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at Los Alamos National Laboratory, New Mexico

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Legacies of the Recent Past: the Built Environment

at Los Alamos National Laboratory, New Mexico

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Los Alamos National Laboratory

Historical significance has long been associated with past events from the time of our forbearers. Yet important historical legacies remain from our recent past, from the time of our own memories. Although arguably a difficult task, some events of worldwide importance can be identified as historically significant even if they have yet to withstand the test of time. The creation of the atomic bomb and the onset of the Cold War are exceptionally significant events from the recent past and both are intimately connected with the WWII and postwar periods at Los Alamos National Laboratory (LANL). In compliance with federal law, LANL buildings and structures associated with these events are being inventoried and systematically documented.

I. INTRODUCTION

In the early 1940s, a remote area of northern New Mexico was selected to be the site of a secret laboratory; a scientific facility whose only goal was the development of the first atomic bomb. Today, more than fifty years after the acquisition of much of northern New Mexico's Pajarito Plateau for wartime weapons research, a modern scientific laboratory still exists near the town of Los Alamos. Los Alamos National Laboratory, or LANL, is operated by the University of California for the Department of Energy and is still involved in nuclear research (Figure 1). But what of the early WWII laboratory, its buildings and history? What legacies of the once secret city are left at Los Alamos?

The National Historic Preservation Act (NHPA) of 1966 requires that U.S. federal agencies address these kinds of questions. Properties, both buildings and structures, older than fifty years, or if more recent, of exceptional historical

