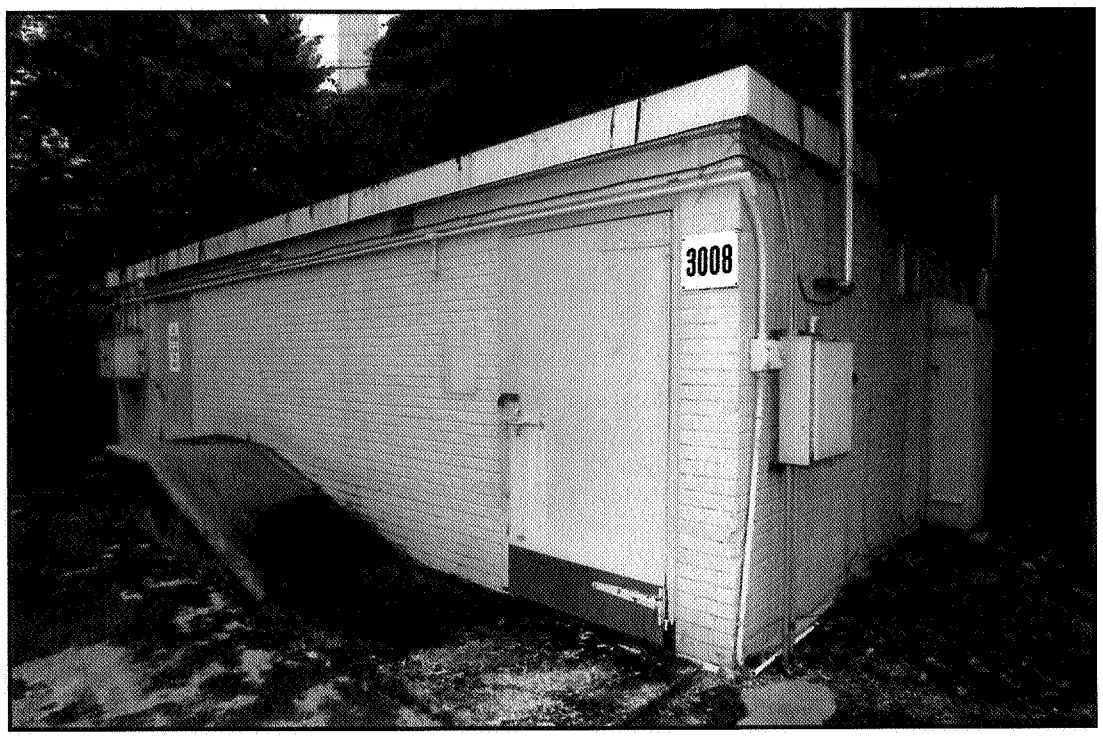


Figure 32: Building 3008 – Storage Vault

BUILDING 3009

ARCHITECTURAL DESCRIPTION:

Building 3009 is a small belowground utilities structure between Buildings 3010 and 3080. The approximately 180 square feet building has its concrete slab roof at ground level. The western cinder block is exposed and next to it are concrete steps that lead down to the entry level. A pumping apparatus is located inside the facility.

HISTORY:

Building 3009 was constructed ca. 1950 as a pumphouse for the Bulk Shielding Reactor Facility (Building 3010).

SIGNIFICANCE:

Building 3009 functioned as a pumphouse and, as an ancillary facility, furthered ORNL's post-World War II mission as a national laboratory. Ancillary facilities – pumphouses, guard posts, warehouses, and utility stations – were vital to the success of ORNL's research and development missions throughout the Cold War years. These types of buildings also contribute to the district's sense of time and place.

Building 3009 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with the site's development as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3009 played a minor role in ORNL's history during the Cold War era. The removal of this small belowground utility building would have a minor visual effect on the ORNL Historic District.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3009 is of minor historic significance. Prior to its demolition, a record file will be prepared for the building. This file will contain any available photographs or construction drawings of the facility as well as a brief written physical description of the building and its historic missions.

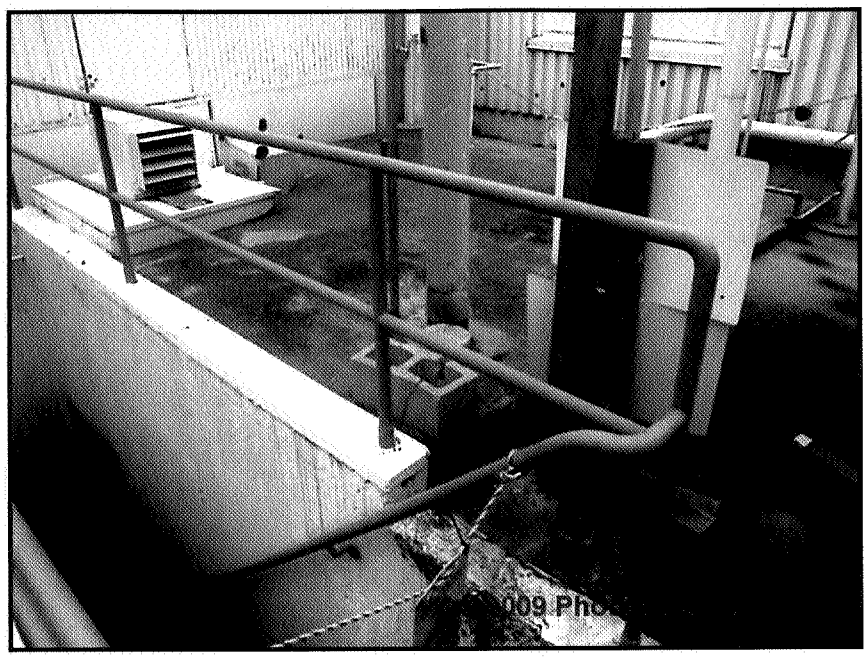


Figure 33: Building 3009 is a belowground utility building.

BUILDING 3010

ARCHITECTURAL DESCRIPTION:

This is an irregular plan building of steel frame construction with one- and two-story sections. The building contains 8,527 square feet and has an exterior of corrugated metal siding, a flat roof, and original multi-light hopper windows. A two-story, flat roof section on the north elevation has a crane bay. Alterations include replacement of the original reactor core in 1960 with the BSR II reactor core and in 1963, a forced-air cooling system was installed.

HISTORY:

Building 3010 is the BSR and was constructed in 1950 as part of the ANP Program. The building was used in radiation shielding studies, mainly to test materials for possible use on a nuclear-powered aircraft. The BSR was the second facility built specifically at ORNL for shielding studies. The core of the BSR was submerged in water for both cooling and moderation purposes. By the use of an overhead crane, the reactor could be moved around in a tank to test shielding in various configurations. A smaller pool and 10K nuclear assembly, the Pool Critical Assembly, allowed the conduct of small-scale experiments in the corner of the building.

After two years of operation, ORNL realized that this facility was inadequate for some of the tests needed for the ARE and the TSF (7700 Area) was constructed in 1952 for additional tests. The BSR continued in use for shielding experiments and in 1960, the BSR II was built. The relatively inexpensive, safe and stable BSR became a prototype for many research reactors around the world. In tandem with the Graphite Reactor (Building 3001), the BSR produced important research in radiation damage processes in solids. Building 3010 is currently in D&D mode.

SIGNIFICANCE:

Building 3010 housed the BSR, an instrumental component of ORNL's ANP Program, one of the Laboratory's most significant projects during the Cold War era. The BSR was used to study, in bulk, various materials for use in improved radiation shields. Also, data from the project resulted in various spin-off research into other fields. As a reactor developed for the ANP Program, Building 3010 aided in the development of new technology and substantially advanced the field of nuclear science.

Building 3010 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with the site's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3010 is one of three reactors constructed during the 1950s as part of the ANP Program at ORNL. The building played a key role in this program and in the development of shielding materials and radiation damage processes. The building is relatively large in size and is located in the heart of the historic district. Building 3010 is important in conveying the district's history and its sense of time and place. Removal of this building would have a major effect on the district's visual appearance and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3010 is of major historic significance. If the demolition of Building 3010 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

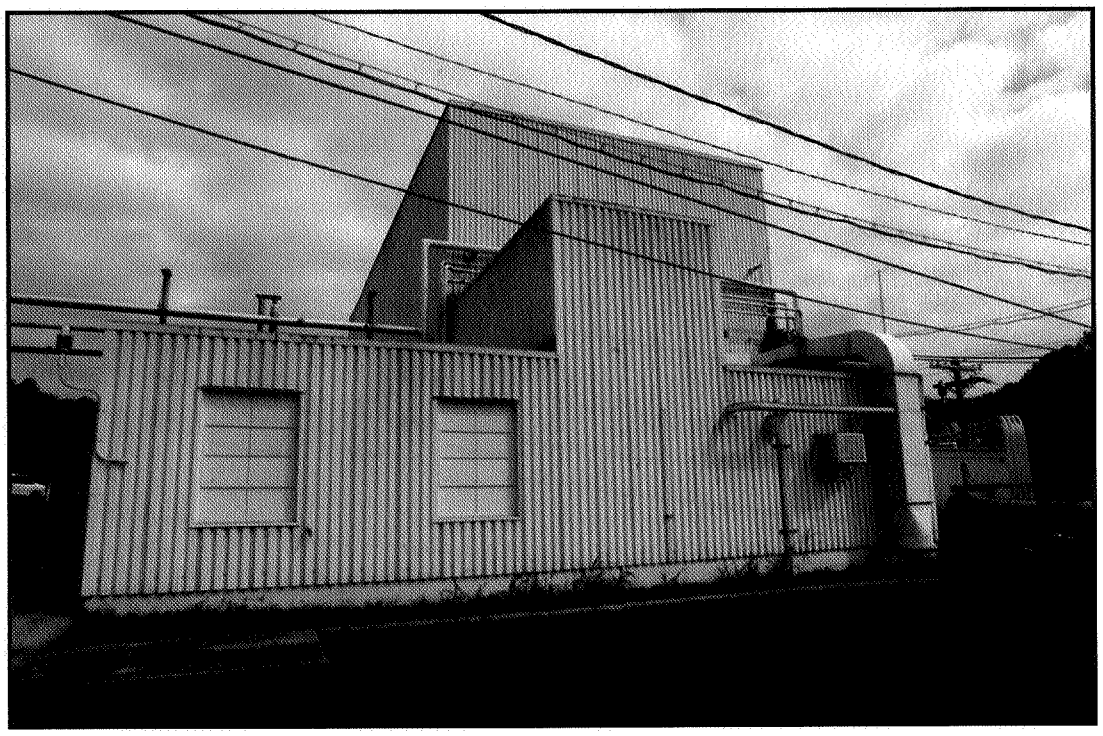


Figure 34: Building 3010 houses the BSR.

BUILDING 3012

ARCHITECTURAL DESCRIPTION:

This is a two-story, steel frame building with a gable roof. The building has ridgeline vents and original hopper windows. At the gable ends are large roll-up garage bay doors. Small shed roof additions are located on the north and east elevations. The interior of the building contains a large room housing the milling equipment. A track in the concrete floor was for the rolling mill. The building contains 10,752 square feet.

In 1951, a bay was added to the north end of the building for a shop and the existing roll-up doors and hopper windows were relocated to the north end. Some existing equipment was relocated to the new section and other equipment was purchased.

HISTORY:

Building 3012 was constructed in 1947 to house a rolling mill. Clinton Laboratories purchased the rolling mill second hand and used it to roll, cast and forge reactor fuel elements and metal parts. Building 3012 and the rolling mill were assigned to the Metallurgical Division (now Metals and Ceramics Division), which conducted intensive research into metallic elements under high temperatures and radiation stress produced in reactors.

SIGNIFICANCE:

Building 3012 has continuously served as a rolling mill operation since its construction in 1947. The building is associated with ORNL's Metallurgical Division (Metals and Ceramics Division) and its research programs.

Building 3012 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the evolution of ORNL as a national laboratory and the post-World War II government-sponsored scientific movement.

PROPOSED DEMOLITION: 2012

ASSESSMENT OF IMPACT:

Building 3012's supportive role in ORNL's historic missions was important, but not vital to the functions and activities of the Laboratory. However, the building does retain much of its original architectural character and is located in the heart of the NRHP-eligible historic district. As such, it strongly contributes to the streetscape of the district and helps to convey a sense of time and place. Removal of Building 3012 would have a moderate effect on the district's integrity and a major effect on the district's visual appearance.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3012 is of moderate historic significance and is of major importance to the visual appearance of the district. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through

demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

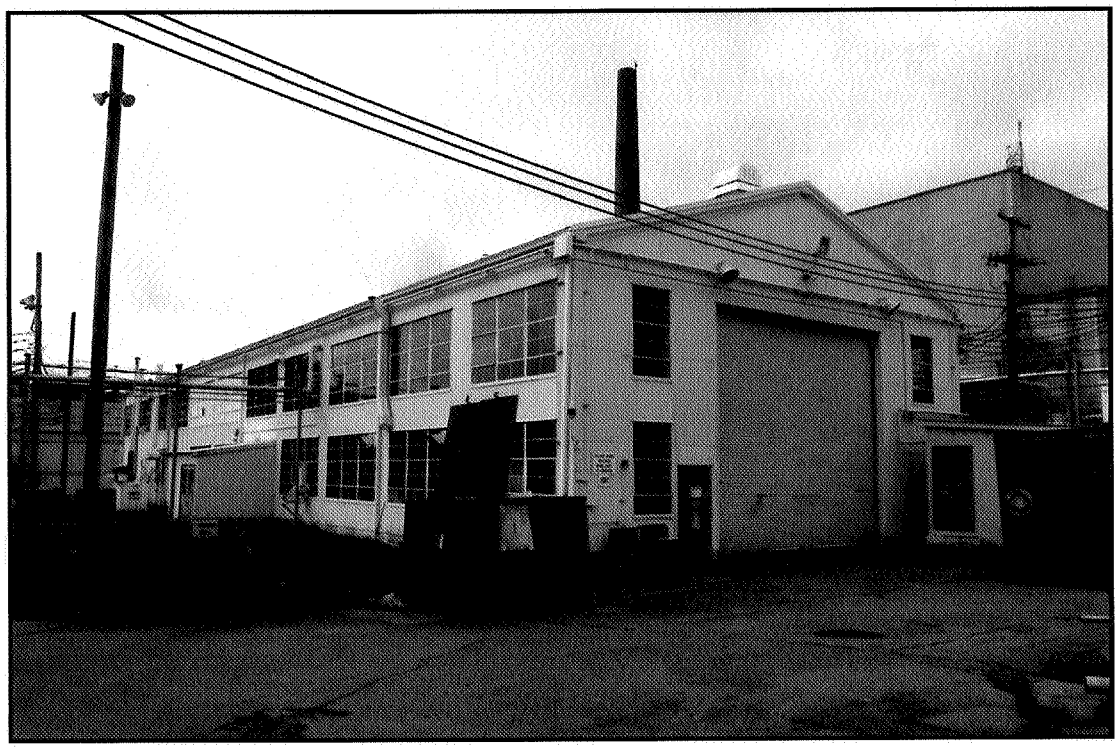


Figure 35: Building 3012 – Rolling Mill

BUILDING 3017

ARCHITECTURAL DESCRIPTION:

This one-story concrete block building has a flat roof with metal coping. Windows in the building are paired six-light hopper designs with concrete sills. The main entrance is located on the north elevation, and steps lead down under a flat roof portico to the door. The west elevation has a secondary entrance that is recessed and has paired doors. The building contains 10,244 square feet.

HISTORY:

Building 3017 was constructed in 1952 and is associated with the ORSORT. The building housed laboratory facilities for students. The ORSORT grew out of a program operating at the Clinton Laboratories in 1946 and 1947. In 1950, a decision was made to establish a full-fledged training program, ORSORT, which continued to operate until 1965. Currently, the building provides laboratory space for the Chemical Technology Division.

SIGNIFICANCE:

Building 3017 served as a laboratory of the ORSORT. This program was initiated at ORNL in 1950 because the field of nuclear science was so new, that the United States' university system could not adequately train scientists. The training school at ORNL played an important role in the development of nuclear power because it was crucial in the dissemination of knowledge about nuclear reactors and nuclear power.

Building 3017 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with the site's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear development.

PROPOSED DEMOLITION: 2006

ASSESSMENT OF IMPACT:

As a lab for the ORSORT, Building 3017 played an important, but not essential role in ORNL's missions and goals during the post-World War II era. Although relatively large in size, the building is located on the perimeter of the historic district and its removal would have a moderate effect on the district's appearance and integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3017 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

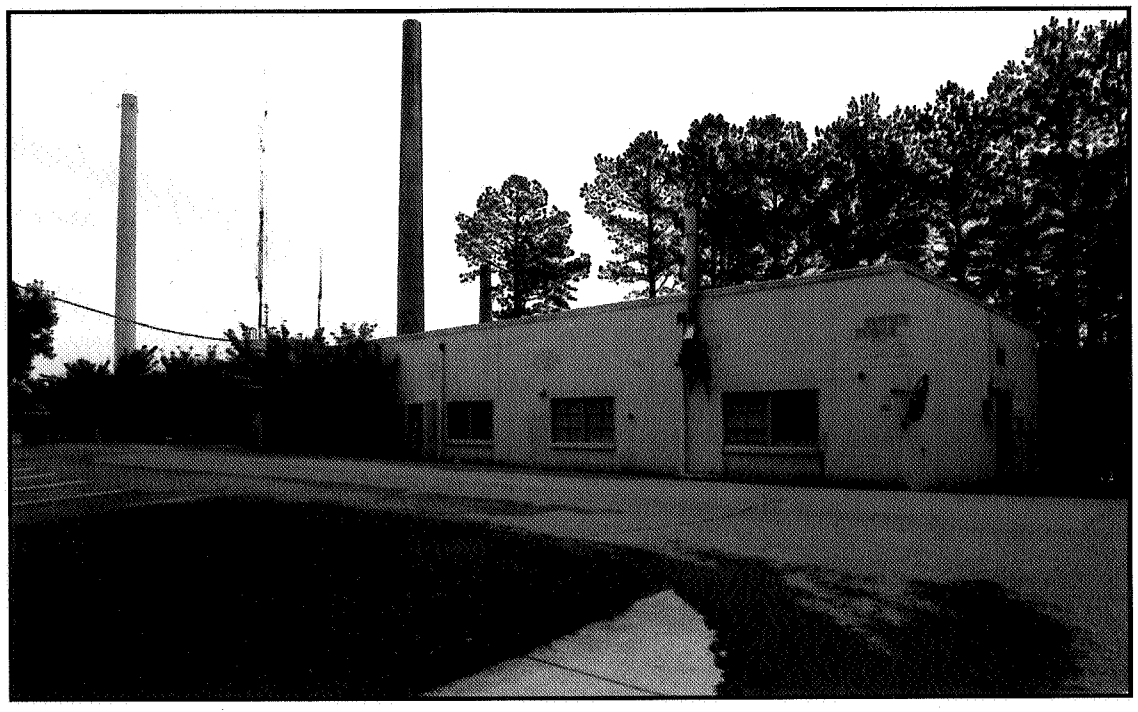


Figure 36: Building 3017 was built as a laboratory for the ORSORT.

BUILDING 3018

ARCHITECTURAL DESCRIPTION:

This 200-foot tall structure is an exhaust stack of concrete construction with outside irons.

HISTORY:

Building 3018 is an exhaust stack that was constructed in 1943 to serve the air-cooled Graphite Reactor (Building 3001). Air was drawn through the fan house and up through the stack. Today it serves as an exhaust stack for the Solid State Accelerator Facility (Building 3003).

