Jewels of the Desert

Collections from the First Dump at White Sands Proving Ground

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Prepared for
White Sands Missile Range
Submitted by
Human Systems Research, Inc.

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PREFACE

The artifacts left on a site can provide information about the life and times of the site's occupants. This is the case with the artifacts recovered from an early dump site on White Sands Proving Grounds (WSPG), now known as White Sands Missile Range. The dump was discovered in August 1994 during construction of a new water line for the commissary building. Artifacts observed in the side walls of the trench and the backdirt pile included Coca-Cola bottles, beer cans, and fragments of mess-hall dishes, and unidentifiable glass bottles.

Jewels of the Desert is one of the first studies of material culture of a Cold War military installation. The artifacts from this dump, possibly the earliest on WSPG, provide us with insight into the daily life of soldiers and scientists working on the V-2 missile program. Many of the artifacts relate to the personal lives of these men, stationed in temporary quarters in the desert of southern New Mexico. Dates on milk, ketchup, and prescription medicine bottles indicate the dump was in use from July 1945 to 1947.

Jewels of the Desert provides the reader with a brief history of WSPG, a photographic inventory of diagnostic artifacts, and an interpretation of daily life of personnel at the post. The report title resulted from the excellent color photographs of the artifacts that are part of a traveling exhibit that was developed as part of this project. A companion volume, *From Barren Desert to Thriving Community: A Social History of White Sands Missile Range, 1945-1954* (William B. Boehm, 1997) documents the development of White Sands Proving Ground as a community in addition to a test facility for missiles.

David T. Kirkpatrick, Ph.D.
Principal Investigator

Jewels of the Desert: Collections from the First Dump at White Sands Proving Ground

Results of Archaeological Investigation of
an Early Landfill on White Sands Missile Range

Meliha S. Duran, J. K. "Pete" Finney, Toni Laumbach, Martha Yduarte,
Peter L. Eidenbach, and William B. Boehm

ABSTRACT

In September, 1994, during construction activities for the new White Sands Missile Range (WSMR) Commissary building at the Post Headquarters, a previously unknown dump was discovered. This dump holds the potential for documenting some of the earliest activities for the headquarters of White Sands Proving Ground (WSPG), which was designated by the War Department on July 9, 1945, and was officially activated on July 13, 1945. The initial mission of the Rocketry Branch, U.S. Army Ordnance Corps, at WSPG was to develop an effective missile program for the United States. The V-2 rocket program began on July 10, 1945, with the construction of the Army blockhouse located at Launch Complex 33, now a National Historic Landmark. Almost a year later, on June 14, 1946, the U.S. Navy Bureau of Ordnance Missile Test Facility was established at WSPG, and in July of that year construction began on the Navy cantonment area.

Installation of a water-line trench between the new Commissary Building and an existing water tower exposed buried deposits relevant to that period. A wide variety of artifacts was exposed in the construction trench required for the plumbing, including Coca-Cola and other soft-drink bottles; dining-hall plates, bowls, and mugs; cone-top beer or oil cans; a fountain pen; a German instrumentation panel; newspaper; and a variety of construction materials. Based on artifacts recovered from this dump, it dates to the mid-1940s, the earliest occupation of White Sands Proving Ground.

The dump contained potentially hazardous levels of lead and other dangerous materials. Excavation techniques were modified for recovering archaeological remains. Excavation was conducted by White Sands Missile Range fire crews in selected areas of the site—specifically, both faces of the water-line trench near 100 m from the datum and five perpendicular trenches extending approximately 1 m into the face of the trench. Trenches stepped into the sidewalls and measuring approximately 1-by-1-m at the lowest level were hand excavated to recover a sample of the artifacts. During the sampling, preference was given to artifacts instead of construction debris. Artifacts removed from the trenches provided a sample of 1,379 artifacts from this site. The artifacts were then carefully cleaned for analysis, illustrated, and cataloged.

The dump, designated Site LA 106,155, is one of the first early Cold War archaeological sites to be excavated in the state of New Mexico. Human Systems Research, Inc. (HSR), provided artifact analysis for the materials removed from the dump, placed them in a historic context, documented the results of investigations, and prepared this report. This report addresses research questions identified in the research design, providing information on early life at White Sands Proving Ground and presents information on the excavation methods and results for the artifacts recovered.

CONTENTS

FIGURES

TABLES

ACKNOWLEDGEMENTS

Many different people assisted the authors with research topics and support services. Because of the presence of hazardous materials, the collection of the artifacts required special techniques. A special thank you to the personnel of the WSMR Fire Department and Environmental Services Division who "suited up" and collected the artifacts. They were supported by construction staff who operated loaders, cranes, and other equipment. All of these individuals are recognized by name in Appendix D.

Human Systems Research, Inc., would like to express thanks to Mr. Robert Burton, WSMR Archaeologist, for organizing the fieldwork and initial cleaning of the artifacts. He patiently answered our questions on excavation and collection methods. Ms. Yolanda Romero, Program Specialist and COR, was very helpful in administering the delivery orders that enabled us to write this report, write a lesson plan for teachers, and develop the museum exhibits. Mr. Jim Eckles, Public Affairs Office, allowed us to go through the historical photographs and select those used in this report. Mr. Bruce Allen and Mr. Marshall Hunter, White Sands Missile Range Museum, assisted us with setting up the exhibit in the museum and with the photography of the artifacts.

A special thank you to Jo Ruprecht, Photographer, who worked miracles with the rusty cans, reflective bottles, and dull china. She created excellent interpretative color photographs for the traveling exhibit and the black-and-white photographs for the teacher lesson plan and this report.

Meliha S. Duran
Human Systems Research, Inc.
1997

INTRODUCTION

Between September 9 and 21, 1994, a previously unknown dump was discovered during construction activities for a water line in conjunction with the new White Sands Missile Range (WSMR) Commissary Building at the Post Headquarters (Figure 1). The dump is located in the north-central area of the headquarters area (Figure 2). When artifacts were discovered, preliminary evaluation of the site was conducted by Robert Burton, Archaeologist, White Sands Missile Range, who believed the site to be eligible for nomination to the National Register of Historic Places, based on criterion (d), its potential to yield data to answer specific archaeological research questions, such as those presented in this report.

Robert Burton developed a plan to mitigate WSMR's disturbance of the excavation to this potentially eligible dump. This plan involved removing a sample of dump materials for appropriate processing, analysis, and evaluation. The archaeological scope of work, research design, field methods, and artifact analysis were governed by dump policies, the potential for hazardous materials, and associated procedures.

The dump was subsequently declared a solid-waste management unit (SWMU) under state and federal regulations. Upon discovery of the dump, eight samples were collected and analyzed for the presence of hazardous materials. One sample yielded excessive amounts of lead. Additional sampling was conducted to identify the presence and location of hazardous materials. During excavation, excavation personnel used filter masks, and the filters were sampled, as needed. The techniques were conducted according to the Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations, requiring modification to traditional archaeological excavation techniques. Additional methods used to excavate this potentially hazardous dump are discussed below.

David T. Kirkpatrick served as the principal investigator for the project, coordinating all work between WSMR and HSR. WSMR Fire Department personnel handled the excavation as part of their regular training in handling hazardous materials. All fire personnel had the required HAZMAT training course prior to beginning fieldwork. Their efforts were monitored by Robert Burton and Michael Mallouf of the Environmental Office, WSMR. These archaeologists also performed preliminary clean-up on the artifacts. Toni Laumbach and Martha Yduarte, of HSR, further cleaned and analyzed the artifacts and prepared the catalog information for the artifacts. J. K. "Pete" Finney prepared a draft of this report. Meliha S. Duran adressed the research questions and edited and designed the final report. John Hilley prepared the maps and inked the illustrations. Jo Ruprecht took the artifact photographs for publishable illustrations.

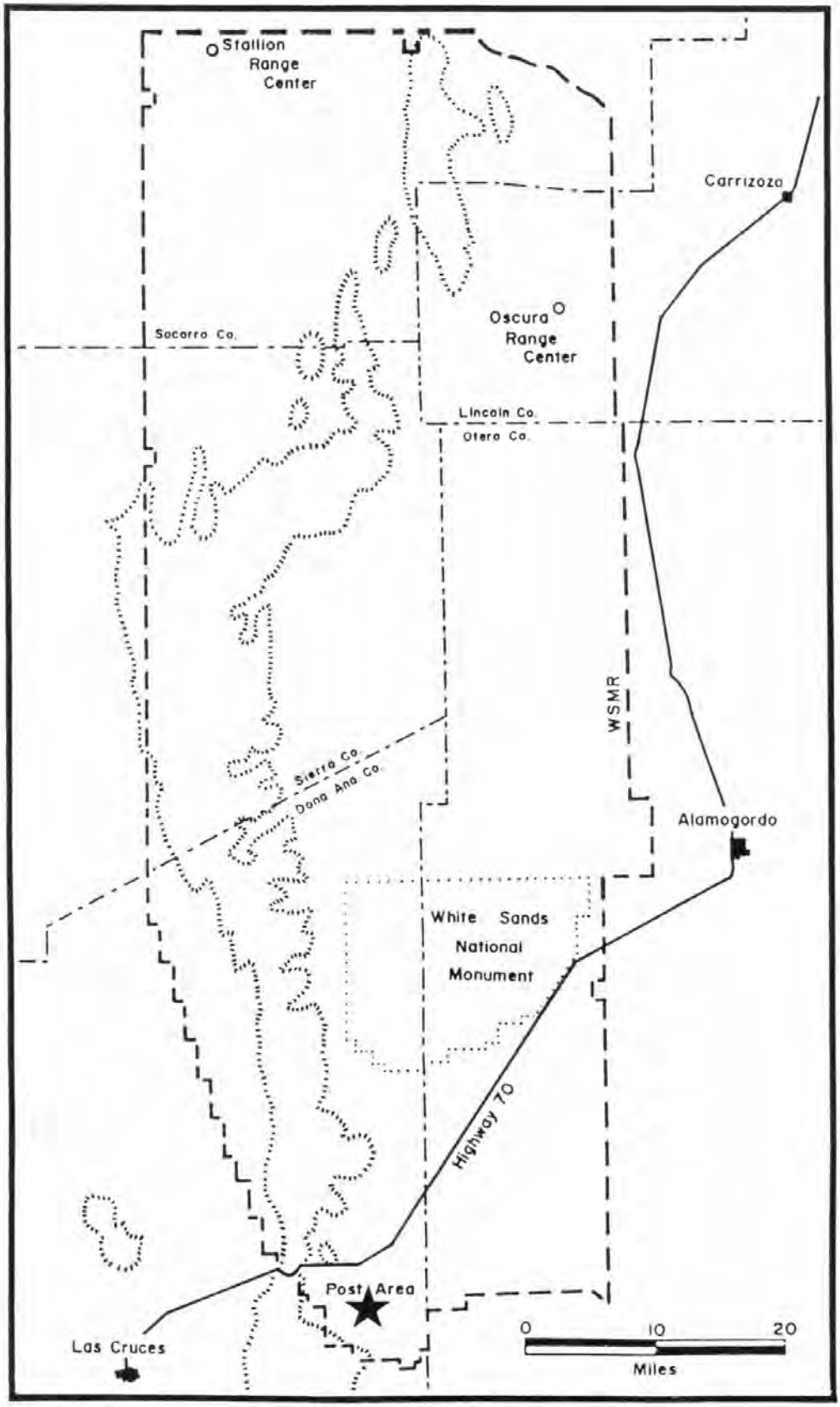


Figure 1. Location of White Sands Missile Range Post area.

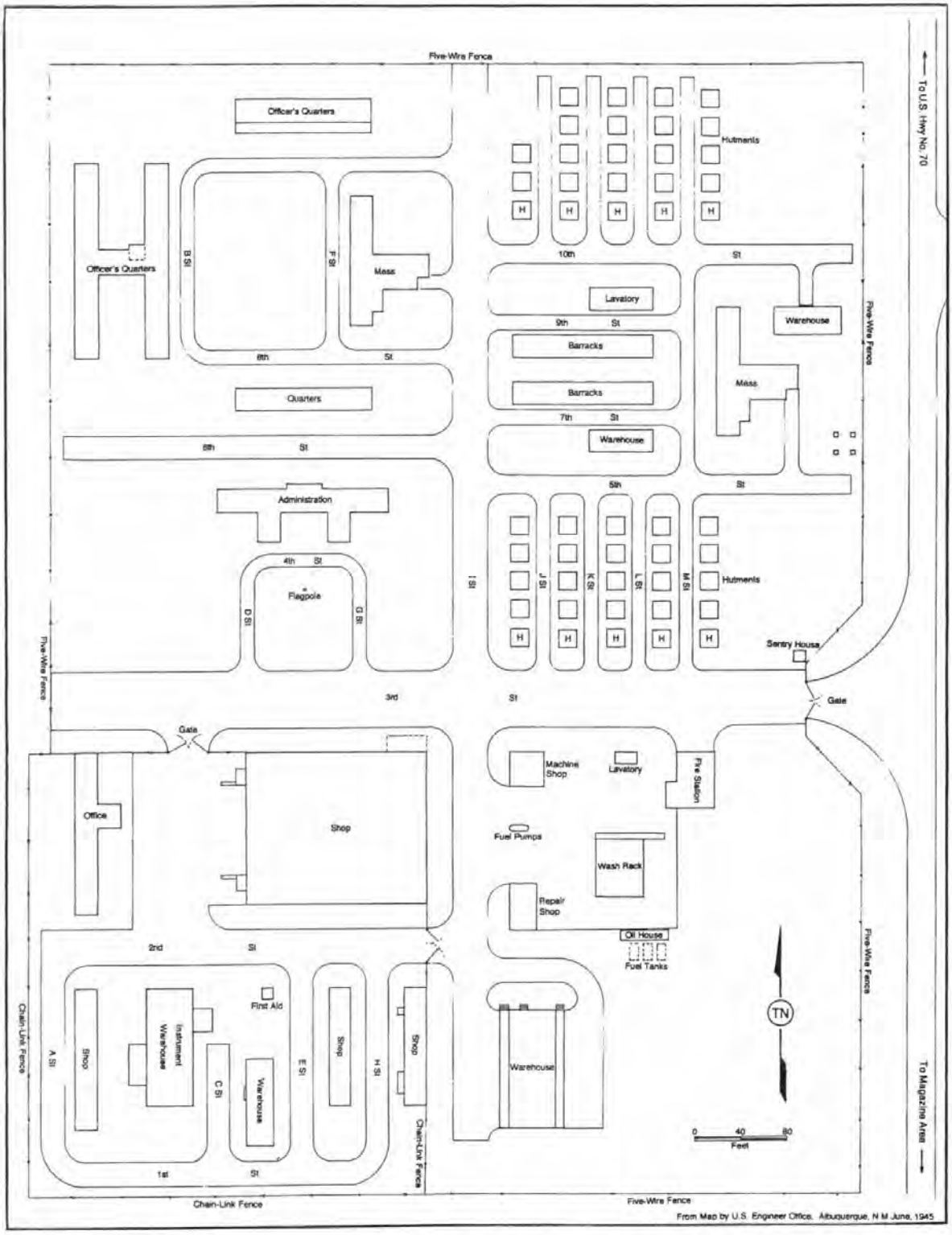


Figure 2. White Sands Proving Ground, as drawn in 1945.

ENVIRONMENTAL SETTING

The environment of the Tularosa Basin is varied, ranging from wooded forests to barren salt flats. Historic selection of the initial location for White Sands Proving Ground was based on its isolation in combination with flat terrain, accessible power and water, lack of industry, etc. On these counts, the WSPG location was appropriate for the test facility.

Climate

The survey area is in an arid portion of the Tularosa Basin, in the eastern foothills of the Organ Mountains (Houghton 1976:59-60). The backdrop of these mountains influences the microweather patterns in the area. Most of the moisture is brought in by southeasterly winds from the Gulf of Mexico. The average annual precipitation is less than 8 in. on the floor of the Tularosa Basin. The rainy season is from July to September, when approximately half of the annual moisture falls. Mean annual air temperature is 62° F near WSMR headquarters. The frost-free period averages 177 days.

Soils

The WSMR Headquarters area is in the Sonoita-Pinaleno-Aladdin soil association (Neher and Bailey 1976:27). The slope is 1 to 15 percent, overall. Elevation is 4,800 to 6,000 ft. The Sonoita and Pinaleno soils have developed on gently undulating to gently rolling areas of old alluvial fans found on the east slope of the Organ Mountains. The Aladdin soil has developed on gently sloping to strongly sloping areas of young surfaces adjacent to arroyos and narrow, elongated ridges bounding arroyos. Runoff is medium and the hazard of water erosion is severe. Blowing soil is a moderate hazard.

The Sonoita gravelly, sandy loam comprises 35 percent of the association; Pinaleno gravelly, sandy loam, 25 percent; Aladdin gravelly, loamy sand, 20 percent; and Rock outcrop, arroyo beds, and unclassified soils comprise the remaining 20 percent of the association. The unclassified soils include both deep light- and dark-colored gravelly, sandy loams.

Aladdin soils are nearly level to strongly sloping on recent alluvial fans with slopes of 1 to 15 percent. In a representative profile, the surface layer is brown gravelly, loamy sand about 7 in. thick. The underlying layer is brown gravelly, light sandy loam about 39 in. thick, below which is light brown sand. The soil is neutral throughout and has moderately rapid permeability. Roots can penetrate to a depth of 60 in. or more, but the available water capacity is only moderate.

Pinaleno soils are 1-9 percent slope and are found in gravelly and sandy loam alluvial sediments on old alluvial fans. In a representative profile, the surface layer is brown gravelly, sandy loam about 3 in. thick. Below that is brown and reddish-brown gravelly, sandy clay loam in the upper part and pink,

very gravelly, heavy sandy loam in the lower part. The subsoil totals about 26 in. thick. The upper soil is noncalcareous.

Sonoita soils are deep, well-drained soils that formed in gravelly, sandy alluvial sediments on old alluvial fans. Their slope is 1 to 9 percent at elevations from 4,000 to 5,900 ft. In a representative profile, the surface layer is brown gravelly, sandy loam about 5 in. thick, with a subsoil of about 45 in. The soils are noncalcareous to a depth of 36 in. and moderately permeable.

Vegetative Groups

The project area falls within the foot-slopes grassland on the alluvial fans at the base of the Organ Mountain Range (Robertson and Galt 1976:50). The dominant grasses are black grama (*Bouteloua eriopoda*), blue grama (*B. gracilis*), and sideoats grama (*B. curtipendulum*). Shrubs include four-wing saltbush (*Atriplex canescens*), soaptree yucca (*Yucca elata*), broom snakeweed (*Gutierrezia sarothrae*), and sand sagebrush (*Artemisia filifolia*). Vegetation can also include agave (*Agave parryi*) and mesquite (*Prosopis juliflora*).

PAST RESEARCH

Previously, archaeological research at WSMR Headquarters was limited to, for the most part, an inventory survey and cultural-resources management surveys. In 1984, Kirkpatrick (1986) surveyed around the periphery of the established WSMR Post and east toward Nike Avenue. He documented archaeological sites in the dune areas around the Post, but the dump area was a grassy field and yielded no evidence of buried prehistoric or historic remains. At that time, the dump had not been discovered, because it was buried under nearly 2 ft of fill. Burrowing-rodent activity had not yet brought any historic artifacts to the surface of the grassy field.

Similarly, Leftwich (1986) surveyed a fiber-optics right-of-way that touched on the western boundary of the headquarters and found no cultural resources. He documented an isolated occurrence northeast of the Post and encountered Site LA 58861 (HSR 8524-12), previously recorded by Clifton et al. (1987).

Three Cold War surveys have documented buildings within the Post area and east along Nike Avenue. Rieder (1993), in one of the first of these projects, provided documentation for a Quonset hut within the Post. In a much more extensive project, begun by Michael Lawson and Michael Cunningham (Eidenbach et al. 1995) and finished by Meyer and Wimberly with an extensive publication on Cold War properties (Eidenbach et al. 1996), HSR archaeologists documented important buildings on the Post, provided a context for their construction, and gave an evaluation of the importance of these buildings. For a third project, individual buildings were documented and evaluated one at a time. For these projects, documentation includes photographs, drawings, and comparisons of plans and as-built drawings.

HSR archaeologists have also conducted similar evaluations of Cold War buildings at Holloman Air Force Base (Eidenbach and Wessel 1994).

SITE DESCRIPTION

The details of the dump discovered in conjunction with construction of the new WSMR Commissary provide information on the description, formation, and treatment of the area as a prepared dump facility.

The earliest maps or photographs of historic White Sands Proving Ground do not provide any information on the dump. From the surface, there has been no evidence of a dump at this location. The WSMR Public Affairs Office maintains collections of historic photographs from the inception of the range. A search of the WSMR Public Affairs photograph file yielded two early photographs dated 1945 and1946 (Figures 3 and 4). These photographs include the area of the dump, but none of them shows a dump in this vicinity. This lack of photographic documentation may provide information on the length of its construction or use; that it was used for a very short period of time and was not photographically documented

The 1955 USGS White Sands quad map shows a reservoir (Figure 5); however, it is not visible on the 1956 or 1957 aerial photographs (Figures 6 and 7). It is also outside the area illustrated on the 1946 cantonment map with the U.S. Navy site (Figure 8).

At the time the site was found, on August 30, 1994, Meliha S. Duran, Publications Director for HSR, obtained a Laboratory of Anthropology (LA) site number for the dump site from the Archaeological Records Management System (ARMS), State Historic Preservation Division, Santa Fe. An ARMS site record was completed in conjunction with this data-recovery activity. The site number is LA 106,155 with the NMCRIS Activity and Project No. 46870 assigned to the proposed archaeological investigation.

When an archaeological survey was conducted in the area surrounding the Post in 1984 (Kirkpatrick 1986), the area of the dump was under a grassy field among the existing buildings. No surface evidence of the dump was present, even in the back dirt from gopher mounds.

There is evidence that the dump had been formed by cutting a bulldozer trench into the desert, then after repeated fill and burn episodes extending over a period of weeks or months, the trash was eventually covered by up to 2 ft of dirt. Unless some disturbance punctured this dirt cap, there would be no evidence of the dump from the surface.

At the time the dump was in use, it was located approximately .6 mi away from the west end of Nike Avenue and away from contemporary buildings on the Post (Figures 2 through 4). As would be expected, at the time of its use, the dump was located away from the center or focus of Post activities, because burning dump fill might cause fumes and noxious odors.

Figure 3. Aerial view looking west, circa 1945-1946.

The overall size of the dump is estimated to be 140 ft long and 10 to 15 ft wide (Robert J. Burton, Field notes, 1994). The deposits exposed during the excavation range in thickness from 2 to 6½ ft. Fill includes building materials, bottles and glass, cans, burned paper, metal artifacts, and construction debris (asbestos tile, wood, wire, pipe, etc.) to a depth of approximately 5 ft in the trenches. At the deepest depths are some of the largest artifacts mixed with dirt.

Five backhoe trenches were excavated across the main trench through the site. The main trench is oriented 160 degrees south of magnetic north. The backhoe trenches are located at 25 m north of 0, 50 m north of 0, 80 m north of 0, 120 m north of 0, and 140 m north of 0. In the deeper trenches, fill was removed by the backhoe to create a stepped cross-section that followed established safety procedures and helped prevent the sidewalls from collapsing. Then, 1-by-1-m or 1-by-.5-m units were hand excavated into the sidewalls of the backhoe trenches, with the deepest units extending to the bottom of the main trench. Backhoe Trench 140 was excavated in .25-m levels. In this unit,

again, most of the artifacts were nearer the surface. Backhoe Trenches 25 and 50, especially, showed thin layers of trash with lots of dirt fill.

Discolored portions of the dump indicate the condition of the artifacts associated with the area, because materials were apparently burned in place. The pit sidewalls were fire-reddened, and associated artifacts were burned and some of the glass was melted. Other areas of the trench lacked well-defined pit profiles, although changes in soil color that were not attributable to natural processes were noticeable. The artifacts in the extreme northern portion of the trench, away from WSMR, did not appear to be badly burned.

Figure 4. Aerial view looking north, circa 1945-1946.

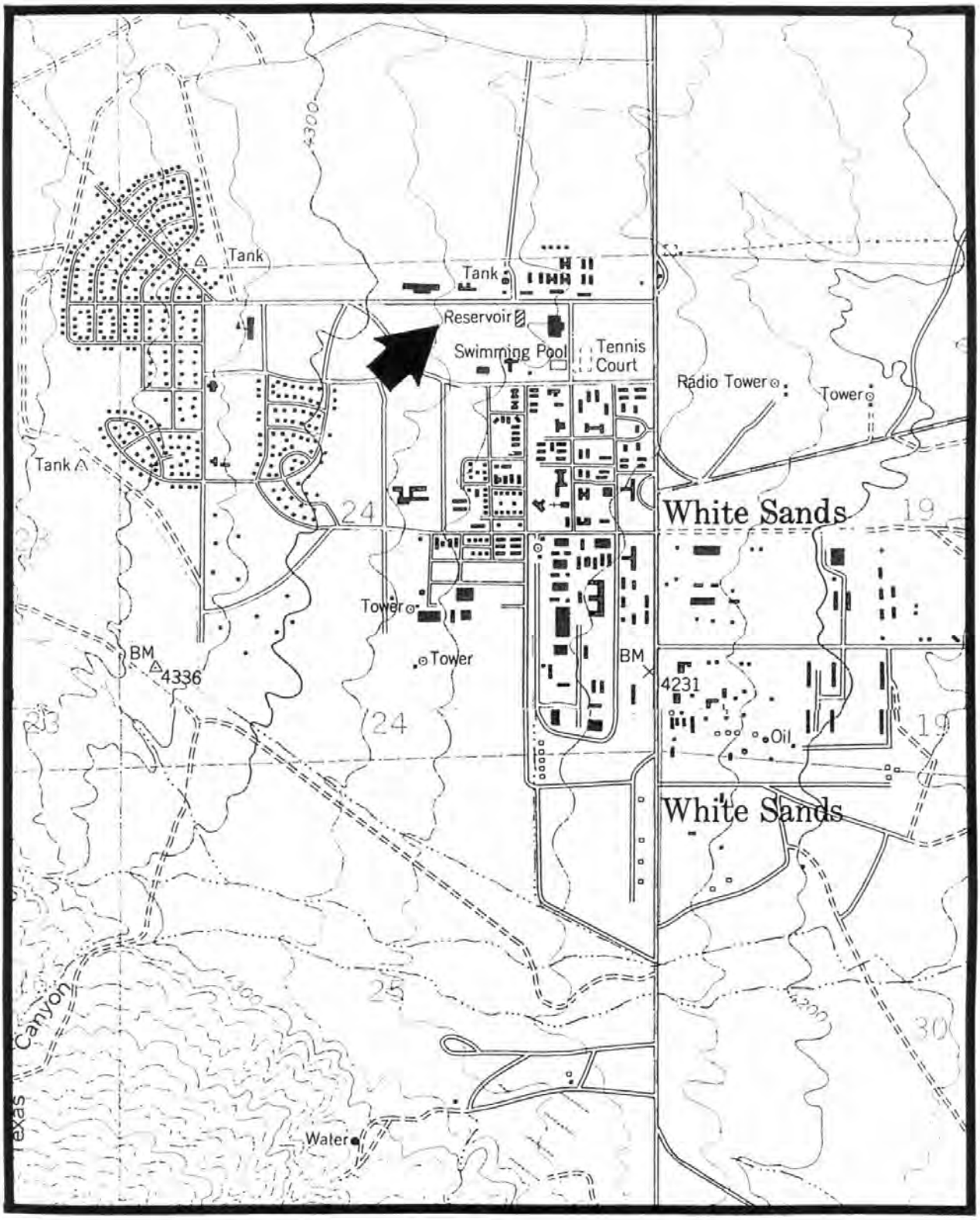


Figure 5. 1955 USGS map of WSMR, showing reservoir and more recent Wherry Housing.