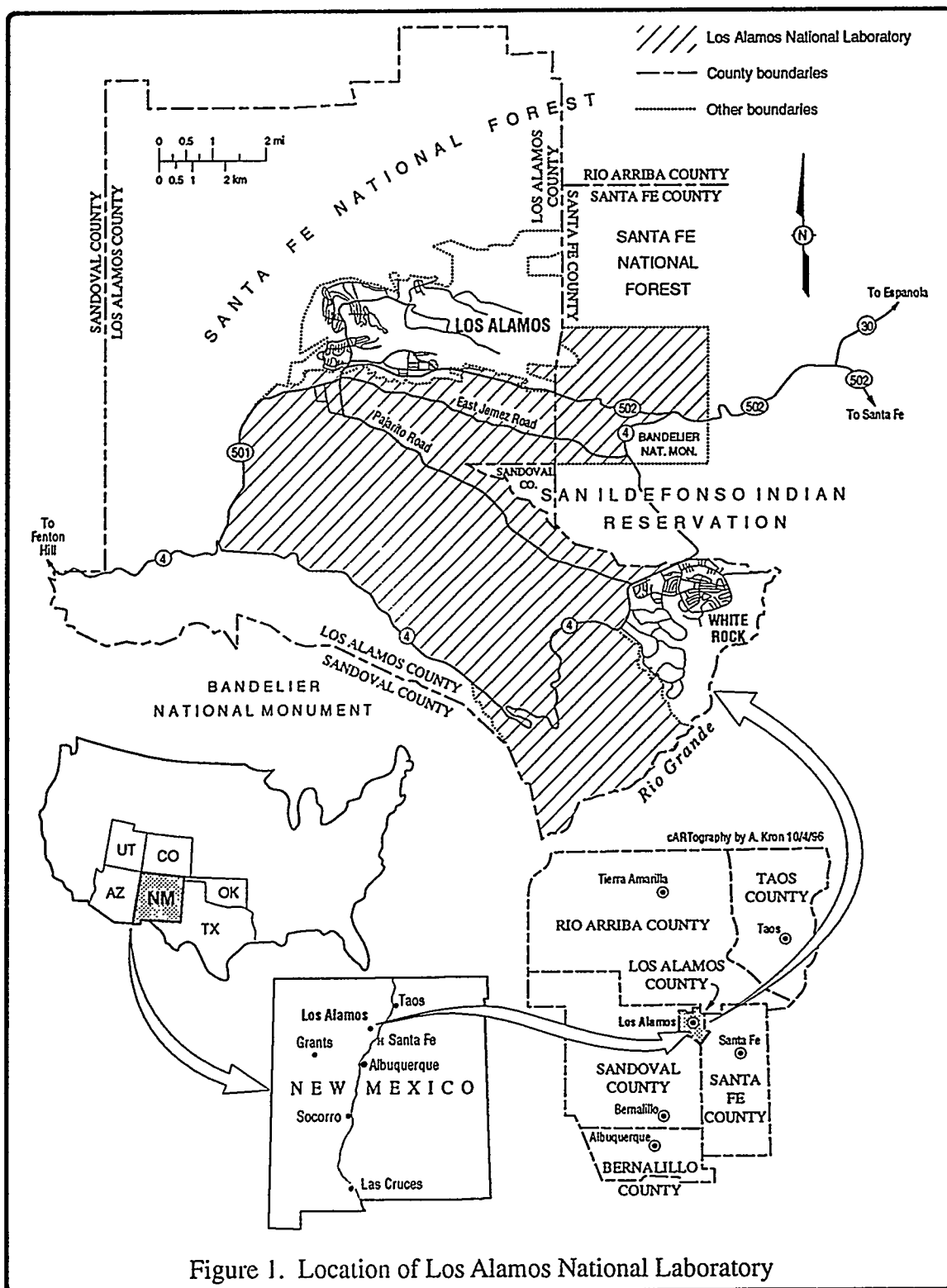


Figure 1. Location of Los Alamos National Laboratory

importance, are to be evaluated for eligibility to the National Register of Historic Places. In compliance with this regulation, LANL has begun to identify and inventory historic properties eligible for the register.

This paper will provide an overview of LANL's WWII and postwar history and will describe recently identified LANL property types and significant historic themes associated with the years 1943–1956. Past NHPA "Section 106" documentation efforts will also be summarized.

II. HISTORIC OVERVIEW

A. Site Selection, Acquisition

In 1942, Albert Einstein wrote a letter to President Franklin Roosevelt warning him of a possible German atomic bomb threat (Rothman 1992). In the same year, a University of California physicist, J. Robert Oppenheimer, organized a physics conference that concluded that a fission bomb was feasible (LANL 1995). However, several problems existed: the research efforts of universities and industry needed to be coordinated and a process to produce sufficient fissionable material needed to be determined (Rothman 1992). President Roosevelt, acting on Einstein's concerns, gave approval to develop the world's first atomic bomb and appointed Brigadier General Leslie Groves to head the "Manhattan Project." Groves, in turn, chose Robert Oppenheimer to coordinate the design of the bomb.

A single research facility, isolated and secret, was proposed. This would enable top scientists and engineers from all over the country to work together to complete this daunting task. A site had to be chosen. General Groves had several criteria: security, isolation, a good water supply, an adequate transportation network, a suitable climate, an available labor force, and a locale west of the Mississippi (Rothman 1992). Oppenheimer, who had visited the Pajarito Plateau on a horseback trip, suggested the Los Alamos Ranch School.

The school's setting was indeed remote and afforded natural physical barriers, i.e., numerous canyons and cliffs. The

ranch school had been in operation since 1918 and the 27 school buildings with numerous outbuildings could very easily support the small-scale facility Oppenheimer originally had in mind (LANL 1995; LANL 1993). Founded by Ashley Pond and operated by a former forest ranger, A.J. Connell, the school catered to the "frail and unhealthy" sons of society's "higher echelons" (Rothman 1992:219). Connell, using Boy Scout ideals, ran a school where rigorous outdoor activities were combined with a formal classroom education (Rothman 1992).

On November 25, 1942, the War Department approved the appropriation of the Ranch School and on December 7, 1942, the school was officially notified (LANL 1995). Additional lands were acquired from nearby Government agencies, mostly Forest Service lands, and from the predominantly Hispano homesteaders (Rothman 1992). With the graduation of the last class of the Los Alamos Ranch School in 1943, the Pajarito Plateau was balancing on the brink of change; a scientific revolution was in the making.

B. Manhattan Project (1942–1945)

A suitable site selected, Oppenheimer and his staff moved to Los Alamos to begin work. The recruitment of the country's "best scientific talent" and the construction of technical buildings were top priorities (LANL 1995:8). The University of California agreed to operate the site, code name "Project Y," under contract with the government (an arrangement that has continued to this day). Although the fission bomb was conceptually attainable, many difficulties still stood in the way of producing a usable weapon. Technical problems included the timing of the release of energy from fissionable material and the engineering aspects of having everything fit into a bomb casing. Nuclear material and high-explosive (HE) studies were of immediate importance (LANL 1995).