SIGNIFICANCE:

Building 3018 is one of the original structures built at the X-10 site as part of the Manhattan Project. As an exhaust stack, Building 3018 was an important component of the Graphite Reactor's operation and supported the site's World War II mission of plutonium production. The stack continued to operate in conjunction with the Graphite Reactor in the post-war years until the reactor was shut down in 1963.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3018 is associated with the historic operations of the NHL Graphite Reactor (Building 3001) and played a critical role in the complex's plutonium production operations during the Manhattan Project and isotope production during the Cold War years. At 200 feet in height, the stack has a strong visual presence and its location adjacent to the Graphite Reactor creates a strong sense of time and place. The exhaust stack is important in conveying the historic character of the Graphite Reactor and the district. Removal of this building would have a major effect on the district's visual appearance and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3018 is of major historic significance. If the demolition of Building 3018 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

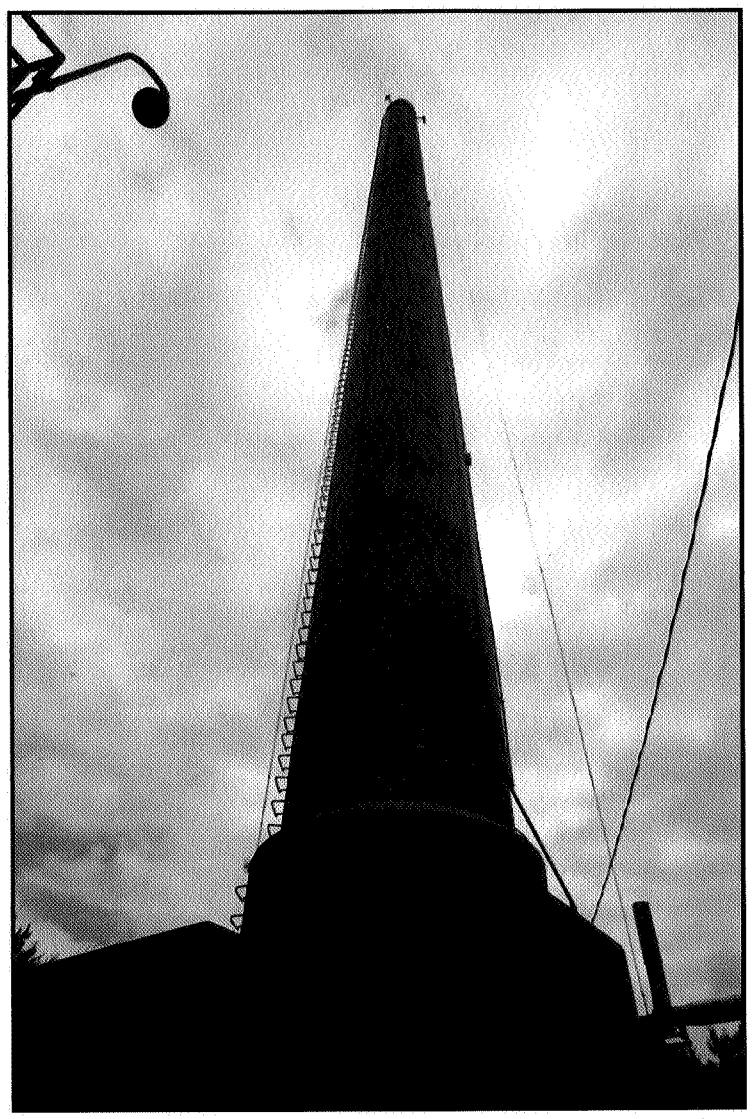


Figure 37: Building 3018 served as an exhaust stack for the Graphite Reactor.

BUILDING 3019(B)

ARCHITECTURAL DESCRIPTION:

This one-story, concrete block building is appended to the west elevation of Building 3019(A). It has a flat roof and a small cubical concrete block section on the west elevation. The building has a flat roof and paired metal doors, which replaced original six-light doors.

HISTORY:

Building 3019(B) was constructed in 1954 as an addition to Building 3019(A), the Radiochemical Processing Pilot Plant. Building 3019(A) was completed in December 1943 and housed the radiochemical processing pilot plant for the X-10 facility. The purpose of the building was to serve as a pilot plant to process and separate plutonium from irradiated slugs produced in the Graphite Reactor. After World War II, Building 3019(A) continued to play a very important role in the evolution of chemical recovery processes. It served as a pilot plant for testing of the Redox (separation) Method until 1951 when the method was put into use at Hanford. The Purex Process developed by the ORNL, which had significant advantages over the Redox Method, went through the pilot plant stage at Building 3019(A) and was put into operation at both Hanford and Savannah River. These and later processes researched and developed at the ORNL played a major role in the advancement of chemical reprocessing techniques used worldwide. Building 3019(B) was built as an addition to 3019(A) in 1954 for the handling of highly radioactive materials.

SIGNIFICANCE:

Building 3019(B) is significant for its association with Building 3019(A), the Radiochemical Processing Pilot Plant. During the Cold War era, these buildings served as a pilot plant for the development of chemical separation processes that have been used in government and commercial facilities on a worldwide basis.

Building 3019(B) is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with the post-World War II government-sponsored scientific movement and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3019(B) was utilized for the handling of highly radioactive materials associated with Building 3019(A), the pilot plant for chemical separation. The work conducted in these buildings had important implications in the field of nuclear science. The removal of Building 3019(B) would have a major effect on the visual appearance and historic integrity of the NRHP-eligible historic district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3019(B) is of major historic significance. If the demolition of Building 3019(B) is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of

facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

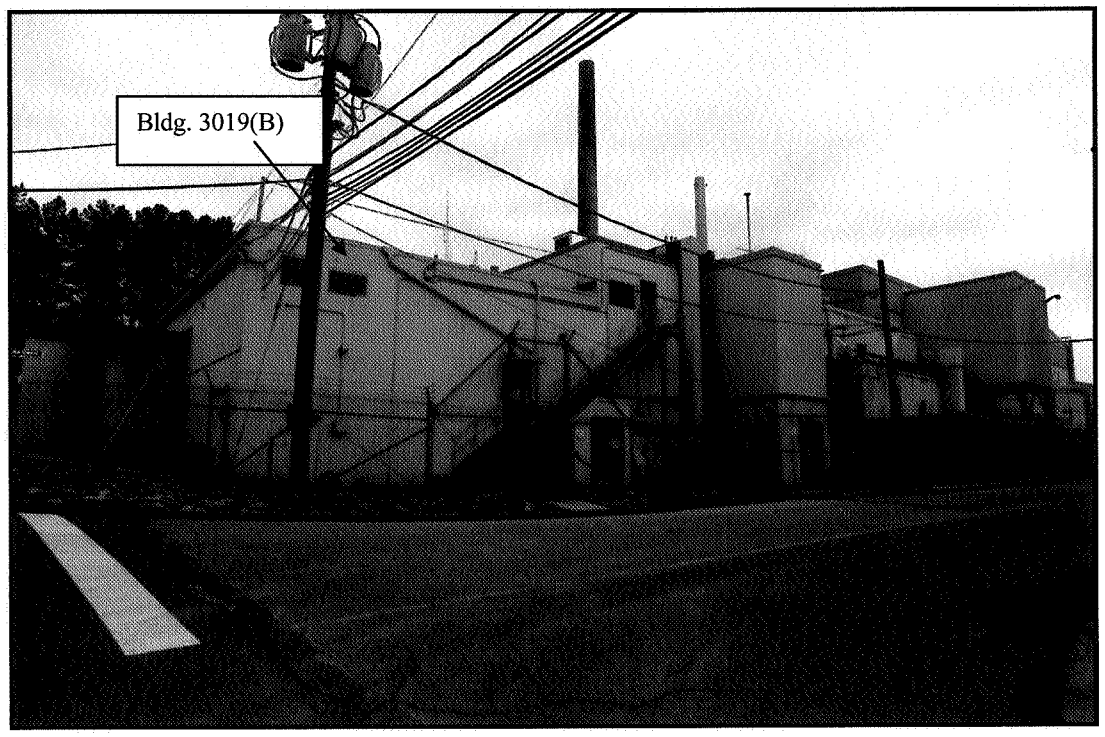


Figure 38: Building 3019(B) is an addition to 3019(A) and serves as a High Level Radiation Analytical Laboratory.

BUILDING 3026(C)

ARCHITECTURAL DESCRIPTION:

This is a one-story steel frame structure that was built in an irregular plan with a flat roof. The main (south) section is one-story in height and has modern metal siding and a bank of modern tinted glass fixed-light windows. Attached to the north elevation of this section is a one-story, metal frame wing with a low-pitched gable roof and a steel frame, flat roof section. The cells inside the building are in banks and have two-foot thick concrete walls. The lead glass windows on each hot cell are lined with a zinc bromide solution for liquid shielding. There are manipulators in each cell and lead glass windows with liquid shielding.

In 1959, plans indicate the cells were modified by installation of new doors, lowered ceilings, relocated doors and new manipulators. In 1961, plans to rehabilitate the structure indicate that the original portion of Building 3026, which is now Building 3026(C), was demolished with the exception of the cells. These plans show the building as radically different from its 1940s appearance.

HISTORY:

Building 3026(C) was originally constructed in 1943 as a By-Product Process Building and Chemistry Separations Laboratory. Research here focused on improving the plutonium separation procedure. At least 150 by-products of fission were known at that time and research revolved around characterizing each as to amounts produced, chemical properties, nature of radiation, and rate of decay. In the post World War II era, the focus changed to the production and development of radioisotopes, one of ORNL's most successful programs. Currently, Building 3026(C) is associated with the Chemical Technology Division (Chemical and Analytical Sciences Division). At the time of the 1993 architectural survey of ORNL, only one of the cells remained active and it was used for nuclear medicine research. This cell, Cell 1, is said to be one of the oldest hot cells in the world. The two other cells are used for storage.

SIGNIFICANCE:

Building 3026(C) functioned as a research laboratory for plutonium separation during the Manhattan Project and later served in the production of radioisotopes during the Cold War era. The building is historically significant for its role in the Manhattan Project and advancements in the filed of nuclear science.

Building 3026(C) is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the Manhattan Project, the post-World War II government-sponsored scientific movement, the evolution of ORNL as a national laboratory, and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3026(C) played an important, but not essential role in the site's World War II mission of plutonium production. The research laboratory focused on the by-products that resulted from the fission process. The building has been altered substantially from its original construction, and

plays a modest role in conveying the history and character of the district. Removal of this building would have a moderate impact on the integrity and visual appearance of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3026(C) is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

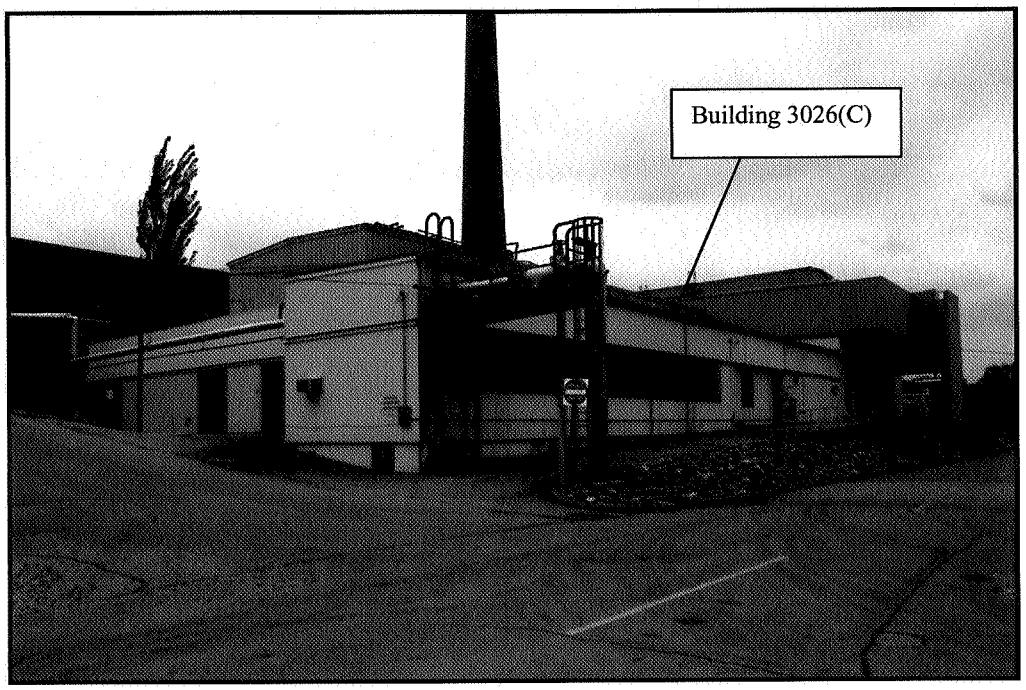


Figure 39: Building 3026(C) is associated with by-product research and chemical separation.

BUILDING 3026(D)

ARCHITECTURAL DESCRIPTION:

This is a 8,376 square-foot, steel frame building that was constructed in an irregular plan. The building has a flat roof and an exterior of corrugated metal siding. A concrete ramp leads up to a frame drive-thru portico to an overhanging crane bay. Doors at this location are original wood designs with four-light windows. The crane bay to the west of this portico also has original wood bracket supports and original wood doors. There are two hinged doors on the ground level and directly above are two additional hinged doors. To the west of the crane bay is a single-light fixed window.

HISTORY:

Building 3026(D) was constructed in 1945 at a cost of $473,000 to provide facilities containing a series of examination and hot cells. It is physically and historically connected with Building 3026(C), which focused on fission by-products and the production and development of radioisotopes. In recent years, the building has been used by the Chemical Technology Division (Chemical and Analytical Sciences Division).

SIGNIFICANCE:

Building 3026(D) is historically significant for its association with Building 3026(C) and its operations as a laboratory in by-products research and radioisotope production. Building 3026(D) contained a series of hot cells in connection with this research.

Building 3026(D) is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the Manhattan Project, the post-World War II government-sponsored scientific movement, ORNL's evolution as a national laboratory, and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

As an addition to Building 3026(C), Building 3026(D) had a moderate role in the historic missions and goals of the X-10 site and later ORNL. Due to alterations, its role in conveying the district's historic character and a sense of time and place are limited. Removal of this building would have a moderate impact on the historic district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3026(D) is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

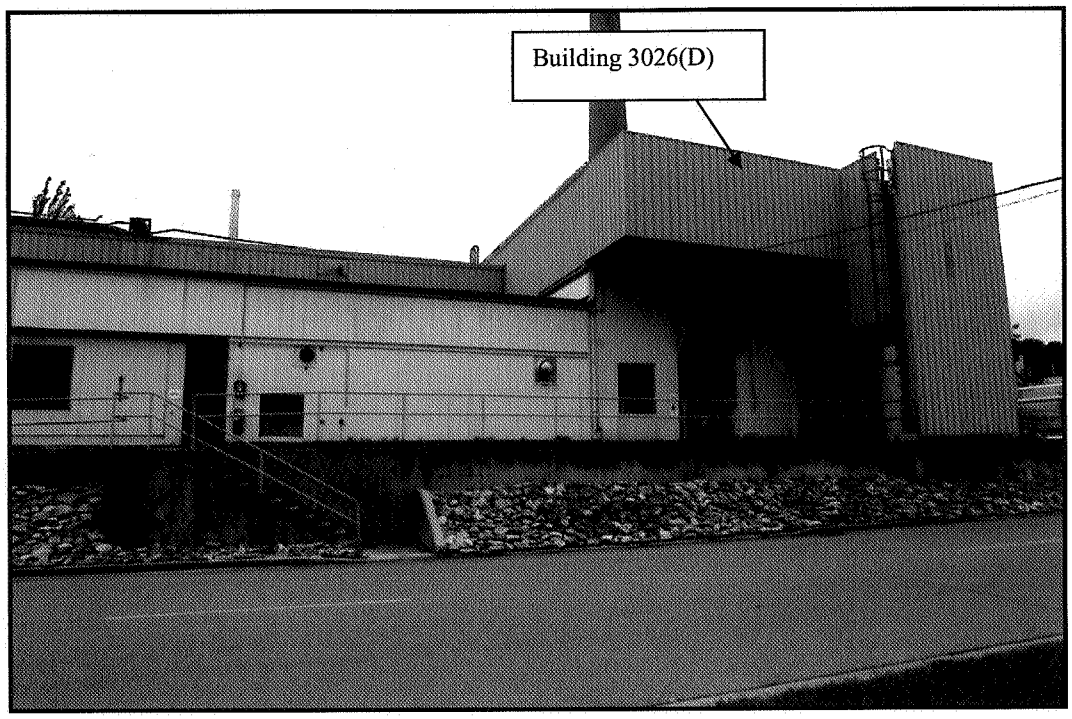


Figure 40: Building 3026(D) – Dismantling and Examination Hot Cells.

BUILDING 3028

ARCHITECTURAL DESCRIPTION:

This laboratory is a 17,054 square foot, steel frame building with a flat roof, irregular plan, and an exterior of corrugated metal siding. The building has no windows and there is ductwork on the roof.

HISTORY:

Building 3028 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3028 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3028 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3028 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3028 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the

center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3028 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3028 is of major historic significance. If the demolition of Building 3028 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 41: Building 3028 is part of the Isotope Complex at ORNL.

BUILDING 3029

ARCHITECTURAL DESCRIPTION:

This laboratory is of steel frame construction. Its irregular plan occupies 2,273 square feet. It has a flat roof and an exterior of corrugated metal siding. Exterior metal stairs lead to the roof, which has roof-top ductwork. There is a tall hinged door on the north elevation, and there are no windows in the building.

HISTORY:

Building 3029 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3029 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3029 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3029 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3029 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently

proposed for demolition. These buildings are located adjacent to one another in a row in the center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3029 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3029 is of major historic significance. If the demolition of Building 3029 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

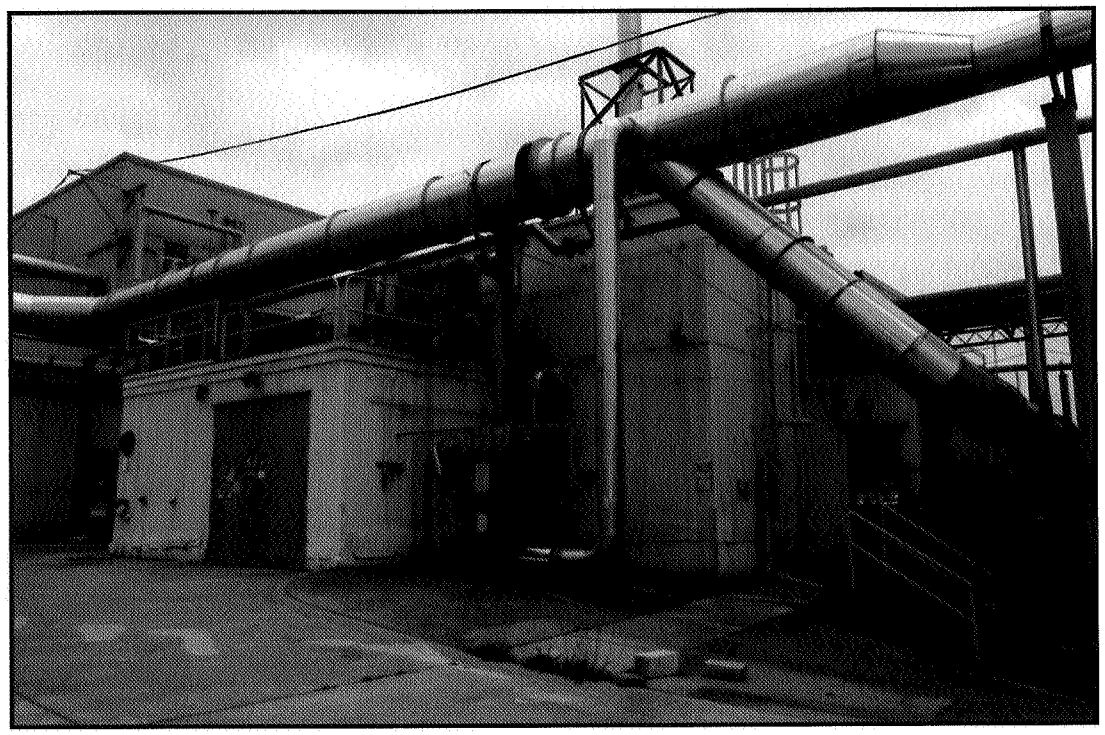


Figure 42: Building 3029 is part of the Isotope Complex.