A BRIEF HISTORY OF WHITE SANDS PROVING GROUND

World War II and the Tularosa Basin

In **1941**, the U.S. Army Air Force (USAAF; on June 20 of that year the name was changed from the USAA Corps) began planning for rapid expansion of existing training facilities throughout several western states. Anticipating the inevitable fall of Europe to the Axis and direct American participation in World War II, military planners recognized the need for a fallback position for the Royal Air Force (RAF). In April, Major General H. H. "Hap" Arnold, USAAC, met with Vice Marshall Sir Guy Garrod, RAF, to establish the British Overseas Training Program, which would use new air bases built in the vast, open spaces of the American West. Alamogordo Army Air Field (AAAF) was officially established on Easter Sunday, April 13, 1941. By October, the government ordered local ranchers to begin disposing of livestock in anticipation of the establishment of the proposed bombing range. In December, following the air

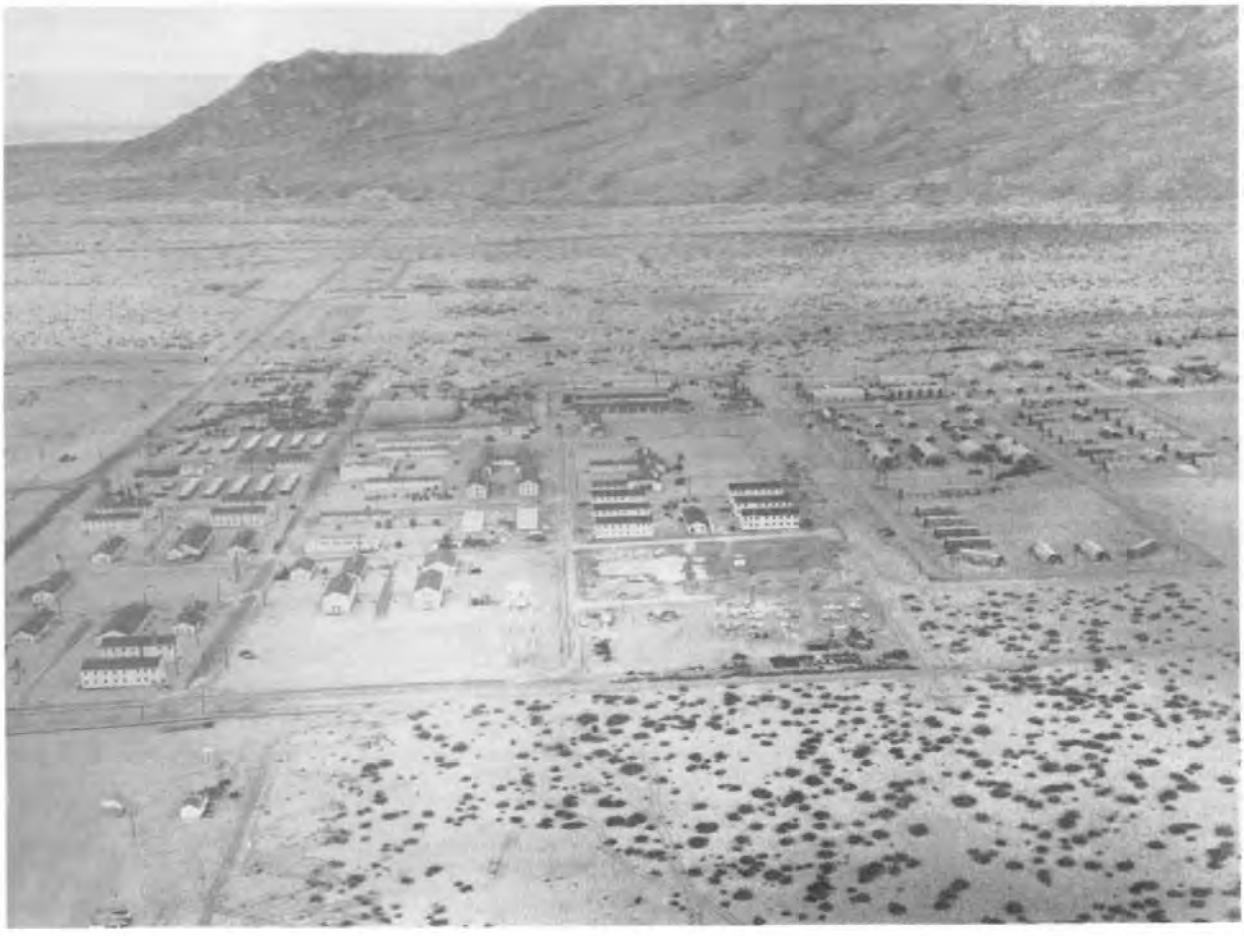


Figure 6. Aerial view of Post, looking south, circa 1948.

attack on Pearl Harbor, the United States declared war on Japan, Germany, and Italy, and ranchers in 55 townships in four New Mexico counties were rapidly notified that grazing leases on public lands had been canceled to accommodate the newly established Alamogordo Bombing and Gunnery Range.

By early **1942**, new construction was underway at the Alamogordo, Carlsbad, Deming, Clovis, and Roswell Army Air Fields, resulting in a massive increase in the military presence in southern New Mexico. Five of the 14 major bombardier training bases in the United States, designed to accommodate 45,000 trainees, were located in New Mexico. Five additional bases were located in Texas, and one was built in each of the states of California, Colorado, Arizona, and Louisiana (Couchman 1994). Ten practice ranges were also established in the New Mexico-Texas Southwest. Most of these ranges lay within Doña Ana, Otero, and neighboring counties within or close to the current White Sands Missile Range (WSMR) and Fort Bliss reservations. Construction began at Alamogordo Army Air Field on February 6, and the base was elevated to full status on June 1.

Figure 7. Aerial view of Post, looking southwest, circa 1953.

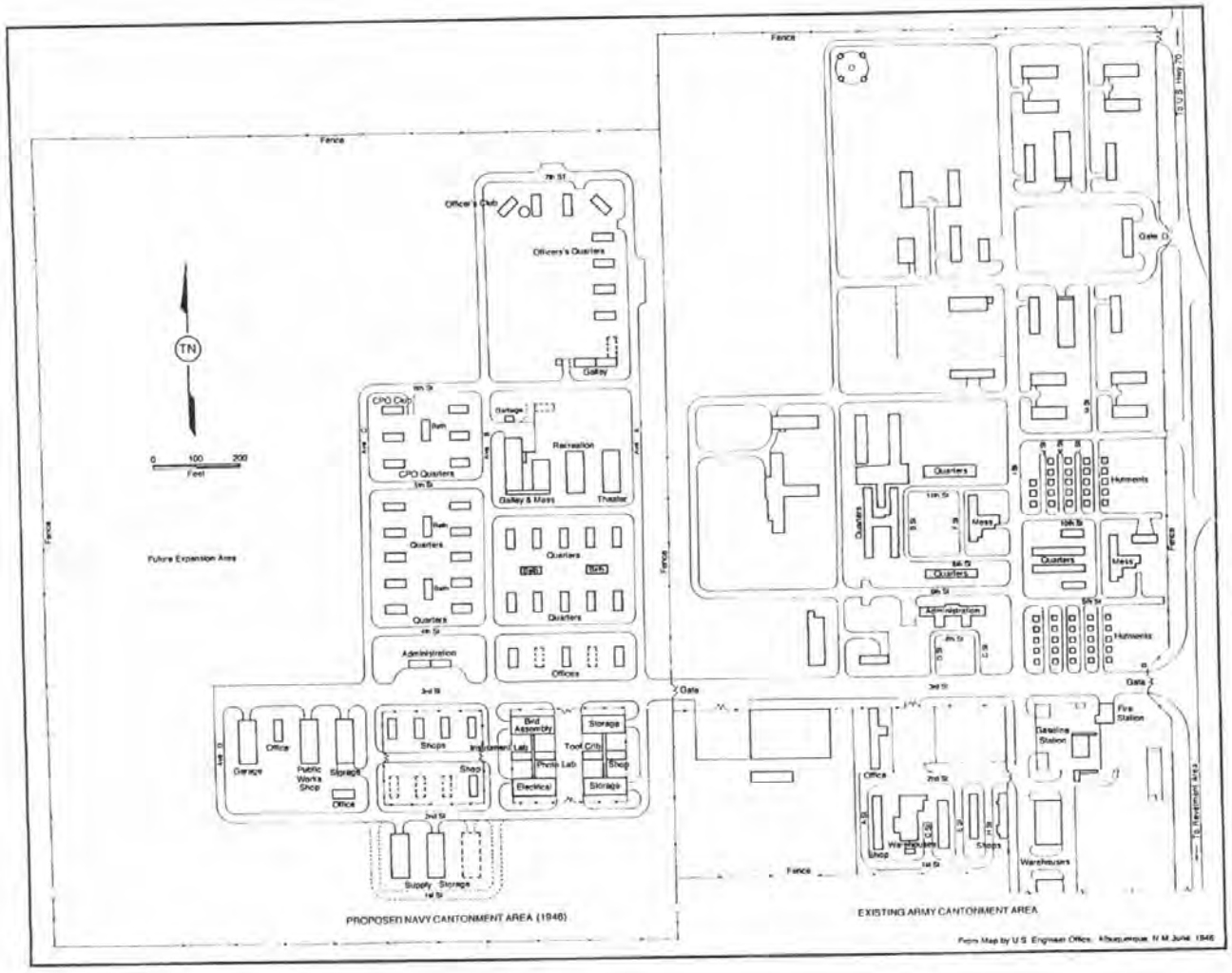


Figure 8. Drawing of White Sands Proving Ground in 1946, showing Navy Cantonment.

In June, the Manhattan Project, initiated the previous year, was transferred from its original headquarters at the Manhattan, New York Engineer District, to the U.S. Army, under the command of (then) Colonel Leslie Groves, who supervised its relocation to the secret site of Los Alamos, New Mexico, the following year. Groves, promoted to Brigadier General on September 22, continued to command the Manhattan Project until its transfer, in March 1947, to the new Atomic Energy Commission.

Robert Goddard's rocket research group, the only such effort in the United States prior to World War II, had been operating in nearby Roswell, NM (about 200 miles northeast of WSMR and Fort Bliss), since 1930, under the sponsorship of the Guggenheim Foundation. Goddard's program relocated to the Naval Engineering Experiment Station in Annapolis, Maryland, in July 1942, just three years before the fruits of his early research arrived at the new Proving Ground with the captured V–2 program. Goddard, who had flown the first liquid-fueled rocket in 1926, had failed to interest the War Department in rocketry until September 1941, when he finally obtained contracts with the Navy Bureau of Aeronautics and the Army Air Corps. Ironically, Goddard's success in obtaining military sponsorship and the subsequent relocation permanently removed him from participation in the first major U.S. rocketry programs conducted in the western United States.

On October 3, 1942, Goddard's early rocketry research bore fruit in Peenemünde, Germany, with the first successful launch of an A–4 (V–2) missile for the German Army. This rocket was larger but almost identical to missiles Goddard tested years earlier at Roswell. In December, the German Air Force pulse-jet propelled V–1 was also successful in tests at Peenemünde, although this first flight only achieved a distance of 3,000 yd (Helfers 1954).

U.S. Army and Air Force histories suggest (but do not document) that by **1943**, the Alamogordo Army Air Field (AAAF) was already being informally considered as a guided-missile development site. The Rocketry Branch, part of the U.S. Army Ordnance Corps, was officially established in September of that year.

In August, the Luftwaffe in Italy began air attacks on allied combat ships with Fritz X, the first successful modern ASM. On September 9, 1943, a 1,400-kg armor-piercing Fritz X sank the battleship *Roma* and severely damaged the *Italia* in the Strait of Bonifacio. During the next week, Fritz X sank two cruisers, damaged two more cruisers and a battleship, and sank several merchant ships off Salerno.

In May **1944**, the USAAF, through the Office of the Chief of Ordnance (OCO), contracted with the Jet Propulsion Laboratory (JPL) of the Guggenheim Aeronautical Laboratory, California Institute of Technology, for the Army's first ballistic-missile program to "develop long range rocket missiles and ramjets and...associated guidance and launching equipment" (OCO 1948). This project became known as ORDCIT, an acronym for Ordnance-California Institute of Technology, also used as the name of the original range. Between 1944 and

circa 1960, the ORDCIT program produced the Private A and F, the WAC (Without Attitude Control) Corporal, Corporal E, Bumper-WAC (two-stage V-2/WAC combination to demonstrate launch and separation using available components), and the Sergeant missile series. Burrows (1990:38) suggests an alternative explanation for the name WAC. He states that WAC was "named after the Women's Army Corps because its developers thought of it as Corporal's little sister."

Also in May, the search began for a location to test the Manhattan Project's atomic bomb. Eight potential locations were originally identified: one in Colorado, one in South Texas, two in California, and four in New Mexico. The final choice was narrowed to three: the Grants, NM, Malpais (lava flow); the Rice, CA, Desert Training Area; and the Jornada del Muerto, NM. The Grants Malpais was eliminated because of the difficulty of moving Jumbo (the plutonium-containment vessel) across the lava. Groves refused to consider the California Desert Training Area because George Patton (whom he considered "the most disagreeable man I have ever met") had trained his Africa Corps troops there (Starkweather 1989). The Jornada del Muerto (Journey of the Dead) was chosen. Col. Roscoe Wriston, Commander of the Alamogordo Bombing and Gunnery Range, turned over an 18-by-24 sq mi area to the Manhattan Project, and construction began in November (Starkweather 1989).

On June 13, one month after the ORDCIT project was initiated, German V-1 Buzz Bombs began to strike London. Within three weeks of the first impacts, American engineers were engaged in "reverse-engineering" a V-1 copy, known as the JB-2 (Jet-Bomb 2), from parts recovered at unexploded crash sites in occupied Europe and England. The JB-2 was tested between 1944 and 1946 at Muroc Army Air Field (later Edwards AFB) in California, Eglin AFB in Florida, and Wendover AAF in Utah. It was finally transferred to Holloman Air Force Base (HAFB) in 1948, when both HAFB and White Sands Proving Ground (WSPG) missile programs began to expand.

Birth of the White Sands Proving Ground

During the summer of 1944, less than one month after the Normandy D-Day invasion, the first Allied radio-controlled Aphrodite drone aircraft missile, carrying 20,000 lbs of TNT, struck German rocket launch-site targets in the Pas de Calais. That fall, selection of a suitable missile test range began under the command of Major General G. M. Barnes, Chief of the Research and Development Service, OCO. The selection criteria required a large, level, uninhabited area within the continental United States—with clear skies and access to water and rail and power facilities—near a permanent Army post. Starkweather (1989) believes that initial alternatives were identified in Utah, Nevada, California, and Texas. A Corps of Engineers team, led by Colonel G. W. Trichel, Chief of the Rocket Development Division, OCO, visited the alternatives. The selection team, under the command of Col. L. R. Skinner, OCO (coinventor of the bazooka), identified the Tularosa Basin in south-central New Mexico as the best of several available sites. The following

February, the OCO directed the Corps of Engineers to acquire the lands necessary for establishing the ORDCIT Range, Area 3.

On November 20, OCO contracted with General Electric to undertake the Army's second missile program, the Hermes Project, to develop long-range surface-to-surface guided missiles. By December, OCO had decided to include the V-2 rocket within the Hermes Project and began planning for the capture of 100 V-2 rockets after the liberation of Europe. That same December, the first of 24 JPL Private A missiles was fired at Camp Irwin, California.

Early in **1945**, OCO contracted with Western Electric's Bell Telephone Laboratories to develop a supersonic surface-to-air guided missile to attack high-speed, high-altitude aircraft. Bell (which tested the first U.S. jet aircraft three years earlier), with its subcontractors, Douglas Aircraft and Aerojet Engineering and Aberdeen's Ballistic Research Laboratory, produced the first successful Nike by October of the following year. Meanwhile, the Navy Bureau of Ordnance, concerned with the potential threat of kamikaze suicide attack, directed the Johns Hopkins University Applied Physics Laboratory (APL, established in 1942) to initiate the Bumblebee guided-missile and antiaircraft program, which led to the 3T missile family—Talos, Terrier, and Tartar.

The new WSPG site in the Tularosa Basin incorporated the Alamogordo Bombing Range, ORDCIT, and portions of the Fort Bliss Artillery Range. The site was approved by the Secretary of War on February 20, the day after the last V-2 was fired in Europe. Initially, the northern portion was under the jurisdiction of the Army Air Force (which became the Air Force in 1947); the central portion was under the jurisdiction of the Department of the Army, OCO; and the extreme southern portion, including the Ft. Bliss Antiaircraft Firing Range, remained part of Fort Bliss. This split in jurisdiction lasted until Army consolidation in 1950. Beginning on April 1, the first of 17 JPL Private F missiles was fired from Hueco Range on Fort Bliss, Texas.

One month later, on May 2, Wernher von Braun and his rocket team fled the advancing Soviet Army and surrendered to American forces at Oberjoch, Germany. They had evacuated their Peenemünde rocket-research site and hidden their research documents in an old mine shaft near Dorten. U.S. Army Ordnance Technical Intelligence Special Mission V-2 captured the V-2 hardware at the underground Mittelwerk factory in Nordhausen, Germany. The 144th Ordnance Company secretly marshalled the Dorten documents, nearly 100 of some 400 Peenemünde personnel, and large quantities of V-2 hardware for transport to the United States.

By May 22, 1945, the first train of captured V-2 rocket components was underway to Antwerp for shipment to the new Proving Ground. By June 30, evacuation of Peenemünde personnel to the United States was approved. Actual construction at WSPG began on June 25, with water-well drilling. Camp construction began on June 29, with the reerection of three barracks buildings (referred to as CCC buildings in the 1959 WSMR history) moved from Sandia Air Base near Albuquerque or Camp Luna near Las Vegas, NM. These buildings

had been sawn in half and transported to the new site with house-moving wheel sets. A relocated hangar, Dallas-type hutments, a missile-assembly building, and a building for the Fire Department were added. In correspondence to Starkweather, Col. E. W. Bradshaw, one of the three OCO officers who helped choose the WSPG site, recalls that (then) Lt. Col. Harold Turner, the first WSPG Commanding Officer, with the help of C Battery, 69th Antiaircraft Artillery Battalion, selected base camp and launch-site locations, erected wood-floor squad tents, established generator and line power, drilled the first wells, and reerected the three barracks moved from Sandia Air Base. The new Proving Ground was officially authorized by ASF Circular 269, July 13, effective July 9, 1945. Construction of the Army blockhouse at Army Launch Area 1 (the first at WSPG, now Launch Complex 33) commenced on July 10. By late July, 300 freight-car loads of V-2 (and probably other) missile parts were enroute to WSPG. Operation Overcast, a program to exploit German civilian scientific personnel, was established on July 19 and assumed responsibility for the captured Peenemünde staff. Meanwhile, the Manhattan Project, operating in secret at Site Y (Los Alamos, NM) under the command of Maj. Gen. Leslie Groves, had successfully designed the world's first atomic device. Unbeknownst to Col. Turner, WSMR's first commander, the Commander of the Alamogordo Bombing and Gunnery Range, Col. Roscoe Wilson, had reluctantly transferred control of the 432 sq mi Trinity Site to the Manhattan Project (Powell and Scala 1994). Construction at Trinity was underway by November 1944, and the Trinity test was ignited July 16, 1945, at 5:29:45 a.m., Mountain War Time (Starkweather 1989). Less than one month later, atomic weapons were first used against Japan, just as the captured German V-2 materiel began to arrive at WSPG. On August 6, 1945, the first atom bomb was dropped at Hiroshima, Japan, followed by another at Nagasaki on August 9. The following day, C Battery, 69th Antiaircraft Artillery Battalion was officially assigned to WSPG, and 163 officers and enlisted troops from the 9393d Technical Service Unit, OCO, arrived, followed later by elements of the 4119th Area Service Unit (formerly 4845th), 8th Service Command, 4th Army. Robert H. Goddard, the father of American rocketry, died the same day.

Post-World War II and the Early Years of the Cold War

In September 1945, von Braun and the first group of German scientists arrived in Paris. They were flown to Newcastle AFB in Wilmington, Delaware; transferred to Fort Strong near Boston; and then to Fort Bliss, Texas. The remainder of the 118 Paperclippers arrived aboard the transport liner *Argentina* in November and reached Fort Bliss by January 1946.

The Army blockhouse at Launch Area 1 (LC-33) was completed in September 1945. On September 26, a modified Navy Tiny Tim rocket (configured as a booster for WAC Corporal) became the first missile launched by the Army at the new Proving Ground. The first full WAC–Corporal A was fired less than one month later, on October 11, reaching an altitude of 44 mi. That same day, the 1st Guided Missile Battalion was constituted and stationed at the Proving Ground. Later that month, a contract was awarded for construction of the first (100-K) static test stand and the Chief of Ordnance invited the Navy to

participate in WSPG's new guided-missile program (Office of the Chief of Ordnance 1948). The Air Force had also initiated a guided-missile program of its own at Wendover AFB, Utah, and had begun construction of its first high-speed test tracks: K–2 at China Lake and the 2,000-ft track at Edwards AFB. By November 1945, troopers from the 1st Guided Missile Battalion were guarding captured German materiel at railway sidings near Las Cruces and General Electric employees at WSPG had begun to identify, sort, and reassemble V–2 components in the reerected hangar (Building 1538), designated as Assembly Building 1.

In **1946** Hermes project personnel were assigned the task of assembling captured V-2 rockets (and, by 1947, supervising Bumper). Between 1947 and 1954, Hermes utilized four modified German V-2 missiles (redesignated Hermes B-1), five Hermes A-1s (based on the German *Wasserfall* antiaircraft rocket), and 13 Hermes A-3s. As the Project Hermes V-2 program neared readiness at the close of 1945, its scientific potential began to eclipse its original, purely military purpose. In December 1945 (or January 1946), the Naval Research Laboratory (NRL) had established a Rocket-Sonde Research Branch.

In early January 1946, after OCO offered the NRL use of captured V-2s for research, NRL invited other military and university programs to join the V-2 Upper Atmosphere Research Panel (originally the V-2 Panel, later, the Rocket and Satellite Research Panel), chaired by Dr. James A. VanAllen, APL (who later directed the Aerobee program). The panel membership included Ernest H. Krause, NRL; W. G. Dow, University of Michigan; M. H. Nichols, Princeton; Fred Whipple, Harvard; Col. James G. Bain, OCO; Col. Holger N. Toftoy, the Army Proving Ground Forces; and representatives of the Air Materiel Command, the Army Signal Corps, Cal Tech's Jet Propulsion Laboratory (JPL), and General Electric, among others (Brown et al. 1959:71; Burrows 1990:43).

In April, the Army Air Corps contracted with Consolidated Vultee (later General Dynamics) for a study of a long-range ballistic missile (known as MX-774) as a back-up program for the Navaho I missile, which was to succeed the Hermes B-1. The program was canceled the following year, but three launches of the MX-774 Hi-Roc were conducted in 1948 at LC-33.

The V-2 program began in earnest with the full onset of the Cold War, an era which actually started at Trinity, but is usually marked by Churchill's Iron Curtain speech on March 5, 1946. Assembly Building II (Building 1558; a *Mills* building, later known as "The Mill") was erected in 1946. On March 15, the first V-2 was static-test fired on the new 100-K Test Stand, which had been designed by the German rocket team, based on earlier examples in Germany (Brown et al. 1959:65). The following day, Operation Overcast was officially renamed Operation Paperclip. On March 21, Strategic Air Command (SAC) was created, and the Air Materiel Command began developing the XB-63 Rascal, a subsonic air-to-ground pilotless parasite bomber, under contract with Bell Aircraft. Rascal was used in the first off-range firing at WSPG 10 years later. Aberdeen Proving Ground's Ballistic Research Laboratory (BRL) organized a permanent White Sands Annex the same month. On April 2, the Signal Corps

Engineering Laboratories (SCEL) in Fort Monmouth, New Jersey, dispatched personnel to establish Field Station No. 1 at WSPG. Alamogordo Army Air Field, temporarily deactivated since February, was reactivated in April to support the increasing missile-firing schedule. OCO established the Ordnance Research and Development Division Suboffice (Rocket) at Fort Bliss to provide facilities for a select group of German scientists who were engaged in the new Hermes II project to develop a two-stage missile based on a modified V-2.

After one unsuccessful launch attempt on April 16, the first successful V-2 firing occurred on May 10, 1946, and reached an altitude of 70 mi. On May 17, the Naval Bureau of Ordnance, already envisioning the need to replace its small supply of V-2s, contracted through the Applied Physics Laboratory at Johns Hopkins University with Aerojet for 20 XASR-1 Aerobee sounding rockets (originally called Venus) and established the U.S. Naval Ordnance Missile Test Facility at WSPG. In July, the USN Bureau of Ordnance began constructing the Navy Cantonment Area at the Proving Ground.

In January 1946, Dr. George Gardiner, head of the Physics Department at New Mexico College of Agriculture and Mechanic Arts (NMAMA, later New Mexico State University), met with Col. J. G. Bain, OCO, to discuss possibly providing student labor for data reduction of ballistic Askania films. The resulting contract with the Army's Ballistics Research Laboratory, effective in May, led to the founding of the Physical Science Laboratory (PSL, originally the Laboratory of Applied Science) by the Regents of the college in September. A second contract for similar services with the Johns Hopkins Applied Sciences Laboratory, acting for the Navy Bureau of Ordnance, was negotiated that fall. After a historic meeting between Lewis Del Sasso and NMAMA's Harold Brown at the Amador Hotel in Las Cruces early in 1947, a third contract, this time with the Naval Research Laboratory, was undertaken (Starkweather 1989). PSL has continued since that time to supply support, research, data reduction, and a wide range of other services to WSMR and its tenant organizations.