Key research areas dealt with

"measurements of the neutron flux and energy range during fission, the time between fission and neutron emission, and the probability that a certain reaction would occur in a given target area; development of new techniques to conduct the

measurements; radiochemical studies of neutron sources needed to initiate a chain reaction; studies of the chemistry and metallurgy of plutonium and uranium; studies of high explosives to trigger the fission process; and experiments for the development of a fusion, or thermonuclear, bomb." (LANL 1995:9).

The manufacture of fissionable material, primarily uranium-235 and plutonium-239, was being carried out at two other Manhattan Project facilities: Hanford in Washington State and Oak Ridge in Tennessee.

Two bomb designs appeared to be the most promising: a uranium "gun" type and a plutonium "implosion" type. The "gun-type" bomb involved bringing fissionable material together to form a critical mass by firing a mass of fissionable material at another mass of the same material, in this case uranium-235. This method led to the development of the "Little Boy" device. Scientists were less confident about the second "implosion-type" method, a design that necessitated the compression of fissionable material using explosives. The compression action would increase the density of a slightly subcritical mass of plutonium-239 and would cause a critical reaction. In 1944, due to the uncertainties surrounding the second design, the search began for an appropriate test site for the implosion method, later used in the "Fat Man" device. The Alamogordo Bombing Range in south central New Mexico was selected. A trial run involving 100 tons of TNT was conducted at "Trinity Site" on May 7, 1945. This dress rehearsal provided measurement data and simulated the dispersal of radioactive products (LANL 1995). The Trinity test was planned for July and its objectives were "to characterize the nature of the implosion, measure the release of nuclear energy, and assess the damage" (LANL 1995:11). The HE components of the "Trinity" device were test assembled in building TA-16-516 at Los Alamos in an area known as V-Site. Other buildings at V-Site were used to prepare and finish the HE components and to run preliminary tests on the "Trinity" bomb (Wilder 1991:111). The world's first atomic bomb was successfully detonated in the early morning of July 16, 1945. "Little Boy," the untested uranium gun-type bomb, was exploded over the Japanese city of Hiroshima on August 6, 1945. "Fat Man" was exploded over Nagasaki three days later on August 9, 1945. The war with Japan was essentially over.

C. Early Cold War Era (1946–1956)

The Manhattan Project had come to a close with the end of WWII and many Los Alamos scientists and site workers went back to their pre-war existences. The future of Los Alamos was in question. With the beginning of the Cold War, continued weapons research was a top priority. Norris Bradbury had been appointed director of the Laboratory following Oppenheimer's return to his pre-WWII duties (LANL 1993). Bradbury felt that the nation needed "a laboratory for research into military applications of nuclear energy" (LANL 1993:62). In 1945, stockpiling and development of additional atomic weapons was an important mission. In 1946, the Laboratory became involved in the technical direction of the atmospheric testing program in the Pacific, dubbed "Operation Crossroads." Later in 1946, the U.S. Atomic Energy Commission (AEC) was established to act as a civilian steward for the new atomic technology born of WWII. The AEC formally took over the Laboratory in 1947, making a commitment to retain Los Alamos as a permanent weapons facility. Postwar weapons research revolved around the development of advanced fission weapons and, acting on an idea born in 1942, the development of the hydrogen bomb. The combined work of Edward Teller and Stanislaw Ulam led to the beginnings of the Laboratory's thermonuclear research program. In 1952, the first thermonuclear device, known as "Mike," was detonated at Eniwetok atoll in the Pacific (LANL 1993). The Mike shot used liquefied deuterium fuel. The Castle-Bravo shot, conducted in the Pacific in 1954, was revolutionary in that it contained dry, solid thermonuclear fuel (LANL 1995). Other early Cold War weapons-related developments included 1) from 1952 to 1956, "improvements to the primary stage of a nuclear weapon," and 2) in 1956, "the first use of plastic-bonded explosives in a nuclear explosion" (LANL 1995:30).