BUILDING 3030

ARCHITECTURAL DESCRIPTION:

This is a 720 square-foot, steel frame building with a flat roof, corrugated metal siding, and an awning over paired doors.

HISTORY:

Building 3030 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3030 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3030 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3030 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3030 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the center of the historic district. Together they form a cohesive unit that projects a strong sense of

time and place and effectively conveys the district's historic character. Removal of Building 3030 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3030 is of major historic significance. If the demolition of Building 3030 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 43: Building 3030 is part of the Isotope Complex.

BUILDING 3031

ARCHITECTURAL DESCRIPTION:

This 720 square-foot building is of steel frame construction. It has a flat roof and an exterior of corrugated metal siding. There is ductwork on the roof. The building has a metal awning over the entrance.

HISTORY:

Building 3031 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3031 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3031 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3031 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3031 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the

center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3031 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3031 is of major historic significance. If the demolition of Building 3031 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 44: Building 3031 is part of the Isotope Complex.

BUILDING 3032

ARCHITECTURAL DESCRIPTION:

This laboratory is of steel frame construction with an exterior of corrugated metal siding and a flat roof. The 720 square-foot building has ductwork on the roof, and a metal awning above the entrance.

HISTORY:

Building 3032 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3032 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3032 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3032 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3032 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the

center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3032 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3032 is of major historic significance. If the demolition of Building 3032 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 45: Building 3032 is part of the Isotope Complex.

BUILDING 3033

ARCHITECTURAL DESCRIPTION:

This is a steel frame, 720 square-foot building with an exterior of metal siding and a flat roof.

HISTORY:

Building 3033 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3033 was constructed as a radioisotope laboratory.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3033 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3033 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3033 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3033

would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3033 is of major historic significance. If the demolition of Building 3033 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 46: Building 3033 is part of the Isotope Complex.

BUILDING 3036

ARCHITECTURAL DESCRIPTION:

This is a one-story, steel frame building with a flat roof, corrugated metal siding and paired doors with four-light windows. The building contains 1,449 square feet of space.

HISTORY:

Building 3036 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3036 was constructed as a decontamination building for the Isotope Complex.

SIGNIFICANCE:

Building 3036 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3036 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3036 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3036 would have a major effect on the visual appearance and historic integrity of the district. Removal

of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3036 is of major historic significance. If the demolition of Building 3036 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 47: Building 3036 was built as a decontamination building for the Isotope Complex.

BUILDING 3037

ARCHITECTURAL DESCRIPTION:

This is a two-story building with a brick veneer exterior. The building contains 8,185 square feet. Columns divide each elevation into bays. The building has a flat roof and stone coping.

HISTORY:

Building 3037 is one of ten buildings constructed in 1951 for the Isotope Program during the Program H building expansion at ORNL. The production of radioisotopes was among one of ORNL's most important contributions to science in the years following World War II. Isotopes are used for a variety of biological, medical and industrial research. By 1950, ORNL was distributing over fifty radioisotopes to research centers throughout the world. One of the most widely distributed was cobalt-60, used in cancer research. Building 3037 was constructed as an office building for the Isotope Complex at ORNL.

SIGNIFICANCE:

Building 3037 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3037 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3037 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3037 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3037 is of major historic significance. If the demolition of Building 3037 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 48: Building 3037 was constructed as an office building for the Isotope Complex.

BUILDING 3038

ARCHITECTURAL DESCRIPTION:

Building 3038 is a 7,538 square-foot building with a brick veneer exterior and a flat roof. Vertical brick columns divide each elevation into bays. The building has metal awnings and no windows.

HISTORY:

Building 3038 is one of ten buildings that comprise the Isotope Complex, also known as Isotope Circle, which were constructed in 1951 for the processing of radioisotopes. Following World War II, Clinton Laboratories was forced to refocus its research and development efforts, and turned to the production of radioisotopes, which became one of the site's most important contributions to science. Isotopes are produced in reactors, extracted by chemical processes and then utilized for biological, medical and industrial research. As early as 1946, radioisotopes were used for cancer research. By 1950, the ORNL was distributing by order over fifty radioisotopes to research centers throughout the world.

In the late 1940s, the future of the ORNL became more stable because of such successful programs as the production and shipping of isotopes. ORNL manager, Union Carbide, initiated a building expansion known as "Program H" to replace the temporary wartime structures with more permanent buildings. A major focus of this program was the provision of a radioisotope complex costing two million dollars and consisting of ten buildings. These included six production laboratories, a service building, decontamination building, office, analytical and packing building, and an exhaust stack. Building 3038 was constructed as the analytical and packing building for the complex.

In 1957, the Isotope Division was disbanded and reassigned to several other sections. In the 1980s, it was reorganized and continuing isotope programs were assigned to the Chemical Technology Division.

SIGNIFICANCE:

Building 3038 is one of ten buildings constructed in the 1950s as part of the Isotope Complex at ORNL. The construction of these buildings and the initiation of the Isotope Program represent the transition of the site from a wartime production facility to a national laboratory. The Isotope Program became one of the most successful and influential projects at ORNL and gained the Laboratory international attention and respect.

Building 3038 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with research and production of radioisotopes, one of ORNL's principal programs in the Cold War era.

PROPOSED DEMOLITION: To Be Determined.

ASSESSMENT OF IMPACT:

Building 3038 is one of ten buildings constructed for ORNL's Isotope Program, one of the Laboratory's chief programs in the Cold War era. All but two of these buildings are currently proposed for demolition. These buildings are located adjacent to one another in a row in the

center of the historic district. Together they form a cohesive unit that projects a strong sense of time and place and effectively conveys the district's historic character. Removal of Building 3038 would have a major effect on the visual appearance and historic integrity of the district. Removal of additional isotope related buildings currently proposed for demolition would intensify this effect.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3038 is of major historic significance. If the demolition of Building 3038 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

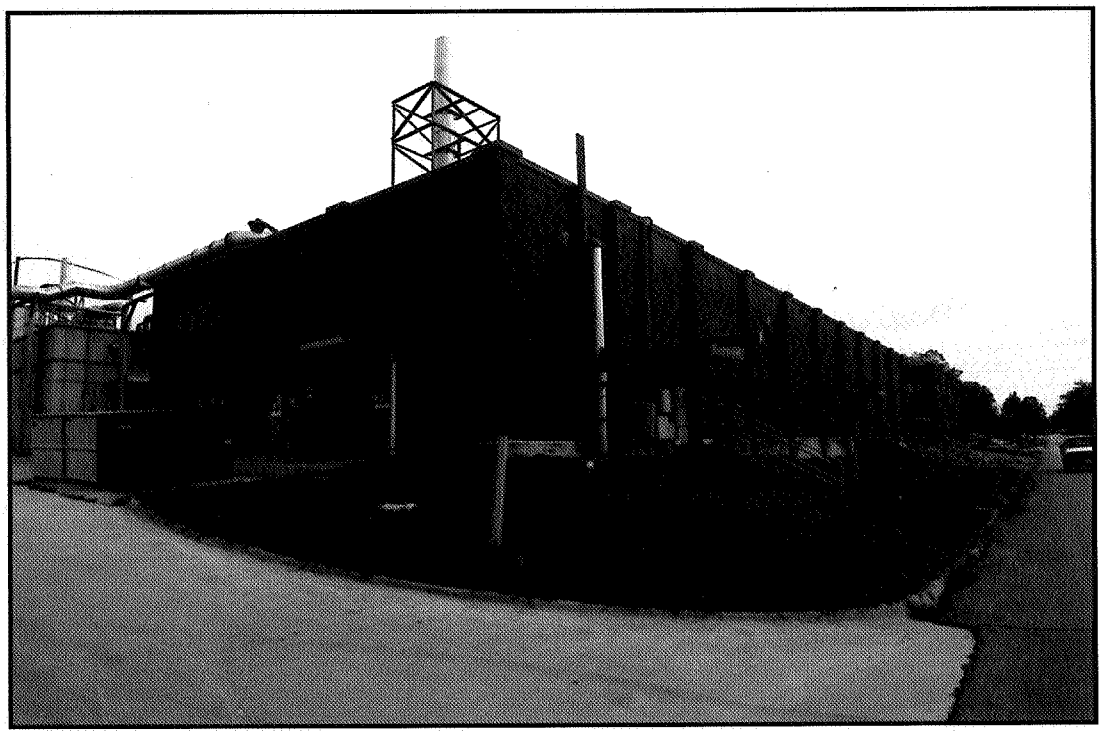


Figure 49: Building 3038 is part of the Isotope Complex.

BUILDING 3042

ARCHITECTURAL DESCRIPTION:

This is a 37,369 square-foot building of steel frame construction. The building has a flat roof and an exterior of corrugated metal siding. There are no windows in the building. The core of the building is three stories in height, and to the north and south are one-story, flat roof wings. On the west elevation are two massive hinged steel doors and on the east side is an exterior metal stairway.

HISTORY:

Building 3042 was constructed to house the Oak Ridge Research Reactor, a general purpose research tool. Construction began in 1955 and was completed in 1958 at a cost of $4,607,000. The reactor combined the technologies of the earlier MTR and BSR. It operated for twenty-nine years and facilitated studies in physics, materials research, irradiation, and neutron beam studies. It was a high performance reactor that supported many scientific advances and attracted scientists as well as visiting dignitaries to the ORNL. The Oak Ridge Research Reactor was shut down in 1987, but offices of the Research Reactors Division continued to occupy the building. Following shut down in 1987, all of the fuel, shim rods and beryllium were removed and all hot cells cleared of equipment.

SIGNIFICANCE:

Building 3042 is associated with ORNL's Cold War era missions and programs. For twenty-nine years it functioned as a general purpose research reactor at the site. During this period it supported a wide variety of research and strengthened ORNL's position as a national laboratory.

Building 3042 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with the post-World War II government-sponsored scientific movement, the evolution of ORNL as a national laboratory, and early nuclear development.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3042 is one of ORNL's chief reactors from the Cold War era. The building played an important role in the Laboratory's research and development programs and the development of nuclear science. It is one of the largest buildings in the historic district and occupies a prominent position in the district adjacent to the NHL Graphite Reactor. Removal of Building 3042 would have a major effect on the district's visual appearance and historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3042 is of major historic significance. If the demolition of Building 3042 is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the building's historic missions and activities, which may include interviews with former workers associated with the building.

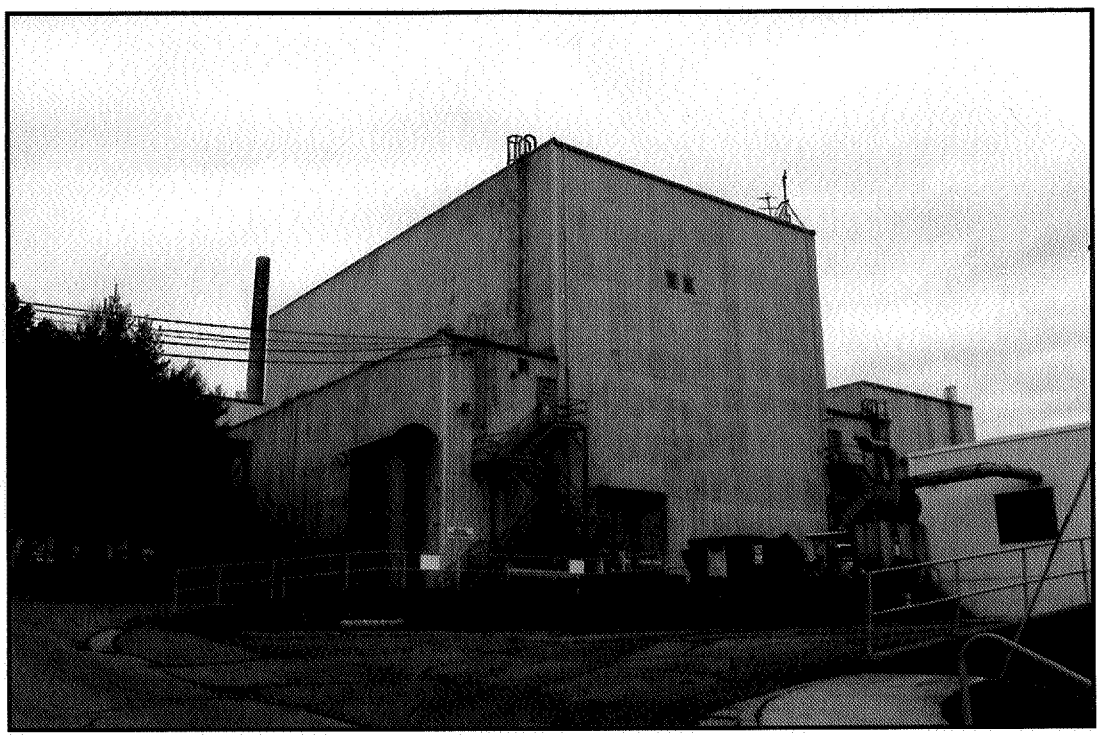


Figure 50: Building 3042 is the Oak Ridge Research Reactor.

BUILDING 3074

ARCHITECTURAL DESCRIPTION:

This is a one-story, steel frame building with a gable roof and an exterior of corrugated metal siding. A garage bay at the gable end has a roll-up door. Adjacent to this is a pedestrian entrance with a single-light metal door. The building contains 3,153 square feet.

HISTORY:

Building 3074 was constructed in 1954 adjacent to the Radiochemical Processing Pilot Plant (Building 3019A). Building 3074 housed a maintenance shop. In recent years, the building has been used for repair of hot cell manipulators.

SIGNIFICANCE:

As a maintenance shop, Building 3074 supported the Cold War missions and goals of ORNL. Ancillary facilities such as maintenance shops, utility buildings, and security posts, were vital to the successful operations of the national laboratory. In terms of the logistics and support provided ORNL's research and process buildings, ancillary facilities contribute to the district's sense of time and place.

Building 3074 is eligible for the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its association with ORNL's evolution as a national laboratory and the post-World War II government-sponsored scientific movement.

PROPSED DEMOLITION: 2009

ASSESSMENT OF IMPACT:

Building 3074 served as a support facility to ORNL's process and research facilities during the Cold War era. As a support building it was important, but not vital to, ORNL's historic missions. However, the building retains much of its original architectural character and is located in the core of the NRHP-eligible historic district adjacent to Building 3019(A) and the Graphite Reactor (Building 3001). As such, Building 3074 contributes to the streetscape and helps to convey the transition of the site from a World War II industrial installation to a national research laboratory. Removal of Building 3074 would have a moderate effect on the district's visual appearance and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3074 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

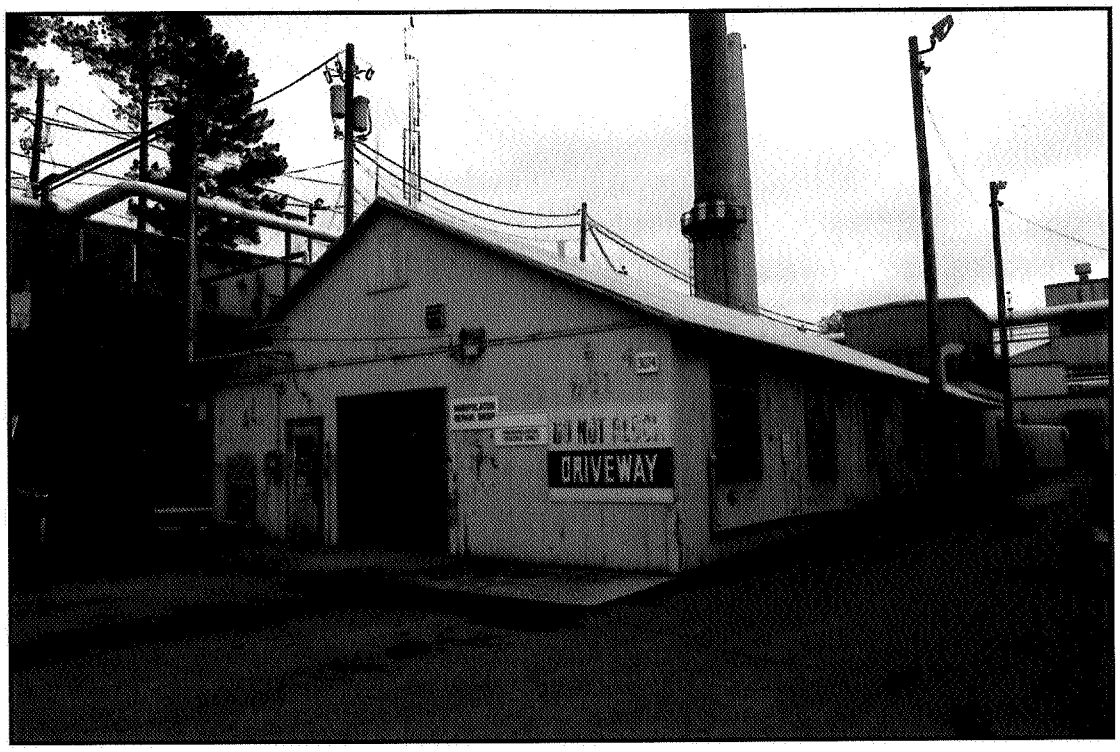


Figure 51: Building 3074 – Maintenance Shop/Interim Manipulator Repair Facility

BUILDING 3080

ARCHITECTURAL DESCRIPTION:

Building 3080 is a one-story building of steel frame construction. It sits on a raised concrete foundation and has an exterior of corrugated metal siding. Windows in the building are original multi-light hopper design, most of which have been painted. Some original awnings remain on the west elevation.

HISTORY:

This structure was built ca. 1953 as a storage facility for the BSR (Building 3010). It has historically served as the control house for BSR experiments.

SIGNIFICANCE:

Building 3080 is significant for its association with the BSR, a major component of the ANP Program of the 1950s. This was one of the chief programs of ORNL during the Cold War and solidified its role as a national laboratory. As a control house and storage facility, Building 3080 supported the operations of the BSR.

Building 3080 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its association with the post-World War II government-sponsored scientific movement, the evolution of ORNL as a national laboratory, and early nuclear development.

PROPOSED DEMOLITION: 2005

ASSESSMENT OF IMPACT:

Building 3080 is associated with the activities of the BSR (Building 3010) and is located adjacent to that historic building. Building 3080 played a supportive role to the BSR's operations. The building is located in the main reactor area of the complex and contributes to the streetscape. Removal of Building 3080 would have a moderate effect on the visual appearance and historic integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3080 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

Figure 52: Building 3080 served as the control house for the BSR.

BUILDING 3503

ARCHITECTURAL DESCRIPTION:

This is a four-story building with a total of 12,206 square feet. It has a steel frame and an exterior of metal siding. Track doors serve as entrances and there are no windows in the building. The west elevation has vents under the gable, and there are vents at the rooftop.

HISTORY:

Building 3503 was constructed in 1948 for research on Solvent Operations. This research conducted in this building involved development of solvent extraction methods for the reprocessing of spent nuclear fuel. Currently it serves as a research laboratory for the Chemical Technology Division (Chemical and Analytical Sciences Division).

SIGNIFICANCE:

As a research facility, Building 3503 furthered the missions and goals of ORNL as a national laboratory. Research regarding spent nuclear fuel was a key activity at ORNL throughout the Cold War era.

Building 3503 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research.