During the summer and fall of 1946, PSL student crews began surveying baseline instrumentation stations A through Z to provide position data for missile test firings (Billups 1959). On September 17, Bell engineers static-test fired the first Nike surface-to-air missile (SAM) at LC-33. By October, the Bell Nike No. 1 was successfully fired to an altitude of 28 mi. That same month, von Braun's German rocket team arrived at WSPG to assist General Electric engineers with V-2 testing. Several sources indicate that 39 scientists led by von Braun spent six months at WSPG, billeted in Building H (which may have been the H-shaped, single-story Officer's Quarters fronting B Street, shown on the June 1945 cantonment map). Starkweather notes that members of the team used Army buses for weekend trips to Ruidoso and Cloudcroft in the Sacramento Mountains. The German team apparently reached a size of approximately 200 before mid-year 1947.

The first motion pictures of the earth from space were taken from V-2 No. 13, which reached an altitude of 65 mi on October 24, 1946. Construction

at LC-33 continued, and the gantry tower was completed in November. On December 17, V-2 No. 17 made the first American night rocket flight.

By **1947**, the need for an accurate, three-dimensional coordinate system became apparent. The requirements for measuring vertical angles were unprecedented, and eventually a modified transverse-mercator projection was developed and anchored to the U.S. Coast and Geodetic Survey Texas-California Arc at Kent Peak in the San Andres Mountains and Elephant Mountain near Orogrande. Because no suitable survey equipment was then available, three damaged Zeiss theodolites, shipped to WSPG with the loads of V-2 missile parts, were cannibalized and adapted into two usable instruments by local personnel.

The original ORDCIT WAC-Corporal program was nearly complete by early 1947. On February 24, 1947, WAC-Corporal B No. 17 reached a record altitude of 45.5 mi. The final WAC launch took place on June 12. Blossom, another V-2 program, began firing in February under the auspices of the Air Force Cambridge Research Center. Blossom's mission was to study ionospheric conditions and develop an instrument-package parachute-recovery system. The Blossom program continued through 1951. Five Blossom experiments, carrying four rhesus monkeys, all named Albert, and a mouse, were conducted for the Wright-Patterson AFB Aero-Medical Laboratory. However, only the first of a total of 11 Blossom launches was fully successful. Blossom I (V-2 No. 20), fired February 20, carried a canister containing fruit flies and various seeds to an altitude of 68 mi and returned safely to Earth by parachute.

In February, shortly after the first Blossom flight, AAAF was transferred to the Air Materiel Command in return for transfer of Wendover AFB to the new Strategic Air Command. In March, the Air Force guided-missile program, including Boeing's GAPA (Proving Ground to Air Pilotless Aircraft), North American's NATIV (North American Test Instrument Vehicle), and the Tarzon Vertical Bomb, was moved from Wendover to AAAF, which was rechristened Holloman AFB the following year. On July 26, The National Security Act created the Department of Defense with three separate departments, and the U.S. Air Force was established as an independent service. The Act also set up the National Security Council (NSC), the Central Intelligence Agency (CIA), and the Joint Chiefs of Staff. The following day, Lt. Col. Turner, WSPG, and Col. Paul F. Helmick, AAAF, executed a cooperative-use agreement locally integrating the *New Mexico Guided Missiles Range*. The new Air Force missile program at AAAF expanded rapidly—in its first year, AAAF fired the first GAPA, three early Falcon AAMs, and the first Firebird AAM; launched the first OQ-19 drones; began the first high-altitude balloon operations; and started the first dummy missile drop tests for the Snark ICBM.

In October, Air Force Captain Chuck Yeager flew the Bell X-1 beyond the sound barrier. Two months later, Major John Stapp made the first two rocket-sled runs at Edwards AFB Test Track in California.

The Navy guided-missile program began construction of two tiltable 140-ft Aerobee launch towers and the Navy Blockhouse at Launch Complex 35 in May. On November 24, the Navy launched the first fully configured Aerobee sounding rocket (No. A-4), which carried cosmic-ray instruments to an altitude of 36.7 mi. Earlier, in May, Douglas Aircraft launched a Corporal E, the first American-designed, engineered, and fabricated surface-to-surface missile (SSM), and the first ORDCIT test vehicle with command guidance. This first Corporal E reached an altitude of 24.4 mi, impacting 62.5 mi downrange within 2 mi of its target, after receiving and executing a radar course-correction signal. In September, the Navy tested the V-2 at sea during Project Sandy, successfully launching from the *Midway's* carrier deck in the Atlantic Ocean. At WSPG, in Operation Pushover, the Navy intentionally toppled and exploded a fully fueled V-2 onto a segment of carrier flight deck.

The OCO approved the Bumper V-2 program in June 1947. Under the direction of JPL, Bumper was the first multistage rocket system, wedding a WAC Corporal to a V-2, an idea originally suggested prior to July 1946 by Col. Holger Toftoy, who had organized Special Mission V-2 to acquire captured missiles for testing at the Proving Ground. The first Bumper flight occurred in May 1948. Less than one year later, Bumper No. 5 penetrated outer space.

Following two near-mishaps with off-course missile impacts, steps were taken to increase range safety. On May 15, steering trouble developed in V-2 No. 26, causing an off-range impact near Alamogordo. Two weeks later, on May 29, the first Hermes B-1 (known as Hermes II) impacted outside Juarez, Mexico.

In August, efforts to secure a more permanent test range had resulted in 52 co-use and full-use agreements with local landowners. In November, the Army Corps of Engineers, Albuquerque District, reported on the first feasibility study for a northern Range expansion. In December, plans were approved for a new Loki antiaircraft free-flight rocket (based on the German *Taifun*). Loki was contracted to Bendix Aviation and JPL after initial feasibility studies were completed in 1948-1949, and it was first test fired at WSPG in June 1951.

In January **1948** the AAAF was redesignated Holloman Air Force Base, effective the following month, with a formal dedication in September. Missile programs continued to expand at both WSPG and HAFB. Between 1946 and 1950, the Army and Navy launched 235 missiles and the Air Force launched 329, in addition to 604 drone flights, 111 parachute-recovery drop tests, 157 bomb drops, and 52 miscellaneous missions (King 1963:3).

General Electric launched the first successful, electronically controlled missile, V-2 No. 36, on February 6. On June 11, USAF Blossom III (V-2 No. 37) carried the first rhesus monkey, Albert I, to a height of 39 mi, but failed to reach recovery altitude.

In addition to the three original Wendover programs (GAPA, JB-2, and Tarzon) transferred in 1947, the Air Force at Holloman had initiated 11 new

missile and drone test programs between 1947 and 1948. The first of four North American Test Instrument Vehicle (NATIV) flights was launched in May. In July, USAF Project MX-774 commenced with the first Consolidated Vultee HI-ROC launch from LC-33. Project MX-774 led to the Atlas rocket, the first intercontinental ballistic missile (ICBM). By December, the first fully powered Ryan Firebird air-to-air missile, which used plastic in the nose, and the fore and aft fins, was launched.

Bumper, designed to demonstrate the feasibility of multistage rockets, began the first of six WSPG test firings on May 13. Bumper's WAC Corporal atop a V-2 stood 58 ft high. The first flight successfully demonstrated stage separation and reached an altitude of 70 mi. The WAC Corporals for this and the second test (where the V-2 booster failed), contained only a separation charge. Bumper No. 3 achieved 93 mi with its first stage, but its WAC exploded before separation. A fully successful multistage flight was not achieved until the following year.

Development of the Integrated Range

At Holloman, planning for the High Speed Test Track was initiated with Northrup and Hughes in October; and by December, HAFB had been reorganized under the Air Materiel Command. All three services now had successful missile programs in place—the Army and Navy at WSPG and the Air Force at HAFB. In September, WSPG was "declared a Class II activity under the control of the Chief of Ordnance at Fort Bliss, Texas" (Department of the Army, General Order 59, 8 September 1948).

Late in the year, two developments occurred that would greatly expand the WSPG mission. During August and September, the two Koreas were established, setting the stage for the conflict that would begin in less than two years. On December 29, 1948, Secretary of Defense James Forrestal announced the establishment of the U.S. earth satellite vehicle program, which would launch the first U.S. satellite, Explorer I, into space less than a decade later.

On January 4, **1949**, Army General Order 2.II designated the Signal Corps Engineering Laboratory at WSPG (which had been temporary since April 1946) as the 9577th Technical Service Unit, SCEL Field Station No. 1, at Fort Bliss. On October 26, an additional Signal Corps unit was added to the WSPG complement with the arrival of six officers and 210 enlisted men from the 169th Signal Construction Company at Camp Gordon, Georgia. In March, USAF control of WSPG's local support airfield, Condron Field, was transferred from Biggs Army Air Field at Fort Bliss to Holloman.

WSPG's second Commanding Officer, Brigadier General Phillip Blackmore, established a Joint Range Coordination Committee on January 7, composed of the WSPG Commanding General, the HAFB Commanding Officer, and the WSPG Naval Officer-in-Charge, to resolve problems of cooperation and jurisdiction at a local level. The Committee's authority was challenged within a month by the Commanding General at Fort Bliss, who asserted his command

authority over WSPG, based on the General Order establishing the Proving Ground as a permanent Class II activity under his command (Redmond 1957). The Air Force and Navy vehemently opposed this action—more than three years of negotiations were conducted before the Secretary of Defense's final decision on July 18, 1952, resolved the dispute by centralizing range operational authority under the Commander, WSPG. The decision recognized advice by deputies from both the Air Force and Navy and denied the authority of the Commander, Fort Bliss. The new chain of command led directly from the WSPG Commander to the Department of the Army through the Ordnance Department. The Air Force retained title and command of HAFB, while the Navy retained title and administrative control over all Navy facilities. The final integration plan was issued on August 19, 1952, and took effect September 1. The dispute concerning use of the range for training purposes continued at the departmental level, which had a detrimental effect on the Air Force guided-missile program at Holloman by creating a belief that the program was to be taken over by the Army. This belief led, in turn, to the cancellation of plans and monies, seriously jeopardizing the guided-missile program (Redmond 1957:19).

In early January, the Hermes II (or B-1) program resumed test firing after more than a year's delay following the loss of course control and the impact of test vehicle No. 0 near Juarez in 1947. Hermes II used a modified V-2 to carry a smaller, second-stage ramjet missile, known officially as RAM and nicknamed Organ. The second Hermes II B-1 was successfully launched from LC-33 on January 3, followed by two additional tests in October 1949 and November 1950.

The GE Bumper No. 5, fired at WSPG on February 24, was the first with a fully fueled second stage and the first to be completely successful. After 30 seconds, the first stage V-2 had attained a speed of 3,600 mph. The WAC separated and continued upward to a distance of 250 mi into outer space, reaching a speed of 5,150 mph and achieving the highest altitude ever reached to date by a man-made object. This was the first time radio equipment had ever been operated at such extreme altitudes. On July 29, Bumper No. 7, fired at the Long Range Proving Ground, Florida (as was No. 8), attained Mach 9 and reached 2,039 mph, the highest sustained speed ever reached to date in the earth's atmosphere.

On May 3, 1949, the Navy's new American-designed Martin Viking research rocket (originally called Neptune) was first launched from LC-33, reaching an altitude of 50 mi. At Holloman, the Hughes Falcon (the world's first operational, guided air-to-air missile), the first Martin Matador surface-to-surface pilotless bomber, and the first USAF X-8 Aerobee had been launched. Preliminary development testing for the Bell Rascal program, the world's first supersonic strategic air-to-surface missile, had begun with dummy drops of the Shrike reentry vehicle.

Meanwhile, the range co-use and full-use agreements with landowners were found to be unworkable and were terminated in March 1949. In May 1952,

Public Land Order 833 withdrew range lands for exclusive military use, and an additional 168,000 acres were transferred from Fort Bliss to WSPG in August.

On May 11, 1949, President Harry S. Truman signed legislation authorizing development of a 3,000 sq mi guided missile test range. That July, the public and press were first allowed to visit Trinity Site. The following month, the Soviet Union exploded its first atomic bomb.

The Korean War

In **1950** international events had a major impact on the U.S. Military establishment and operations at WSPG. In January, President Truman approved development of the hydrogen bomb. By April, the National Security Council had prepared NSC 68, which redefined the Cold War in military terms, calling for the build up of a nuclear arsenal and expansion of conventional weapons to counter the Soviet threat. The nuclear arms race had begun.

On June 25, North Korean troops crossed into South Korea and President Truman committed U.S. forces to its defense. Late in that year, the United States and South Vietnam signed a Mutual Defense Assistance Agreement. Together, these events dramatically spurred guided-missile development programs in the defense agencies.

In February, the Navy announced tests of Mighty Mouse, the first successful air-to-air rocket. The Air Force established nearby Sacramento Peak Observatory to study solar radiation. The first Holloman 3,550-ft High Speed Test Track was completed on June 15, and the first unloaded Snark launch-sled test was conducted on June 23, with the sled reaching a top speed of 101 mph. The new Army Ordnance Missile Center was established at the Redstone Arsenal in Huntsville, and von Braun's scientific team, composed of more than 100 captured German scientists stationed at Fort Bliss and WSPG since 1946, was transferred in November.

On May 19, 1950, the Army unsuccessfully launched the first Hermes A-1 antiaircraft missile (based on the German *Wasserfall*). In August, attention shifted to the Air Force high-altitude balloon program. On August 8, Captain Vincent Mazza set a new altitude record of 42,176 ft, parachuting from a balloon. This record was surpassed three weeks later by Captain Richard Wheeler, who parachuted from 42,449 ft above Holloman. That same day, HAFB personnel launched the first Wright Field AeroMedical Laboratory high-altitude cosmic radiation balloon from WSPG. On November 21, the Navy Viking V launched from LC-33 set a new single-stage altitude record of 107 mi. The first flight-test of Snark on December 21 proved unsuccessful when the missile disengaged from its sled below flight separation speed and was destroyed.

During **1951**, the interservice debate about the Proving Ground chain of command continued. WSPG completed construction of its new headquarters, the Post Administration Building No. 100, in January. The Air Force

reorganized its missile program, including Holloman, under an independent command, the Air Research and Development Command (ARDC). On March 29, an Aerobee launch from HAFB was broadcast on nationwide radio. Run No. 15 at the Test Track produced the first successful Snark launch and up-range test flight on April 16. Two days later, the first Aerobee flight carrying a monkey was conducted.

Meanwhile, in March and June, the final two Air Force Cambridge Research Center Blossom tests, IV-E and IV-F, suffered tail explosions shortly after launch. Another American redesign of a German antiaircraft concept, Loki (based on *Taifun*), was launched from the new Small Missile Range in 1951. The Douglas Honest John SSM, which became the first post-war operational American missile, was also test fired at the Proving Ground. In August, the Navy's Viking set another single-stage altitude and speed record of 135 mi at 4,100 mph. On September 20, Aerobee carried a monkey and 11 mice (the first living creatures to survive outer space) to an altitude of 236,000 ft. This flight provided the first successful recovery of animals from a rocket flight. In November, a Nike-Ajax achieved the free world's first successful antiaircraft interception by destroying a B-17 drone over WSPG.

The Navy Talos program, an outgrowth of the original 1945 Bumblebee Project experiments in ramjet propulsion at the Naval Ordnance Test Station in China Lake, CA, had progressed to the point that it needed an extended range. Talos was transferred to the Navy Launch Area at LC-35 on WSPG.

The year **1952** marked the continued expansion of test programs and further integration of the range. Another phase of the Cold War began with the first hydrogen bomb test on November 1, at Enewetok Island in the Pacific, and the laying of the keel of the world's first atomic-powered naval vessel, *U.S.S. Nautilus* by President Truman. In February, the Aberdeen BRL transferred range instrumentation responsibilities to the new WSPG Flight Determination Laboratory. In May, Public Land Order 833 withdrew on-range public lands from the public domain for exclusive military use, and additional Fort Bliss acreage was transferred in August. On August 19, the Secretary of Defense established WSPG as a permanent Class IV activity under the command of the Chief of Ordnance. On September 1, HAFB and WSPG ranges were consolidated by order of the Secretary of Defense. On September 22, the WSPG Commanding General issued General Order 30, *Plan for the Operation of the Integrated Range*, just three days after the 73rd and final V-2 was fired at the range.

In July **1952**, WSPG Commander, Brig. Gen. G. G. Eddy, and Dr. J. W. Branson, NMAMA, initiated the College Student Cooperative Program. The first launch of the Type 1 tactical version of Corporal was conducted in August, and the first Navy Talos at WSPG was fired in October. At Holloman, the 33rd and final Snark Test Track run was conducted on March 28. Snark was immediately succeeded at the Test Track by Sandia Corporation's Project Sleighride, which tested the effects of impact, deceleration, and rainfall on a "free rocket special warhead" for the Atomic Energy Commission on behalf of the Ordnance Corps,

U.S. Army. On September 20, the first Rascal ASM was launched at Holloman. Late the following month, the newly integrated range broadened its mission to an international scale with the announcement that the Swiss Oerlikon missile was to be tested from Tularosa Range Camp.

After Korea and the Death of Stalin

On August 14, **1953**, five months after the death of Josef Stalin and less than one month after the Korean Armistice was signed, the Soviet Union tested its first hydrogen bomb. Local research and logistic support for the WSPG expanded. Texas Western College (later the University of Texas at El Paso) founded the Schellenger Research Laboratories (SRL) and gradually began to undertake research and development contracts for the Army Signal Corps, OCO, and other military organizations. Sometime during the late 1950s, SRL developed the SOTIM (Sonic Observation of Trajectories and Impacts of Missiles) System for WSPG, an array of sensitive, ground-positioned microphones capable of precisely triangulating impact sites to supplement radar-tracking systems.

In April, Lt. Col. John Paul Stapp was reassigned to Holloman from Edwards AFB to undertake a new test program on the Biophysics of Abrupt Deceleration, the first of several innovative AeroMedical programs designed to focus on the problems of aircraft escape and bailout from high-speed aircraft, which provided the basis for the soon-to-emerge field of space medicine.

The Desert Navy at WSPG completed the LLS-1 Desert Ship in June. The Desert Ship's concrete-blockhouse complex provided assembly and launch facilities simulating shipboard conditions.

On June 13, the Hermes A-3 series, larger and more powerful than the *Wasserfall*-based A-1 (a modified V-2 Hermes B-1), reached the testing stage with the first successful Hermes A-3A launch. The following month, WSPG officially assumed maintenance and operation responsibility for all instrumentation within the integrated range; and in October, the WSPG-Fort Bliss boundary was finally clarified by the Office of the Adjutant General, Fourth Army.

In December, the Nike-Ajax was deployed around Washington D.C., becoming the first guided SAM defense system in the world. Within four years, more than 16,000 rounds had been produced. By 1957, Ajax had been deployed throughout the United States and in Europe and Asia.

In **1954**, WSPG began a survey of potential range extensions that finally led to the addition of the FIX (Firing-in-Extension) in 1960 to the north of the existing range. It also investigated test-flight corridors for Matador and Redstone, from WSPG into British Columbia and Alaska, with ranges of 1,500 and 2,000 nautical miles, respectively. In May, the Navy Viking No. 11, launched from the new Desert Ship facilities, set another single-stage altitude record of 158 mi, and the Army Hermes A-3B flew for the first time under radar

guidance. Testing at White Sands had grown from a total of 14 launches in 1945 to 656 in 1954, to supporting more than 12 separate programs, including Aerobee, Corporal, Crossbow, Hermes, Honest John, Lacrosse, Nike, Papa John, Pogo–Hi, Talos, and Viking. The nearby Air Force AeroMedical Laboratory High Speed Test Track programs also expanded and, on March 19, Lt. Col. John Paul Stapp rode the first human rocket-sled test into history, reaching a top speed of 615 ft per second and enduring a peak deceleration of 22 gravities.

WHITE SANDS PROVING GROUND POST HISTORY

In response to U.S. intelligence reports regarding German development of the A-4 (V-2) rocket, in 1943 the Army Ordnance established the Rocket Branch to research the feasibility of developing a comparable weapon (Powell and Scala 1994:82). In the following year, it was determined that an overland missile ground was needed to permit recovery of missiles and parts after flights were terminated or successfully completed (Fulwyler 1994:37-38). For many reasons, the Tularosa Basin in southern New Mexico was chosen as the best location for this Class I activity. Initially, the Alamogordo Army Air Field (AAAF) was considered, but a new facility was chosen, and WSPG was officially established there on July 9, 1945.

Building Inventory

Construction of new facilities was begun in 1945. However, because missile testing was not considered to be a permanent activity, adequate and available CCC structures and temporary buildings were moved to WSPG from Sandia Base near Albuquerque, New Mexico. A general layout map of WSPG produced by the U.S. Engineers Office, Albuquerque, New Mexico, in 1945, indicated the locations of various planned facilities. A layout produced the following year shows that existing construction at WSPG included 1 headquarter's building, 1 office building, 2 mess halls, 2 officers' quarters, 2 barracks buildings, 2 lavatories located near these, and the 48 hutments, 1 fire station, 1 first-aid building, 3 workshops, 1 warehouse, 1 instrument warehouse, 1 missile-assembly building, 1 oil house, 1 vehicle wash rack, 1 grease rack, and 1 machine shop. Most of these buildings appear as they were planned on the 1945 map (Figure 2). In addition to these, other existing construction, as indicated by the 1946 map produced by the U.S. Engineers Office, Albuquerque, included 8 barracks, a second missile-assembly building, and a dispensary, as well as other buildings that were not labeled (Figure 8).

Construction of new permanent facilities began in earnest in 1948, the year WSPG was redesignated as a Class II Activity. In that year, the Officer's Club, the Post Commissary, and a housing area consisting of 69 units were partially completed to accommodate military families. Construction of some of these facilities began in 1947.

By the close of 1955, all modern conveniences expected in a community of that era were available to the residents. At that time, there were 430 housing units and 93 trailer spaces, as well as officers' and enlisted men's barracks. A consolidated mess hall for military personnel and a cafeteria for civilian personnel had been built, a PX gas station was opened, and a bus service was initiated for transportation to and from neighboring communities. There was a Post Exchange Store and a Thrift Shop. The U.S. Post Office and a branch of the Otero County Bank operated on the Post. A WSPG newspaper, which was published in Las Cruces, was distributed on Post. The elementary school building included a kindergarten, and a Post Chapel conducted Catholic as well as Protestant services.

Recreational facilities included a swimming pool and snack bar, bowling alley, theater, library, athletic fields, hobby shops, and an enlisted men's club. The hobby shops included automotive repair, radio, and woodworking. Recreational facilities were tennis courts and a Service Club with handball courts and other gymnasium facilities. A new fire station was in operation in 1950. Also present were laundry and dry cleaning, as well as telephone and telegraph facilities. Two gun clubs were established during this time, and hunting was a recreational activity.

The wide range of military activities related to the WSPG mission and the operation of support and recreational facilities and domestic households would have generated a diverse assemblage of refuse, if all these existed at the time the landfill was in use. The assemblage could contain material ranging from such exotics as parts of German-manufactured V-2 missiles to the ubiquitous soft-drink bottle of the time period.

Population Characteristics

As is evident from the history of the first 10 years of WSPG operations, the character of the population on the Post, as well as the nature of the testing activities conducted there, expanded and changed considerably between 1945 and 1955. Between July 1945 and the close of 1947, the population consisted largely, if not entirely, of male missile scientists and technicians, as well as military and construction contractors. Many of the buildings were temporary in nature, and several had been relocated from other military facilities. By 1947, buildings under construction or completed included officers' and enlisted men's quarters, two missile-assembly buildings, a dispensary, mess halls, headquarters and offices, a fire station, warehouses, workshops, and vehicle maintenance and repair facilities. Probably very few women were involved in activities on WSPG in these early years.

In the following years, from 1948 to 1955, family housing, recreational, and other consumer and service facilities greatly expanded to include a commissary built in 1948, the first year of this expansion period, and a Post Exchange (PX). Several large, permanent, mission-oriented buildings were constructed. Women and children who were family members of military personnel lived on Post during this time. Mobility patterns of military personnel also changed. More had personal vehicles in which to travel to Las Cruces, El Paso, and other nearby towns. Also, women from nearby communities were employed reducing data and at the PX, commissary, cafeteria, and other facilities. The composition of the refuse generated by the WSPG population and activities would have changed during these years to reflect the character of the population and the nature of the activities.

As the military mission developed, more mission-oriented facilities and personnel were required for the tasks. As the population expanded and diversified, so did demands for goods and services and nonmission-oriented facilities. The increasing mobility of this population provided an avenue for reaching suppliers and retailers other than those on the Post.

RESEARCH DESIGN

Robert Burton, WSMR archaeologist, developed a set of research questions based on preliminary field observations and limited to the historical data at Site LA 106,155. These pertain to the temporal, functional, social, and economic history of White Sands Proving Ground during its earliest years. From initial evidence, it is possible that the remains found here date to the earliest years of occupation of WSPG, from 1945-1948. The excavation represents another dimension of information about the Cold War period in addition to the building documentation (Eidenbach et al. 1996) and also may represent the first excavation of Cold War remains in New Mexico from immediately after World War II.

The following questions were designed to address temporal, functional, social, and economical aspects of the archaeological and historical record.

Temporal Research Questions

1. Is Site LA 106,155 the first landfill or one of the first landfills on WSPG? Temporal data here should differentiate between July 1945, when White Sands Proving Ground was first begun, and later occupation or use.

   Data Requirements

   — Evidence would be dates on artifacts, especially those that are commonly used and rapidly discarded, such as water, soda, and liquor bottles.

   — Additional items would include any artifacts that might be identified with the earliest military units assigned to the earliest days of the Post, especially if the units were reassigned during the next few years to other Posts.

2. Is the dump associated with the Cold War use of White Sands Proving Ground, and, if so, what period of the Cold War? Early projects would be identified with specific projects, such as the Paperclippers, or Cold War projects that are not specific to WSPG.

   Data Requirements

   — Artifacts that might reflect early Cold War projects, especially those dealing with the Paperclippers and the V-2 rocket program.

Functional Research Questions

1. What type of dump is it? Does it represent use by the whole Post or a specific group?

   Data Requirements

   — If the dump had been used by the whole Post, then a variety of artifacts representing such functions as food preparation, personal activities, military activities, and construction would be represented. If Site LA 106,155 is a special-use dump, representing only a portion of the population or activities on the Post, then only one or a few categories of activities would be represented in the artifacts.

2. Is there evidence of a military build up at WSMR that can be related to the Cold War? Were surplus missile parts or associated test equipment disposed of in this landfill?

   Data Requirements

   — If there is evidence of a military buildup, there would be a predominance of surplus military parts or associated test equipment from the nearby V-2 workshop or the Launch Complex on what is now Nike Avenue. This statement is especially true, considering the size of these items in comparison to personal items or disposal kitchen items.