D. Construction History

In order for Oppenheimer to "perform the necessary research, develop the technology and then to produce the actual bombs in time to affect the outcome of the war" (LANL 1993:3), a scientific laboratory had to be built at the site of the former Los Alamos Ranch School. Although some of the Ranch School buildings were used for housing and other administrative functions, new technical facilities were needed for the specialized research and production that was to

come. In December 1942, construction contracts were negotiated for temporary housing and laboratory buildings (LANL 1993). Street and utility planning were primary objectives. A reliable water supply had to be developed. Water sources included streams in Los Alamos Canyon, Water Canyon, Pajarito Canyon, and Guaje Canyon. A homestead-era reservoir at Anchor Ranch was also utilized. A steam plant, sewage system, telephone system, and natural gas system were planned and constructed (Truslow 1991). Laboratory buildings, apartments, barracks, and dormitories were being built at an incredible rate (LANL 1993). Newcomers to Project Y were surprised to find

"a ramshackle town of temporary buildings scattered helter-skelter over the landscape, an Army Post that looked more like a frontier mining camp." (LANL 1993:13)

The town was new and raw.

"Hurriedly built green Laboratory buildings, rows of barracks, apartments, Quonset™ huts, government trailers, and prefabricated units created an unsightly assortment of accommodations that lined row upon row of nameless, unpaved streets." (LANL 1995:19)

Outlying technical areas were also constructed. Due to the hazardous nature of the HE work, S-Site was situated far away from the main technical facilities and housing areas at the townsite. Many different buildings were built at S-Site in the early days of the project and construction continued up until the Trinity test (Wilder 1991).

After the end of WWII, the Laboratory's population plummeted. Where 3,000 people lived in Los Alamos during the peak wartime occupation, only 1,000 people remained in the fall of 1945. In 1946, General Groves approved construction of the first permanent housing in Los Alamos. In 1947, with the AEC take over, the revitalization of the Laboratory became a top priority. In the late 1940s, a \$121 million plan for community development was implemented. A new scientific facility was constructed on South Mesa and other mesas away from the townsite area. Old laboratory buildings and fences were torn down and new, permanent schools, housing, and community buildings were added. This AEC-driven construction boom was responsible for the construction of a new post office, medical center, and library. In

1957, the townsite guard gates were removed and Los Alamos became an "open" city (LANL 1993).

III. IDENTIFIED PROPERTY TYPES AND HISTORIC THEMES

LANL has conducted a preliminary inventory and has identified approximately 488 buildings or structures constructed during the years 1943 to 1956. Six functional property types have been proposed and include 1) laboratory facilities and experimental areas such as HE inspection buildings, X-ray buildings, reactor buildings, and firing bunkers, 2) utilities and maintenance facilities such as well houses, pump stations, warehouses, water tanks, and steam plant systems, 3) administrative and health and safety facilities such as office buildings, fire stations, weather stations, and cafeterias, 4) site security facilities such as vaults, guard stations, and guard towers, 5) communication and transportation facilities such as switchgear stations and service stations, and 6) waste treatment facilities such as filter beds, chlorination stations, water treatment facilities, and waste storage facilities.

An architectural evaluation of the 488 properties has not been conducted; however, basic construction types include metal "Butler " buildings, wooden buildings with asbestos shingles, and concrete buildings .

Although weapons research and development has always played a major role in the history of LANL, other key themes were identified. Significant scientific themes for the years 1943–1956 include the development of the atomic and hydrogen bombs, early advancements in super computing, fundamental biomedical research and health physics issues, explosives research and development, early reactor technology, pioneering physics research, and the development of early high-speed photography.

IV. SECTION 106 DOCUMENTATION

Due to the nature of the activities conducted in Manhattan Project and early Cold War era facilities, many of these properties are now candidates for decontamination and decommissioning (D&D) as part of LANL's Environmental

Restoration Program. Moreover, a great number of these buildings were constructed during the 1940s before the future of the Laboratory was assured. They were built rapidly, using available materials, and were often used for functions that today would never be carried out in similar building types. Abandoned buildings all over the Laboratory have suffered from neglect and from the ravages of the elements. Many facilities have holes in their roofs, internal drywall has decayed, windows are broken, insulation is hanging loose from the walls and ceilings, and evidence of rodent activity, including active nests and droppings, is prevalent. Structural soundness is a concern in many of these old properties, especially those buildings with abutted earthen barricades.