PROPOSED DEMOLITION: 2004

ASSESSMENT OF IMPACT:

Building 3503 is one of several research facilities constructed at ORNL as the site developed as a national laboratory. The building is one of the larger research facilities of this era and is located along the southern boundary of the NRHP-eligible historic district. Removal of Building 3503 would have a moderate effect on the visual appearance and historic integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3503 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

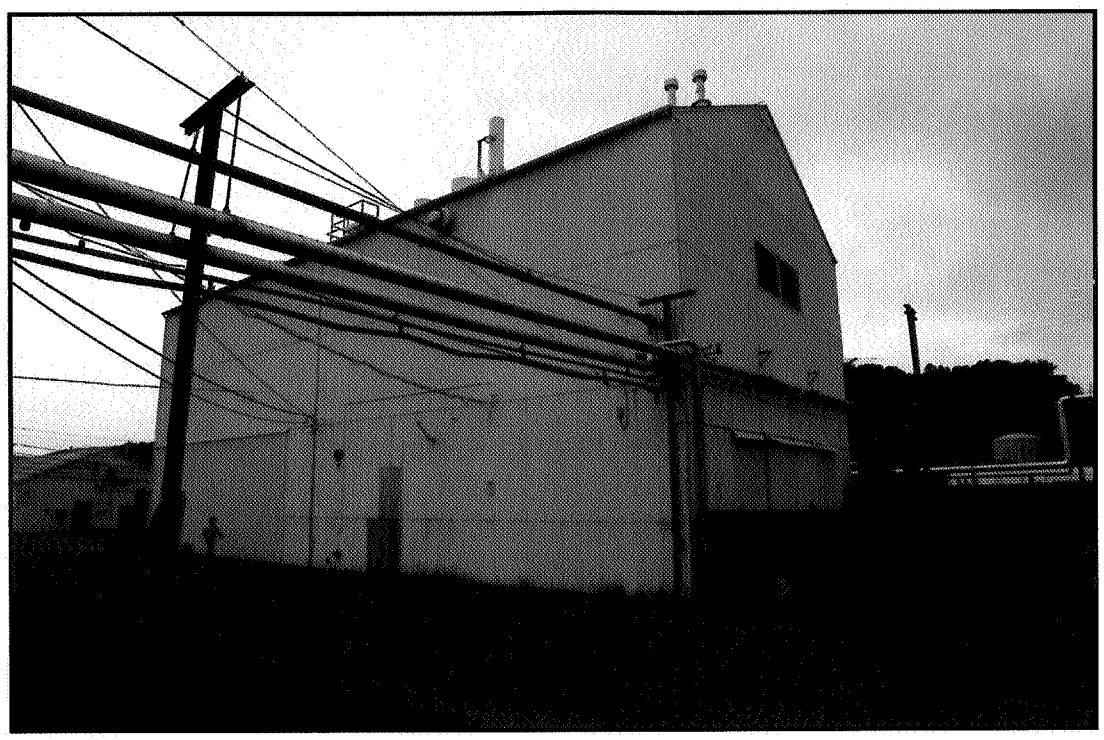


Figure 53: Building 3503 was built as a research facility for Solvent Operations.

BUILDING 3504

ARCHITECTURAL DESCRIPTION:

Building 3504 is a two-story, steel frame building with a gable roof and an exterior of metal siding. The building retains original paired multi-light hopper windows and single-light steel doors. On the west elevation is a roll-up door. The building occupies 7,316 square feet.

HISTORY:

Built in 1951 at a cost of $204,000, Building 3504 was originally associated with the Health Physics Division, which was formed in 1946. The building was used for research into the health and biological effects of radioactive wastes.

SIGNIFICANCE:

Building 3504 served as a research facility focusing on the biological effects of radioactive wastes, a major function of ORNL's Health Physics Division throughout the Cold War era. This activity was an important component of ORNL's role as a national laboratory.

Building 3504 is eligible for inclusion in the NRHP under Criterion A for its historical association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research. Building 3504 is included in the NRHP-eligible ORNL Historic District.

PROPOSED DEMOLITION: 2005

ASSESSMENT OF IMPACT:

Building 3504 is one of several research facilities constructed at ORNL during the 1950s as the site developed as a national laboratory. The building retains much of its original design and is located at the southern edge of the NRHP-eligible historic district. Removal of Building 3504 would have a moderate effect on the visual appearance and integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3504 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

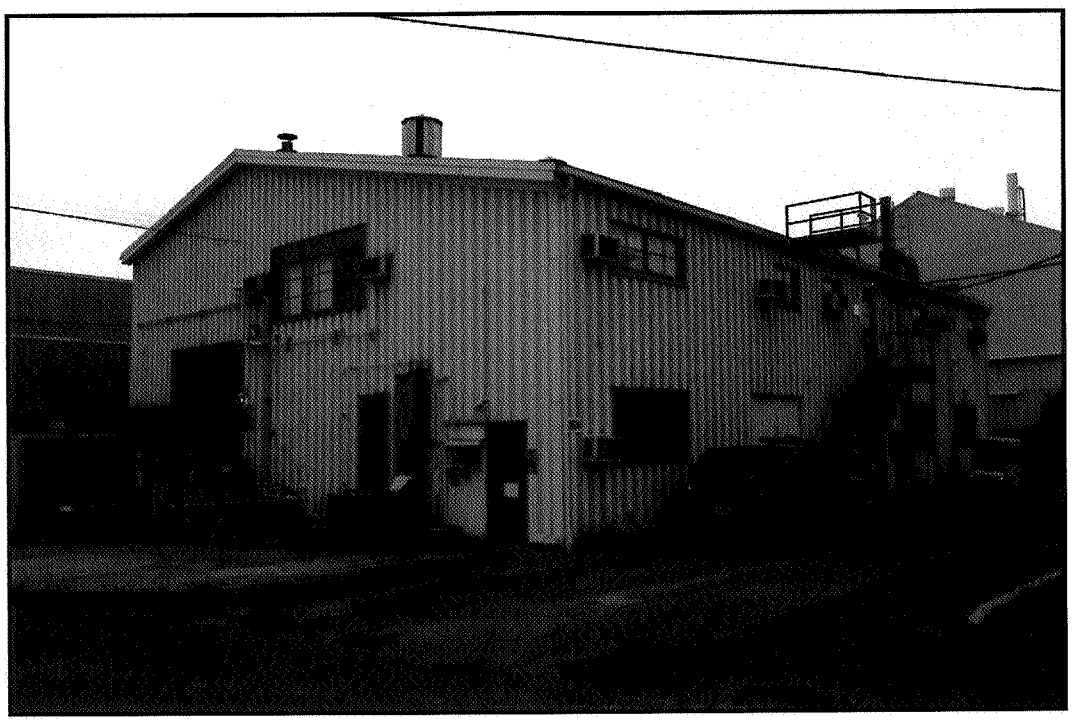


Figure 54: Building 3504 was originally associated with the Health Physics Division.

BUILDING 3508

ARCHITECTURAL DESCRIPTION:

This is a two-story, steel frame building with a flat roof and an exterior of corrugated metal siding. An exterior metal staircase and a series of solid metal doors are on the ground level. There are no windows in the building. The building occupies 13,950 square feet.

HISTORY:

Building 3508 was constructed in 1951 as part of the Program H building expansion. The structure originally served as a laboratory for ORNL's Chemical Technology Division. The Chemical Technology Division experimented with a wide variety of methods for reprocessing spent nuclear fuel and waste and Building 3508 focused on work with high-alpha activity isotopes. The building is in a shut-down mode pending D&D.

SIGNIFICANCE:

As a research laboratory, Building 3508 furthered ORNL's missions and goals as a national laboratory. Research studies on spent nuclear fuel and waste were a continuous aspect of ORNL's activities during the Cold War era.

Building 3508 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with ORNL's evolution as a national laboratory, the post-World War II scientific movement, and early nuclear research.

PROPOSED DEMOLITION: 2005/2006

ASSESSMENT OF IMPACT:

Building 3508 is one of the larger research buildings constructed at ORNL during the Program H expansion of the 1950s. The building retains much of its original design and is located near the southern boundary of the NRHP-eligible historic district. Removal of Building 3508 would have a moderate effect on the visual appearance of the district and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3508 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

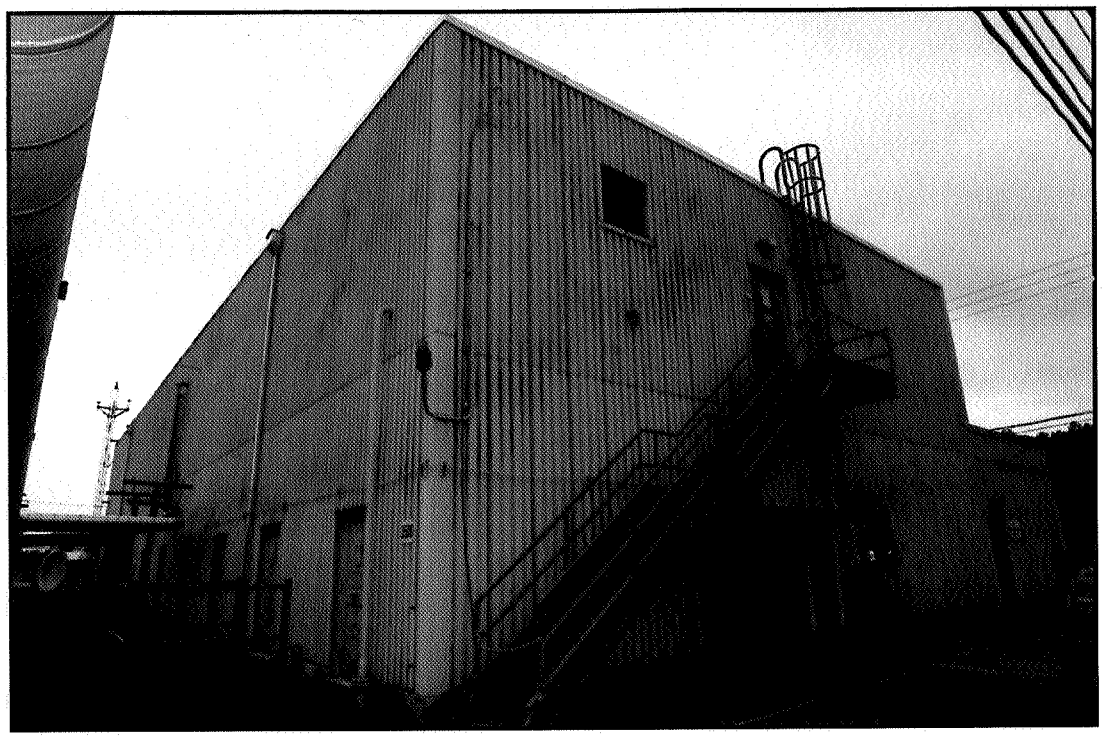


Figure 55: Building 3508.

BUILDING 3515

ARCHITECTURAL DESCRIPTION:

This facility is comprised of a concrete block structure containing an unlined concrete cell with tanks, valves and controls inside. The concrete block outer structure dates post-1958 and was built to entomb the cell and equipment.

HISTORY:

This structure was built in 1948 as a component of ORNL's fission product recovery development program. The facility was used to extract radionuclides from liquid low-level (radioactive) waste. It was shut down in 1958.

SIGNIFICANCE:

Building 3515 functioned as a cell in ORNL's fission product recovery development program from its construction in 1948 until 1958. Processes involving radioactive waste have been an ongoing activity at ORNL throughout its history and are an important function of the Laboratory.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 3515 played a minor role in ORNL's history as a national laboratory. The cell is surrounded by a post-1958 outer structure. Removal of Building 3515 would have a minor effect on the visual appearance and integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3515 is of minor historic significance. Prior to its demolition, a record file will be prepared for the building. This file will contain any available photographs or construction drawings of the facility as well as a brief written physical description of the building and its historic missions.

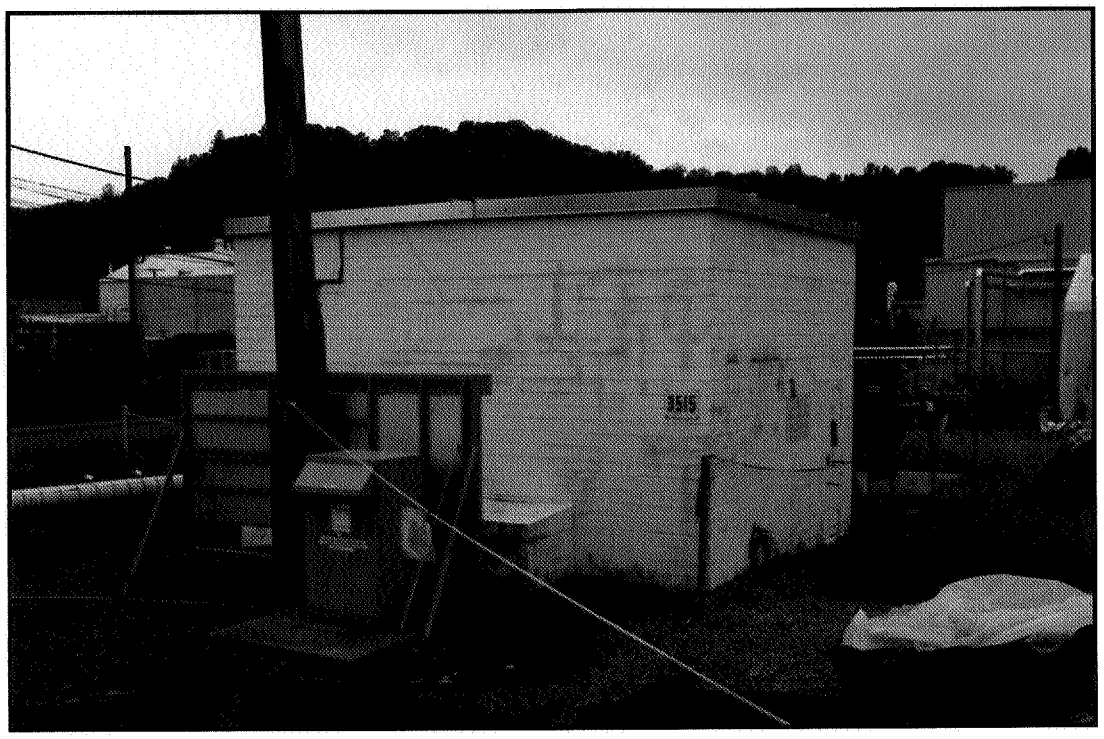


Figure 56: Building 3515.

BUILDING 3523

ARCHITECTURAL DESCRIPTION:

Building 3523 is a one-story, 1,200 square-foot building of metal frame construction. The building has an exterior of corrugated metal siding, a gable roof with ridgeline vents, and multi-light hopper windows.

HISTORY:

This building was constructed in 1957 as the Controls Research Laboratory. It is currently used as an expensed bench stock building.

SIGNIFICANCE:

As a research laboratory, Building 3523 furthered ORNL's missions and goals as a national laboratory. The building retains much of its original architectural character and contributes to the historic district's sense of time and place.

Building 3523 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, it is eligible for its historical association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research.

PROPOSED DEMOLITION: 2004

ASSESSMENT OF IMPACT:

Building 3523 was one of several laboratories constructed at ORNL during the 1950s. It is one of the smaller research facilities on the complex and in recent decades has been used for storage. No major research efforts are known to be associated with the building, which is located at the southern edge of the NRHP-eligible historic district. Removal of Building 3523 would have a minor effect on the visual appearance of the district and its historic integrity.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3523 is of minor historic significance. Prior to its demolition, a record file will be prepared for the building. This file will contain any available photographs or construction drawings of the facility as well as a brief written physical description of the building and its historic missions.

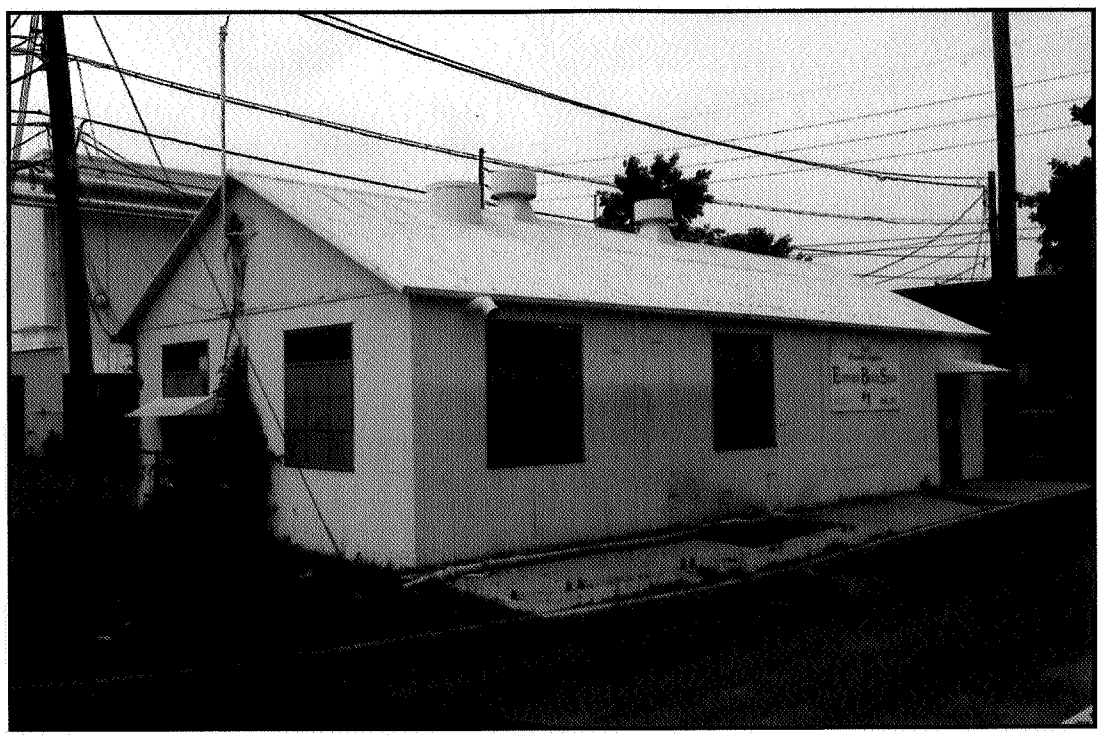


Figure 57: Originally a lab, Building 3523 now serves as an expensed bench stock building.

BUILDING 3587

ARCHITECTURAL DESCRIPTION:

Building 3587 is a one-story, L-plan building. It is of steel frame construction with an exterior of corrugated metal siding. The building has a gable roof and multi-light hopper windows. A gable roof wing is on the south elevation. Most windows have been painted, and doors are metal with a single-light window. The building contains 3,405 square feet.

HISTORY:

This building was constructed ca. 1950 as a field service shop. It currently serves as a mail service facility

SIGNIFICANCE:

As a field service shop, Building 3587 supported ORNL's missions and goals as a national laboratory during the Cold War era. Ancillary facilities such as service shops, guard posts, utility buildings, etc., were important components of the overall complex.

Building 3587 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its historical association with ORNL's evolution as a national laboratory and the post-World War II government sponsored scientific movement.

PROPOSED DEMOLITION: 2004

ASSESSMENT OF IMPACT:

Building 3587 played an important, but minor role in the history of ORNL as a support building to its research and development operations. The building retains much of its original character and design and is located near the southern border of the historic district. Removal of this building would have a minor effect on the visual appearance and historical integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3587 is of minor historic significance. Prior to its demolition, a record file will be prepared for the building. This file will contain any available photographs or construction drawings of the facility as well as a brief written physical description of the building and its historic missions.