   Limited disposal might indicate either limited buildup or, more likely, that this dump was for trash associated with construction and living activities around the Post and not with testing activities, and that only occasionally did test materials get into the dump.

3. How were the early post-World War II military landfills structured? Was trash burned inside or outside the pit and were only selected types of trash being burned?

   Data Requirements

   — Answers to this question require observation of the layering of the artifacts and their condition as they were removed from the fill.

4. What was the relationship to other buildings and the site-selection criteria?

   Data Requirements

   — Early photographs and maps provide the physical location of the dump; measurements from these would provide information on the selection process and how far away from known activity areas dump features were placed.

Social Research Questions

1. Is there any evidence of personnel located at WSPG prior to July 1945?

   Data Requirements

   — Evidence of an earlier occupation, before the Post was commissioned on July 9, 1945, would be disposable artifacts dating prior to July 1945. Even if a few of these were found, their context in an extensive dump with later artifacts would not be conclusive. The only conclusive proof would be if all the materials in the dump could conceivably predate July 1945.

2. Is there evidence of families living on the Post from the time it was first established?

   Data Requirements

   — Excavation and analysis would show materials normally related to families. Household items might include common rather than military china and glass and heirloom items; women's artifacts, such as perfume bottles, jewelry, hair items, and toiletries; and children's shoes and toys.

3. What aspects of the lifeways of the WSPG personnel are reflected in the landfill?

   Data Requirements

   — The analysis is designed to divide the remains into categories that reflect the lifeways of the soldiers, scientists, and other early inhabitants of the Post. Depending on the types of artifacts recovered in the different categories, it is possible to address such potential topics as food preferences, family composition, types of activities, etc.

Economic Research Questions

1. What was the role of WSPG in relation to the local economies of Las Cruces, New Mexico, and El Paso, Texas? This question can be answered in a limited way through artifacts recovered from the dump, with regard to the amount of material coming from these communities to the Post. The reverse relationship is not possible to detect by looking at the trash dump, but has been partially answered through a social history prepared for WSMR from 1945 to 1954 (Boehm 1997).

   Data Requirements

   — Specific artifacts reflecting ties to Las Cruces and El Paso. These can be soda containers, newspapers, etc.

2. Were goods obtained from local suppliers or through the larger military procurement system?

   Data Requirements

   — If items were obtained through local suppliers, they would bear local brands, although possibly from farther afield than those specified in the previous question. Specific items might include fresh meat (bones); New Mexico, Texas, or Arizona brands on disposable bottles, newspapers; etc.

   — On the other hand, items distributed through the larger military procurement system would bear military insignia or Quartermaster information.

3. How much and what types of war-surplus materials were being used and discarded? Answering this question requires careful differentiation between World War II surplus and items that might be necessary for the Cold War missile and rocket-test effort at WSPG.

   Data Requirements

   — The lack of World War II surplus would provide the best answer. The number of items or volume of material from World War II, compared to other categories of artifacts, would help indicate whether the Cold War was fueled by the remains of World War II.

The degree to which these questions could be answered with the sample of artifacts removed from the dump was determined by two factors. The first is the nature and composition of the artifact assemblage in the dump, which is a typical concern for all historic archaeological sites. The second factor was the limitation of data-collection methods, which was limited by restrictions on field methods in potentially hazardous dump deposits. It was not possible to acquire and analyze some of the artifacts from portions of the dump, because of hazardous materials. However, once the materials were removed, the laboratory methods conformed to traditional methods, providing no limitations on the results, as presented here. Given these restrictions, every effort was made to recover and analyze the artifacts from this important archaeological site.

MARKET SYSTEM

Identification of the types of goods and services used and consumed during the Cold War at the WSPG, the potential sources for goods and services, the primary use areas and subareas on the WSPG Post, the optimum chronological indicators, and refuse types are all necessary for addressing the research questions on a market system. The text for this study is included in Appendix A.

DATA-RECOVERY STRATEGIES

The data-recovery strategies, consisting of excavation and analysis strategies, were a combination of those procedures dictated by the Environmental Protection Agency and those commonly employed by HSR staff for excavating historic sites. Because of the nature of the deposits and the limitations of time and available funds, some of the standard techniques for excavation and analysis were modified or eliminated; these are described in this section.

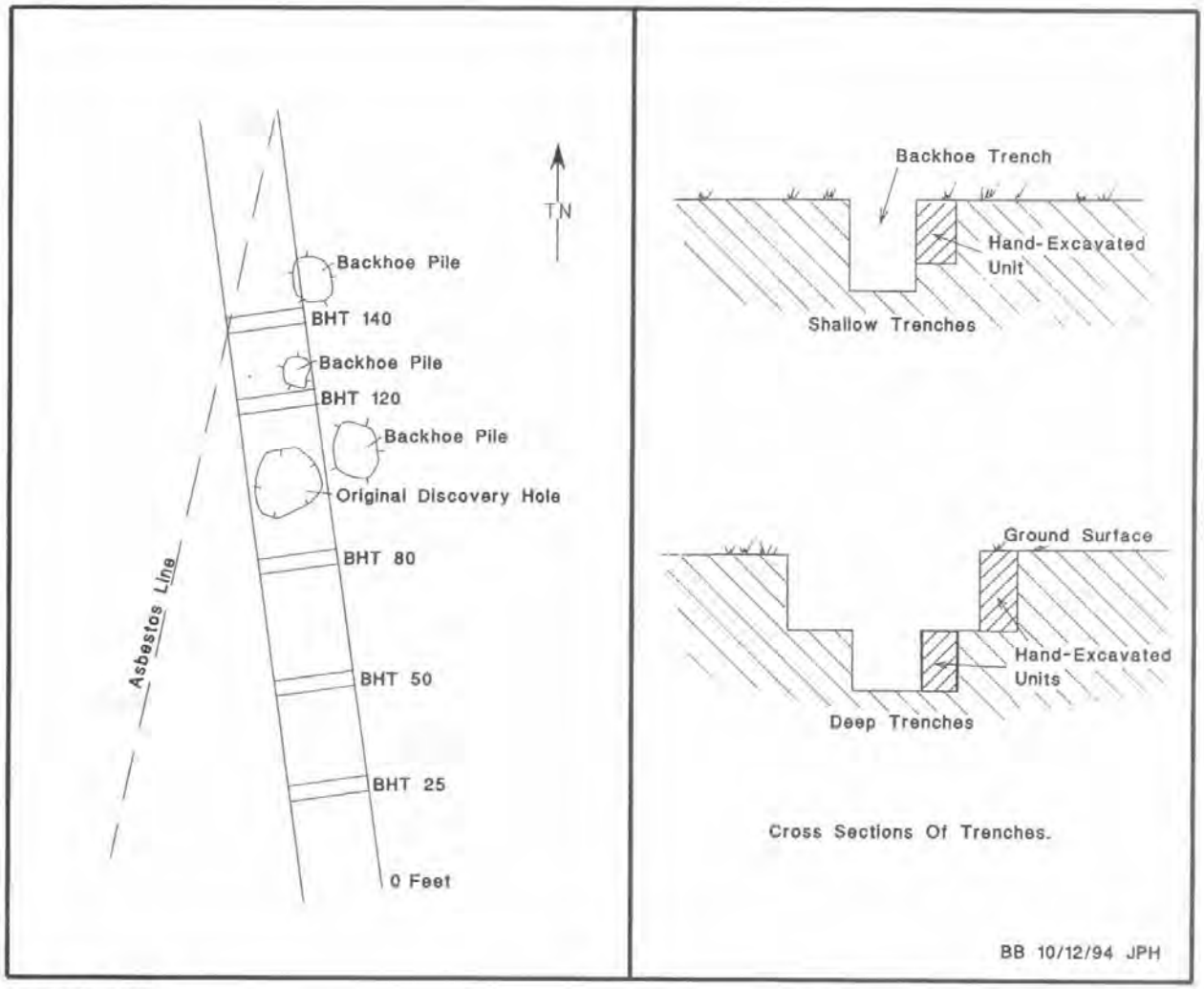
Excavation Strategies

Because of time and budgetary limitations, it was not possible to excavate the whole dump. During excavation of select trenches, Robert Burton and Michael Mallouf monitored the excavation and guided the WSMR Fire Department personnel in removing diagnostic artifacts that would provide the best information to answer the research questions. The fire fighters included Larry Burns, Robert Valles, Guillermo Rendon, Paul Self, Raymond Martinez, Linzy Hall, Gilbert Flores, Jose Alayo, and Frederico Sanchez. Three archaeological assistants—Bobby Meyers, Joe Cook, and Celestine Mayaseca—oversaw the excavation. Other staff members are listed in Appendix D. The excavation adhered to OSHA regulations for working in trenches, which included a stepback excavation from top to bottom for working in a trench deeper than 3 ft.

Excavation procedures for the dump materials were subject to several safety issues: (1) The excavation was conducted by WSMR Fire Department personnel who had received certification in handling hazardous materials. No untrained archaeologists were used for the excavations. (2) All personnel involved with the excavation were required to wear full-face respirators, boots, gloves, and disposable overalls to provide protection from contamination by the hazardous waste. All personnel involved in the excavations were currently certified in hazardous-waste operations training. (3) No dump material was excavated during periods when local wind conditions exceeded 10 mph. An industrial hygienist from WSMR was present to monitor air quality. (4) Excavated material was handled in such a way as to minimize airborne dust, which excluded screening of the fill for artifacts.

A sample of the deposits was obtained, based on stratigraphic deposits. A backhoe was used to excavate a main plumbing trench at irregular intervals up to 140 m (460 ft) from the datum, and five trenches were excavated perpendicular to the existing trench (Figure 9). The number and location of these trenches within the main plumbing trench were dependent on the size and shape of the dump. In selecting the areas to excavate, those with mostly construction debris were avoided.

The main trench and five backhoe or cross trenches were selected in areas of fill that appeared to contain artifacts most likely to be relevant to the



Not to scale.

Figure 9. The main plumbing trench and five perpendicular trenches.

research questions. For example, areas with bottles, diagnostic metal artifacts, ceramics, and food remains were selected over areas with construction debris. Because of the relatively large size of the artifacts, excavation levels were 25 cm thick. For the most part, backhoe trenches were excavated 1 m (3 ft) into the face of the trench, but especially around Backhoe Trench 80, it was necessary to step the trench into the face. As a result, the trench was 3 m (10 ft) wide near the top and 1 m (3 ft) at the base.

The test pits were excavated from the top down using the exposed stratigraphy. Artifacts were picked from the backhoe bucket. Shovels, picks, and trowels were used, subject to safety concerns. Artifacts were very carefully placed in plastic buckets, keeping dust to a minimum. Because the fill was not screened, the primary recovery of artifacts and any other observations were made in the test pit. Large items were seen better than small ones.

This resulted in a series of rectangular stratigraphic profiles across the dump. After the trenches were excavated, the stratigraphic profiles were recorded with color photographs and on video tape.

Prior to delivering the artifacts to HSR, the diagnostic artifacts were sorted by material and artifact type within the provenience (e.g., glass [Coca-Cola bottles], ceramics, dishes with makers' marks, etc.). These artifacts were checked for contamination and handled accordingly. Uncontaminated artifacts were set aside for later analysis. Data from contaminated diagnostic artifacts were recorded, and a decision was made to either clean the artifacts or discard them with the rest of the dump materials. Descriptions and counts were recorded for nondiagnostic artifacts, including melted bottles, crushed cans, construction materials, and any other types of artifacts and materials.

Laboratory Analysis

Historic artifacts came to the HSR laboratory packed in boxes, paper sacks, plastic bags, and buckets. Many items had been prewashed by the WSMR Fire Department personnel who had conducted the excavation at the dump site. These artifacts had been wrapped in newspaper and packed into containers. All artifacts, both prewashed and unwashed, had been grouped by provenience. This included proveniences of a mixed surface context, undifferentiated fill, and six different multilevel backhoe trenches.

The refuse-dump context of the artifacts presented the potential for hazardous materials contaminating of artifacts. Analysis for hazardous materials was conducted by WSMR personnel on Toxicity Characteristic Leaching Procedure (TCLP) metals that may be present in the filter equipment used by WSMR Fire Department personnel. The TCLP metals included arsenic, barium, cadmium, lead, and silver. Lead was found in quantities, in some cases, above regulatory limits.

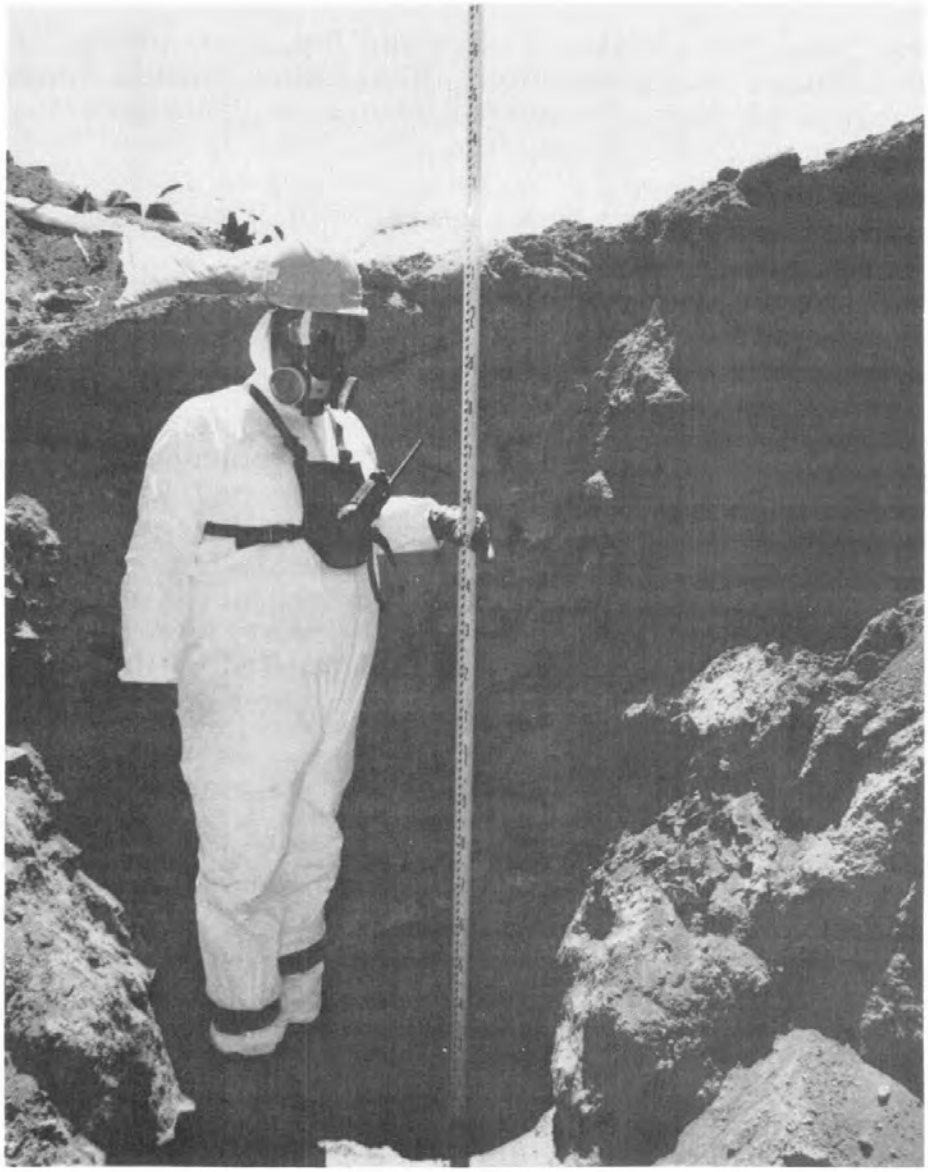


Figure 10. WSMR firefighter in full safety gear holds stadia rod during Dump site excavation.

HSR personnel who processed the recovered dump artifacts wore rubber gloves and filter masks during washing activities. All artifacts were washed in plain water. This included artifacts that had been prewashed. After washing, artifacts were air dried. The only exception to the washing activities was the newspaper fragments. These items were dusted and stored in polyurethane bags. Some metal objects required brushing before they were washed, which was accomplished with a wire brush.

Artifacts were cataloged using the WSMR Catalog Number System, which consists of a year and project number, location data, and a unique artifact number. Each artifact or group of similar artifacts was described in detail and measured in inches, and a temporal affiliation was assigned when possible. Artifacts were stored individually or in groups within resealable polyurethane bags. Pertinent information was written in indelible ink on each storage bag and duplicated on a label enclosed within each storage bag. The information included LA number (Laboratory of Anthropology, State of New Mexico), contractor's project number, project title, catalog number, and artifact classification.

The analysis of artifacts from archaeological sites is important for interpreting past human behavior and historic events. The types, quality, and quantity of material items provide information on chronology, lifeways, and social and economic conditions of the population using the site. Diagnostic artifacts with makers' marks are useful for addressing questions of chronology. Other types of artifacts (e.g., toys or toiletries) may represent the presence of children or women at the site. For example, it is assumed that the first occupants of WSPG were primarily men. The presence or absence of toys and toiletry items will provide some insight into the social composition of the headquarters staff and the date of the dump.

Artifacts were analyzed in two phases, descriptive and analytical (Duran and McKeown 1980:1027). The descriptive phase involved presenting basic information about the material, size, shape, and functional criteria. Use of the product or remains allows artifact assemblage to be analyzed by the type of item, addressing questions of chronology and use. The problems of time lag and recycling were considered when studying artifacts found in the dump.

The analytic phase involves the use of descriptive data to address specific research questions. During this phase, different sets of descriptive data will be looked at when considering a research question. Data from the ceramic, glass, and metal artifacts may indicate if the source of the dump was specialized discards from the general mess or Officer's Club or if it was generalized debris from various missile-construction facilities at the main Post. The question of reusing World War II materials can be addressed by the types of artifacts present and the dates of manufacture, with consideration of the problem of time lag, especially for ceramic vessels.

Archival sources were consulted for photographs, plans, and other written documents that would provide data about the dump and its

relationship to the rest of the Post. These sources included White Sands Missile Range, Los Alamos Labs, U.S. Army Archives, Rio Grande Historical Collections (New Mexico State University), and the State of New Mexico Archives.

Various literature sources were used to assist in the identification of artifacts. Data on makers' marks for bottles include Fike (1987), Hull-Walski and Ayres (1989), and Toulouse (1969, 1971). Munsey (1972) was consulted for Coca-Cola bottles. A historical study of twentieth-century ceramics was done by Hannah (1986). Sources for makers' marks include Duke (1989), DeBolt (1988), Hull-Walski and Ayres (1989), and Lehner (1988). Kovel and Kovel (1988) have compiled a book on Depression glass and dinnerware, complete with illustrations and makers' marks. Florence (1990) provides an excellent photographic description of Depression glass. If the dump was used by families, Depression glass and dinnerware would be expected to be present. Hull-Walski and Ayres (1989) provide a good review of makers' marks on metal artifacts. Hardware catalogs (e.g., McMaster-Carr 1948, 1972) were consulted to help identify metal and other types of artifacts. Wright (1976) contains a good review of the history of beer cans, including cone-top cans. Viklund (1991) provides a chronology of common twentieth-century artifacts, including personal items.

ARTIFACT ASSEMBLAGE

More than 1,379 complete artifacts or fragments were recovered from the dump on White Sands Missile Range. The artifacts are presented in the categories used for the analysis; more detailed information is presented in Appendix B. The artifact count represents estimates for some of the items that were recovered as rusted or melted together during the excavation. Also, where several fragments of an identifiable item, such as a Coca-Cola bottle, were present in a single provenience or an adjoining one, it is not always possible to determine if all fragments came from one bottle or several. In other words, for these fragmented artifacts, the counts do not represent minimum counts. Therefore, all totals given in the following discussion are approximate.

Recognizable consumer package goods include four brands of soft drinks—66 Coca-Cola bottles, 1 Yucca brand soft drink bottled by Coca-Cola, 1 7-Up bottle, and 1 Barq's beverage. Other package goods present are alcoholic beverages (18 4/5 quart bottles, including 1 from Mexico; 10 pint liquor bottles; 20 beer bottles; and 5 beer cans), and milk (3 half-pint and 4 quart) bottles. There are 100 other whole or fragmented bottles that do not have product information. Some resemble containers for toiletry products, over-the-counter medicine, liquid shoe polish, and condiments, such as ketchup. There are 32 glass jars that probably contained food or condiments, such as mustard. Thirty-five animal bones were recovered from the dump (Appendix C).

Personal care or toiletry bottles that are clearly labeled include hair tonics: Lucky Tiger, Wildroot, Vitalis, and Fitch's (12 bottles), Mennen after-shave (1 bottle), and 1 tube of Barbassol shaving creme. Noxzema was apparently a useful product, possibly for relieving the effects of sunburn or windburn (6 glass jars). Two razor-blade shavers were also present. What were originally identified as 14 shaving mugs have since been verified as handleless coffee mugs, several of which are Army-issue, as indicated by the USQMC mark on the bottom. One toothbrush is present in the collection of recovered items and one pair of spectacles with a metal frame. There are fragments of Army-issue clothing and 49 insignia.

There are 24 pieces of assorted serving ware, many of which are marked with USQMC; 2 salt shakers; an assortment of 12 metal utensils, a few marked USQMC; 1 spoon of serving size rather than an individual size; and 3 glass tumblers. Fragments of possibly 8 separate burned newspapers were collected, including one printed in Germany. A fountain pen and 4 ink bottles were also recovered. Three D-sized, one C-sized, and three 8-volt batteries were found. The collection also includes 3 electrical fuses, 6 light bulbs, and 3 vacuum tubes. There is a large assortment of wires and metal and ceramic fragments that are probably electrical-related. Miscellaneous construction and plumbing materials include shingles, bricks, wood, metal pipes, concrete fragments, metal nails, bolts, and nuts. There is also a small amount of coal and a damper from a wood-burning stove. One horseshoe of the type used in the pitching game was recovered.

There is evidence that medical services were available. A dentist's pick was recovered, as well as 29 medicine bottles. One qualifier of the medicine bottle designation is the embossed pharmaceutical measurements (e.g., drams, milliliters/cc's) on the bottle. Another qualifier is the configuration of the sterile seal style bottle, which strongly suggests a container for injectable medication. One of these bottles still retains remnants of the metal seal. One part of an electric hair cutter indicates barber services were available. One waxed-paper soft-drink cup may be an indicator of the presence of concession services.

Descriptions of Selected Artifacts.

A representative collection of artifacts was selected for description here and for illustration. Many of the other items are comparable to these artifacts or fragments of artifacts.

Description: Metal wood stove deflecting damper plate (1) (Figure 11). Cast iron from wood burning stove. One side reads "THE ADAMS CO/ESTABLISHED 1883/DUBUQUE LA", other side reads "DIAMOND/PAT NO 1937708/6 INCH".

Company: Adams Co. established 1883.

Provenience: BHT 140 (25-50 cm)
95.4.LA 106,155.00603

Figure 11

Description: Glass ashtray fragment (1) (Figure 12a) Clear square shaped ashtray with rounded corners measures 4¼ in. long and 4¼ in. wide by 1 in. deep. Round base and center measures 3⅜ in. across. Top has indentations for holding cigarettes.

Provenience: BHT 120 Mixed
95.4.LA 106,155.00219

Description: Ashtray (1) (Figure 12b)
Round, clear glass ashtray with slightly chipped handle. Kick-up center. 4¾ in. diameter. Base embossed "PAT APPLIED FOR" / * / NOMISSER".

*"H-over-A" monogram symbol from Hazel-Atlas Glass Co. dates 1920-1964 (Toulouse 1971:239).

Company/Brand: "Nomisser" unidentified.

Provenience: South end of trench, deepest level
95.4.LA 106,155.00020

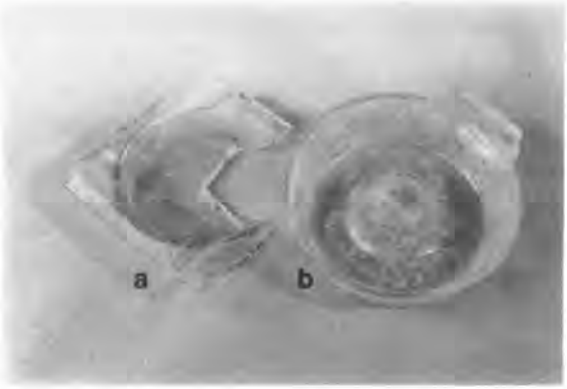


Figure 12

Description: Steel-frame eyeglasses (2 pieces) (Figure 13). Hook temple bows reach behind ears. Round, convex lenses. Broken along nose piece.

Provenience: Surface/Mixed, undifferentiated fill
95.4.LA 106,155.00358

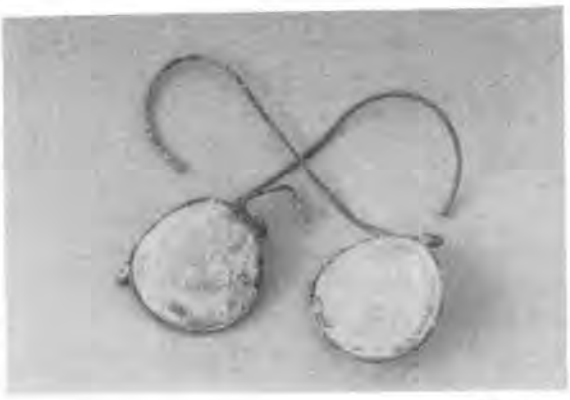


Figure 13

Description: Car part (1) (Figure 16a) Cylindrical electrical part with clamp for bolting. Interior has copper wiring and pleated rectangular center, probable ignition coil.

Provenience: BHT 80 Mixed
95.4.LA 106,155.00443

Description: Spark plug (1) (Figures 14 and 16b) Whole, rusted and eroded. Orange print on porcelain "J-8/MADE IN U.S.A/ CHAMPION/REG. U.S. PAT. OFF."

Company/Brand: Champion Spark plug.

Provenience: Surface/mixed. undifferentiated fill.
95.4.LA 106,155.00067

Figure 14

Description: Metal can top with pour spout (Figure 16e or f). Similar to modern "brake fluid" cans. Pour spout would take a snap-on lid. Diameter of pour spout ¾ in. Diameter of base of pour spout 2¾ in. Severely corroded. Possible beer can, soft-drink, or oil can.