In the last several years, historic LANL properties at various technical areas have been decontaminated and decommissioned. An important first step has been determining the National Register eligibility status for each affected property. If major impacts to a National Register eligible property are the only recourse due to contamination, safety issues, or programmatic needs, LANL, in consultation with the New Mexico State Historic Preservation Officer (SHPO) has conducted detailed documentation in compliance with Section 106 of the NHPA. In general, acceptable levels of documentation include the completion of a New Mexico Historic Building Inventory Form for each affected property as well as the compilation of architectural drawings, large format negative photographs, and historical information following Historic American Building Survey/Historic American Engineering Record (HABS/HAER) standards. Recent "Section 106" evaluations and documentation projects are summarized below.

A. Technical Area (TA) 21

(DP-Site)

In June 1994, a historic building evaluation was conducted for buildings TA-21-3 and TA-21-4 (Figure 2). This evaluation was conducted prior to a proposed LANL D&D project involving the two buildings, associated parking areas, drain lines, and utilities. Proposed D&D project activities included the removal of all contaminated and uncontaminated equipment, tanks, and piping inside the buildings. Other project activities included the razing of Buildings 3 and 4, the removal of building foundations and associated parking areas, the removal of soils from underneath the foundations, and

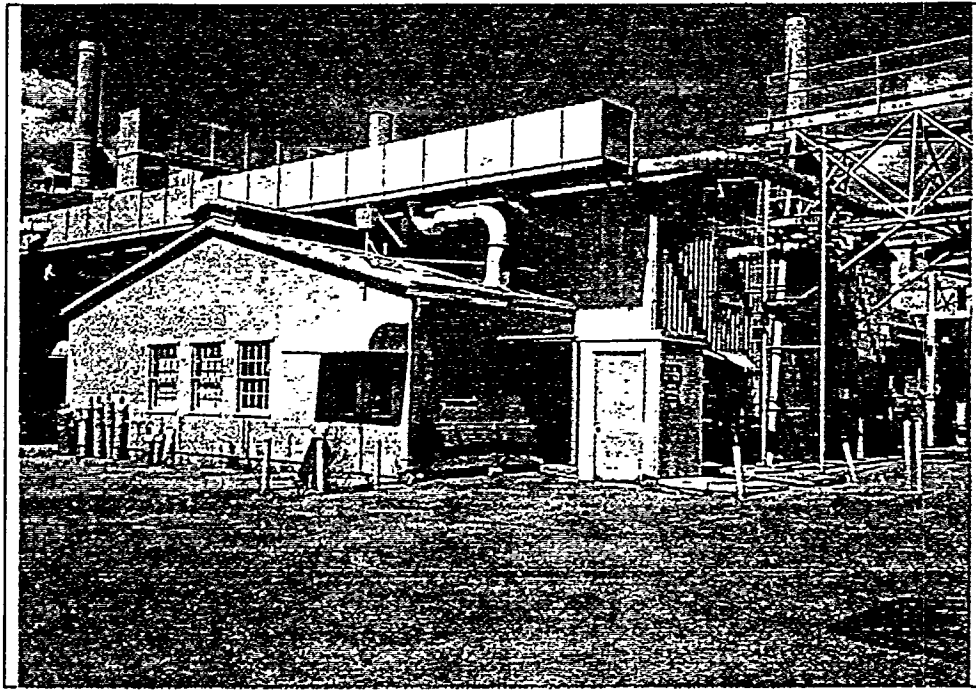


Figure 2. Building TA-21-4 (north and east sides)

the removal of associated drain lines and utilities.

The buildings were recorded on New Mexico Historic Building Inventory Forms. Photographs were taken and records research at LANL's engineering records group (FSS-9) was also carried out. Building plan information was obtained and the LANL archivist was consulted in order to assess the historical significance of the original activities conducted in the buildings. Historical and construction information was also provided by Environmental Management/Environmental Restoration (EM/ER) project personnel.