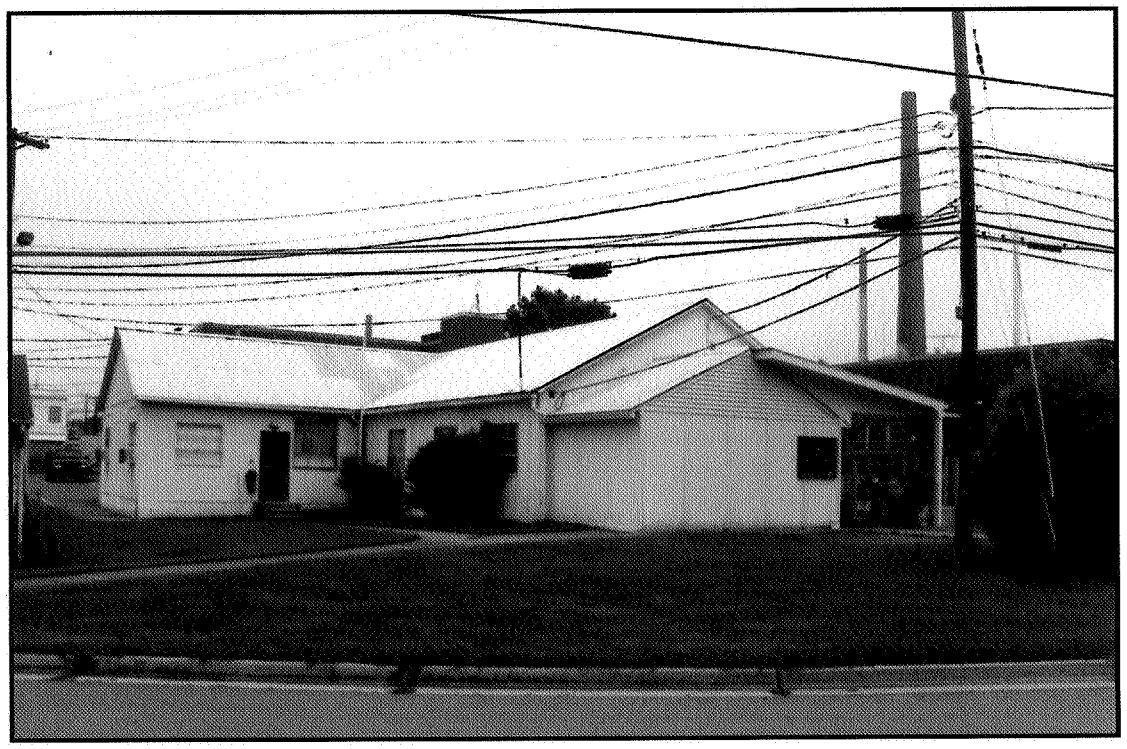


Figure 58: Building 3587 was originally a field service shop and currently serves as a mail service facility.

BUILDING 3592

ARCHITECTURAL DESCRIPTION:

This is a two-story, steel frame building with a gable roof. The building has multi-light hopper windows. On the east elevation is an exterior staircase and a one-story shed roof addition. The building contains 1,200 square feet.

HISTORY:

Building 3592 is associated with the Chemical Technology Division and was constructed in 1952. Its major role at that time was its use in the Fluoride Volatility Processing Program being studied in the 1950s at various locations in the United States. The purpose of the program was the development of alternative methods for recovering uranium from spent nuclear fuel. This method had advantages over the conventional aqueous recovery processes that included high concentrations of waste and increased nuclear safety. The emphasis at ORNL was in the Molten Salt Fluoride Volatility Process. Developed and tested in Buildings 4500N and 4507, the process underwent unit operation and engineering studies in Building 3592. A full-scale process plant for this recovery process was installed in Building 3019. Building 3592 is currently in a shut-down mode pending D&D.

SIGNFICANCE:

Studies connected with the Fluoride Volatility Processing Program took place in Building 3592 during the 1950s. This was one of various programs at ORNL that focused on recovering uranium from spent nuclear fuel. The building retains much of its original architectural design and character.

Building 3592 is eligible for inclusion in the NRHP under Criterion A and is included in the NRHP-eligible ORNL Historic District. Under Criterion A, the building is eligible for its association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research.

PROPOSED DEMOLITION: 2005/2006

ASSESSMENT OF IMPACT:

Building 3592 is one of many buildings constructed at ORNL during the early 1950s as the site evolved as a national laboratory. The building was initially used for research purposes regarding spent nuclear fuel and its role in ORNL's history as a national laboratory is limited. The building retains much of its original architectural character and is located near the southern boundary of the historic district. Removal of Building 3592 would have a moderate effect on the visual appearance and historical integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 3592 is of moderate historic significance. Prior to its demolition, a detailed interpretive record will be prepared and a final report will be issued to document the facility. The interpretive report will include a collection of available photographs of the facility to document its life from construction through demolition, a collection of any available maps and drawings of the facility, and a detailed account of its historic missions and activities.

Figure 59: Building 3592 was associated with the Fluoride Volatility Processing Program.

BUILDING 4507

ARCHITECTURAL DESCRIPTION:

This is a 3,812 square-foot, one- and two-story building with an exterior of brick veneer and a flat roof. The building is connected to the south (rear) side of Building 4505. Building 4507 contains four shielded hot cells with master slave manipulators. The cells currently contain material and instrumentation from past operations.

HISTORY:

Building 4507 was constructed in 1957 as a High Radiation Level Chemical Development Laboratory. It is historically associated with the Chemical Technology Division. It was designed and operated in that period as a laboratory and small scale pilot plant for development studies for reactor fuel reprocessing. Research in Building 4507 was focused on the Fluoride Volatility Processing Program being studied in the 1950s at various locations in the United States. The purpose of the program was the development of alternative methods for recovering uranium from spent nuclear fuel. This method had advantages over the conventional aqueous recovery processes, which included high concentration of waste and increased nuclear safety, but there were also disadvantages. The emphasis at the ORNL was in the Molten Salt Fluoride Volatility Process. Developed and tested in Building 4500N. The process was then taken to hot cell level in Building 4507 before installation of full-scale production in Building 3019.

SIGNIFICANCE:

Building 4507 served as a research facility focusing on alternative methods for recovering uranium from spent nuclear fuel. This activity was an important component of ORNL's role as a national laboratory.

Building 4507 is eligible for inclusion in the NRHP under Criterion A for its historical association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research. Building 4507 is included in the NRHP-eligible ORNL Historic District.

PROPOSED DEMOLITION: To Be Determined

ASSESSMENT OF IMPACT:

Building 4507 is one of many buildings constructed at ORNL during the early 1950s as the site evolved as a national laboratory. The building was used for research purposes regarding spent nuclear fuel. The building retains much of its original architectural character and is located to the rear of Building 4505. Removal of Building 4507 would have a major effect on the visual appearance and historical integrity of the district.

RECOMMENDED INTERPRETIVE EFFORT:

Building 4507 is of major historic significance. If the demolition of the facility is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps

and drawings (if available), and a detailed account of the facility's historic missions and activities, which may include interviews with former workers associated with the building.

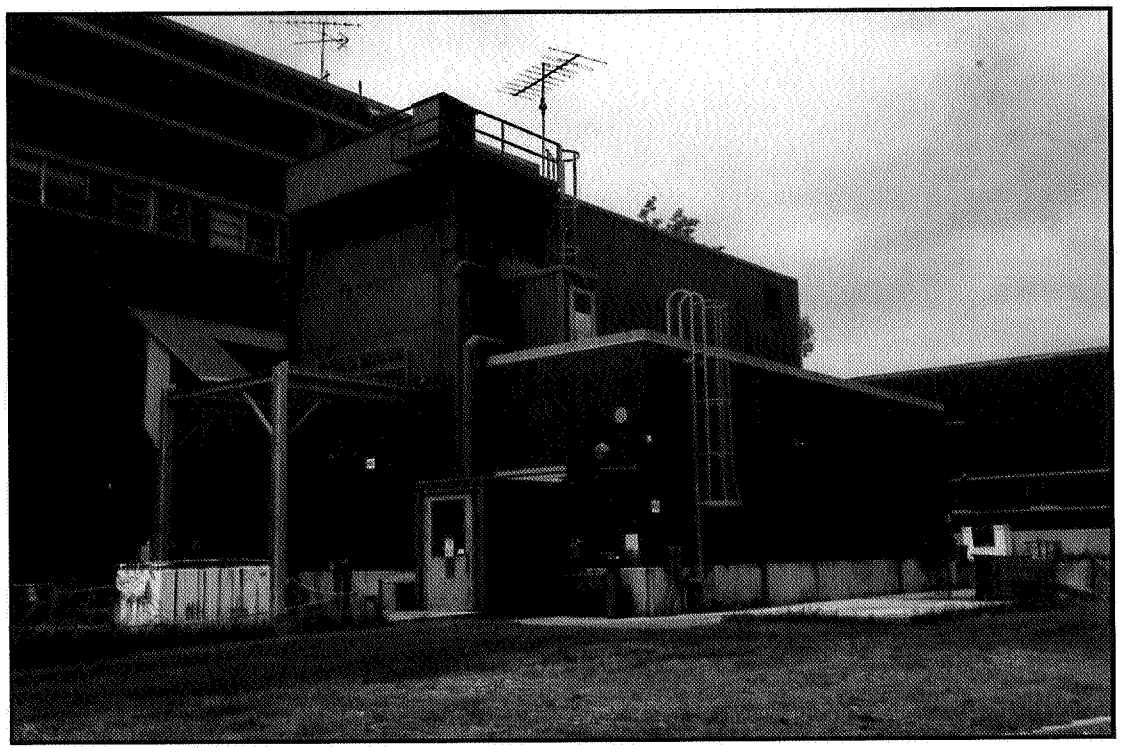


Figure 60: Building 4507.

BUILDING 7503

ARCHITECTURAL DESCRIPTION:

This 16,999 square-foot building is of steel-frame construction with corrugated asbestos siding and a flat roof. The building has original multi-pane steel-frame hopper windows. The building was altered in 1961 to accommodate the Molten Salt Reactor. The reactor cell is located in the southwest quadrant of the building along with a drain tank cell, and in the northwest quadrant are six cells: one for fuel, one for spent fuel, one decontamination cell, one hot storage cell, a hot waste pump cell and a hot waste storage cell. The reactor and the cells are at the basement level and are encased in steel and concrete structures with built-in containment features. Access to the cells are from removable concrete roof plugs. The east half of the building contains the control room and the change room. A large stack is on the south end of the building. Following shutdown in 1969, the fuel and coolant salts were drained to storage tanks within the containment cells and isolated. The reactor and drain-tank cells are sealed and the top shield caps (roof plugs) secured.

HISTORY

This building was constructed in 1953 as the ARE Facility. The following year, an experimental molten salt fueled reactor with a fuel mixture developed at the ORNL became operational. ORNL established the ARE to develop a reactor system for aircraft propulsion that would meet demanding requirements regarding weight, size, and performance of the reactor as well as shielding weight and capabilities. The hoped-for reactor design would drive a long-range bomber. The ARE performed well and demonstrated the advantages of fluid fuel reactors. The reactor is said to be one of the most advanced reactor types ORNL developed and ranks among the laboratory's highest achievements. The project was discontinued in 1958 due to costs and changing military needs.

During the development and operation of the ARE, the ORNL saw the opportunity to further develop the molten salt reactor technology for electric power production. The decision to continue development occurred because of the fact that molten salt fueled reactors almost uniquely combined the advantages of very high temperature, wide solubility limits and low pressure in a liquid system. The Molten Salt Reactor Experiment operated in Building 7503 beginning in 1965 and continued until 1969.

SIGNIFICANCE

Building 7503 initially served as a facility for the ARE, which focused on the development of a reactor system for aircraft propulsion. During the 1960s, the building housed the operations of the Molten Salt Reactor Experiment. Technological advances gained in the field of chemical processing gleaned from the project were substantial.

Building 7503 is eligible for inclusion in the NRHP under Criterion A for its historical association with ORNL's evolution as a national laboratory, the post-World War II government-sponsored scientific movement, and early nuclear research. Building 7503 is not included in the ORNL Historic District.

PROPOSED DEMOLITION: 2007/2008

ASSESSMENT OF IMPACT:

Building 7503 is one of many buildings constructed at ORNL during the early 1950s as the site evolved as a national laboratory. The building housed innovative research on the use of reactors for aircraft propulsion and advances in chemical processing. The building retains much of its original architectural character. It reflects an important chapter in the history of ORNL and the removal of this facility would have a major effect on the site's ability to interpret this history

RECOMMENDED INTERPRETIVE EFFORT

Building 7503 is of major historic significance. If the demolition of the facility is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps and drawings (if available), and a detailed account of the facility's historic missions and activities, which may include interviews with former workers associated with the building.

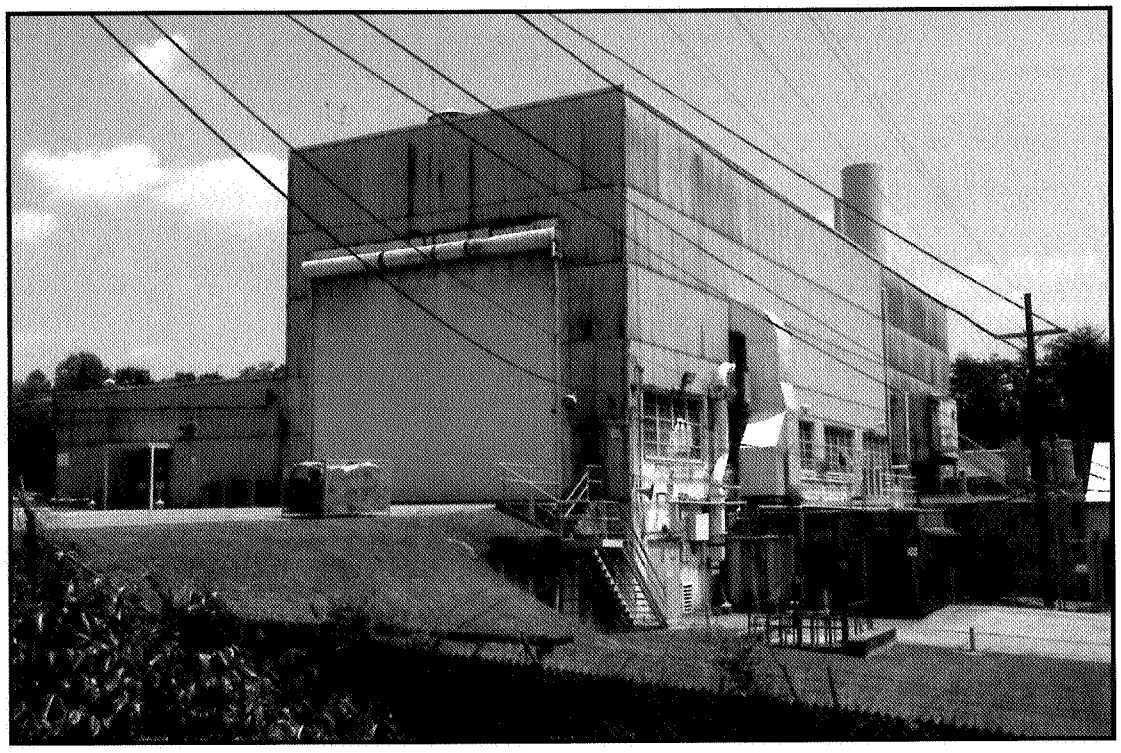


Figure 61: Building 7503

TOWER SHIELDING FACILITY (BUILDINGS 7700, 7701, 7702, 7703, & 7704)

ARCHITECTURAL DESCRIPTION:

The TSF is located approximately two miles southeast of the ORNL main facilities complex. It is access controlled and is reached via an access road. The complex is surrounded by a security fence and stands in a cleared wooded area. The tower is constructed on a manmade hill. Individual properties associated with the TSF that are eligible for inclusion in the NRHP are:

Building 7700: Tower (1953). Building 7700 is a tower comprised of four, 315-foot tall steel towers erected at each corner of a rectangular concrete pad, which is 100' x 200' in size. Towers at the short sides of the rectangle are connected at the top by a cross steel support; the towers at the northwest side of the rectangle have an additional connector in the center that served as the instrument platform. Guy wires (two-inch plow steel guys) connect to anchors at each corner of the tower. The tower is equipped with a hoist system designed to lift the reactor off the ground. The concrete pad originally contained a pool for storage of the reactor.

Building 7701: Pool (1953). Building 7701 was a pool on the concrete pad beneath the tower of the TSF. The rectangular pool was for storage of the reactor. It was located on the north side of the concrete pad and has been infilled in recent years. It is now covered with a two-foot thick concrete slab.

Building 7702: Control House (1954). This is an underground bunker that is 12,768 square feet in size. It is built directly under the concrete pad and tower of the TSF. It is entered on the east side of the elevated tower area, and on the west side a ramp descends from the pad to a hoist control station and the west entrance to the control house. The building contains offices, laboratories, and original control panels.

Building 7703: Hoist House (1954). This is a one-story, shed roof building with metal exterior siding. On the south elevation are six multi-light windows. Below each window are openings for the cables from the tower to connect to the hoisting mechanism. Between the building and the tower are cylinders on concrete pedestals that serve as guides for the cables.

Building 7704: Control House No. 2 (1954). This facility is an underground bunker that is 2,235 square feet in size. The facility is constructed of concrete and is connected by a short tunnel to Building 7702 and to a ramp leading to the concrete pad.

Building 7751: Sentry Post No. 22 (1947). This 64 square-foot, frame building has a hip roof, shiplap siding, and one-over-one wood sash windows. The building stands off State Route 95 at the perimeter of the security fence and entrance to the TSF facility. It is thought to have been moved here from another location in 1952.

Under present planning, all but one of these buildings is proposed for demolition. Building 7751, the Sentry Post, is not scheduled for demolition at this time.

HISTORY:

The TSF is associated with the ANP Program. This program rose from the desire of the U.S. Air Force to develop a nuclear powered long-range bomber. Built between March 1953 and February 1954, the TSF was one of three reactors constructed for this program. It is the only reactor facility in the United States designed and built for radiation shielding studies in which both the reactor source and shield samples are raised into the air. The purpose of this research was to answer questions about the effects of radiation from a reactor flying overhead as well as to better understand the type and amount of shielding needed for a nuclear aircraft. Because the reactor had no built-in shielding, operations were built underground and covered with several feet of earth. These bunkers housed the reactor controls, data-recording equipment and hoist controls. Operators viewed the experiments by means of a television system.

The ANP Program was discontinued in 1957; however, various types of research continued at the TSF until the facility was closed in 1992. In 1963, the shielding technology developed at the TSF was applied to the NASA space program concerning silo shields. TSF technology and experimental research also contributed to Civil Defense shelters, radiation leakage measurement, development of breeder reactors, and the shipment of highly radioactive materials.

SIGNIFICANCE:

The ANP Program was one of the chief research projects at ORNL during the post-World War II era. The TSF was one of three unique reactors built for this program and was the only reactor facility of its type in the nation. Versatility of the TSF allowed its use for numerous technological advancements in the fields of shielding and radiation scattering.

The TSF is eligible for inclusion in the NRHP under Criteria A and C. Under Criterion A, the facility is eligible for its historical association with ORNL's evolution as a national laboratory, the post-World War II government sponsored scientific movement, and early nuclear research. Under Criterion C, the facility is eligible for its engineering merits and its contributions to science. The TSF is not included in the ORNL Historic District.

PROPOSED DEMOLITION: 2009

ASSESSMENT OF IMPACT:

The TSF is a unique property that has supported innovative research and numerous technological advancements. It is representative of the wide variety of research projects conducted at ORNL and the pioneering operations undertaken at the Laboratory. As part of the ANP Program, the TSF is also reflective of the commitment of the U.S. government in the support of nuclear research. The TSF, including the underground bunkers, remains largely unchanged from their 1950s construction, and the facility's location in an isolated area contributes to its sense of time and place. The TSF conveys an important chapter in the history of ORNL and the removal of this facility would have a major effect on the site's ability to interpret this history.

RECOMMENDED INTERPRETIVE EFFORT:

The TSF is of major historic significance. If the demolition of the facility is agreed upon, substantial recordation and interpretation of this building will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of the facility, a collection of facility maps

and drawings (if available), and a detailed account of the facility's historic missions and activities, which may include interviews with former workers associated with the building.

Figure 62: Building 7700 – Tower of the TSF.

Figure 63: Building 7701 – Pool, TSF.

Figure 64: Building 7702 – Control House, TSF.

Figure 65: Building 7703 – Hoist House, TSF.