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00112

Description: Metal gas cap fragment (1) (Figure 16c)

Provenience: BHT 120 Mixed
95.4.LA 106,155.00235

Figure 15

Description: Electrical plugs (1) (Figure 15) Thick insulated cable extending out from male and female black plastic fittings. Probably separable attachment plugs (cap and base).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00228

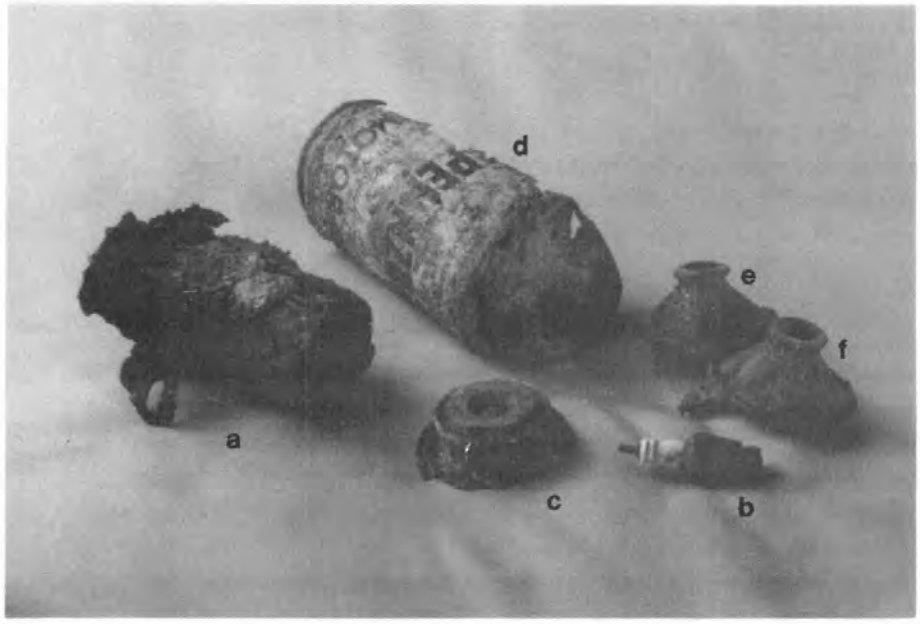


Figure 16

Description: Pennzoil motor-oil can fragment (1) (Figure 16d). Key opened. Painted red and yellow label reads "SAFE LUBRICATION/ PENNZOIL/THE TOUGH-FILM/MOTOR OIL/GUARANTEED ... CONTAIN ... S .../... 83 ... 1A ... QUART/... MADE ..." Quart size.

Company/Brand: Pennzoil dates 1933 to present (Periodical Publishers Assoc. 1934:67 and Can Manuf. Institute nd:22-39 referenced in Hull-Walski and Ayres 1989:204).

Provenience: BHT 80 Mixed
95.4.LA 106,155.00551

Figure 17

Description: 120 volt incandescent light bulb (1) (Figure 17). Whole, General Electric "MAZDA/60W/120V."

Company: General Electric dates since 1909 (Periodical Publishers Association 1934:36 referenced in Hull-Walski & Ayres 1989:204).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00021

Description: Vacuum tube (1) (Figure 18a)
Glass with black (hard plastic). Embossed body K3E/RCA/U.S.A./VT-244. Base embossed: "LICENSED ONLY TO EXTENT/INDICATED ON CARTON" Measures 5¼ in. long by 1 14/16 in. wide.

Company: Radio Corporation of America.

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00063

Description: Vacuum tube (1) (Figure 18b)
Whole with prongs. Glass body with black plastic base. Metal prong on bottom.

Provenience: BHT 120/140 Surface/mixed
95.4.LA 106,155.00300

Figure 18

Description: Military issue collar/lapel button (1) (Figure 19a). Brass with slide-on clip on back side. Front side has raised lettering reading "U.S."

Provenience: BHT 120 (0-25)
95.4.LA 106,155.00506

Description: Military issue insignias (49) (Figure 19b). Front reads "COAST ARTY," back reads "STERLING." Top and bottom have extended holed prongs. Jump rings are attached to top holes. Rectangular body measures 1 by 3/16 in. These insignias could belong to the New Mexico National Guard unit that lost so many men at Bataan Peninsula, Philippines in December and January 1941-1942. Insignias were probably discarded en masse when the unit was deactivated/redesignated.

Provenience: BHT 50 (0-25)
95.4.LA 106,155.00652

Figure 19

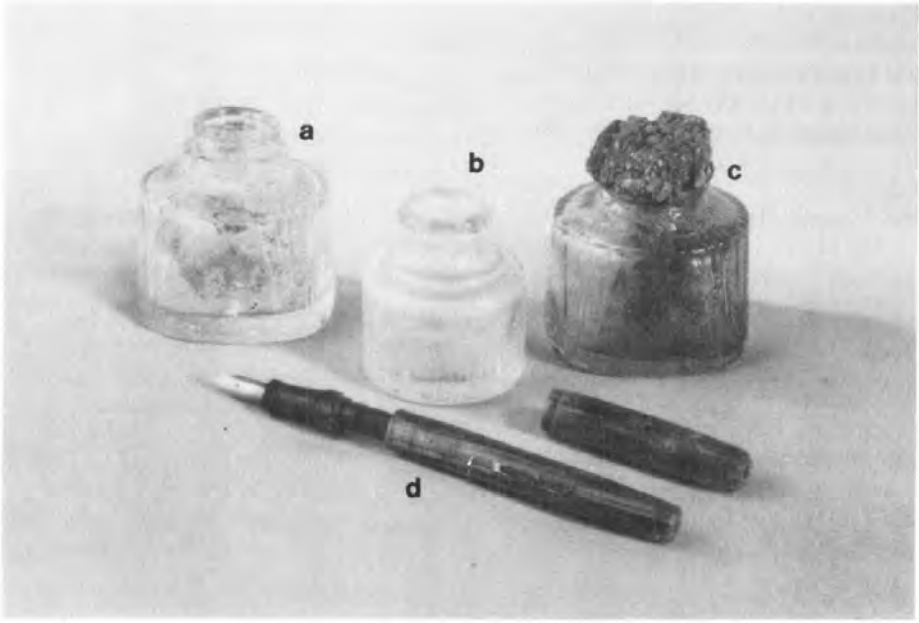


Figure 20

Description: Ink bottle (1) (Figure 20a)
Whole, clear glass bottle with continuous tread finish. Vertical lines decorate shoulders and corners. Height 2¼ in., base 2³⁄16 by 2³⁄16 in. Size 2 oz.
Base embossed: **PARKER***
MADE IN U.S.A.
2 OZ
59CC

*Company: Parker unidentified (Hull-Walski and Ayres 1989:114).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00306

Description: Toiletry or medicine bottle (1)
Whole, clear glass wide-mouthed jar with continuous treaded finish. Measures 2⁴⁄16 by 2⁴⁄16 by 1¾ in. Base is rectangular with flat chamfers. Contents possible paste medicine.

Base embossed: **2**-

Provenience: South end of trench, deepest level
95.4.LA 106,155.00014

Description: Ink bottle (1) (Figures 20c and 21)
Whole, clear glass bottle with corroded metal screw cap. Decorative vertical lines along shoulder and sides. Measurement with cap 2 6/16 in. high. 2 2/16. Base profile is almost a rounded square.

Base embossed: **PARKER**
MADE IN U.S.A.
2 OZ
59CC
3

Figure 21

Company: Parker Ink unidentified (Hull-Walski and Ayres 1989:114).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00054

Description: Ink bottle (1) (Figure 20b)
Whole, clear glass bottle with bead finish and a cylindrical shaped body. Measures 1 13/16 in. high and 1 11/16 in. wide.

Round base embossed: **KEUFFEL**
& ESSER CO NY
2 * 4

*Owen-Illinois Glass Co. maker's mark. Numeral 2 indicates Plant No. 2, Huntington, West Virginia. Numeral "4" represents the year 1934 or 1944 or 1954. Numeral "1" equals Mold No. 1 (Toulouse 1971:403).

Company: Keuffel & Esser Co., New York is unidentified.

Provenience: BHT 120 Mixed
95.4.LA 106,155.00310

Description: Fountain pen (1) (Figures 20d and 22)
Whole, plastic swirl brown and gold-tone body and cap. Gold-plated tip embossed "WATERMANS/IDEAL/14-KT." Ink bladder inside rubber.

Company/Brand: Watermans, student style.

Provenience: Next to well 10A–ca. 100 ft southwest of lot bordered by Dyer, Picatinny, and Wingate
95.4.LA 106,155.00033

Figure 22

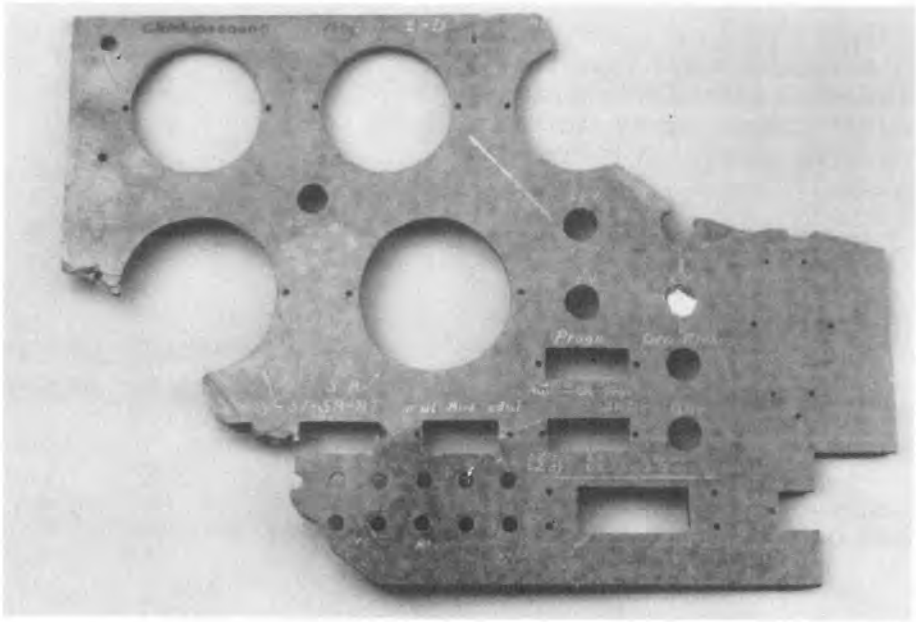


Figure 23

Description: Radio/Control panel (2 pieces fit) (Figure 23). Appears homemade out of composite or fiber board. Notations on board are written in German.

Provenience: Surface/mixed, undifferentiated fill
95.4.LA 106,155.00461

Description: Tablespoon (1) (Figures 24a and 25c)

U.S. Government issue. Hole in handle indicates this spoon issued for use with mess kit. Measures 7 7/16 in. long.

Provenience: BHT 120 Mixed
95.4.LA 106,155.00334

Description: Mess kit fork (2 fragments fit) (Figures 24b and 25d). Fork missing portion of teeth. Handle has oval opening for hanging and is embossed "U.S. Government issued. "Approximate length 7½ in. long by 1 in. wide. Burned.

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00075

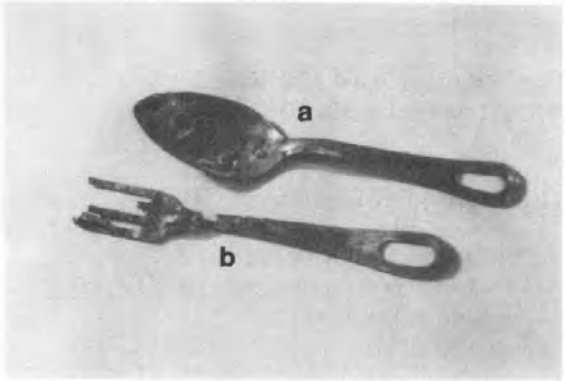


Figure 24

Figure 25

Description: Canteen (1) (Figure 25a)
Burned and corroded metal. Continuous treads on top for screw type cap. Measures 7¼ in. high. Base is 4 by 2 in.

Provenience: BHT 140 (25-50 cm)
95.4.LA 106,155.00594

Description: Mess kit (3 pieces) (Figure 25b), possibly tin-plated pan with cover and handle.

Provenience: South end of trench, deepest level
95.4.LA 106,155.00027

Description: Bottle (1) (Figure 28a)
Whole clear glass bottle with crown top finish. Measures 7 6/16 in. high by 2 14/16 in. wide. Shoulder and neck decorated with vertical section lines. Possible contents vinegar.

Round base embossed: **1301**
*
8

*Symbol from Tygart Valley Glass Co., circa 1940 to 1960 (Toulouse 1971:500).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00012

Figure 26

Description: Pepper sauce bottle (1) (Figures 26 and 28e). Contents: Food Whole clear glass cylindrical tapered bottle with black plastic screw cap. Body sectioned with vertical lines. Embossed "EVANGELINE PEPPER SAUCE/MADE IN/ST. MARTINVILLE, LA. USA." Measures 5¼ in. high and 1 11/16 in. wide. d

Round base embossed: **3 RIVERS***
27
6

*Symbol from Three Rivers Glass Co. dates 1925 to 1937 (Toulouse 1971:494). The numeral "27" may represent the year 1927.

Company/Brand: Evangeline Pepper Sauce, St. Martinville, Louisiana.

Provenience: South end of trench, deepest level
95.4.LA 106,155.00013

Description: Salt shaker (1) (Figures 27 and 28d) Whole, clear glass bottle with rusted metal cap. Measures 3 2/16 in. high by 1 9/16 in. wide. Decorative square panels.

Embossed: *
6 491

*"H-over-A" monogram symbol from Hazel-Atlas Glass Co. dates 1920-1964 (Toulouse 1971:239).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00019

Figure 27

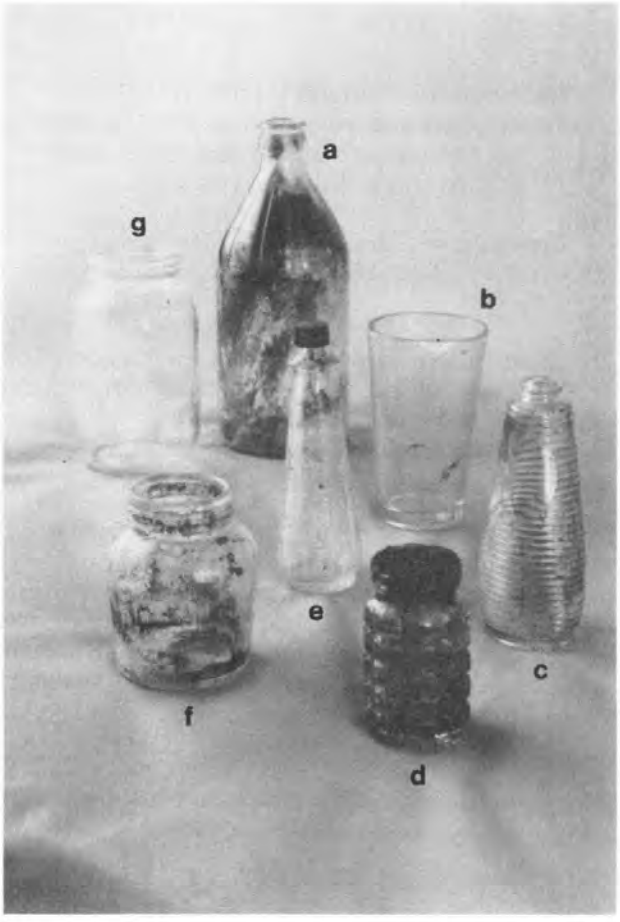


Figure 28

Description: Mustard jar (1) (Figures 28f and 29) Whole, clear glass. Continuous tread finish. Pleated decorative body. Round base.

Base embossed: **L***
DESIGN
PATD
2

*Manufacturer's mark (L) from W. J. Latchford Glass Co., Los Angeles, California. Possibly 1925 to 1938; definitely 1957 to date (Toulouse 1971:314).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00399

Figure 29

Description: Condiment bottle (1) (Figures 28c and 30) Whole, clear glass oval-shaped bottle with continuous treaded finish. Measures 4¾ by 1⁶⁄16 by 1⁵⁄16 in. Body has concentric horizontal rings with clear space for applied label. Eye-shaped base.

Base embossed: **6**

Provenience: South end of trench, deepest level
95.4.LA 106,155.00015

Description: Wide-mouthed jar (1) (Figure 28g) Contents: Possibly mayonnaise. Clear glass, whole jar with continuous treaded finish. Measures 4⁴⁄16 in. high and 2¾ in. wide. Capacity approximately 8-9 oz.

Round base embossed: **6742**
*
F 14

*"H-over-A" monogram symbol from Hazel-Atlas Glass Co. dates 1920-1964 (Toulouse 1971:403).

Figure 30

Provenience: South end of trench, deepest level
95.4.LA 106,155.00008

Description: Slightly melted clear glass jelly jar (1) (Figures 28b and 31) 6.5 to 7 oz. size. Marked on base "4." Height 4⅛ in., diameter at mouth 2⅝ in., diameter at base 1¾ in.

Provenience: BHT 80 (0-25 cm)
95.4.LA 106,155.00156

Figure 31

Description: Half-pint milk bottles (3) (Figure 32a) Whole clear glass bottles. Measure 5 7/16 in. high and 2 7/16 in. wide. Bottle pictured dates 1944. One side embossed "ONE HALF PINT/ Prices/DAIRY/ CO." Opposite side reads "PHONE MAIN 2050/EL PASO, TEXAS." Same face near bottom embossed "WASH AND RETURN/SEALED BB48."

Round base embossed: **Duraglas**
P
18 * 4

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "18" indicates Plant No. 18, Columbus, Ohio, and "4" represents the year 1944. "Duraglas" dates since 1940 (Toulouse 1971:395, 403).

Company: Prices Dairy Co., El Paso, Texas.

Provenience: South end of trench, deepest level
95.4.LA 106,155.00003

Figure 32

Description: One-quart milk bottle (2) (Figure 32b) Whole clear bottles. Measure 9 9/16 in. high and 3¾ in. wide. Bottle pictured marked near base "ONE QUART LIQUID/REG. CAL." Opposite side:

Embossed in Triangle: **7**
MINN.
SEALED 52 L-G/B-74-45.

"L-G," which dates 1946 to 1954, is manufacturer's symbol from Liberty Glass Co. (Toulouse 1971:321).

Round base embossed: **B**
30
C44

Provenience: South end of trench, deepest level
95.4.LA 106,155.00004

Figure 33

Description: Fork (1) (Figure 33e)
Whole corroded metal fork. Handle reads "U.S. government issued" at one end and "SILCO" on bottom. Measures 7¼ in. long and 1 in. wide.

Company/Brand: "SILCO," unidentified.

Provenience: BHT 80 Mixed
95.4.LA 106,155.00527

Description: Stainless steel spoons (2) (Figure 33d)
Whole, corroded. Handle has "U.S. government issued." Measures 8¼ in. long. Bottom handle reads (a) "SILCO"

Company: Silco unidentified.

Provenience: Surface/Mixed, undifferentiated fill
95.4.LA 106,155.00360

Description: Stainless-steel spoon (1)
Corroded, whole spoon. Measures 8¼ in. long and 1¾ in. wide. Handle reads "U.S. government issued" at one end and "SILCO Stainless" on bottom.

Company/Brand:"SILCO," unidentified.

Provenience: BHT 80 Mixed
95.4.LA 106,155.00526

Description: Spoon (1)
Plated copper, serving size. Handle bent at 90 degree angle to spoon. "US" stamped at end of handle (government issued). Spoon end is 3 by 1¾ in. and handle is 5¾ in.

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00098

Description: Mug (1) (Figure 33a)
White stoneware, fragment. Measures 3 9/16 by 2 3/16 in. Probable coffee mug, no handle style. Round base is stamped with blue maker's mark:

McNICOL CHINA
U.S.Q.M.C
W43IQM-3266 (0.1.7...)
JULY 15, 1940

Manufacturer's mark belonging to the D. E. McNicol Pottery Co. dates 1930-1954 (Kovel and Kovel 1986:145). This item dates July 15, 1940.

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00065

Description: Stoneware coffee mug (1) (Figure 33c). No handle. Slight crack and chip from rim downward. Measures 3½ in. high by 3¾ in. wide. Base width is 2¾ in. Maker's mark stamped in green reads "CARR CHINA CO./GRAFTON/W. VA./46.

Manufacturer: Carr China Co., Grafton, West Virginia dates 1916 to 1952 (Lehner 1988:82).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00024

Description: White stoneware bowl (1)
(Figure 33b). Soup or cereal bowl, intact. Base marked "MCNICOL China", "U.S.Q.M.C.", W-431-QM-4812 (O.T. 6063), April 24, 1941. Height 2⅝ in., diameter 5 in.

Manufacturer's mark belongs to the D.E. McNicol Pottery Co. dates 1930 to 1954 (Kovel and Kovel 1986:145). This item dates April 24, 1941.

Provenience: BHT 25 mixed
95.4.LA 106,155.00150

Description: Bottle (1) (Figure 34b)
Whole, clear bottle. Long, bulged neck with vertical decorative lines. Continuous treaded finish. Measures 7 14/16 by 2¾ by 2 2/16 in. Base is rectangular with rounded corners. Probable hair tonic bottle.

Base embossed:

2 *1
LOANED BY
MADE IN USA
AR WINARICK. INC
3

*Owen-Illinois Glass Co.
Manufacturer's symbol. Numeral "2" indicates Plant No. 2, Huntington, West Virginia. Numeral "1" represents the year 1931 or 1941 or 1951 (Toulouse 1971:395, 403).

Company: "Loaned AR WINARICK, Inc." Product unknown, advertised 1929-30 by AR Winarick, 799 E. 140th St., New York City (Fike 1987:186).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00011

Description: Toiletry bottle (1) (Figure 34a)
Clear glass whole bottle with continuous tread finish. Possibly hair-care product, narrow aperture in top as if for shaking liquid contents out. Measures 6 3/16 in. high by 2⅜ in. wide by 1¼ in. thick. Base profile is irregular polygon.

Figure 34

Base embossed: **USA**
2 * 5

*Owen-Illinois Glass Co. manufacturer's symbol. The numeral "2" indicates Plant No. 2, Huntington, West Virginia. The numeral "5" represents the year 1935 or 1945 (Toulouse 1971:395, 403).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00326

Description: "Vitalis" bottles (2) (Figures 34f and 35) Whole clear glass bottles with continuous tread finish and small bore. Vitalis brand symbol (v inside oval) on shoulder. Measures 5 1/16 in. high by 2 1/2 by 2 6/16 in. wide. Rectangular base with flat chamfer corners. Contents: Hair tonic.

Base embossed: **2 * 6**
8

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "2" indicates Plant No. 2, Huntington, West Virginia. The numeral "6" represents the year 1936 or 1946. The numeral "8" represents Mold 8 (Toulouse 1971:395, 403).

Company: Bristol Myers Co. dates 1883 to ? (Brand Names Foundation 1947:np., referenced in Hull-Walski and Ayres 1989:109).

Provenience: Surface/mixed. Undifferentiated fill.
95.4.LA 106,155.00042

Figure 35

Description: Fitch's bottle (1) (Figures 34e and 36) Part of label still attached. Reads "FITCH'S/REG U.S. PAT. OFF/(unreadable)/ ROSE HAIR OIL." Base reads "FITCH." Trace of red fluid still inside, metal screw cap still on. Clear glass.

Company: F. W. Fitch Co. Dates 1892 to ? (Brand Name Foundation 1947:np, referenced in Hull-Walski and Ayres 1989:110). Company sold ca. 1955 (Fike 1987:59).

Provenience: BHT 50 Surface/Mixed
95.4.LA 106,155.00388

Figure 36

Description: "Fitch's" bottle (1) (Figure 34d)
Whole green glass bottle with small bore opening and continuous tread finish. Neck measures 1⅛ in. long. Bottle measures 5 15/16 in. long and 2 7/16 in. wide. Manufacturer of dandruff remover and other personal care items. Cylindrical shaped body and neck.

Round base embossed: **3*5**
Fitch's
1

*Owen-Illinois Glass Co. manufacturer's symbol. The numeral "3" indicates Plant No. 3, Fairmont, West Virginia, "5" represents the year 1935 or 1945 (Toulouse 1971:403).

Company: F. W. Fitch Co. dates 1982 to ? (Brand Name Foundation 1947:np, referenced in Hull-Walski and Ayres 1989:110). Company sold ca. 1955 (Fike 1987:59).

Provenience: BHT 140 Mixed
95.4.LA 106,155.00186

Description: Bottle (1) (Figures 34c and 37)
Clear glass, slightly melted, whole bottle with continuous treaded finish. One side embossed "LUCKY TIGER/FOR/SCALP AND HAIR". Opposite side reads "LUCKY TIGER/MFG. CO/KANSAS CITY, MO." Small bore opening and plain panel. Measures 7½ by 2¼ by 1 6/16 in. Capacity about 9 oz. Contents: Hair tonic.

Rectangular base embossed: **2 N**

Manufacturer's symbol from Obear-Nester Glass Co. dates 1915 to present (Toulouse 1971:374).

Figure 37

Company: Lucky Tiger Mfg. Co., Kansas City, MO (Fike 1987:68).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00009

Description: Noxzema jar (1) (Figure 38a)
Whole cobalt blue wide-mouthed glassed jar, slightly melted. Continuous tread finish. Measures 2 3/16 in. high and 2¾ in. wide.

Round base embossed: **Noxzema**

Company: Noxell Co., Noxzema, an all-purpose skin cream, was nationally distributed in 1938 by the Noxell Co. The name Noxzema dates 1914 to present (Noxell Company representative, personal communication 1995).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00002

Description: Noxzema jar (1) (Figure 38b)
Whole, cobalt blue, glass jar. Measures 2 in. high by 2 2/16 in. wide. Continuous tread finish. Round base.

Round base embossed: **Noxzema**

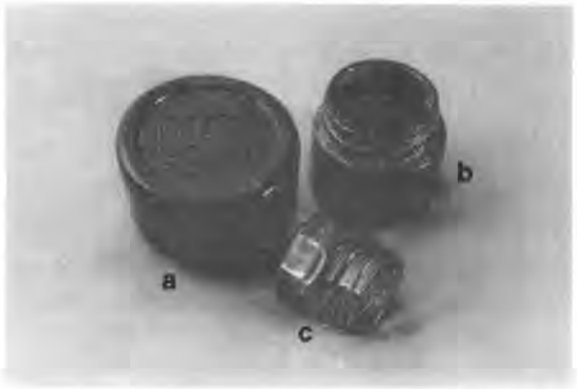


Figure 38

Company: Noxzema, an all-purpose skin cream, was nationally distributed in 1938 by the Noxell Co. The name Noxzema dates 1914 to present (Noxell Company representative, personal communication 1995).

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00085

Description: Noxzema jar (1) (Figure 38c)
Whole, transparent blue glass bottle with continuous tread finish; octagonal body, wide-bore. Measures 1 7/16 in. high by 1 1/2 in. wide.