Buildings TA-21-3 and TA-21-4 were of similar construction; they were both industrial-sized metal "Butler" buildings. The original activities carried out in these two laboratory buildings were associated with the Manhattan Project (circa 1943–1950). Buildings 3 and 4 were both constructed in 1945 and were used for plutonium research until the 1950s. At that time, the buildings were converted from plutonium work to enriched uranium recovery (Stout 1994a). The Enriched Uranium Processing Facility was established to recover and recycle enriched uranium from scrap. The converted scrap would be reused in nuclear research programs, nuclear weapons, and reactors (Johnson 1984). The Enriched Uranium Processing Facility ceased operations in July 1984 (Stout 1994b). The buildings had both been extensively remodeled and decontaminated since their original construction in 1945, resulting in a significant loss of historical and physical integrity. Although associated with important historical events, the buildings were determined ineligible for the National Register and have subsequently been demolished.

B. Los Alamos Townsite, ISF Gas Line

("Peggy Sue" Bridge)

In August 1995, a historic building evaluation of the Peggy Sue Bridge was conducted prior to a proposed LANL demolition project involving the pipeline suspension bridge. The Peggy Sue Bridge is a steel utility suspension bridge that supports a section of 12-inch gas line across "Acid" Canyon, a branch of Pueblo Canyon. The bridge is a cable stayed, open spandrel arch design and is approximately 550 feet long with a 3-foot-wide bridge deck (Figure 3).



Figure 3. Peggy Sue Bridge, direction ~west

The Peggy Sue Bridge was designed by Black and Veatch of Kansas City, Missouri in 1949. The bridge was constructed in 1949 or 1950 by Morrison Construction Company of Austin, Texas (Kesler 1994). Proposed demolition project activities included the removal of the steel bridge, attached gas line piping, and associated anchors and cables.

A historic building evaluation was accomplished by first conducting a field visit to the bridge location. The bridge was recorded on a New Mexico Historic Building Inventory Form and photographs were taken. Records research at Los Alamos County and at LANL was also carried out. Bridge structural information was obtained and the bridge's designer, Black and Veatch, was consulted in order to assess the architectural significance of the bridge's design. Historical information was also acquired from the Los Alamos Historical Museum's archives. Several offices of the Gas Company of New Mexico and the Roswell office of the Transwestern Pipeline Company were contacted in order to identify similarly designed utility suspension bridges in New Mexico.

The Peggy Sue Bridge is a part of the folklore of Los Alamos. Several local myths are associated with the bridge. The most commonly repeated story concerns a girl named Peggy Sue who purportedly jumped or fell off the bridge to her death. In 1981, the Los Alamos Historical Museum collected some of the Peggy Sue Bridge stories for the museum's archives (Hunn 1981). According to this research, the name "Peggy Sue" was well associated with the bridge in the 1950s and school children from that era were familiar with the Peggy Sue Bridge stories. Several variations exist: she fell off trying to catch a falling bicycle, falling homework papers, or a falling dog. It is interesting to note that the Los Alamos Police Department had, up until 1981, no record of anyone, Peggy Sue or otherwise, who had jumped off the bridge (Hunn 1981). Some associate the bridge's name with Peggy Church, an early resident of Los Alamos and the daughter of Ashley Pond. Anticipating the possible demolition of the bridge, a recent documentary was produced for the local Los Alamos public access channel (PAC-8).

Since the bridge is not yet fifty years old, the four National Register Criteria of Eligibility can only be applied in conjunction with Criteria Consideration G, "[exceptionally important] properties that have achieved significance within the last fifty years" (U.S. Department of the Interior 1991:41). The Peggy Sue Bridge, although important in the folk

lore of the community, does not meet Criteria Consideration G requirements and was determined ineligible for the register. To date, the bridge is awaiting demolition.

C. Technical Area (TA) 16

(S-Site)

In 1994 and 1995, a historic building evaluation and documentation program was initiated for 28 historic properties at LANL's Technical Area (TA) 16: buildings TA-16-10, -27, -59, -61, -63, -73, -75, -76, -77, -78, -79, -80, -89, -90, -91, -92, -93, -99, -101, -164, -515, -516, -517, -518, -519, -520, -1451, and structure TA-16-13. This evaluation was conducted prior to a proposed LANL D&D project involving these 28 Manhattan Project and early Cold War era properties, constructed during 1944 and 1951.