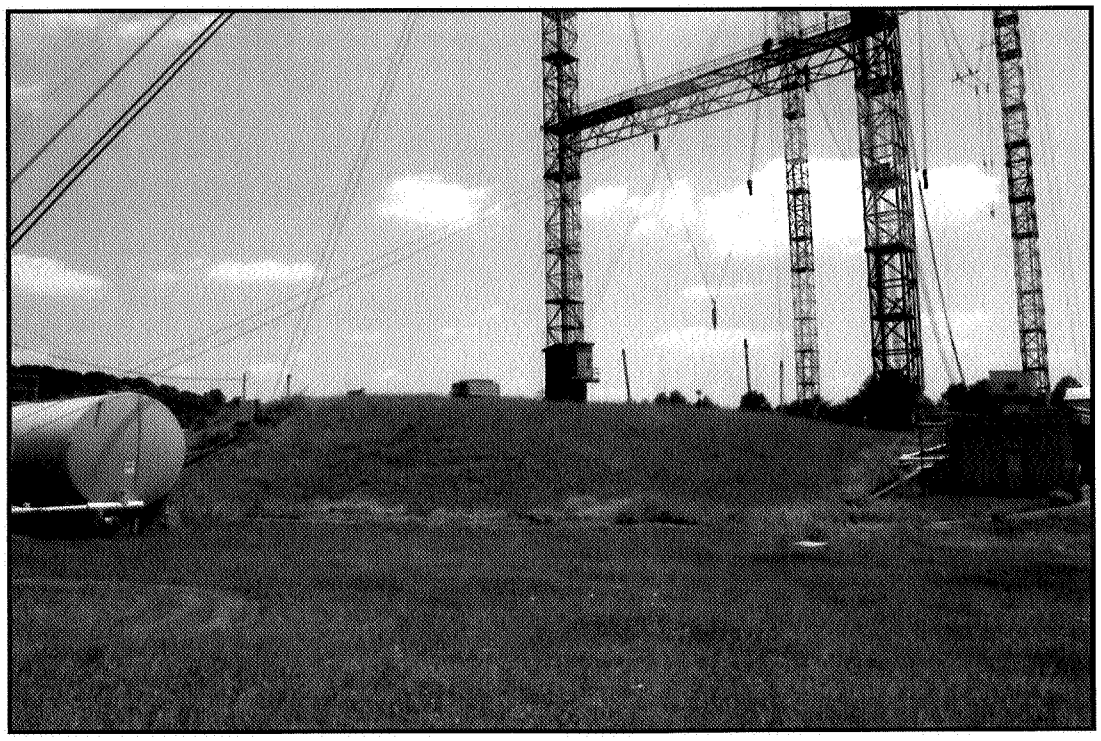


Figure 66: Building 7704 – Control House No. 2, TSF.

7.5. *Summary of Proposed Demolition*

There are currently thirty-eight ORNL historic properties categorized as excess to future mission needs and proposed for demolition over the next ten years. Thirty-two of these historic properties are contributing buildings or structures to the NRHP-eligible ORNL Historic District. The remaining six historic properties proposed for demolition include the Molten Salt Reactor Experimental Facility/ARE (Building 7503), which is located approximately one half mile southeast of the ORNL main facilities complex, and five properties associated with the TSF, which is located approximately two miles southeast of the ORNL main facilities complex.

At present there are a total of fifty-four contributing buildings and structures in the NRHP-eligible ORNL Historic District. Removal of thirty-two contributing properties from the district will have a major effect on the appearance of the district and compromise its historical integrity. The most significant properties within the district are those associated with the Graphite Reactor and the site's Manhattan Project missions and those associated with the Isotope Complex and the post-World War II production and development of radioisotopes.

The Graphite Reactor (Building 3001) is the most significant historic building at ORNL and is a NHL. The building reflects the site's role in the Manhattan Project of World War II and pioneering work in nuclear science. Few buildings from the Manhattan Project era remain extant on the ORNL campus, and the majority of these are located near the Graphite Reactor. Many served as auxiliary facilities to the Graphite Reactor. These include an exhaust stack, a filter house, and storage facilities. Ancillary buildings such as these help to convey a sense of time and place in the district. Along with the main process and research buildings, they demonstrate the complete historic operations of the site and more fully express its history.

The Isotope Complex at ORNL is of major historical significance in the evolution of ORNL as a national laboratory. The development and production of radioisotopes for biological and medical research was a principal mission of ORNL in the Cold War era and helped to secure the Laboratory's reputation as a leading scientific institute. The isotopes produced at ORNL have been used in a wide variety of research projects and have contributed to advancements in many fields. Buildings associated with the Isotope Complex are research labs (Buildings 3028, 3029, 3030, 3031, 3032, 3033, and 3038), storage and service facilities (Buildings 3034 and 3036), an office (Building 3037), and an exhaust stack (3039). These buildings form a cohesive complex in the center of the NRHP-eligible ORNL Historic District.

The most significant historic property outside the boundaries of the NRHP-eligible ORNL Historic District are those associated with the TSF. The TSF was a unique and innovative reactor experiment that supported a wide range of technological advancements. The TSF retains a strong degree of its architectural and historic integrity and conveys an important chapter in the history of ORNL. Also located outside the boundaries of the NRHP-eligible ORNL Historic District and proposed for demolition is Building 7503. This building initially housed the ARE, which was an innovative project designed to develop a reactor system for aircraft propulsion. The building later housed the Molten Salt Reactor Experiment, which focused on the development of a molten salt breeder reactor. These programs were among the laboratory's most significant achievements in reactor research and technological advances in the field of chemical processing.

The removal of historic properties with major historic significance will occur only after careful evaluation. If demolition is agreed upon, substantial recordation and interpretation of these buildings will be necessary. This effort will include, but not be limited to, the use of video and/or CD-ROM technology, as appropriate, as well as an attempt to develop a photo-record history of

the facilities, a collection of facilities' maps and drawings (if available), and a detailed account of the buildings' historic missions and activities, which may include interviews with former workers associated with the buildings.

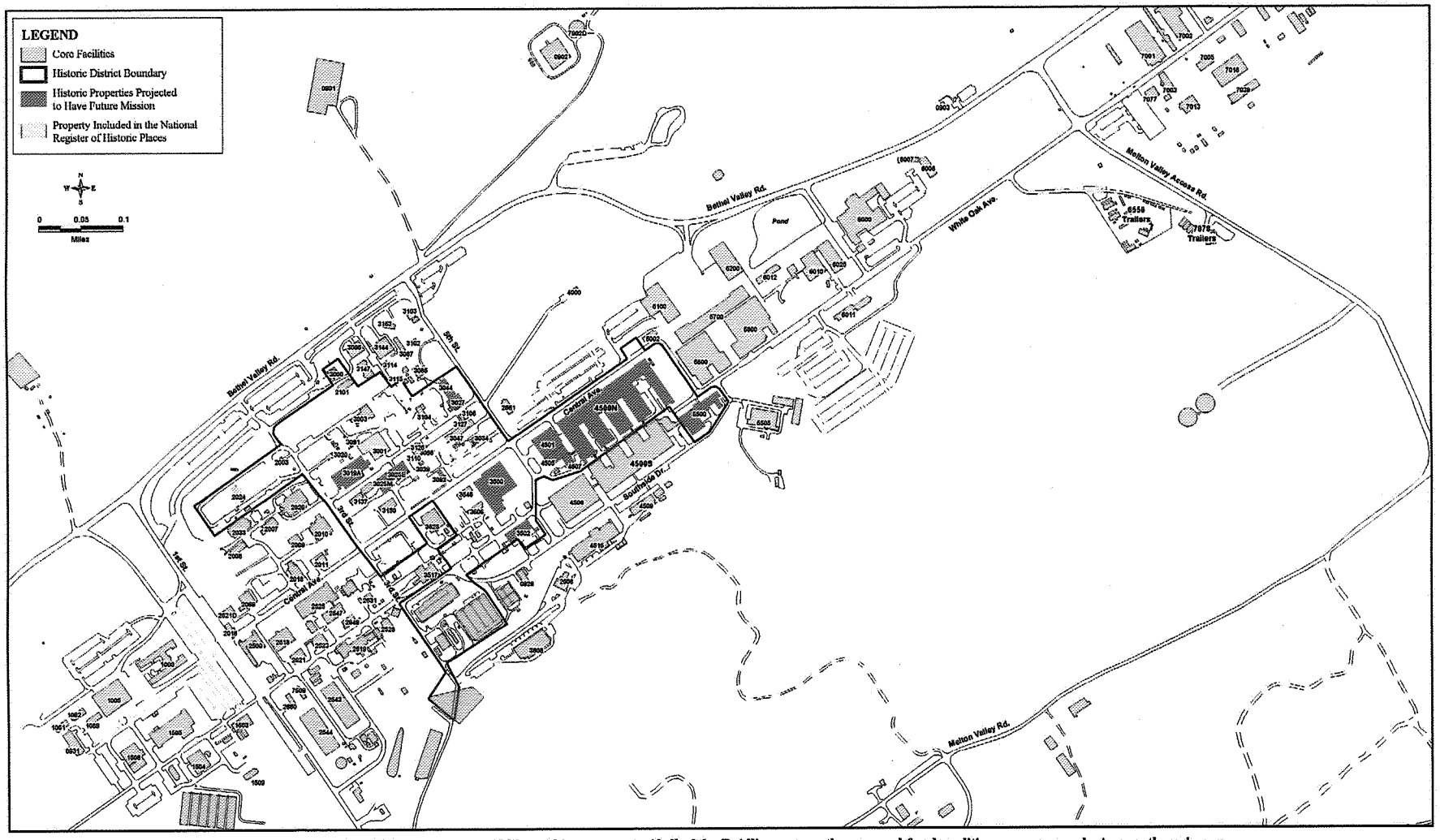


Figure 67: The ORNL Historic District would have this appearance if all of the Buildings currently proposed for demolition were removed. Among the primary buildings to be removed are nine buildings associated with the Isotope Complex, the Bulk Shielding Reactors, and the Oak Ridge Research Reactor.

7.6. The ORNL Master Plan

The Master Plan for long-term development at ORNL focuses on a multicampus layout to accommodate the multiprogram nature of ORNL research activities. The layout provides identifiable campus centers for development in the east, central, and west portions of the site, around commons areas that promote researcher collaboration. Each campus will serve as a hub for particular areas of research. The East Campus will continue the historical mission work in High Energy Physics, Computational Sciences, Chemical/Analytical Sciences and Engineering, and Materials Research. The West Campus focuses on support of Environmental and Life Sciences research needs. The Central Campus will continue to be a primary area for Solid State, Materials, Energy, Instrumentation, and Chemical Technology research.

Architectural consistency will be provided within each campus to ensure blending of new construction with the existing strategic structures, while allowing state-of-the-art improvements in building sustainability designs. Recognition of the history of the ORNL site will be a critical element of the design and siting of new buildings, with preference given, where possible, to protecting those important features of the Laboratory.

7.6.1. Proposed New Construction and Assessment of Impact

ORNL's long-range Master Plan calls for a number of new facilities to be constructed on the site to replace deteriorated, contaminated, and inefficient facilities. In the future, changes to ORNL's mission may necessitate other additional new construction. Any new construction within 250' of historic buildings and structures will impact those adjacent historic buildings and structures. New construction within the historic district should not diminish the overall sense of time and place and should be compatible with existing, adjacent buildings.

As part of the ORNL Master Planning effort, an overall vision for the facilities revitalization effort was developed and adopted. That vision is to provide ORNL staff with world-class facilities, consolidated at the main ORNL site. Future renovation and new construction will be based on the following goals:

Scientific Mission: Support the multiprogram nature of the Laboratory and accommodate program growth and technology changes well into the 21st century. Integrate the program needs into a research campus environment that encourages interdisciplinary teaming.

Work Environment: Provide a quality work environment for employees and visitors that enhances their productivity and attracts the next generation of world-class scientists to ORNL. Facilities will contain the latest advances in information technology and research laboratory infrastructure and will be designed to provide maximum flexibility for program changes.

Environment, Safety, Health, and Security: Provide a safe, healthy, environmentally conscious, secure workplace for employees and visitors. The Master Plan should maximize the use of already disturbed (brownfield) areas for new development, emphasize energy efficiency and sustainability design features, and provide an open campus security environment wherever possible.

Operations and Maintenance: Provide facilities and infrastructure that are efficient to operate and maintain. New building designs will incorporate energy-efficient heating/cooling systems, utility services, insulation, and exterior surface materials that are state-of-the-art, yet durable and maintainable.

Architecture: Provide a new ORNL campus of unifying architectural style that reflects the multiprogram scientific nature of the Laboratory mission and celebrates the unique history of the main ORNL site and the natural beauty of East Tennessee. The new research facilities will be built around an identifiable campus center where staff, visitors, and the general public will be welcomed and allowed to meet and exchange ideas.

The ORNL Master Plan for long-term site development defines projects for the East, West, and Central Campuses of the main facilities complex through 2011. Main points of the plan are:

- **East Campus:** Centered around new ORNL Research Support Center. Siting is proposed for up to eight new research and related buildings. Existing labs and offices in the 4500N/S complex, as well as those in the Physics and Computational Sciences complex in the 6000 Area and the HTML Area (4515), will be upgraded as required.

- **West Campus:** Emphasis is on the consolidation of Environmental and Life Sciences research activities into a complex surrounding a natural commons area. This includes the construction of a Center for Systems Biology facility and other buildings. This will involve the demolition of Building 1000 (a non-eligible building). Existing facilities housing Environmental and Life Sciences Division staff will be retained and upgraded as required.

- **Central Campus:** Few features have been developed at this point for the Central Campus area. Continued use and upgrade of current strategic research facilities is planned.

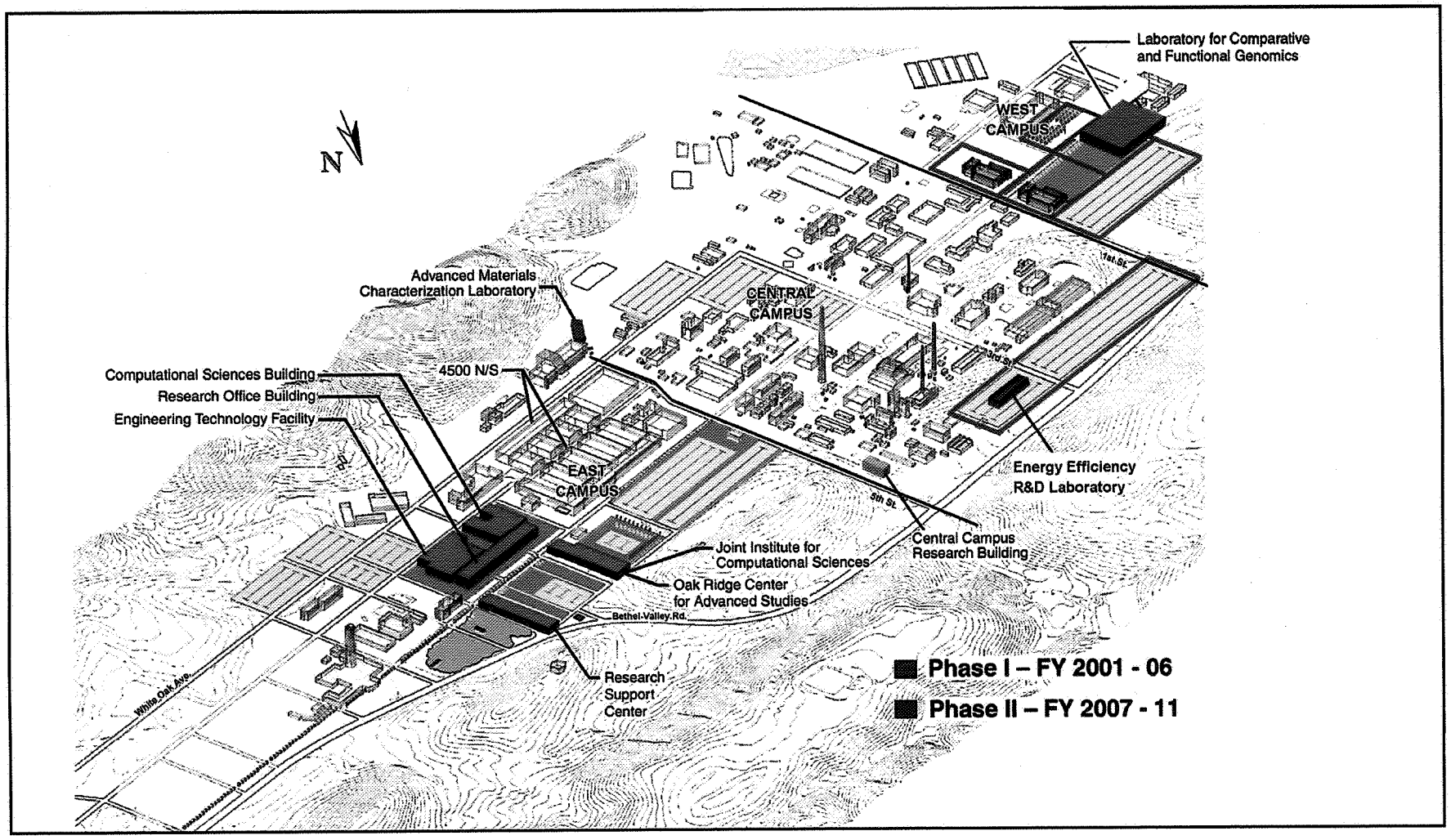
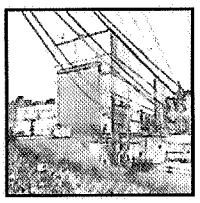


Figure 68: Proposed new construction at the ORNL Complex over the next 10 years.

7.7. Summary

ORNL has remained an evolving and active facility whose various missions require continuous construction and building modifications. The historic properties at ORNL can be affected in a variety of ways. Due to the evolving mission of the facility, some historic buildings will no longer be used and the HPP outlines future foreseeable actions for these facilities. Other facilities will require remodeling and regular maintenance to remain functional.

The ORNL Historic Preservation Strategy will be implemented through the combined application of historic preservation interpretive initiatives and the physical preservation of historic properties. Physical preservation will be based on sound comprehensive planning and DOE SC mission directives. The forthcoming ORNL Interpretive Plan will be in place by the end of 2007 and will provide a set of interpretive initiatives to preserve the complex's historic properties. ORNL will complete an oral history program of current and former employees by the end of 2005. ORNL's *Strategic Facilities Plan* and *Land and Facilities Plan* are updated annually, and the goals and objectives of the HPP should be incorporated into future planning efforts.



8.0. ORNL BUILDING MANAGEMENT

8.1. Overview

The majority of historic buildings and structures at ORNL are located within the boundaries of the NRHP-eligible ORNL Historic District that was identified in the 1993 survey. The district contains 118 buildings, of which 54 are considered to be contributing to the character of the district. An additional eleven buildings and structures in outlying areas surrounding the main ORNL complex are also individually eligible for the NRHP. ORNL's historic buildings and structures encompass the range of facilities located on the grounds of the ORNL campus and include laboratories, process buildings, administration buildings, portals, pumphouses, storage buildings, utility and maintenance buildings, etc.

ORNL's historic buildings and structures were constructed in basic utilitarian designs to accommodate the largely industrial and technological nature of the installation. Buildings that date to the era of the Manhattan Project were constructed with the utmost speed using the quickest building methods available. In the race to build atomic weapons, buildings had to be constructed in the shortest time possible, which required that facilities be very simple in design. Many of the buildings from this era had an original estimated life span of fifty years. During the Program H building expansion of the 1950s, more permanent buildings were constructed. These also were basic designs specifically intended for scientific research.

ORNL's historic buildings reflect a variety of construction methods. Buildings range in size from small ancillary buildings such as pumphouses to large industrial buildings and laboratories three-stories in height with large exhaust stacks and up to 341,000 square feet of interior space. Many are of steel frame construction with corrugated metal siding. Several buildings are of concrete construction and have an exterior of brick veneer. Roofs are predominantly flat structural steel or precast concrete roof systems. Most buildings reflect a rectangular plan and have cast concrete slabs or foundations.