Embossed base: **Noxzema**

Company: Noxzema, an all-purpose skin cream, was nationally distributed in 1938 by the Noxell Co. The name Noxzema dates 1914 to present (Noxell Company representative, personal communication 1995).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00039

Figure 39

Description: "BARTONS" bottle (1) (Figure 39)
Melted, whole, clear glass bottle with continuous tread finish. Wide bore 14/16 in. Cylindrical body with stepped neck. Measures 4 1/8 in. long and 1 3/4 in. wide. Same as Catalog No. 121.

Round base embossed: **BARTONS**
K
*
4
DYANSHINE

"H-over-A" monogram symbol from Hazel-Atlas Glass Co. dates 1920 to 1964 (Toulouse 1971:403).

Company: Bartons Dyanshine shoe polish liquid.

Provenience: BHT 140 Mixed
95.4.LA 106,155.00207

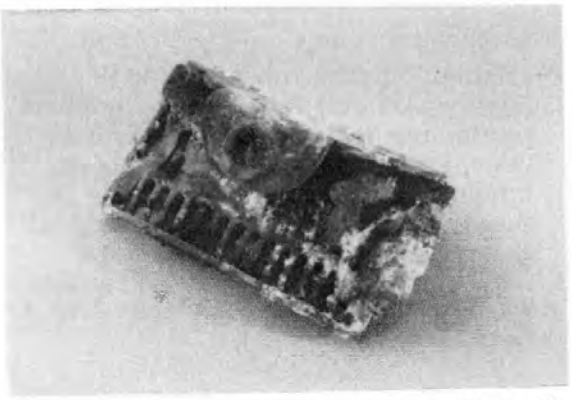


Figure 40

Description: Metal housing for cutting blade from electric hair cutter (1) (Figure 40). Severely corroded. Measures 1¾ by 1 in.

Provenience: BHT 120 mixed
95.4.LA 106,155.00137

Figure 41

Description: Razor blade type shavers (2) (Figures 41 and 42b). Whole metal razor blade type shavers. One with hard black plastic covered handle.

Provenience: BHT 120 (0-30)
95.4.LA 106,155.00263

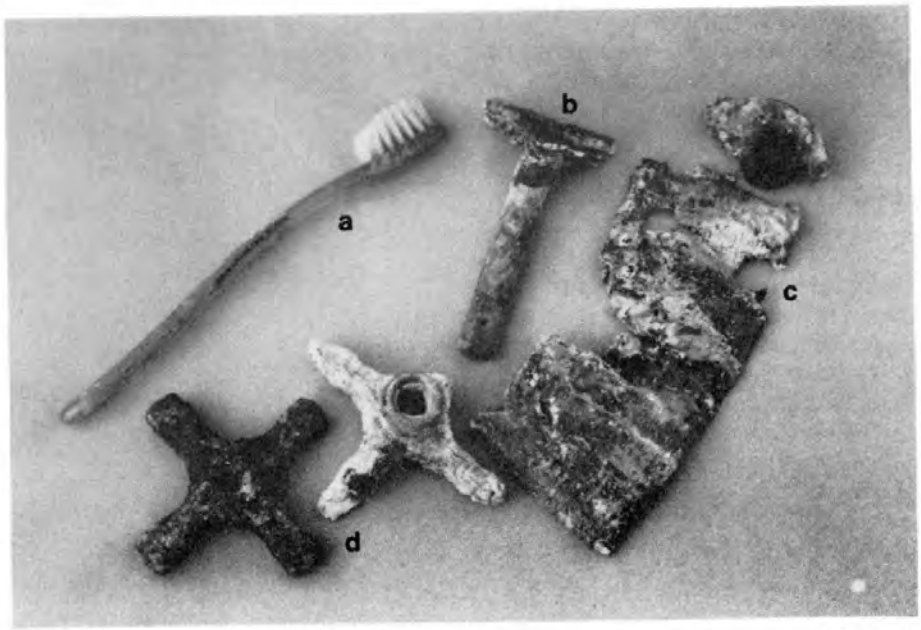


Figure 42

Description: Squeeze tube with cap (2 pieces) (Figures 42c and 43). Burned aluminum. One portion has a screw-on cap, the other is the body portion of tube with some of the label intact. Length of body portion 5 in., width 2 ¼ in. Painted label reads "Beard/ Softener/P?arbasso/... No Lather/ ...o Rub-1..." "... Boric?/... and Lanolis/ Barbaso Company/Indianapolis, USA,/ Net. Wt. 4.9 oz."

Company: Barbasol dates at least 1923-1934 (Periodical Publishers Assoc. 1934:14, referenced in Hull-Walski and Ayres 1989:171).

Provenience: BHT 140 (25-50 cm)
95.4.LA 106,155.00579

Figure 43

Description: Toothbrush (1) (Figure 42a) Whole, transparent yellow plastic toothbrush. Warped by heat. Handle reads "Johnson and Johnson/tek/Nylon N."

Company: Johnson and Johnson dates 1887 to present (Periodical Publishers Assoc. 1934:53, referenced in Hull-Walski and Ayres 1989:203).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00410

Description: 4-arm style sink handles (2) (Figure 42d). Severely corroded metal, chrome plating visible in one handle with two missing arms, other is intact. Each 7.2 cm.

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00095

Description: Miniature glass jug (1) (Figure 44) Whole. Brown and white paint. Design similar to Albany slip and Bristol paint (Ketchum 1991:136). Round base embossed "2-2." A container for aftershave lotion.

Provenience: BHT 120 Mixed
95.4.LA 106,155.00336

Figure 44

Description: Medicine bottle (1) (Figures 45a and 46h). Partial label reads Date "1947." Whole clear glass bottle with sterile seal. Measures 2 5/16 in. high by 1 1/2 in. wide.

Round base embossed:

NEUTRAGLAS
N-51A
*
U.S.A.
10

*Manufacturer's symbol (K inside irregular pentagon) belongs to the Kimble Glass Co. Circa 1947. Neutraglas trademark dates since 1941 (Toulouse 1971:292). This bottle dates 1947.

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00088

Figure 45

Description: Medicine bottle (1) (Figures 45b and 46g). Whole, clear glass sterile-sealed bottle with cylindrical body. Measures 2 5/16 in. high and 1 3/16 in. wide. Round base.

Round base embossed: ***TCWCO**
2
USA

*Maker's mark from T. C. Wheaton Co., Millville, New Jersey, dates since 1888 (Toulouse 1971:492).

Provenience: Surface/Mixed, undifferentiated fill
95.4.LA 106,155.00353

Description: Medicine bottle (1) (Figure 46c) Whole clear glass marked "Sani-Glas." Symbol ("t" inside circle) embossed near base. Marked 2 gram on shoulder. Measures 4 in. High by 1 1/4 in. wide.

Company/Brand: Sani-Glas symbol unidentified.

Provenience: BHT 23 mixed
95.4.LA 106,155.00118

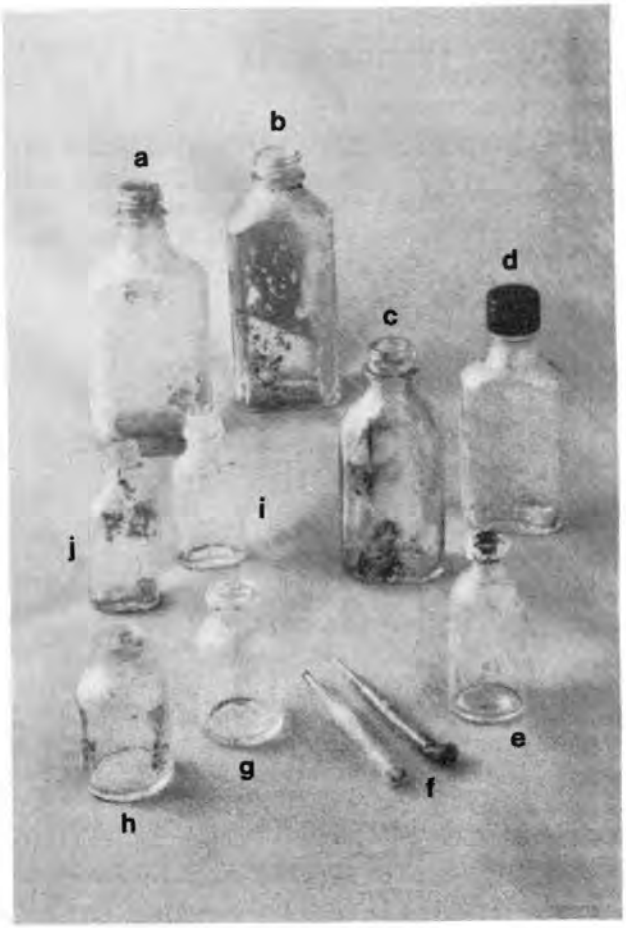


Figure 46

Description: Medicine bottle (1) (Figure 46d) Whole clear glass bottle with black plastic screw-on cap. Side marked with 2 dram symbol and "Duraglas." Bottom marked "OWENS" and "19 * 5." Height with cap 4¼ in., base measures 1⅝ by 1⅛ in.

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "19" ? Numeral "5" represents the year 1945. Duraglas dates since 1940 (Toulouse 1971:395, 403).

Provenience: BHT 25 mixed
95.4.LA 106,155.00154

Figure 47

Description: Medicine bottle (1) (Figures 46e and 47) Sterile-sealed bottle with partial corroded metal cap. Clear glass, whole bottle. Measures 2¾ high by 1 2/16 in. wide. Round base embossed with numeral "4."

Provenience: BHT 140 Mixed
95.4.LA 106,155.00194

Description: Medicine bottle (1) (Figures 46j and 48a) Whole clear glass bottle. Neck with threads for screw on cap and two rings. One side marked with ½-dram symbol. Measures 2⅞ in. high by 1⅛ in. wide.

Provenience: BHT 23 mixed
95.4.LA 106,155.00125

Description: Medicine bottle (1) (Figure 46i and 48b) Whole, clear glass ½-dram size bottle with continuous tread finish. Measures 2 13/16 in. high by 1⅛ in. wide by ¾ in. thick. Base is variation of "Beveled Ideal."

Base embossed: **OWENS**
18 * ?

*Owen-Illinois Glass Co. manufacturer's symbol. Bottle dates 1929 to 1946 (Toulouse 1971:395,403).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00332

Figure 48

Description: Medicine bottle (1) (Figure 46b)
Whole, clear glass bottle with continuous tread finish. Embossed four fluid dram symbol on shoulder. Graduated drams on left side and graduated "cc" on right side. Base is rectangular with chamfer corners. Height 5 in., base 2 by 1 6/16 in.

Base embossed: **7 * 904**

*Manufacturer's mark (F-like) unidentified (Hull-Walski and Ayers 1989:107).

Provenience: BHT 120/140 Surface/mixed
95.4.LA 106,155.00294

Description: Medicine bottle (1) (Figure 46a)
Whole, clear glass bottle. Neck has threads for screw on cap and one ring. One side marked with 4 dram symbol and "Duraglas." Round base marked "OWENS 12 * 2. Height 5 in., width 2 1/8 in.

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "2" represents the year 1942 or 1952 (Toulouse 1971:395, 403).

Provenience: BHT 120 mixed
95.4.LA 106,155.00133

Description: Medicine bottle (1) (Figure 49a)
Whole, green glass bottle with metal screw cap. Shoulders embossed "SQUIBB." Height with cap 4 14/16 in.; base measures 2 10/16 by 1 14/16 in. Rectangular base with flat chamfers.

Base embossed: **DESIGN PAT 87481**
4 * 4
8
BOTTLE MADE IN USA

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "4" indicates Plant No. 4, Clarksburg, West Virginia. The numeral "4" represents the year 1934 or 1944. The numeral "8" represents Mold 8 (Toulouse 1971:395, 403).

Company: E. R. Squibb, New York, Pharmaceutical Laboratory, was established in 1857 (Fike 1987:182).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00043

Figure 49

Description: Bottle (1) (Figure 49c)
Whole, transparent blue glass bottle with treaded lug finish. Measures 4 1/6 in. high by 1 10/16 in. wide. Embossment near base reads "BROMO-SELTZER/EMERSON DRUG CO." Round base embossed with M in circle* and "6."

*Manufacturer's symbol from Maryland Glass Corp., dates after 1916 (Fike 1987:111; Toulouse 1971:339).

Company: Bromo-Seltzer, Emerson Drug Co., Baltimore, MD. Isaac E. Emerson compounded and trademarked Bromo Seltzer in 1889 (Fike 1987:111).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00040

Description: Bottle (1) (Figure 49b)
Clear glass. Neck has threads for screw-on cap and one ring. Body marked "LISTERINE" "LAMBERT PHARMACAL CO." Base is textured and marked 7 * 5. Height 4¼ in. Diameter at base 1⅝ in.

*Owen-Illinois Glass Co. manufacturer's trademark. The numeral "7" indicates Plant No. 7, Alton, Illinois. The numeral "5" represents the year 1935 or 1945 (Toulouse 1971:395, 403).

Company: Lambert Pharmacal Co. was founded in St. Louis, in 1878. The product was named after Sir Joseph Lister, who popularized the use of antiseptics in 1865 (Fike 1987:67).

Provenience: BHT 120 mixed
95.4.LA 106,155.00134

Description: Vicks nasal decongestant (1) (Figure 49d). Eroded aluminum two-piece cylindrical shaped container with round top and flat base. Very faint embossment on base reads "Vicks."

Company: Vick Chemical Co. dates ca. 1894-? (Periodical Publishers Assoc. 1934:88 and Brand Names Foundation 1947:np, referenced in Hull-Walski and Ayres 1989:116).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00081

Description: Stoneware coffee mug (1)
(Figure 50 and 51). Whole, white glazed mug with handle, measures 3 11/16 in. high by 3 2/16 in. wide. Circle stamped in red on exterior near rim reads "UNITED STATES ARMY MEDICAL DEPARTMENT," Heralder's staff (winged) with entwined serpents. Round base is stamped with green maker's mark: circular green leaves above "TAYLOR/ SMITH/ TAYLOR/USA." Numerals under symbol 4438?

Manufacturer: Taylor, Smith and Taylor, ca. 1935-1981 (Kovel and Kovel 1988:75).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00023

Figure 50

Description: Dentist's pick (Figure 52)
Covered with corrosion, but tool itself is fairly intact. Length 6 in.

Provenience: BHT 80 (0-25 cm)
95.4.LA 106,155.00160

Description: Glass droppers (4) (Figure 46f)
Clear glass droppers (2 whole, 2 fragments). Whole pieces measure 3 in. long and 6/16 in. wide. Fragments represent a thinner type dropper.

Provenience: BHT 120 (0-30)
95.4.LA 106,155.00260

Figure 51

Description: Horseshoe (1) (Figure 53)
Used in pitching horseshoes. Measures 7 1/2 in. long and 7 in. wide. Rusted and corroded metal.

Provenience: BHT 140 (25-50 cm)
95.4.LA 106,155.00593

Description: Pint whiskey bottles (5) (Figure 54b)
Whole glass bottles with continuous tread finish, measures 8 1/16 in. high, 2 by 3 9/16 in. wide. Near base on both sides marked "ONE PINT." Shoulder embossed "FEDERAL LAW FORBIDS SALE OR RE-USE OF THIS BOTTLE." Law passed December 1993, so date for these bottles is actually 1934-1964 (Munsey 1972:126 referenced in Hull-Walski and Ayres 1989:68). Pictured is clear glass bottle with additional numeral "11" near base.

Figure 52

Round base embossed: **64**
***D-1**
46

*Owen-Illinois Glass Co. manufacturer's symbol dates 1929-1954 (Toulouse 1971:403). Numeral "46" may represent the year 1946.

Provenience: South end of trench, deepest level
95.4.LA 106,155.00006

Figure 53

Description: One pint Whiskey bottle (1) (Figure 54a). Whole brown glass bottle with screw on black phenolic screw cap. Round cap bears "SCHENLEY". "ONE PINT" embossed on both faces. Measurement with cap 81/4 by 13/4 by 31/2 in. Shoulders "FEDERAL LAW FORBIDS SALE OR REUSE OF THIS BOTTLE". Law passed December 1933, so date for this bottle is actually 1934-1964 (Munsey 1972:126 referenced in Hull-Walski and Ayres 1989:68).

Oval base embossed: **D-9**
43-46
*****

*"H-over-A" monogram symbol for Hazel-Atlas Glass Co. dates 1920 to 1964 (Toulouse 1971:239). The numeral "46" may represent 1946.

Company/Brand: "Schenley" unidentified.

Little pieces of applied black and red on white label still adhering to front panel. Fragment reads:

"...REE F...S"
"...WHISKEY C..."
"...ED..."
"RE"

Above shoulder piece of label reads "...DIVISION...."

Provenience: Next to well 10A–ca. 100-ft southwest of lot bordered by Dyer, Picatinny, and Wingate
95.4.LA 106,155.00036

Figure 54

Description: Soft-drink bottle (1) (Figures 56 and 59d). Whole, clear bottle. Painted label reads:

DRINK
Barq's
TRADEMARK
IT'S GOOD

Barq brand dates 1939 to present (Arizona Directory Co. 1939:336 and 1947:601 in Hull-Walski and Ayres 1989:98).

Round base embossed: **BARQS BTLG. CO**
Ball*
83-12
1 _
EL PASO TEX

*"Ball" in script style is from Ball Bros. and was used by the turn of the century. Ball changed back and forth, so that no exact dating can be given. Manufacturer dates 1888 to present (Toulouse 1971:66).

Figure 56

Company: Barqs Bottling Co., El Paso, Texas.

Provenience: BHT 50 Surface/Mixed
95.4.LA 106,155.00370

Description: "Yucca Brand" 7 oz. Bottle (1) (Figure 57 and 59b). Whole, clear, crown-top finish. Both sides embossed with picture of yucca and shoulders embossed "YUCCA BRAND." One side near base reads "COCA-COLA BOTTLE CO." Other side near base reads "LAS CRUCES N.M." Measures 8¾ in. high and 2 5/16 in. wide. Round base.

Round base embossed: **7 FL. OZ**
***©**
4

*Chattanooga Glass Co., since 1927 (Toulouse 1971:108).

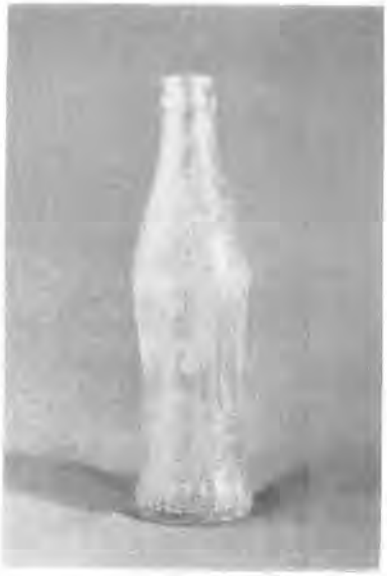


Figure 57

Company: Las Cruces Coca-Cola Bottling Co., Las Cruces, New Mexico, established in 1917 (Munsey 1972:63, 305).

Provenience: BHT 120 Mixed
95.4.LA 106,155.00398

Description: 7 oz. 7-Up bottle (1) (Figures 58 and 59a) Whole green glass bottle with crown-top finish. Painted white label on neck on both sides "7 Up." Front body, white and orange label "7 UP/REG. U.S. PAT. OFF." and women with swim suit raising up hands toward bubbles. back body, "THE Fresh Up" DRINK/CONTAINS CARBONATED WATER,/SUGAR, CITRIC ACID, LITHIA AND/SODA CITRATES, FLAVOR DERIVED/FROM LEMON AND LIME OILS./YOU LIKE IT/IT LIKES YOU/CONTENTS 7 FL. OZS./THIS TRADE MARKED BOTTLE MUST NOT/BE USED FOR ANY OTHER DRINK./7-UP BOTTLING CO. OF EL PASO/EL PASO, TEXAS. Measures 8 in. high by 2¼ in. wide.

Round base embossed: **G-94 Duraglas 3 * 46 20**

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "3" indicates Plant No. 3, Fairmont, West Virginia. The numeral "46" represents the year 1946. The numeral "20" equals mold number. Duraglas dates since 1940 (Toulouse 1971:395, 403).

Company: Howdy Co. dates 1920 to present (Woodruff and Phillips 1974:38).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00038

Figure 58

Description: 6 oz. Coca-Cola bottles (4) (Figure 59c) Natural glass, crown-top finish. Measures 7 3/4 in. high by 2 3/8 in. wide. One side embossed "Coca-Cola/TRADE-MARK REGISTERED/MIN CONTENTS 6-FL. OZS." Other side embossed "Coca-Cola/TRADE-MARK REGISTERED/ BOTTLE PAT. D-105529." This type of contour bottle dates 1937 to 1948 (Munsey 1972:63).

Whole bottle pictured. Embossment near base "L-46"*. *Possible manufacturer's symbol from W. J. Latchford Glass Co. (Toulouse 1971:314). The numeral "46" represents the year 1946.

Round base embossed: **EL PASO TEXAS**

Company: Magnolia Coca-Cola Bottling Co., El Paso, Texas, established in 1911 (Munsey 1972:309).

Figure 59

Provenience: Next to well 10A–ca. 100 ft southwest of lot bordered by Dyer, Picatinny, and Wingate
95.4.LA 106,155.00035

Description: Coca-Cola 6 oz. bottle (2)
Natural glass. Crown-top finish, whole. Measures 7 13/16 in. high by 2 5/16 in. wide. One side embossed "Coca-Cola/TRADE MARK REGISTERED/ BOTTLE PAT. D-105523." Other side embossed "Coca-Cola/TRADE MARK REGISTERED/ MIN. CONTENTS 6-FL. OZS." This type of contour bottle dates 1937 to 1948 (Munsey 1972:63).

Round base fragment embossed:

LAS CRUCES
N.M.

Company: Las Cruces Coca-Cola Bottling Co., Las Cruces, New Mexico. Established 1917 (Munsey 1972:305).

Provenience: BHT 120/140 mixed
95.4.LA 106,155.00086

Description: Metal bottle cap (1)
Severely corroded metal crown-top cap.

Provenience: BHT 120 (0-30)
95.4.LA 106,155.00261

Figure 60

Description: 12 fl. oz. beer can (1) (Figures 60b and 61). Crushed and rusted, church-key opened. Side reads "TRADEMARK AM. CAN. CO/ KEGLINED/PATS 2064537/9259498-2178618." Top reads "DISREGARD/ STATEMENT WITH/...W...FRE.../INTERNAL REVENUE/FOR EXPORTATION/ INTERNAL REVENUE/TAX PAID."

Manufacturer: American Can Co. bearing the "Keglined" vinylite trademark of "Flat top" (today's universal shape) dates since 1935 (Wright 1976:3).

Provenience: South end of trench, deepest level
95.4.LA 106,155.00025

Figure 61

Description: Metal cans (23) (Figure 60c)
Rusted and corroded, some burned. A few are nearly complete, most are fragmented. All have crimped tops and bottoms when present. Interlocking side crimping with taps are predominant. All of the items feature one or more triangular openings in the "top" of the can made by a can tapper ("church key"). All of these cans are assumed to be beverage containers. Average height 5 in., diameter 2⅝ in.

Provenience: BHT 140 (25-50 cm)
95.4.LA 106,155.00582

Description: Beer bottles (6) (Figure 60a)
Brown glass bottles with crown-top finish. Measure 6¾ by 2½ in. Shoulder embossed one side "NO DEPOSIT NO RETURN." Shoulder opposite side reads "NOT TO BE REFILLED." Capacity about 9-10 oz. Pictured bottle is whole; embossed near base "CB 50."

Round base embossed: **Duraglas**
4 * 6
13

*Owen-Illinois Glass Co. manufacturer's symbol. Numeral "4" indicates Plant No. 4, Clarksburg, West Virginia, which was closed about 1946. Numeral "6" represents the year 1936 or 1946. Numeral "13" equals Mold No. 13. Duraglas dates since 1940 (Toulouse 1971:395, 403).

Provenience: Surface/mixed. Undiff. fill.
95.4.LA 106,155.00060

DISCUSSION

Temporal Research Questions

1. Is Site LA 106,155 the first landfill or one of the first landfills on WSPG? Temporal data here should differentiate between July 1945, when White Sands Proving was first commissioned, and later occupation or use.

Temporally dated artifacts from the dump at Site LA 106,155 begin in 1939 with a Coca-Cola bottle, and end with a medicine bottle in 1947 (Table 1). The most numerous dated artifacts represent 1940, 1944, 1945, and 1946, with their distribution by year listed in Figure 62. It is obvious that the last use of the dump was in 1947, with the disposal of a medicine vial, which is probably an artifact that would not, even 50 years ago, be reused or recycled. It is necessary to look at the rest of the dated artifacts in the assemblage to get a better idea of when the dump was actually used and whether it was one of the first dumps on the Post.

The earlier chronological indicators, which date from 1939 to 1943, are from items produced for the Army, such as ceramic serving ware, a handleless coffee mug, and a canteen. These items were either service items at the mess hall or personal items brought to the Post by the soldiers assigned here to help with the early test missions (i.e., personally assigned military gear carried by the soldiers). These items do not indicate an initial date for use of the dump.

The other dated items are reusable soft-drink and milk bottles from throughout southern New Mexico, west Texas, and elsewhere. The dates on these bottles give an idea of how long the bottles could be left in service and refilled and potentially how often the bottles were actually collected from the Post to be refilled and returned. As with the military items, these recycled items do not provide an initial date for use of the dump.

Better chronological indicators are one ketchup bottle, as well as bottles that contained liquor, beer, medicine, and two glass bottles that contained products that have not been identified. Bottles dated 1944 and 1945 with beer, liquor, over-the-counter medicine, and sometimes condiments are products that are typically consumed or used shortly after purchase and then disposed of and could be good indicators of the time the site was in use, therefore, they represent a limited lag time.

Lag time is the interval between when an item was manufactured and dated and when it appears in an archaeological context. There are several steps in the manufacturing process that can result in time lag, including the following: the container is made by a manufacturer, then shipped to the bottler where it was filled, there may be temporary storage before filling the container, then filling and packaging; another temporary storage period; and shipping to a distribution point, whether regular commercial distribution through the Army Exchange System or directly to WSPG. Each of these distribution processes could involve delays, especially if they require agents

Table 1. Site LA 106,155 Chronology.