Early activities at TA-16 (S-Site) supported the development of the first atomic bombs: the "Trinity" bomb, the Hiroshima bomb, and the Nagasaki bomb. The manufacturing of the HE components for the implosion bomb was carried out at TA-16. Several steps were necessary in order to process the HE into a finished casting. First, molten HE was poured into a mold (various techniques were developed in order to control the cooling of the HE as it solidified; including the use of steam heat and controlled temperatures of water). The castings were then machined under water at the different process buildings. Physical inspection of the castings utilized X-rays, and darkrooms were used to develop the resulting films. HE castings were stored in "rest houses" or bunkers during the different stages of processing. Finally, finished castings were coated with a protective layer of varnish, felt, and paper (Wilder 1991).

The 28 S-Site properties can be grouped into functional categories, related to the overall HE manufacturing process: storage magazines, bunkers/personnel shelters (Figure 4), casting (Figure 5 a & b), processing, inspecting, cleaning (Figure 6), assembly (Figure 7), and security (Figure 8).

Proposed D&D project activities included the removal of all contaminated equipment and material from the interior and

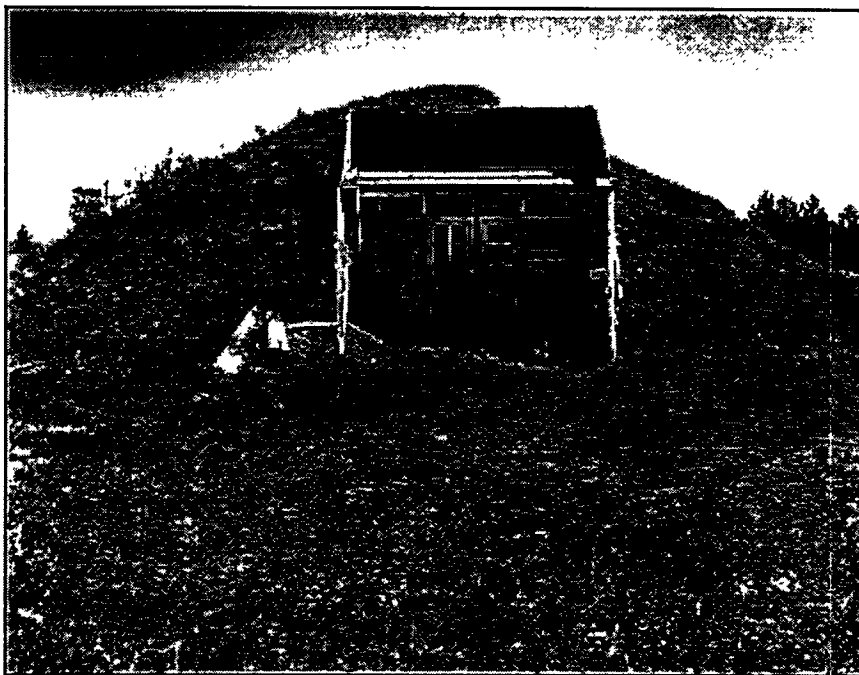


Figure 4. Building TA-16-77, concrete bunker with earthen barricade



Figure 5a. Building TA-16-27, east side of casting facility



Figure 5b. Building TA-16-27, interior view of main casting room



Figure 6. Buildings TA-16-99 (processing facility) and TA-16-164 (shed)