8.2. Functional Use

The ORNL complex covers approximately 1100 acres. Real property includes more than 600 buildings and other structures with a floor area of approximately 3.5 million square feet. While DOE SC is the site landlord and is responsible for approximately 85% of the floor space, other DOE program offices have responsibility for the remaining 15%. Situation assessments have revealed the following key points about the functions and infrastructure of today's ORNL complex:

- ORNL has one of the oldest physical plants in the DOE laboratory system, and many facilities have reached the end of their safe operating life. Continuing efforts will be required to renovate and rehabilitate general-purpose buildings and utility systems that have deteriorated, as well as provide for new mission-related facilities for expanded scientific endeavors.
- Much of current ORNL space is substandard and needs to be replaced or upgraded in order to support the long-term research mission of the Laboratory.
- The poor condition of facilities is a key environmental, safety, and health concern; adds considerably to overhead costs in terms of energy consumption, increased maintenance costs,

and research inefficiencies; and reduces the ability to attract and retain world-class scientific talent.

- ORNL needs to focus on more efficient space utilization within strategic buildings, and existing space holdings must be reduced.
- ORNL has a utility infrastructure that is outdated. Health and safety requirements can no longer be met by older equipment, and reliability concerns cannot be tolerated. This situation provides opportunities for reduction in size, efficiency upgrades, replacement of aging infrastructure, and reduced operating costs.
- Obsolete and inefficient process and equipment technologies, when modernized, could further reduce overall facility maintenance, security and manufacturing costs.

8.3. Age of Facilities

The majority of the total ORNL site floor space (approximately 52%) is over forty years old, with the vast majority being constructed in the 1950s and 1960s. Most of the original facilities have seen several changes in mission and have been operating for nearly 60 years. From the original mission of producing plutonium through the site's evolution as a national laboratory with increasingly broad areas of scientific research, the majority of the infrastructure, though sometimes upgraded, has remained in continuous use. An expansive building program in the 1950s occurred due to the site's status as a national laboratory and a focus on research and development of radioisotopes and peaceful applications of nuclear energy. Over two million square feet of floor space at ORNL was constructed during the 1950s and 1960s.

Limited DOE budgets have allowed the physical condition and adequacy of facilities to decline over the years. This lack of investment in utility infrastructure has led to significant inefficiencies and maintenance requirements, and the necessity to carefully and thoroughly monitor and assess the physical condition of the facilities and supporting infrastructure.

8.4. Maintenance Process for DOE SC Facilities

Two processes are in-place for assessing the condition of ORNL facilities including those buildings and structures that are eligible for the NRHP.

The Condition Assessment Survey (CAS) process involves a visual evaluation of separate building systems that comprise a facility. These systems traditionally fall under three broad professional disciplines: Architectural (including structural), Mechanical, and Electrical. The CAS inspector describes each deficiency noting its severity and coverage, i.e., how much of the component or assembly reflects the deficiency. The inspector also codes each component or assembly as to condition and the urgency and purpose of the proposed repair. Based on these recorded deficiencies, corrective actions and their associated repair codes are defined and processed by the Condition Assessment Information System (CAIS) database. Costs to accomplish repairs are generated by the CAIS system, which employs several methods for costing, based on R. S. Means Construction estimating program.

The Facility Assessment process is a consistent approach for performing annual assessments of the condition of buildings and systems by facility engineers and project leaders assigned to the buildings. In addition to assessment of the infrastructure and its systems, this process includes validation and prioritization of deficiencies identified in the CAIS system. Project Leaders generate service requests for deficiencies requiring immediate correction and monitor the corrective maintenance. Those deficiencies not requiring immediate attention are entered into the CAIS system. The Facility Assessment process also includes a review of preventive maintenance status for building equipment or systems.

Facility Assessment and Condition Assessment deficiencies are incorporated into Annual Work Plans for maintenance of each ORNL facility. The Annual Work Plan is the basis for budget requests and allocation of maintenance funding. Dependent on the urgency of the deficiency and the level of funding deficiencies are either corrected or entered in the Deferred Maintenance Program.

8.5. The "Cheap-to-Keep" Process

As ORNL facilities reach their end of expected life and are declared excess, they transfer from an operational mode into a transition phase that prepares them for ultimate disposition. This phase typically includes deactivation, S&M, and D&D. Deactivation involves identifying and eliminating hazards and placing the facility in a stable shutdown condition, known as the "cheap-to-keep" mode. The building is put in a state of minimum cost and minimum utilities required to maintain the integrity of the structure. S&M activities occur that include inspection of the facility and routine and preventive maintenance actions required to sustain the property. Each facility's environmental, radiological, and physical condition is assessed. The goal of ORNL's Facilities Revitalization Project is to minimize the S&M period. For facilities that are transferred to the DOE EM Program, the S&M period is expected to be longer. Ultimately, if there is no future mission requirements for these buildings and as sufficient funding is made available, demolition of these facilities will be required.

8.6. DOE EM Program Facilities at ORNL.

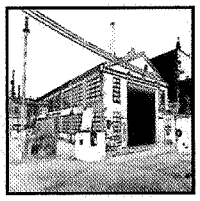
The EM program is responsible for approximately 15% of the floor space at ORNL. BJC is the contractor responsible for EM facilities. The level of maintenance provided for BJC facilities depends upon the current use and planned disposition of each facility.

The facilities for which BJC is responsible under the EM Program and include active and inactive facilities. The active facilities are related to waste treatment and storage or remedial action support, such as the Liquid & Gaseous Waste Operations, the permitted Resource Conservation Recovery Act (RCRA) hazardous waste storage areas, office space for BJC staff and subcontractors, and facilities used during remediation. Inactive facilities include not only buildings, such as former laboratories and reactor facilities, but also non-buildings, such as burial grounds, impoundments, and streams. The inactive facilities are either undergoing or are awaiting remediation under CERCLA.

Maintenance of active facilities is performed to maintain the buildings and systems in a condition necessary to perform the designated use. Maintenance of inactive facilities is performed at a level necessary to protect human health and the environmental and to comply with applicable regulations and DOE orders.

8.7. Summary

ORNL has an ongoing facility assessment and maintenance planning process to identify and prioritize facility maintenance needs across the site. In accordance with this process, facility maintenance needs of ORNL historic properties with an ongoing mission need (see Section 7) are identified via the ORNL Condition Assessment Program and are put into the maintenance planning process for implementation. As a part of maintenance or project planning, work that has the potential to impact ORNL cultural resources is reviewed by the site NHPA Coordinator as part of the NEPA review process. In accordance with the procedures outlined in Section 11 of this document, consultation with the SHPO will be performed as part of the planning process when appropriate.



9.0. ARCHAEOLOGICAL SITE MANAGEMENT

9.1. General Consideration for Prehistoric and Historic Archaeological Sites

There are no known NRHP-listed or -eligible archaeological sites at ORNL. Ground disturbance has taken place in most areas of the installation and the potential for archaeological sites is considered to be minimal. The PA between the DOE and Tennessee SHPO requires the completion of archaeological testing prior to any proposed ground disturbance activities in previously undisturbed areas, or when property is transferred out of ownership or control of the DOE.

9.2. Emergency Discovery Procedures

9.2.1 Background - AHPA and 36 CFR 800

Protection of archaeological sites is primarily conducted by leaving such areas undisturbed if possible. If sites cannot be left alone, they should be excavated and artifacts should be removed and sent for museum curation. There are several laws in existence today, such as the Reservoir Salvage Act amended in 1974 and the Archaeological Resources Protection Act of 1979, which protect archaeological sites. These laws mandate identification of historic and prehistoric resources by Federal agencies whose activities may disturb or destroy archaeological sites.

The Archeological and Historic Preservation Act of 1974 (AHPA) was set up to supplement the Historic Sites Act of 1935. AHPA specifically provides protection for "historical and archaeological data which might otherwise be irreparably lost or destroyed" from floods, road construction, community construction, railroad and highway relocation or terrain alterations due to dams or Federal construction projects ("Preservation Law," p. I-39). As a Federal agency, DOE must follow certain procedures set up under AHPA. Before beginning or issuing a license for a construction project, the agency must notify the Tennessee SHPO in accordance with stipulations set forth in the PA. Copies of the proposal will be made available for public inspection by the Tennessee SHPO. If the Tennessee SHPO concludes that damage or destruction of historic or prehistoric properties could occur, a survey must be conducted to record endangered properties, as well as surrounding areas that may be affected. <u>If a property is discovered once an undertaking begins, AHPA may be substituted for Section 106 **if** the property is primarily of archaeological value.</u>

Public Law 36 CFR 800 was set up by Congress to protect historic properties. This law governs Section 106, which is discussed in detail elsewhere within this report. Section 106 accommodates historic preservation concerns with the needs of Federal undertakings. Public Law 36 CFR 800 requires that Federal agencies evaluate all undertakings and strive to complete proposed actions with as little harm as possible to historic properties. According to the law, Federal agencies must provide the Council a reasonable amount of time to comment on undertakings and strive to comply with Council recommendations. Although Public Law 36 CFR 800 cannot stop a Federal agency from taking action, it does slow the process and allows involved parties an opportunity to mitigate undesirable outcomes. Among those who may be involved in the Section 106 process are the SHPO, the Council, the agency itself, Indian tribes and the public.

9.2.2. Discovery Situations

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.

The preferred option for Federal agencies involved in an undertaking is to plan ahead. Assume there is always the possibility of a late discovery and decide ahead of time what to do should the situation arise. Advanced planning assures a minimal amount of disruption. Such plans should be documented in the MOA. In cases of no advanced planning, the agency has three options:

- *Compliance with Section 800.6.* Under this option, ORNL either enters into consultation with the Tennessee SHPO and the Council to develop an MOA or requests Council comment without an MOA. In either case, the Council must provide an expedited review.

- *Development of a plan.* ORNL may develop plans to handle the discovery itself. Under this option ORNL notifies the SHPO and the Council of its plans as soon as possible. The Council provides initial comments within two days and final comments within thirty days.

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

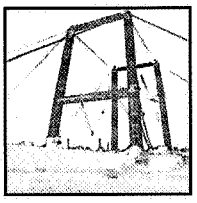
9.2.3. Notification Procedures.

Any time that a property is discovered after project work has begun, ORNL must notify the Council. If ORNL 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, Tennessee SHPO comments, whether the discovery is NRHP eligible, if the project will have an adverse effect on the site, and what ORNL plans to do about the discovery. As in any situation requiring agency action, it is best to consult with the Tennessee SHPO about what actions to take. If ORNL complies with Section 106, rather than AHPA, the Council must comment within an expedited period of time, providing its final comments within thirty days. Discovery procedures for consultation and creation of an MOA are the same as those described under Section 106.

9.3. Summary

No archaeological sites have been identified at the ORNL. The potential for archaeological sites is considered to be minimal at the complex due to soil conditions and the extent of past ground disturbance. Future undertakings which are identified as impacting archaeological resources should follow guidelines set forth in the PA between ORNL, the SHPO, and the Council.



10.0. TRAINING

10.1. Staff Training

DOE ORO and prime contractor personnel at ORNL are trained in the interpretation and application of cultural resource laws and regulations. They have attended and completed Section 106 workshops conducted by the Tennessee Historical Commission and the Council.

As part of the responsibility of the ORNL Cultural Resource Coordinator, with assistance from UT-B's Records, Training, and Standards Based Management System Services Division, training is designed and developed for various site personnel (i.e., Environmental Protection Officers and Environmental Compliance Representatives) to sensitize them to the special needs of the historic resources at the ORNL complex and to foster a spirit of cooperation and pride in their preservation. This service is also available to BJC personnel as well.

10.2. Historic Property Training Opportunities

To effectively manage and care for ORNL's historic properties, DOE ORO and the ORNL site prime-contractor personnel responsible for cultural resource compliance activities are provided technical training in the interpretation and application of cultural resource laws and regulations. Below are listed examples of a variety of available preservation training tools and opportunities. Preservation methods of the U.S. military are especially relevant to ORNL as many U.S. Army and Navy sites have similar building types that date to the World War II era and face many of the same preservation, security, and cost issues that ORNL must manage.

Advisory Council on Historic Preservation
The Council has prepared courses on "Preservation Law and Section 106 Compliance" and an "Introduction to Section 106 Review" which are presented for Federal agencies including the various branches of the military under the Department of Defense and the Coast Guard. This course is held annually at various locations throughout the country and course schedules are available from the Council website provided below and from the Naval School and Civil Engineer Corps Officers. For more information, please refer to their website at www.achp.gov/outreach.html

Tennessee Historical Commission (SHPO)
The Tennessee Historical Commission, which is responsible for consultation with agencies, applicants, and interested persons relative to the Section 106 review process, periodically conducts Section 106 Workshops. For more information, visit their website at www.state.tn.us/environment/hist/sect106.htm.

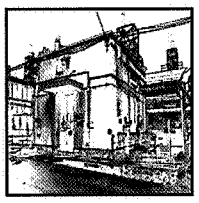
Department of the Navy Cultural Resource Program
The Department of the Navy offers historic preservation and cultural resource training under its Cultural Resource Program. Various training courses are offered annually such as "Historic Preservation Law and Section 106 Compliance" and "Introduction to Cultural Resource Management Law and Regulations." For more information, please refer to the Navy Cultural Resources Program website at www.dandp.com/enviroweb/cultural/index.html.

National Park Service

The NPS offers a training center which provides training courses focused on preservation construction services. They offer these programs to other federal, state, and local organizations as training venues. Technical consultations within the field, federal agencies, and with international organizations is also obtainable. For more information, please refer to the NPS website at www.cr.nps.gov/training.htm or call 301-663-8206.

10.3. Summary

ORNL personnel are trained in the interpretation and application of cultural resource laws and regulations. To effectively manage and care for ORNL's historic properties a variety of preservation training options are available, and those of the U.S. military may be especially useful for ORNL as many military sites have similar preservation issues.



11.0. ORNL HISTORIC PROPERTY MANAGEMENT AND PROCEDURAL REVIEW

11.1. ORNL Historic Property Oversight and Management

The CRMP completed for the DOE ORR in 2001 contains provisions incorporated into a PA. This PA was among the DOE ORO, the Tennessee SHPO, and the Council concerning the management of historical and cultural properties at the ORR. The CRMP outlines the responsibilities of DOE ORO in meeting its cultural resource requirements under Section 106.

The PA contains provisions that are applicable to historic building management and review at ORNL. The types of undertakings identified in the PA as potentially having an affect on historic properties include, but are not limited to, undertakings involving:

a.) construction of new or temporary facilities or permanent or temporary additions to existing facilities;
b.) decontamination and decommissioning of facilities;
c.) replacement of equipment or facility components;
d.) facility renovations;
e.) modifications to facility use, operation, or function;
f.) routine maintenance activities;
g.) site characterization and remedial investigation activities;
h.) ground-disturbing activities;
i.) transfer, disposal, or lease of properties; and
j.) demolition of facilities.

11.2. Procedural Review

Historic property management at ORNL is directed through the Environmental Protection Department via the office of the NHPA Coordinator. The NHPA Coordinator works in conjunction with the DOE SC and ORO Cultural Resources Management Coordinator.

Historic resources at ORNL are defined as the fifty-four buildings and structures within the boundaries of the NRHP-eligible ORNL Historic District that contribute to the character of the district, and the additional eleven buildings and structures in outlying areas surrounding the main ORNL site that were identified as NRHP-eligible in the 1993 architectural and historical assessment of the installation. Contributing buildings and structures within the historic district are:

2003	3026(C)	3091
2624	3026(D)	3092
3000	3027	3500
3001	3028	3501
3002	3029	3502
3005	3030	3503
3008	3031	3504
3009	3032	3508
3010	3033	3515
3012	3034	3518
3017	3036	3523
3018	3037	3587
3019(A)	3038	3592
3019(B)	3039	4500N
3020	3042	4501
3021	3044	4505
3025(E)	3074	4507
3025(M)	3080	5500

NRHP-eligible buildings outside the district are:

7001
7002
7503
7700
7701
7702
7703
7704
7751
7813
7846

Effects to historic properties at ORNL shall follow procedures agreed upon by the DOE ORO, the Tennessee SHPO, and the Council. This agreement will be formalized in a PA in 2004. This review process includes a three-tier system of review for undertakings involving historic properties at ORNL.

Level One: Programmatic Exclusions

The following undertakings will not require review for Section 106 purposes by the SHPO because they will not have an adverse effect on ORNL historic properties. These actions will either be completed as a matter of course by the maintenance department or facility managers, or by the appropriate NHPA Coordinator. Level One activities are:

a. **Communications and Computer Systems:** Siting, installation, modification, maintenance, repair, removal, or replacement of communications and computer systems, including telephone systems, computer and computer networks, and public address/warning systems, facsimile systems, microwave/radio systems. These actions might involve project design, procurement, and installation of communications systems or system components. Installation might include installing aboveground and belowground conduits, cable trays, support poles, manholes, and hub stations that

contain distribution panels, wiring, electronics, power supplies, coaxial and fiber optic cables, and miscellaneous tie-ins to existing systems such as the Broadbrand Communication Network, barcode readers, badge readers, electronic message signs, and computers/peripheral systems (including transmitters).

b. **Electrical Systems:** Installation, maintenance, repair, removal, modification, 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, circuit breakers, capacitors and transmission lines.

c. **Emergency Situations:** Activities required by emergency situations (e.g., health and safety related emergencies) as determined on a case-by-case basis, including those emergency activities in compliance with federal, state, or local regulatory requirements, including (but not limited to) Environmental Protection Act, Federal Facilities Act, Comprehensive Environmental Response Compensation and Liability Act, Resource Conservation and Recovery Act, Superfund Amendments and Reauthorization Act, Occupational Safety and Health Act (OSHA), etc. Emergency activities that will have an effect on historic properties shall be handled in accordance with 36 CFR Part 800.12.

d. **Energy Conservation:** Include actions to conserve energy such as weather stripping, installation of interior storm windows, and addition of ceiling and wall insulation.

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

f. **Fire Protection System:** Routine installation, upgrades, replacements and/or modifications to include, but not limited to, fire doors; fire walls/barriers; fire dampers; exit lights; fire protection systems; fire alarm systems; sprinkler systems; anti-freezing devices in existing sprinkler systems, corridors, stairways; fire alarm systems; smoke detectors, including detectors that activate doors; fire hydrants and associated piping; and emergency generators.

g. **General Equipment:** Installation, direct replacement or removal of equipment or facility components. Maintenance, installation, relocation, removal and repair of equipment, facility components, and associated systems, which include, but are not limited to the following:

1. Machine shop equipment such as jib cranes, motors, valves, shredders, compressors, pumps, castors, power supplies, lathes, saws, shears, presses, welding equipment, dust collectors, dryboxes, and vent systems.

2. Inspection, monitoring, laboratory and analytical equipment such as calorimeters, temperature and humidity chambers, refrigerators, freezers, blenders, grinders, polishers, blasters, X-ray generators, diffractometers,

spectrometers, spectographs, spectrophtometers, chromatographs, desintometers, lasers, microscopes, balances, process controllers, indicating/recording devices, ultrasonic and plasma generating equipment, analyzers, viscometers, and measuring equipment.

3. Control equipment such as weirs, skimmers, glove boxes, hoods, stacks, filters, filter housings, fans, exhausts, bag houses, precipitators, and scrubbers.

   Note: This provision excludes equipment, machinery, or facility components which are contributing elements to a property's historical significance.

h. **Habitat Protection:** Actions in researching, protecting, restoring, or improving fish and wildlife habitat.

i. **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 structures and equipment.

j. **Heating and Air Conditioning Systems:** Installation, modification, and/or upgrades, maintenance, removal, repair, or replacement of heating/ventilating/air-conditioning systems and high-efficiency particulate air filters to (1) enhance workplace habitability, (2) provide for personnel safety and health enhancements (i.e., installing/improving fume hoods and associated collection and exhaust systems), and (3) ensure proper temperature control of buildings and equipment.

k. **Leasing of Property:** Leasing of historical properties when the lease would not involve, at any time, major modifications or alterations to the properties such that their historical integrity would be adversely affected.

l. **OSHA Regulations and Permit Compliance:** Installation, maintenance, repair, or replacement of equipment used in current operations designed to maintain compliance with permits and regulations of OSHA and the Americans with Disabilities Act.

m. **Non-Contributing Properties:** Operation, maintenance, or demolition involving any building or structure determined *not* to be a historic property either by consensus of DOE ORO and the SHPO or as a consequence of a Formal Determination of Eligibility by the Keeper of the NRHP.