Date	Artifact	Quantity	Location	Total
1939	soda bottle	1	Yuma	1
1940	soda bottle	2	El Paso	
1940	soda bottle	1	Tucson, AZ	
1940	soda bottle	1	Hot Springs, AK	
1940	ceramic bowl	2	New Castle, PA	
1940	ceramic plate	1	unknown	1
1940	ceramic bowl	1	unknown	
1940	ceramic bowl	2	unknown	10
1941	ceramic bowl	1	unknown	1
1942	soda bottle	2	Las Cruces	
1942	soda bottle	1	Marfa	3
1943	soda bottle	1	El Paso	
1943	soda bottle	1	Clovis	
1943	soda bottle	1	Austin, TX	
1943	canteen	1	unknown	4
1944	milk	1	El Paso	
1944	soda bottle	4	Las Cruces	
1944	soda bottle	3	El Paso	
1944	soda bottle	1	Dallas	
1944	soda bottle	3	Roswell	
1944	liquor bottle	1	unknown	
1944	soda bottle	1	Clovis, NM	14
1945	milk	3	El Paso	
1945	soda bottle	1	Los Angeles	
1945	soda bottle	14	Las Cruces	
1945	soda bottle	2	El Paso	
1945	liquor bottle	3	unknown	
1945	medicine?	4	unknown	
1945	ketchup	1	unknown	28
1946	soda bottle	3	El Paso	
1946	soda bottle	5	Las Cruces	
1946	beer bottle	4	unknown	
1946	possible medicine	1	unknown	
1946	wide mouth	2	unknown	
1946	Listerine	1	unknown	
1946	ceramic mug	2	Grafton, WV	18
1947	medicine bottle	1	unknown	1

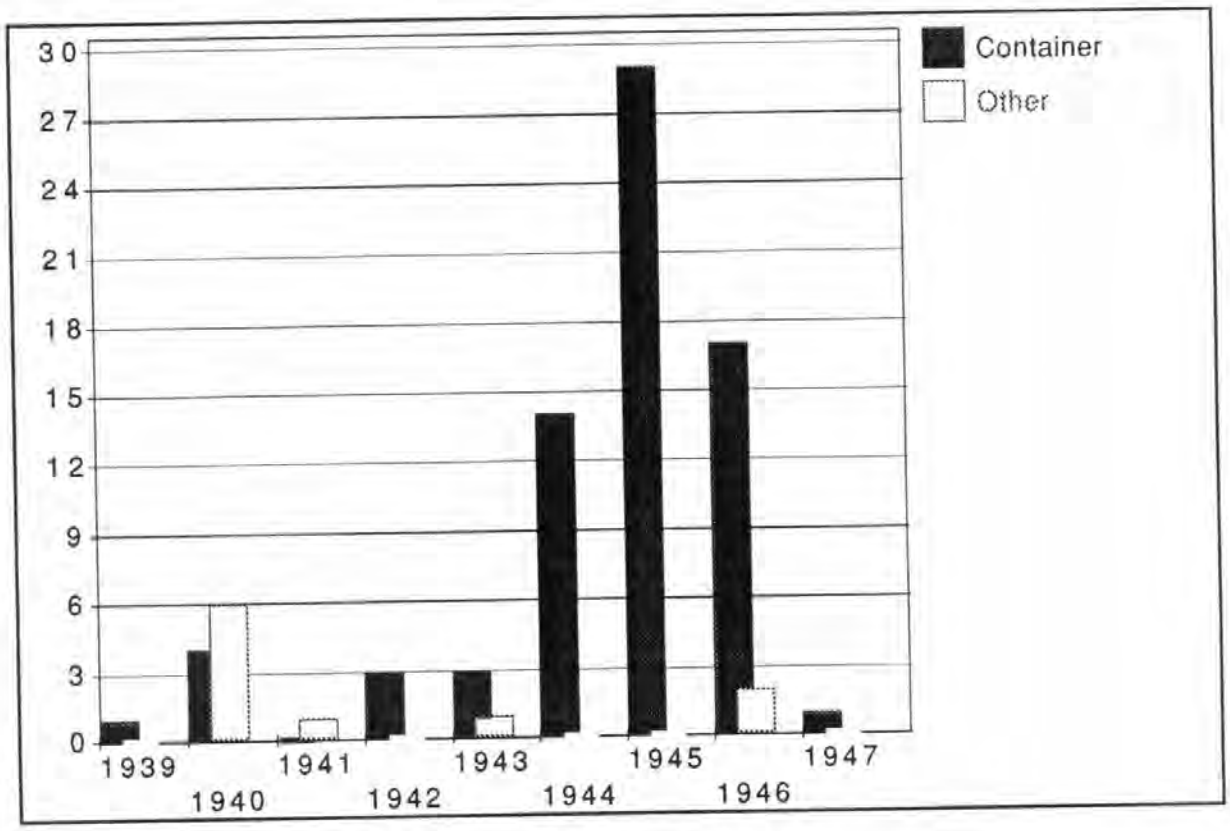


Figure 62. Temporally dated artifacts.

or brokers, as well as wholesalers. At the retailer's distribution point, the product may encounter temporary storage and time spent on the shelf This period may have taken a year or more for some products, depending on the shipping distance and the distribution channel between the manufacturer and WSPG. It is most likely that the products in the dump dated 1945 were purchased and consumed in 1946.

Another aspect of lag time is the time that the user keeps the container. Soda and milk are consumed shortly after purchase. However, while today the plastic containers that these products come in are disposed of immediately, in the 1940s and 1950s, the glass containers were recycled. Even the 1944 and 1945 dates might be recycle dates. Bromo Seltzer and hair tonic may have been kept by the user and only used occasionally, meaning the containers were possibly kept another 6 months to a year after purchase.

The best chronological indicators, therefore, are three medicine bottles, three liquor bottles, and two milk bottles dated 1945 and four beer bottles dated 1946. Taken as a group, these may narrow use of the dump to one or two years. The latest chronological indicator is a single sterile-seal medicine bottle with a manufacturer's date of 1947, a product that might have required refrigeration, similar to milk. A serum-injection medicine probably required a

more expedient distribution than common food, drink, or over-the-counter medicine products.

Despite the earlier dates, there is no evidence that the dump was used before the military began using WSPG in July of 1945. The remains are consistent with use for up to three years through 1947 or early 1948 for the part of the dump that was sampled. However, the actual duration of use is unknown. The dump might have been used for a few months prior to disposition of this final artifact or for two to three years from the earliest inception of the Post. But it is probably one of the earliest dumps on the Post.

2. Is the dump associated with the Cold War use of White Sands Proving Ground, and, if so, what period of the Cold War?

The Cold War period, in retrospect, is defined in the United States as beginning with the German surrender in Europe at the end of World War II. At White Sands Proving Ground, it begins with the development of the Post on July 9, 1945. The Post was initially developed to handle large missile-program tests over land. The first program assigned there was the V-2, which was deployed to Fort Bliss and WSPG. The missiles were developed from the remains of the German program, tested, and fired from the Army Launch Complex built in 1946 (now LC 33), and the Navy Launch Complex built in 1947 (now LC 35). The first firing of a V-2 was in 1946.

The Post itself is an artifact of the Cold War, since it was established for overland testing of missiles rescued from Germany and developed by the Paperclippers or German scientists who had been working on the program under Adolf Hitler during World War II. The history of White Sands Proving Ground outlines early U.S. Cold War activities, beginning with testing of the V-2 rocket program and deployment of some of the Paperclippers to WSPG.

The dump yielded a variety of artifact groups representing the history of WSPG (Table 2). The materials represent a glimpse into the past at one point of this history. Even the sample of the dump yielded two artifacts that could definitely be associated with the Cold War. The first is a bundle of English-language newspapers intended for a German audience. This personal item could have been sent by a German family member to a lonely scientist stationed at WSPG. Without a date on the newspaper, it is hard to answer the question of what period of the Cold War this dump was used.

Even better information is provided by an instrumentation panel with handwritten German labels for the holes where the buttons and valves extended through the panel. This item, one of the few in the dump sample that represents an analog-engineering component, is truly unique. Because little else was found in the dump in the same category as the instrumentation panel, it is possible that this item was a souvenir, something that a U.S. engineer obtained from a German scientist and thought to save for himself, until he disposed of it. Whether it was disposed of directly or kept, it still represents a specific early Cold War activity at WSPG.

No other artifacts were identified as belonging to specific missile projects, based on their instruments, gauges, etc. Many of the items found here, from unidentified tools, to test machines, etc., cannot be differentiated to represent the Cold War or specific activity. However, while much of the V-2 project was brought from Germany, the rest was experimental and potentially was being developed, such as the instrumentation at Trinity (Merlan 1997), in response to new needs as the project progressed. While pieces may have been discarded, units may also have been saved for reuse or disposal elsewhere.

Table 2. Artifact Groups Representing the History of WSPG.

Group	Examples	Total
Animal	Bones	35
Appliance	Stove damper plate	1
Army-Govt.	Stoneware dishes, mess kit, utensils, insignias	81
Automobile	Spark plugs, oil cans, gas cap, ignition coil	22
Building material	Asbestos siding, sheet metal fragments, window screen fragments, wood fragments	194
Clothing	Belt buckles, shoe sole	10
Conglomerate	Cement w/metal can fragments, melted metal and glass lumps	24
Cosmetic	Hair tonic, Noxzema lotion, toothbrush, beard softener	76
Electrical	Battery wire, junction boxes, light bulb, vacuum tubes	72
Gun	Cartridge case	1
Hardware	Chain, nails, bolts, springs	74
Household	Ashtrays	3
Kitchenware	Glass bowls, salt shakers, utensils, pot lid	35
Medical	Listerine bottles, prescription bottles, eye droppers, sterile-seal bottles	45

Table 2. Artifact Groups Representing the History of WSPG (cont.).

Group	Examples	Total
Misc. Metal	Metal fragments, metal plate	12
Newspaper	Newspaper fragments	8
Office	Ink bottles, fountain pen, film	18
Packaging	Plastic bags, paper, metal straps	44
Plumbing	Plumbing fixtures, pipes	22
Professional	Dental pick, hair-cutter parts	3
Recreational	Horseshoe	1
Samples	Chalk, coal, mica, granite	13
Special items	Control panel, round glass, wood sign	6
Tools	File, pick head	2
Unknown	Small fragments of glass, metal, paper, fiberglass	28
Total		1,379

Functional Research Questions

1. What type of dump is it? Does it represent use by the whole Post or a specific group?

Assumptions about the type of dump and its use require information about the population at White Sands Proving Ground and the functional composition of the activities conducted at the Post at the time the dump was used.

A model for the functions being performed at the Post is presented in Appendix A, representing both consumer processes and industrial processes and their disposable remains. The sample recovered from the dump is predominantly consumer packaging, which would be generated principally by any primary area or subarea model. The resulting artifact counts include consumer-package goods (such as those supplied by the PX and the USQM [over 60 percent]);

make-or-buy consumables (30 percent); and small percentages of industrial-support, capital-outlay, and common-services groups. No items representing the industrial process were identified. The high percentage of consumer-package-goods refuse would be expected to be present where there is a population in residence. Items included in this category are principally those required for survival and comfort, such as food and lotions. The high percentage of make-or-buy consumables refuse would be expected to be generated at this location as a result of construction activities during these formative years.

Lacking a fit for the remains to the model for supplying different industrial and consumer processes on the Post, a less specific way of looking at the same information is provided in Table 3 and Figure 63. In a regular dump, the function of the artifacts would be viewed in relationship to the type of site, whether it is a ranch, a mine, or other commercial or domestic site. The percentages of artifacts for the dump at WSMR provide information about the use of that dump that might not be expected for a habitation or specialized dump. The same applies to the WSPG dump. Almost half of the items in the dump relate to food preparation or service. This includes a very large number of food and beverage containers (n=549, 44.90 percent), representing in itself 40 percent of the artifacts recovered from the site. It indicates that the materials recovered from Site LA 106,155 may have come from either of two messes that

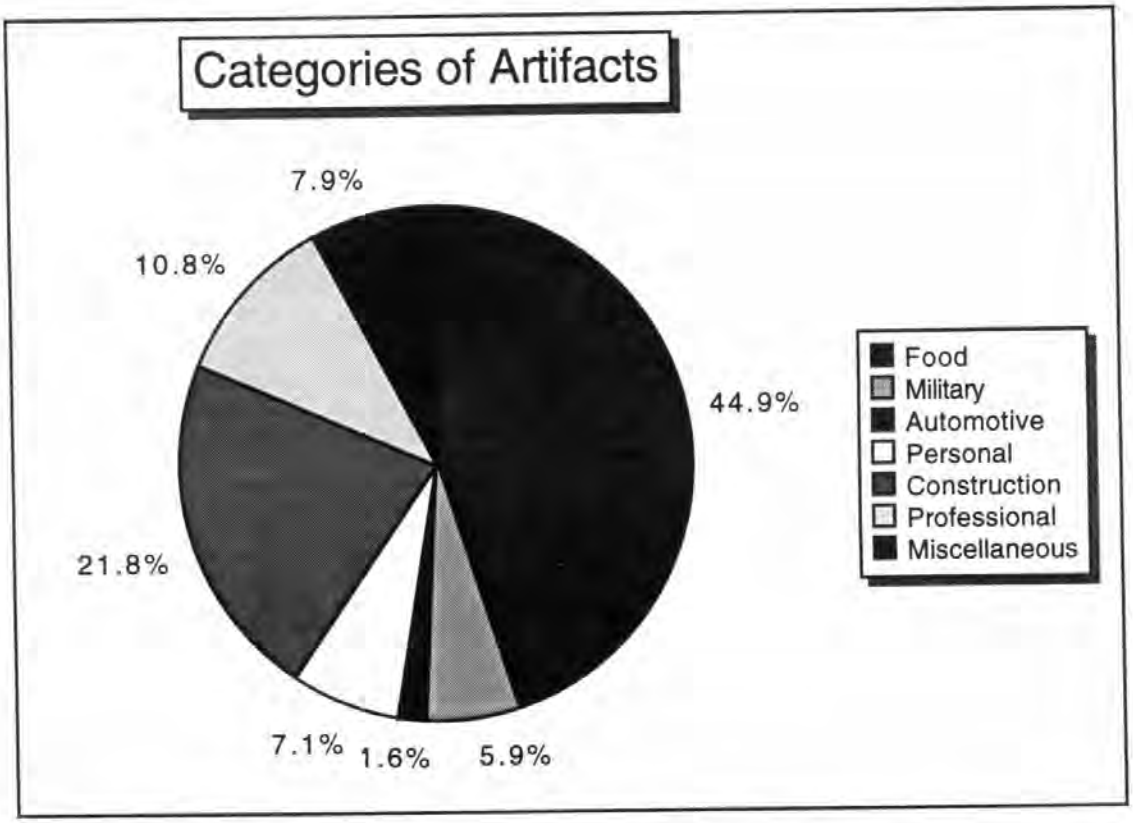


Figure 63. Functionally sorted artifacts.

existed at the time. Another 70 items respresent kitchen and bone categories. Given the remote location of WSPG, food preparation and service were important Post operations, and probably helped keep up the morale of the staff.

Table 3. Initial Categories of Artifacts from the WSMR Dump.

Functional Category	Analysis Category	Count	Subtotal
Food Preparation and Service	Animal Bone	35	
	Beverage/Food Containers	549	
	Kitchen	35	619
Military	Army Issue	81	
	Gun Part	1	82
Automotive	Military or Personal	22	22
Personal	Clothing	10	
	Cosmetic	76	
	Household	3	
	Newspaper	8	
	Recreational	1	98
Construction	Building Material	194	
	Electrical	72	
	Miscellaneous Metal	12	
	Plumbing	22	300
Professional	Appliance	1	
	Hardware	74	
	Medical	45	
	Office	18	
	Professional	3	
	Specialty	6	
	Tool	2	149
Miscellaneous	Conglomerate	24	
	Packaging	44	
	Sample	13	
	Unknown	28	109
Total			1,379

The next largest category of artifacts was cataloged as construction debris (n=300, 21.8 percent), including building materials and electrical and plumbing parts. It could be assumed that new materials would have been used to build the launch facilities and buildings for testing. The items that ended up in the dump (of which only a small percentage were actually collected) were probably of two types: the debris cleaned up from new construction of facilities and potentially debris from remodeling the buildings that were at that time being moved from Albuquerque and rebuilt at WSPG. Both activities would result in construction materials.

The other categories of artifacts represent small samples in the dump. Professional artifacts (total n=149, 10.8 percent) affiliated with specific tasks on base, especially medical, hardware, and other professional, provide a glimpse of the types of specific activities that occurred at the Post. However, many of the hardware items (n=74, 5.4 percent) are pieces that have not been identified.

Automotive (n=22, 1.6 percent) and personal (n=98, 7.1 percent) items are self-explanatory. It is difficult to determine if the automotive parts are from military or private vehicles, although Boehm (1997) indicated that probably few private cars were available at the base during the first years, so vehicles were checked out of the motor pool for pleasure trips to Juarez, Mexico, and to Cloudcroft. If the sample represents a military garage, per se, the quantity of spark plugs and oil filters would be much larger. Therefore, it may be possible to assume that these items came from work on personal vehicles. Personal artifacts include clothing, a few cosmetics, household items, newspapers, and the only truly recreational artifact, a horseshoe. The only other category is miscellaneous (n=109, 7.9 percent).

In summary, the dump probably represents normal dumping of a variety of trash from various activities on the Post. Artifacts especially represent such functions as food preparation and consumption, personal activities, perhaps military-testing activities, and construction. The items do not appear to represent only a portion of the population or specialized activities on the Post.

2. Is there evidence of a military build-up at WSPG that can be related to the Cold War? Were surplus missile parts or associated test equipment disposed of in this landfill?

Archaeologically, there is limited evidence from the dump remains that the build-up at White Sands Proving Ground was fueled by military surplus. First, very few artifacts are military issue—for the most part these items are related to the dining service, personnel mess kits and canteens, a set of marksmanship medals, and some clothing parts. Only one military-issue gun part was found. From the artifacts in the dump, there is little evidence of military automotive parts, and many of the other items that could have been U.S. Army issue without brand names, such as batteries, actually may have had brands.

U.S. Army issue without brand names, such as batteries, actually may have had brands.

If anything, the variety of artifacts indicates a build-up of the civilian population. The variety of artifacts, from the wood-burning stove damper to the many different clothing and newspaper samples, provides evidence of nonmilitary build-up. A search of the artifact database indicated only two green enameled artifacts, a lamp shade and a small canister.

A similar search of the database indicated that very few of the artifacts could be clearly linked with V-2 missile testing. Based on the volume of material brought to Fort Bliss and WSPG to begin testing on the V-2 missile, a very early dump on base should represent significant amounts of material with German writing. A search of the artifact database yielded only the equipment panel with German labels (Table 4; Figure 23) and fragments of a German newspaper that would indicate materials that actually came from Germany. Artifacts classified as professional would be most likely to represent missile testing. These items are vacuum tubes made by Radio Corporation of America, batteries, straps, fuses, plates, carbon rods, a glass rod with a stopper (also potentially from the pharmacy), a few tools, springs, and a vacuum canister. None has German writing.

Table 4. Translation of Instrumentation Panel with German Labeling.

German	English context or equivalence
Gleicksparrung	"direct current voltage"
Abgriff	"handling" or a handle to adjust flow of current
Netz	"circuit network"
Stütz	probably an abbreviation for a control to regulate excess current
Prog.	"program"
Messung (Mess.)	"measurement"
Aus	"out"
Tacho	measures ampherage
Uhr	"clock or watch meter"
Kdo	control

In summary, Site LA 106,155 appears to represent the disposal of food service preparation materials (food and soda containers, Quartermaster food dishes), general construction and remodeling debris, and office clean-up items (pens and ink bottles, marksmanship awards). Also included may be materials from military (canteens) and civilian personnel living quarters (wood-burning stove and automotive parts), living quarters that were cleaned on a routine basis or as personnel were rotated out.

Specific trash from military testing may have been disposed of more selectively, considering the secret nature of the testing. V-2 remains may have been stockpiled or buried in the desert, potentially nearer to the V-2 assembly building or Launch Complex 33 on Nike Avenue.

3. How were the early post-World War II military landfills structured? Was trash burned inside or outside the pit and were only selected types of trash being burned?

Evidence of the structure of the dump is limited to the view provided by the water line trench, where it crossed the construction zone roughly from north to south and the set of cross trenches used to expose the deposits when the dump was excavated. The overall size of the dump is estimated, based on this evidence, to be 140-m long by 10- to 15-m wide. Evidence from Site LA 106,155 indicates that the deposits were placed into a bulldozer trench. The exposed deposits range in thickness from 2 to 6½ ft. Discolored portions of the dump indicate the condition of the artifacts, because materials were burned in place. The pit sidewalls were fire-reddened, and artifacts were burned or melted, depending on the composition matrix. Of the 1,379 artifacts, 232 (17 percent) showed evidence of burning. Many of the animal bones also showed evidence of post-depositional burning (Appendix C). Other areas of the trench lacked well-defined pit profiles, although changes in soil color were noticeable that could not be attributed to natural processes. The artifacts in the extreme northern portion of the trench did not appear to be badly burned.

The dump was located several hundred yards from any existing structure during the period of its use. The 1945 map (Figure 2) only includes features on base within 330 ft of the main gate. The Navy Cantonment map (Figure 8) includes more features, but its boundary fence still only extends 1,590 ft northwest of the administration gate. By 1947, many of the main buildings opposite Nike Avenue are visible on aerial photographs (Figures 3, 4, 6, 7). The Navy facility was being built, as was the Navy Launch Complex along Nike Avenue. Areas of military family housing to the west of the dump were not built until 1948, nor was the commissary.

The apparent short period of use and the fact that the remains were covered with a 2-ft-thick cap of soil to bring the surface level up to that of the surrounding terrain indicate that there were probably U.S. Army regulations in place governing how dumps were structured and used. However, no regulations governing this type of activity for this period have been found. Outdated Army regulations are frequently destroyed to prevent the eventualities that could

occur if military personnel who came into possession of them were to unwittingly implement them.

4. What was the relationship to other buildings and the site-selection criteria?

The earliest aerial photographs show that the dump is completely removed, potentially by several hundred yards, from any buildings that are contemporary with it. This may have been intentional, because the burning of debris, such as kitchen materials (indicated by the bones), some types of construction debris, and cloth can cause noxious odors.

Social Research Questions

1. Is there any evidence of personnel located at WSPG prior to July 1945?

The artifacts provide no evidence of military or nonmilitary personnel at WSPG prior to 1945. Temporally, the earliest artifacts are World War II materials and recycled soft-drink bottles. The other dated artifacts are a medicine bottle, a Mexican liquor bottle, beer bottles, and a potentially recycled milk bottle.

In fact, from the evidence at Site LA 106,155, there is no evidence of ranching or mining activities in this location. Ranching and mining remains each have a distinctive signature, representing specific social activities and functions. None of these are indicated in the remains. For example, the assemblage includes more soft-drink bottles and glass containers. The construction debris—the straps, wiring, batteries, and other specialized debris—and the burning are rarer. Ranch and habitation sites often have more cans than bottles, usually much less construction debris, but more specialized gears and automotive debris, and trash piles that are not burned. Ranch sites usually have family-related artifacts. Mining sites without families are usually earlier and lack many of the amenities noted on this site.

2. Is there evidence of families living on the Post from its first establishment?

The inventory of artifacts provides no evidence of families living at the Post during the period the dump was used, which is assumed to be the first few years of the Post's establishment. Various types of artifacts would be expected for a family situation, including common rather than military china and glass; heirloom items; women's artifacts, such as perfume bottles, jewelry, hair items, and toiletries; and children's shoes and toys. The few recovered artifacts that fit into any of these categories, such as combs and eye glasses, could be worn by either sex and were probably used by the soldiers or civilian scientists. There was no evidence of artifacts that would be used exclusively by women or children in this dump.

A few of the recovered artifacts that could have related to families could also be related to the harsh conditions imposed by life at WSPG during its early years. For example, a piece of a wood-burning stove damper probably came from

a tent or the corner of a workshop. Use of skin creams, such as Noxzema and Avon, was also common in the harsh climate.

3. What aspects of the lifeways of the WSPG personnel are reflected in the landfill?

Certain categories of artifacts provide little information about the personal lifeways of the WSPG and will not be discussed, these include the plumbing and electrical debris from construction and remodeling. These artifacts only indicate that part of the early mission was to provide shelter for the personnel stationed at WSPG.

Additionally, the automotive category is of limited use, except to note that some of the items have brands, such as the spark plugs, and may represent individuals working on their own vehicles rather than motor-pool vehicles.

The other categories of artifacts—food service, professional, and personal—provide additional information about the lifeways of the personnel assigned to WSPG during the early years.

Food is always important in a remote environment. According to building histories, there were two mess halls from the inception of WSPG. The types of artifacts listed in the database provide some information on the variety of food that was prepared at these facilities.

Fresh meat was featured, as indicated by bones from cows, sheep, and chickens (Appendix C). The beef was probably processed elsewhere; the mutton was either processed on Post or at a processor; and the chickens were brought in alive or as carcasses still retaining their feet, which were added to the soup.

Other types of food remains that were eventually deposited in the dump were condiments, including ketchup, pepper sauce, etc. These may have been important to soldiers eating the bland institutional food of those early days.

Most of the artifacts categorized as food-preparation and service were cataloged as miscellaneous food containers (n=352). Many of these are fragments without enough information to say what they once contained, but they represent the food and beverages served and consumed at the Post in the early days.

Based on the number of handleless mugs, bowls, and other dinnerware, food was served at the mess on U.S. Quartermaster thick, white china, further perpetuating the image of institutional food.

Soft-drink bottles in the 1940s and 1950s were probably recycled and only a small portion actually ended up in the dump. Eighty-seven nonalcoholic beverage containers were found in the dump. Even so, soft drinks were probably very important; in the hot climate, they may have been the primary liquid consumed by the personnel at WSPG. Apparently, one company had the

concession to supply soda, because all of the bottles with brand names are Coca-Cola products coming mainly from Las Cruces and El Paso; no Pepsi products were found. However, only a small number of the bottles had brand names.

Consumption of alcoholic beverages was allowed, or at least 67 empty alcohol containers were found in the dump. The inventory includes liquor bottles and beer bottles and cans.

Personal items include clothing, eye glasses, shavers, etc. Military issue items include uniform parts with U.S. Army insignia representing the largest category. Several fragments of newspapers, including the English-language German paper, are assumed to have provided news to this remote location (although some may have been brought to the site as packing material). The only artifact that represents recreational activities is a horseshoe of the type used for the pitching game.

Some of the artifacts in the dump represent professional activities on the base or services performed by professionals. The barber is represented by a plate for hair clippers and possibly some of the Wild Root or other hair tonic bottles. The pharmacy is represented by medicine bottles and vials, as well as possibly the glass vial and tubing. Office activities are represented by ashtrays, ink bottles, and the Waterman fountain pen, and potentially the metal-rim eye glasses. A visiting dentist may be represented by the dental pick.

These provide the picture of very spartan living situations, probably for both the soldiers and the civilian scientists, as well as the other personnel. Without women and children, WSPG must have been, at least for awhile, a fairly isolated military camp (Boehm 1997)

Economic Research Questions

1. What was the role of WSPG in relation to the local economies of Las Cruces, New Mexico, and El Paso, Texas?

The trash provides some answers to this question, while a social history prepared for WSMR for 1945 to 1954 (Boehm 1997) presents additional information.