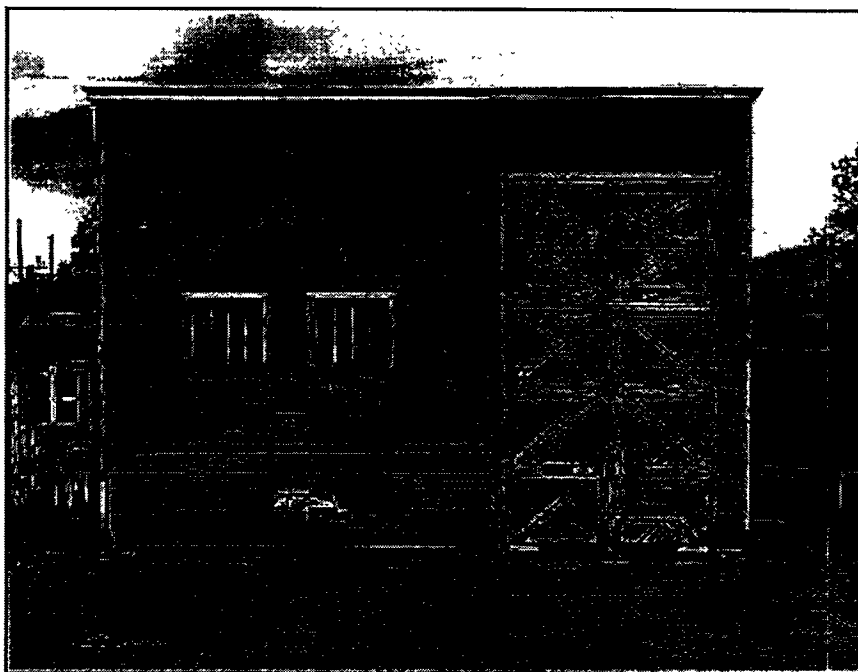


Figure 7. Building TA-16-516, assembly facility

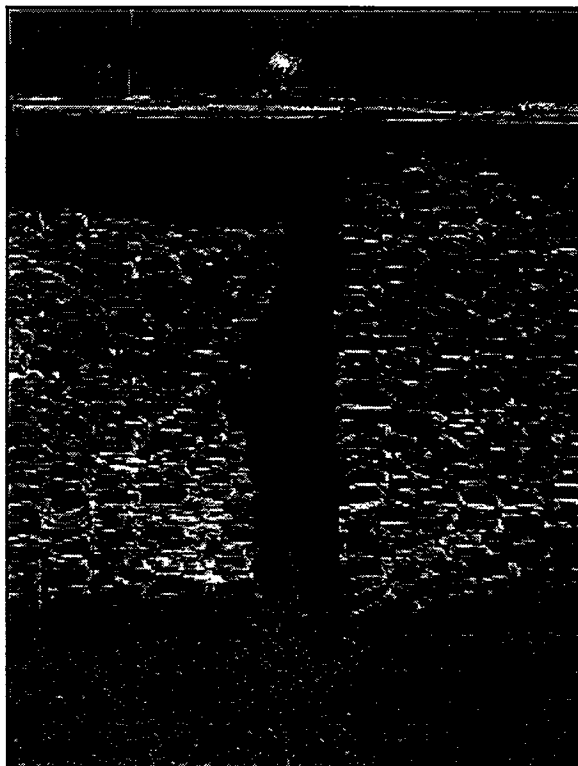


Figure 8. Building TA-16-101, guard station (fortified with concrete-filled sand bags)

exterior of structures and buildings. Associated drain lines and utilities, if contaminated, would also be removed. As a result of the decontamination phase, most of the contaminated properties would be completely demolished.

The evaluation and documentation of the 28 S-Site properties identified for D&D was accomplished in several phases. An initial eligibility report was submitted to the NM SHPO for concurrence. In order to prepare this report, field visits were made to the various building and structure locations. The 27 buildings and 1 structure were recorded on New Mexico Historic Building Inventory Forms and color photographs were taken. Records research at LANL's engineering records group (FSS-9) was also carried out. Building plan information was obtained and historical research was conducted in order to assess the significance of the original activities conducted at TA-16. Historical and construction information was also provided by EM/ER project personnel.

Because all of the properties were determined eligible for the register under Criterion A, "properties ... associated with events that have made a significant contribution to the broad patterns of our history" (U.S. Department of the Interior 1991:12), a Memorandum of Agreement was drafted between the Department of Energy and the SHPO stipulating required mitigation measures.

Key measures included an architectural evaluation of the individual buildings, the generation of HABS/HAER quality drawings, an extensive black and white photo-documentation effort, using a large format camera, and the renovation of one of the buildings, the "Back Gate Guard Station" (TA-16-1451), to a usable state. An in-depth site history document was also stipulated.

All field work has been completed and final preparation of the photographs and drawings is in progress. The history document and the renovation of building 16-1451 have not yet been started. To date, over half of the properties have been decontaminated and demolished.

V. CONCLUSION

The creation of the first atomic bomb and the beginning of the Cold War were events of worldwide significance, events that continue to affect the world today. Los Alamos, New Mexico, was selected to be the "birthplace of the bomb" and some of the early laboratory facilities associated with this key scientific development still exist behind the security fences of present-day Los Alamos National Laboratory. Many of the historic properties are in disrepair and are slated for demolition. However, in accordance with federal historic preservation legislation, a formal evaluation program has been developed and threatened buildings have been documented.

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