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

o. **Process and Laboratory Equipment:** Installation, maintenance, modification, repair, storage, relocation, removal, or replacement of process or laboratory equipment and

associated systems such as presses, rolling mills, foundry equipment, cranes, glove boxes and hoods, fans and tanks, ultrasonic cleaners, machine shop equipment, heat exchangers, ovens and furnaces, brazing and sintering equipment, cryogenic equipment, salt baths, centrifuges, bag houses and scrubbers, conveyors, motors, piping, valves, autoclaves, compressors, pumps, hydro-forms, recovery equipment, metal-forming equipment, inspection equipment, motor control centers, cyclone separators, humidifiers, vacuum pumps, molding and extruding equipment, filtration equipment, grinders, mill, and supercritical cleaning apparatus.

p. **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.

q. **Removal of Polychlorinated Biphenyl (PCB) Contaminated Items:** Removal of PCB 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 determined to be contaminated, will be excavated and removed.

r. **Routine Activities:** Routine administrative, contractual, security, preventative maintenance, financial, or personnel activities.

s. **Routine Plant Service Activities:** Routine plant service activities to include, but not limited to: mowing and trimming of grass, shrubs, or trees; moving and assembling of furniture and equipment; snow removal; routine vegetation and erosion-control activities; janitorial and housekeeping services; small-scale use of pesticides; small-scale road, sidewalk, and parking lot repair; maintenance and repair of plant vehicles and heavy equipment; maintenance of plant safe/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 preventative actions to maintain and preserve buildings, structures, and equipment in a suitable condition; and routine decontamination of tools, surfaces, and equipment.

t. **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, windows.

Note: Original doors and windows and exterior paint should be replaced in-kind or with appropriate substitutes.

u. **Security Systems:** Installation, maintenance, modification, removal, and repair of security systems, such as computer security, detection, monitoring, surveillance, and alarm systems including doors, walls, barriers, barricades, cameras, monitors, and shields.

v. **Steam Condensate and Chemical Treatment Systems of Buildings:** Modification to steam/condensate systems, including (but not limited to) repair or replacement of

associated piping, pumps, and condensers to maintain system integrity; extension of systems to accommodate new construction or building modification; and repair of any associated chemical treatment systems.

Note: This provision excludes the removal of above-ground steam, condensate and other chemical treatment systems that are contributing elements to a property's historical significance.

w. **Supplied Air, Gases, and Liquid Piping Distribution Systems:** Maintenance, repair, modification, relocation, and installation of distribution systems to include but not limited to nitrogen, argon, helium, oxygen, propane, natural gas, and cryogenic piping system, as well as equipment for gas cylinders.

Note: This provision excludes the removal of above-ground supplied air, gases, and liquid piping distribution systems that are contributing elements to a property's historical significance.

x. **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.

y. **Water Systems:** Siting, installation, maintenance, repair, removal, and operation of plant water systems including (but not limited to) water wells, cooling water systems, potable and process water systems, storm sewers, demineralizer, wastewater treatment systems, plant drainage, fire protection systems, and plumbing.

z. **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.

Level Two: Internal Review

The following undertakings will be reviewed within ORNL by the appropriate NHPA Coordinator, and/or DOE ORO, and/or the ORO Cultural Resources Management Coordinator. These undertakings will not require further review by the SHPO or the Council provided that the internal review of these undertakings is based upon information adequate to identify and evaluate affected historic properties and that DOE ORO has determined that these undertakings will either be no effect or no adverse effect based upon the Criteria of Effect and Adverse Effect enumerated in 36 CFR Part 800.5. Level Two activities are:

a. **Repair and Maintenance of Buildings:** Many of ORNL's historic properties have been altered with replacement doors, windows, roofs, etc. Where original architectural elements remain, necessary replacement or repair would be of in-kind materials and designs. All future repair or replacement of original exterior doors, exterior windows, exterior paint, roofing, siding, or any other character-defining elements of a historic property would be reviewed to ensure that in-kind material, size, dimension, color, texture, finish, and construction and fabrication detail are used. These activities should be done in accordance with the Secretary of Interior's Standards for Rehabilitation.

b. **Repair and Modification of Building Interiors:** Some of ORNL's historic buildings retain their original design and configuration, and many interiors have been remodeled into offices or other needed space. All proposed repair or modification to interiors would be reviewed to ensure that such modifications do not effect or adversely affect any intact character defining elements of the historic interiors.

c. **Mothballing of Facilities:** Actions involving the disconnection of utility services such as water, steam, telecommunications, and electrical power after it has been determined that continued operation of such systems will not be needed for safety or for the control of hazardous materials. The specific needs of the structure would be assessed to effectively mothball the structure per the NPS Preservation Brief on "Mothballing Historic Properties."

d. **Steam Condensate and Chemical Treatment Systems of Buildings of Major Production Facilities:** The conduits and piping systems associated with ORNL's processing and research facilities reflect the site's historic configuration and operation. Some of these systems may be associated with ORNL's Cold War or World War II activities. Modifications to steam/condensate systems associated with major production facilities, including (but not limited to) repair or replacement of associated piping, pumps, and condensers and repair of any associated chemical treatment systems should be reviewed to ensure that such modification does not adversely affect the exterior or character-defining elements of the interiors of historic properties.

e. **New Construction Projects:** All new construction would be reviewed to ensure proposed designs are compatible with existing adjacent historic properties and would not have an adverse affect to the historic properties.

f. **Sale or Transfer of Property:** Sale or transfer of historical properties when the sale or transfer includes deed stipulations requiring that management of the properties is conducted in compliance with the NHPA and undertakings involving modification, alteration, or destruction of the properties would be coordinated with the SHPO and/or the Council.

Level Three: SHPO Review

The following undertakings will be reviewed by the SHPO. These activities include those that have the potential to have adverse effects on the integrity of historic properties and which may require mitigation. Undertakings that will require the review of the SHPO are:

a. **Demolition of Contributing Buildings to the Proposed ORNL Historic District:** The demolition of any contributing building to the ORNL Historic District or any individual building or structure identified as eligible for the National Register, other than those identified in this document, the ORNL HPP (Section 7.0), or for which a formal agreement has previously been reached.

i. Should DOE ORO determine that in order to carry out its operations or development at the ORNL, that it would be necessary to demolish historic properties, the SHPO would be notified and consulted to determine whether the operation or development undertaking referent to the proposed demolition of the historic property could be avoided or minimized.

Subsequent to this consultation, the SHPO shall respond within fifteen (15) working days as to its finding.

ii. If the SHPO concurs in writing that the undertaking in question cannot be avoided or minimized, the appropriate Cultural Resource Coordinator will prepare the appropriate documentation for transmittal to the SHPO. Documentation will be developed and prepared per the graded approach described in Section 7.0 of the ORNL HPP.

iii. If the SHPO disagrees in writing that the undertaking in question cannot be avoided or minimized, DOE ORO shall forward all documentation relevant to the dispute to the Council and initiate consultation pursuant to 36 CFR Section 800.6.

b. **Major Modifications to Contributing Buildings in the ORNL Historic District or to Individual NRHP-Eligible Buildings or Structures:** Undertakings such as building repainting, or major modifications, repair or replacement of original doors, windows, roofing, or other architectural element that is not in-kind referent to the material, design, size, color, or fabrication. Modification of historic properties that has been reviewed by DOE ORO and has been determined to have adverse effects to historic properties.

c. **New Construction:** The construction of new buildings that has been reviewed by DOE ORO and has been determined to have adverse effects to adjacent historic properties.

d. **Archeological Surveys:** Archeological surveys will be ongoing as dictated by proposed construction/disturbance activities in previously undisturbed areas and will be conducted in a manner to allow for consultation and coordination with the SHPO.

Unclassified Undertakings

For any undertakings proposed for ORNL that are not classified in the three levels outlined above, the appropriate NHPA Coordinator shall proceed with Section 106 review of the undertaking under regulations enumerated in 36 CFR Part 800.5 through Part 800.7.

11.3. Documentation and Monitoring

a. The SHPO shall review the decisions of the DOE-ORO staff relative to the Programmatic Exclusions at times mutually agreed to by DOE-ORO and the SHPO. Should the SHPO question whether a particular undertaking should be considered among the above-referenced Programmatic Exclusions, DOE-ORO and the SHPO shall make every effort to resolve the issue informally. If these efforts fail, DOE shall refer the question to the Council. If the Council determines that the undertaking in question should not be considered as a Programmatic Exclusion, the undertaking will be reviewed in accordance with 36 CFR 800.4 through Part 800.6.

b. DOE-ORO, in consultation with the SHPO, may develop additions to the above-referenced list of Programmatic Exclusions that identify other types of undertakings that they mutually agree will be excluded from further Section 106 review subject to the conditions enumerated in the Programmatic Exclusion section. Proposals for such additions will be provided by DOE-ORO to the SHPO. Upon its acceptance, the DOE-ORO and the SHPO will maintain records on these additions and submit them to the Council as amendments to this Agreement Document.

11.4. Historic Preservation Plan Updates and Endorsements

DOE with support from its contractors must review and update the HPP in consultation with the SHPO and the Council every five years. 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 HPP. Instead, these updates can consist of attachments or appendices to the original plan.

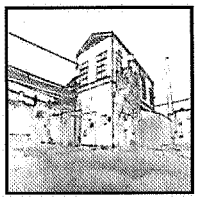
It is recommended that this HPP and later updates be endorsed by UT-B, BJC, and DOE. The plan and later updates should also be reviewed by the SHPO for their concurrence with the recommendations for historic property management and procedural review. Endorsement of the HPP and later updates by the SHPO will facilitate compliance efforts in the future.

It is also recommended that the HPP be used in the preparation of other master planning documents for the ORNL complex. This will ensure that ORNL's long-range plans will incorporate preservation concerns and principles for ORNL's historic properties.

11.5. Summary

Historic properties identified at ORNL consist of fifty-four contributing buildings and structures within the NRHP-eligible ORNL Historic District and an additional eleven individually eligible properties in outlying areas surrounding the ORNL main facilities complex. Construction or maintenance projects that have the potential to affect these properties are identified in the planning process and submitted to the appropriate NHPA Coordinator for further review.

Cultural resource management at ORNL is to follow the recommendations and procedural review outlined within the HPP. The procedural review will be formalized in a PA between the DOE ORO, the Tennessee SHPO, and the Council in 2004. The NHPA staff is to monitor cultural resource compliance efforts at the installation. The HPP is to be updated and endorsed every five years by UT-B, BJC, DOE ORO, and the Tennessee SHPO. Future planning initiatives at ORNL should incorporate the recommendations of the HPP.



12.0. SUMMARY AND ACTION PLAN

12.1. Historic Preservation Plan Summary

ORNL is a Federally-owned installation that has legal responsibilities for the identification, evaluation, and treatment of historic and archaeological properties under its jurisdiction. SC, an agency within the DOE, is the landlord program office having responsibility for the ORNL installation. In addition to DOE SC, the DOE Office of EM has properties located at the ORNL campus.

An intensive survey of historic resources was completed for ORNL in December 1993 (final version January 1994). Following Tennessee SHPO review of the report, eleven individual buildings and one historic district with sixty-six contributing buildings and structures were identified as meeting criteria for listing on the NRHP. Since this time, seven contributing properties within the ORNL Historic District have been demolished or remediated and an additional five have been approved for demolition. The district currently contains fifty-four contributing buildings and structures. These include Building 3001, which has NHL status. The ORNL Historic District has not been formally nominated to the NRHP.

There are currently no known archaeological sites at the ORNL complex and recent studies indicate that the potential for archaeological sites at the complex are minimal. However, it is important that ORNL follow the emergency discovery procedures outlined in the HPP should an archaeological site be identified.

The ORNL HPP defines the preservation strategy for the ORNL and is directed at all historic properties at the ORNL installation. The plan also directs compliance with the NHPA and federal archaeological protection legislation at the ORNL site. Each DOE ORO entity (SC, NE, and EM) as well as the respective operating and integrating contractors, UT-B and BJC, have participated in the development of the HPP and will be committed to the ORNL historic preservation program described in this plan.

ORNL faces significant challenges with respect to its facilities and infrastructure. These challenges include a growing need for consolidation of programs and staff to improve efficiency and effectiveness of missions and a continuing need for a wide variety of buildings and equipment, including specialized laboratories.

To meet these challenges, long-range plans for the ORNL main facilities complex seek to modernize and consolidate operations, which calls for a more efficient use of space and facilities, as well as the disposal of nonessential facilities. Comprehensive planning for the ORNL is a dynamic process and occurs continuously, and recommendations from the HPP will be incorporated within future planning documents for the installation.

The ORNL Historic Preservation Strategy ensures that historic preservation is an integral part of the comprehensive planning process. This strategy will be implemented through the combined application of historic preservation interpretive initiatives and the physical preservation of historic properties. Based on the dynamics of ORNL's planning efforts over the next five years, ORNL's existing historic properties have been categorized into the following four groups: (1) Future Mission Need, (2) Future Mission Need Uncertain, (3) Excess to Mission Need, and (4) NHL Status. Physical preservation of buildings will be

evaluated in the context of, but not necessarily limited to, continuing mission need, functional use, and economic considerations. This strategy recognizes that historic preservation must go beyond the preservation of physical structures – principally due to the long-range need for more efficient space to perform the site's missions. The historic preservation strategy addresses the need to preserve more global historic features.

Currently, thirty-two buildings inside the ORNL Historic District that are contributing elements to the historic district have been determined to be excess to future mission needs and are proposed for demolition within the next ten years. The demolition of five of these thirty-two buildings will have a minor effect on the integrity and appearance of the historic district. These five buildings are 2624, 3009, 3515, 3523, and 3587.

The demolition of eleven of the thirty-two contributing buildings to the NRHP-eligible ORNL Historic District would have a moderate effect on the appearance and integrity of the district. These eleven buildings add to the historic character and integrity of the district as representative examples of specific building types, their association with major research programs and processes, and/or their key locations within the district. These eleven buildings are: Buildings 3008, 3012, 3017, 3026(C), 3026(D), 3074, 3080, 3503, 3504, 3508, and 3592.

The remaining sixteen contributing buildings within the ORNL Historic District that are proposed for demolition within the next ten years are: Buildings 3002, 3005, 3010, 3018, 3019(B), 3028, 3029, 3030, 3031, 3032, 3033, 3036, 3037, 3038, 3042, and 4507. These buildings include major research and processing facilities associated with ORNL's historic operations and their associated support buildings. These buildings are core structures in the heart of the historic district, and are significant in conveying the character of the district. The demolition of any of these seventeen buildings would have a major effect on the historic district.

An additional six NRHP-eligible buildings and structures in outlying areas outside the ORNL Historic District at the ORNL complex have also been determined to be excess to future mission needs and are proposed for demolition within the next ten years. These are Buildings 7503, 7700, 7701, 7702, 7703, and 7704. Building 7503 first housed the ARE and later the Molten Salt Reactor Experiment. These operations were among ORNL's most significant achievements, and Building 7503 is of major historical importance. The remaining five buildings are associated with the TSF, which was developed as part of the ANP Program, and are of major historical significance. The TSF is an important component of ORNL's Cold War history and was the only reactor facility of its kind in the United States.

Interpretation is a key component of the ORNL Historic Preservation Strategy. For each historic property at the ORNL complex that is proposed for demolition, a graded approach will be used to determine the level of interpretation to be performed on the building. This interpretive approach will reflect each building's degree of historical significance as either minor, moderate, or major. ORNL will develop a detailed Interpretive Plan by the end of the year 2007. This plan will address a variety of interpretive efforts designed to preserve the historic character and integrity of the historic district and to comprehensively document ORNL's historical significance.

In order to document the knowledge and experience of those who worked at ORNL during World War II and the Cold War, ORNL will conduct an oral history program of current and former ORNL employees by the end of the year 2005. A crucial component of ORNL's history is the machinery and lab equipment that supported its historic operations. As many of these items are no longer in use and have the potential to be discarded, extant machinery and equipment from the World War II and Cold War eras needs to be inventoried and assessed for its historical significance. ORNL will conduct and prepare an inventory report and assessment of its historic machinery and equipment by the end of the year 2007.

Future ORNL undertakings will be assessed for their potential to effect historic properties through a three-level system of review. This procedural review is outlined in the HPP and will be formalized in a PA among DOE ORO, the SHPO, and the Council in 2004. Programmatic exclusions or activities that require no review by the SHPO are covered in Level One of the review process. These activities are basic daily maintenance and other activities that will have no adverse effect on historic properties. Level Two are those activities that will require internal review through the appropriate review authority. Activities covered in this level include the replacement of in-kind materials and architectural elements and procedures that have the potential to effect the historic interiors, machinery, or lab equipment of historic properties. Level Three activities are those that will have a major effect on historic properties and will require review by the SHPO. These activities include demolition, major alterations or rehabilitations, and new construction in or adjacent to the historic district that has been reviewed by DOE SC ORO and has been determined to have an adverse effect to historic properties.

The effective management of historic properties requires suitable training for key personnel responsible for maintenance and management of historic facilities. To effectively manage and care for the historic properties at ORNL, DOE ORO and the ORNL prime contractor personnel responsible for cultural resource compliance activities are provided technical training in the interpretation and application of cultural resource laws and regulations. As part of the responsibility of the ORNL Cultural Resource Coordinator, training is designed and developed for various site personnel (i.e., maintenance staff) to sensitize them to the special needs of the historic resources at ORNL and to foster a spirit of cooperation and pride in their preservation.

ORNL has an ongoing facility assessment and maintenance planning process to identify and prioritize facility maintenance needs across the site. As a part of maintenance or project planning, work that has the potential to impact ORNL cultural resources is reviewed by the site NHPA Coordinator as part of the NEPA review process. Consultation with the SHPO will be performed as part of the planning process when appropriate.

In order to ensure the care and preservation of its historic properties, the HPP will be updated on a regular basis. Due to the changing nature of its missions, security requirements, and developing long-range plans, ORNL will review and update the HPP no later than 2009 and every five years thereafter. In addition, all master planning documents for the facility will incorporate the recommendations of the HPP and the requirements of the PA, making the preservation of its historic buildings a principal objective of the installation.

12.2. Action Plan

- For future mitigation purposes and to preserve ORNL's unique history for the public, ORNL will create and have in place an interpretive plan that will highlight its signature historic facilities. This plan should be completed no later than the end of 2007.

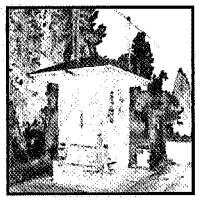
- The historic and archaeological resources management of ORNL will be integrated with overall mission management and planning so that mission goals may be obtained without undue delay, and that significant resources may be preserved and maintained.

- There will be review authority for all projects that have the potential to affect historic and archaeological resources. The system of review will have three levels: (1) activities that require no further review (2) activities that require internal ORNL review through the appropriate review authority, and (3) activities that will require review by the SHPO.

- ORNL will complete an oral history program of current and former ORNL employees in an effort to document the site's World War II and Cold War era history by the end of the year 2005.
- ORNL will prepare an inventory and assessment of its historic machinery and equipment by the end of the year 2007.
- Key personnel responsible for the care and management of historic properties at ORNL will be trained in the interpretation and application of cultural resource laws and regulations.
- The HPP will be reviewed and updated every five years.
- Recommendations of the HPP will be incorporated within future master planning documents for the installation.

12.3. Summary

The ORNL is an integral component in the history of nuclear research and development in the United States. The heritage of its significance in World War II and the Cold War is expressed in its built environment and landscape. As the missions and operations of ORNL evolve over the coming decades, this legacy must be respected through the actions of continued preservation and maintenance, adaptive reuse, interpretation, and recordation. Such actions will enable the ORNL to preserve and maintain its historical legacy while continuing to be one of the nation's centers for scientific and nuclear advancement.



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