Evaluation of the role that WSPG played in the local economies for the very early years of its existence can be answered with data from the dump and from historic research, at least in regard to the amount of material coming from these communities to the Post.

Consumable evidence coming to the base from local sources, such as soda, meat, and milk, all potentially required refrigeration (Appendix A). Local newspapers were also important (Boehm 1997). The brand names on the soda bottles indicate that most came from Las Cruces and El Paso, with a few from cities in Texas, Arizona, and California. Because the vehicle parts are not

military issue, any personal vehicles would have required a source of gasoline, also perhaps distributed from Las Cruces and El Paso.

Boehm's (1997) social history indicates that local merchants were advertising their services especially to personnel stationed at WSPG. Services, such as banks, etc., were opened as the Post grew. However, evidence of these activities in the early years is not reflected in the dump remains.

2. Were goods obtained from local suppliers or through the larger military procurement system?

The terminal date for the dump appears to be sometime in 1947, while the commissary was not in operation until 1948. The variety of miscellaneous glass containers would indicate that a great quantity of materials were obtained from local suppliers. The few artifacts with brand names came from throughout the country. These include such products as Evangeline Pepper Sauce manufactured in Martinsville, Louisiana, and hair and scalp treatments manufactured in Kansas City, Missouri (Table 5). These are nonlocal, non-Army goods, possibly purchased from local retail merchants in Las Cruces or another nearby community. Other nonprescription and grooming brand names include Bromo Seltzer and Vicks inhaler, Noxzema (skin cream), Avon, Barbasol, Dyanshine, Listerine, Parker ink, Lucky Tiger, and Vitalis. Identified foods include vinegar, pepper sauce, mustard, jelly, relish or chow chow, other condiments, milk, alcohol, beer, and soft drinks. This variety potentially indicates individual purchases through local suppliers, possibly with an unofficial commissary on the Post prior to 1948.

3. How much and what types of war-surplus materials were being used and discarded?

Thirty-two items obtained through the U.S. Quartermaster Corps were eventually disposed of in the dump. These included parts of a metal canteen and Army-issue metal mess kits, forks, and spoons. Other Army-issue items recovered are fragments of uniforms. Some items were probably part of the dining service at the mess halls, including a whole ceramic coffee mug and mug fragments with a Medical Corps logo, handleless coffee mugs, and a plate and several bowls marked U.S Quartermaster Corps.

A military-issue 90-mm gun part, possibly modified for an ashtray, also fits into this category.

The remaining 49 items in this category, a bundle of identical Coast Artillery insignia, seem to be an enigma. According to a personal interview with Mr. Bon Burt, the 200th Coastal Artillery was stationed at WSPG in the mid-1940s, which may be the source of these insignia.

It has been suggested that these medals for marksmanship could have belonged to the New Mexico National Guard Unit that lost so many men on Bataan Peninsula in the Philippines, in December 1941 and January 1942, so

Table 5. Bottle Manufacturing Locations for Artifacts from the WSPG Dump.

Functional Category	Product	Location	Count	Subtotal
Food Preparation & Service	Coca-Cola	Las Cruces, NM	31	
		El Paso, Texas	12	
		Roswell, NM	3	
		Clovis, NM	2	
		Deming, NM	1	
		Marfa, TX	1	
		Dallas, TX	1	
		San Antonio, TX	1	
		Austin, TX	1	
		Hot Springs, Arkansas	1	
		Tucson, AZ	1	
		Yuma, AZ	1	
		Los Angeles, CA		1
	7-Up	El Paso, TX	1	
	Barq's	El Paso, TX	1	
	Yucca brand	Las Cruces, NM	1	
	Unknown soda	Las Cruces, NM	1	61
	Milk Containers	El Paso, TX	4	4
	Pepper Sauce	St. Martinville, LA	1	
	Liquor	Mexico	1	
	Unknown	New York City, NY	2	4
Personal	Lucky Tiger	Kansas City, MO	2	
	Bromo	Baltimore, MD	1	
	Squibb	New York	2	
	Wildroot	Buffalo, NY	4	
	Newspaper	Germany	1	10
Military Issue	Handleless mugs	New Castle, PA	5	
		Grafton, WV	2	
	Milkglass handleless mug	Corning, NY	2	
	Ceramic bowl	New Castle, PA	2	11
Miscellaneous	Stove part	Dubuque, IA	1	1
Total				91

that the large number of insignia was no longer required. These insignia were probably discarded when the unit was deactivated.

Answering the question of how much and what types of surplus materials were being used and discarded requires careful differentiation between World War II surplus and items that might be necessary for the Cold War effort at WSPG. At least one dated artifact, a military ceramic mug, dates to after the beginning of the Cold War. As previously indicated, only two artifacts were described as green in the artifact catalog and these, a lamp fixture and a small canister, may also have been war surplus. Therefore, for the materials coming from this sample of the landfill, there is little evidence that war-surplus materials were being used, except for the dining service dinnerware and what might be considered personal items for some of the military personnel.

CONCLUSION

Excavation of Site LA 106,155 provided a unique opportunity to look at early life at White Sands Proving Ground. This was a unique project in many ways, from the mode of excavation of the site to the way that the sample was derived. The site was excavated using modified archaeological techniques. The excavation was not conducted by trained archaeologists, but was monitored daily by the archaeology staff at White Sands Missile Range. Therefore, no attempt was made to impose detailed stratigraphy on the remains. However, the artifacts were analyzed according to standard procedures used for similar projects by Human Systems Research, Inc.

The artifacts reflect the personal side of the men's lives at White Sands Proving Ground; only a few artifacts were found that could be considered to be technical artifacts, reflecting the work being conducted there. The German instrument panel, the vacuum tubes, and maybe some of the electrical wiring are the only technological items found in this dump during this time period, suggesting that technical materials were stored for reuse or dumped elsewhere on the Proving Ground. This is negative evidence of recycling or reuse at Site LA 106,155.

So, if the identifiable artifacts represent the daily life of a scientist or a soldier, what can we infer about these activities. Grooming was a basic factor—shaving (Barbasol lotion and razors), tooth care (toothbrush and Listerine), and hair care (comb and hair tonic bottles). A dental pick and a professional shaver may indicate more organized levels of professional care. Numerous items or parts of clothing were identified, although not always specified by type of clothing; sometimes only scraps were recorded. Leather shoes or boots were indicated by the bottle of shoe polish, again an item representing someone who took pride in his looks.

In the Mess halls, again personal service artifacts were recovered: coffee mugs without handles, a plate, bowls, forks and spoons, and field canteens and mess kits. The lack of larger cooking equipment, suggesting bulk food preparation, might indicate its durability in this setting. Different cuts of meat suggest the variety at the Mess. Salt, pepper, pepper sauce, and other condiments provided a variety of tastes to the food at the Mess hall.

Office items—the Waterman pen (a very good brand), ink bottles, and ashtrays—indicate that some work debris was also placed into this dump, besides just the materials from the living areas. Standard European-style reading glasses might also fall into this category. Concerning the living areas, the stove damper might be from a stove found in one of the hutmuts where a cold soldier or scientist lived.

Health concerns ranged from conditions that could be self-treated with Bromo Seltzer and Noxzema to more serious illnesses requiring prescription drugs. If the glasses are prescription, they might also be resulting from a health concern.

Recreational artifacts suggest two categories: socializing and sports. Items in the first category are soda bottles, beer bottles, and alcohol bottles. Although frequently reused and refilled during this period, these provide the best date for the use of the dump, after July 1945 through 1947. Newspapers, etc., might also be shared with other soldiers or scientists. Only one artifact represented sports, the horseshoe, but a baseball diamond appears on the contemporary aerial photograph to the northeast of Headquarters.

Much of the rest of the debris is related to construction material, plumbing, and electrical—basic renovation and remodeling of the buildings that were being moved to White Sands Proving Ground for the use of the men stationed there. The stove damper may have provided heat to one of the tents or a cold Quonset hut during one of the first winters there.

The artifacts from the dump provided little evidence of adaptation or reuse; they were used for their initial intent and then discarded. Many items were not broken, only discarded to be melted or deformed by burning. In many cultures where certain types of artifacts are scarce, adaptation or reuse is very common, but not here. Neither is there any evidence of women or children on post. From this early dump, there is no evidence that either the soldiers or the scientists had their families with them.

Despite these methodological differences in recovering the data, it has been possible to identify many of the artifacts and their uses during this Cold War era. The first dump on White Sands Proving Ground provided a glimpse into the daily lives of the men stationed here or nearby at Fort Bliss.

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APPENDIX A

POSSIBLE MARKET SYSTEMS AT WSPG

J.K. "Pete" Finney

POSSIBLE MARKET SYSTEMS AT WSPG

Identification of the types of goods and services used and consumed during the Cold War in U.S. military history, the potential sources for goods and services, the primary use areas and subareas on the WSPG Post, the optimum chronological indicators, and refuse types are necessary for addressing the research questions on a market system.

Sources

Four sources of material have been identified as potential avenues for items discarded at this landfill: (1) the Office of the Quartermaster Corps (OQMC), (2) the Army Exchange System (AES), (3) local community businesses, and (4) personnel import of domestic and foreign goods (Figure A-1).

The OQMC was in charge of research and development, procurement, and distribution of goods necessary to fulfill the military mission on bases in the United States and overseas. The Corps' purview included personal clothing, headgear, and footgear; rations, packaging, and personal equipment; and organizational equipment, among other things.

The role of the AES, which was redesignated the Army and Air Force Exchange System (Habgood and Skaer 1994) in 1948, "was to develop, administer and supervise operational procedures for Army exchanges with corps area and local commanders" (Habgood and Skaer 1994). Although the AES established policy, military commanders controlled their installation exchanges (Habgood and Skaer 1994). Goods and services necessary for troop welfare and morale on military facilities were procured through the AES. National profits generated from these operations were used to build, operate, supply, and maintain more recreational and revenue-generating facilities, such as theaters, sports fields, swimming pools, hobby shops, and concession stands. Colonel Harold R. Turner, who was involved in the selection of the WSPG location, served as the first commander from July 1945 to August 1947. Such facilities as the Post Commissary and the Post Exchange (PX) at WSPG would have been supplied through the AES.

An additional source of goods and services purchased by military personnel and members of their families were businesses in Las Cruces and Alamagordo, N.M., and El Paso, Texas, as well as other nearby communities. Evidence of goods and services (in the form of landfill refuse) obtained from local businesses is unlikely to be identifiably different from goods and services provided through AES, except that the sources might be more local.

Personnel and families relocating to the area, including German rocket scientists, probably brought goods with them that were purchased in their home communities or possibly overseas, or they may have had items sent to them by friends and family after they arrived.

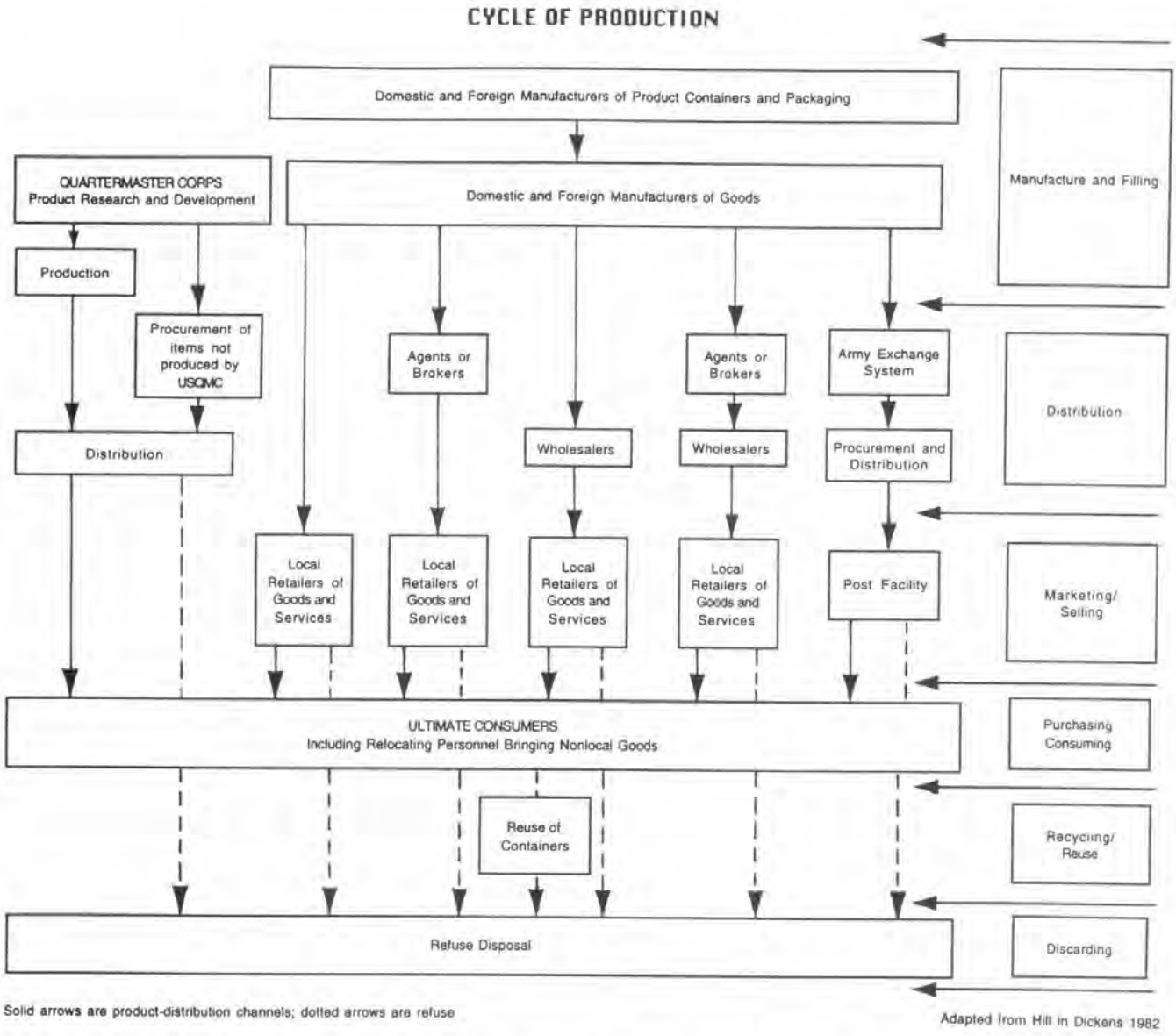

Figure A-1. Avenues for tracking the circulation of goods.

Goods Types

Seven commonly served markets found in most communities were present on WSPG between 1945 and 1955. These include markets for (1) consumer-package goods, (2) consumer-durable goods, (3) industrial-support consumables, (4) industrial-process consumables, (5) make-or-buy consumables, (6) capital goods, and (7) common services (Washburn 1988:26). Consumer-package goods are those packaged products, such as food, detergents, toiletries, and paper goods, that can be purchased at most grocery stores or supermarkets, while consumer-durable goods include major tangible items, such as television sets and refrigerators and intangibles, such as college educations. Industrial-support consumables range from such items as paper clips and paper towels to welding gasses and janitorial supplies. Industrial- process consumables are materials actually consumed in the manufacturing or construction process, including wire, nuts, bolts, and paint. Industrial make-or-buy consumables consist of things the purchaser has decided to buy rather than make, due to cost constraints, such as cabinet hardware and motors. Industrial-capital goods consist of high-priced items, such as milling machines and fork lifts. Common services are created as they are delivered, such as hair cuts, restaurant dining and bar services, and entertainment, including theaters (Washburn 1988:27-43). Service establishments may also sell tangible items as part of the service offered (Washburn 1988:247-248).

These distinctions are important for differentiating functions within the trash in the landfill. The first two categories (consumer-package goods and consumer-durable goods) and the last (common services) pertain to individual consumers; the next four (industrial-support consumables, industrial-process consumables, make-or-buy consumables, and capital goods) relate to industrial, or in this case, military development and testing. However, evidence of common services will be the most difficult to locate in a landfill.

Primary Areas

The WSMR Headquarters or Post Area was initially divided into four primary areas: (1) Administration and Troop, (2) Technical, (3) Industrial and Warehouse, and (4) Quarters and Parade Ground. In Areas 1, 2 and 3, use of industrial and capital goods would be expected to generate refuse that would be significantly different from Area 4, which would be expected to generate refuse resulting from the use or consumption of package and durable goods, as well as service-industry activity. The proportion and volume of refuse associated with the use or consumption of package and durable goods and the services relative to industrial and capital goods is expected to be greater in Area 4. Expected predominance of goods and service refuse generated in each of the primary areas is as follows:

1. Administration and Troop
   Industrial support consumables

2. Technical
   Industrial support consumables
   Industrial process consumables

3. Industrial and Warehouse
   Industrial support consumables
   Industrial process consumables
   Industrial make-or-buy
   Industrial capital goods

4. Quarters and Parade Ground
   Consumer package goods
   Consumer durables
   Common services

Subareas

The Quarters and Parade Ground area has the greatest expected variety in consumer package goods, consumer durable goods, and common services. The other three areas are expected to be primarily industrial in nature, supporting the development and testing objective of WSPG. To attempt to identify with greater certainty the users of this landfill, four subareas were identified in the Quarters and Parade Ground primary area:

Subarea A: Characterized by the purchase of *products* by military personnel, their families, and civilian employees (no consumption or use); discard of outermost (or tertiary) and usually bulkiest forms of packaging; and low diversity of item types.

1. Commissary
2. Post Exchange Store
3. Thrift Shop

Subarea B: Characterized by the final consumption or use of *products* purchased by military personnel and their families; discard of primary and, frequently, secondary packaging; high diversity of item types.

1. Domestic Housing
2. Barracks

Subarea C: Characterized by *services* provided to or purchased by military personnel, their families, or civilian personnel, either through private sector contractors or AES; discard of minimum amounts of secondary packaging; large primary packaging containers, and large bulky tertiary protective packaging; high diversity of item types.

1. Consolidated Mess Hall
2. Cafeteria
7. Theater
8. Dispensary/Dental Clinic

3. Snack Bar
4. Elementary School/Kindergarten
5. Post Office
6. Bank
9. PX Gas Station
10. Officer's/NCO Clubs
11. Laundry/Dry Cleaning
12. Barber Shop

Subarea D: Characterized as participational use areas, minimum amounts of packaging brought to and discarded on the site; moderate diversity of item types.

1. Gymnasium
2. Swimming Pool
3. Athletic Fields
4. Hobby Shops
5. Chapel
6. Bowling Alley
7. Library
8. Gun Clubs

Each of the four subareas on the Quarters and Parade Ground sector of WSPG would be expected to generate refuse characteristic to each of these activities. However, all four primary areas would have generated general construction, electrical, plumbing, grounds and yard maintenance, and automotive refuse. These types of artifacts are made of metal and would be expected to be found in a corroded condition, which might prevent determinations of product source or possible chronological indicators if manufacturer's marks and other identifying characteristics have been obliterated. Only methods of collection and disposal at the landfill that resulted in discrete, source-specific refuse piles would permit interpretation of the place of generation of this type of refuse. For example, a single provenience that contains a concentration of refuse that can be identified as medical paraphernalia from the clinic may also contain electrical wiring refuse resulting from repairs at the clinic.

Subarea A, characterized by the purchase of products by military personnel and their families, are locations where no consumption or use of the finished merchandise occurs. At this location, products are received in bulky packaging necessary to protect them during shipment. This outermost packaging is removed and discarded at this location before the product is placed on display. Also at these locations, refuse from industrial-support consumables could be expected to be generated, principally paper in the form of clerical supplies, such as those necessary for recordkeeping and window and shelf advertisement. The diversity of types of items discarded at these locations would be expected to be low, relative to the volume of refuse. If burning was permitted, either at the primary site of discard or the secondary site after transfer to the dump, little evidence of refuse generated at these types of locations will remain.

Subarea B is characterized by the final use or consumption of products purchased by military personnel and their families, including consumer package goods, consumer durable goods, and common services. Most products at this stage of the product cycle from manufacturer to landfill will be, at minimum, in the primary package, such as bottles for soft drinks, and, frequently, secondary packaging, such as six-pack cartons. Both primary and secondary packaging are likely to be discarded at the family dwelling or barracks. The typical refuse

assemblage generated by occupants at barracks and domestic housing would have many item categories in common, but volume and diversity would vary. For example, although kitchens or other areas specific to the preparation or consumption of food were not present in barracks, food was probably consumed on those premises. Ceramic service-ware was probably used at both domestic housing and barracks, but diversity in the form of food storage-ware and preparation utensils is likely to be present at family dwellings. Items consumed at both locations would have also included prescription and commercial drugs indicated by discarded containers. Other refuse categories common to both included containers for toiletries and household sanitation, personal and military attire (clothing, shoes, buttons, and other accoutrements), alcoholic-beverage containers, tobacco paraphernalia, and automobile parts.

Patterns of domestic refuse not common to barracks would have included women's toiletries and clothing, children's toys, care and education items, gardening paraphernalia, pet-related items, and larger volumes of food items that required preparation, as evidenced by pots and pans.

Subarea C is characterized by services provided to or purchased by military personnel, their families, or civilian personnel. The refuse assemblage generated by the service industry present on the Post, private or government-administered, is expected to contain an item-diversity level similar to that of the Subarea B. However, the nature of the food-service industry—such as the mess hall, the cafeteria, or the elementary school cafeteria—requires (1) larger primary containers, such as gallon jars and cans for products purchased in volume, or large numbers of small containers that are all the same, (2) larger pots and pans and heavy-duty utensils for cooking large volumes of food, (3) infrequent use of secondary containers used in retailing, and (4) large, bulky tertiary or outermost protective packaging. Protective, tertiary containers would have generally consisted of heavy cardboard and possibly wood, which might have been destroyed if burning of refuse was practiced.

Refuse generated by the Officer's and NCO Clubs in the form of liquor and beer bottles would also have been discarded at households and barracks. However, a concentration of this type of refuse at specific provinces in the landfill may indicate use by these clubs. These clubs probably would have purchased liquor in bottles larger than one pint containers. It is most likely that pint bottles of liquor were purchased and consumed at domestic dwellings and barracks. Recycling of quantities of beer and soda bottles might need to be considered, if the source for these was nearby. Frequently local bottling facilities reused their glass containers, and both machines and dispensaries of this period collected the containers to be refilled.

Post Office and bank refuse was not expected to be present in identifiable quantities. Items such as paper, which would have perished if refuse-burning was practiced, and other items associated with these facilities, such as ink pads and bottles, are not industry specific. Evidence of the dispensary and dental clinic in the landfill would be indicated by instruments of the medical profession, many of which were made of metal that could withstand the heat

required for sterilization, and empty sterile-sealed glass serum or drug vials. Evidence of use of the landfill by the barber shop would be indicated by the presence of professional grooming equipment.

Subarea D is characterized by participational use areas. The minimum of nonperishable product packaging would be expected at most of these locations. Activity locations, such as the gymnasium, swimming pool, athletic fields, library, chapel, and bowling alley, are not expected to generate distinctively identifiable refuse in significant volumes. Much of the refuse generated at these places could be expected to be clerical paper goods (industrial-support consumables) and refreshment-associated items, such as candy paper wrappers and soft-drink paper cups or glass bottles (consumer package goods or service-industry related items). Item diversity would be expected to be moderate.

A discarded accumulation of worn-out or broken specialized woodworking tools from the hobby shop may have been ultimately transferred to the landfill, as well as items such as unusable scraps of wood. Unfortunately, this refuse may not be distinguishable by type from general-construction refuse (industrial-process consumables) that would be expected to be distributed throughout the entire assemblage. However, a concentration of such items in the landfill specific to this activity may indicate a specialized source. The same pattern of discard of automobile parts and specialized tools from the automobile hobby shop may have occurred. This type refuse also may not be distinguishable from general refuse generated from the PX gas station, domestic housing, or other automotive maintenance shops, unless method of deposition indicates a source. This pattern would probably hold true for the radio hobby shop refuse. Refuse generated from gun club activities and hunting would include nonmilitary gun parts and spent shells, such as shotgun shells and the boxes the shells were packaged in for retail sale.

Chronology

Chronological indicators that are useful in investigations of earlier historic archaeological times, such as technological attributes of containers (seams on glass containers and welds on metal containers) are of limited value for analyzing the types of containers anticipated within the time period, location, and context of the dump. Research questions can be addressed by identifying manufacturers of products, as well as the manufacturers of containers/packing for those products.

Primary packaging, such as condiment jars and liquor bottles, were not usually made at the same location or by the same manufacturer as the product they contained. For example, Wildroot brand hair tonic was manufactured and bottled in Buffalo, New York, using bottles made by Owen-Illinois Glass Company at Gas City, Indiana, manufactured in the same year or years prior to the bottling of the product. Bottles may be manufactured over a period of several years at several different locations of the Owens-Illinois Glass Company as is true of other container manufacturers. Each of these manufacturing locations may have a limited number of years in operation.

Identifying makers' marks are often embossed on glass jars and bottles. In reference to earlier historic periods, Sarah Hill observed that "bottles tend to enter the archaeological record quickly," because "they are not functional end-products but are containers for products" (Hill 1982:293). In the more recent period under discussion, glass bottles and other glass containers had become more common and more frequently used. Rates of discard of glass containers that were not reusable by product distributors may have become even more rapid than in earlier historic times.

Many assumptions about products for the middle of the twentieth century need to be studied further. However, many archaeologists remember that containers for such products as soft drinks and milk were frequently returned to the product manufacturer to be sterilized, refilled, and distributed until they were broken or otherwise became unserviceable. These types of bottles could be used for several years and could potentially enter the archaeological record several years after they were manufactured. This is certainly true of soft-drink bottles, many of which have the year of manufacture embossed on their exterior.

The principal advantage of recovery of such accurate chronological markers as glass containers from the archaeological record is that the bottle(s) with the most recent date is the best indicator of the latest use of the site. Few other artifacts of this period in this context are more reliable as chronological markers.

Refuse Types

Refuse items are separated into the following five categories:

1. Disposable packaging necessary to protect the product during transportation to final place of purchase (retail or service establishment). This refuse will be referred to as tertiary or outermost packaging and is frequently bulky, including items such as cardboard or wooden boxes. Product manufacturer and source location is often indicated on this type of packaging. However, if refuse was burned, this packaging would have been destroyed.

2. Disposable secondary packaging for convenience in retail merchandising, including such items as six-pack cartons for soft drinks. Although product manufacturer and source locations may appear on this type of packaging, it is most frequently made of perishable material, such as paper or light cardboard, and is not expected to be present or in a legible condition if burned.

3. Disposable and returnable primary packaging required to physically contain the product, such as a glass soft-drink or condiment bottles, or paper soft-drink cups. Labels on this type of packaging are usually made of perishable material and are not expected to be present. Most glass containers have an embossed manufacturer's mark that often identifies a

period of time it was used, but usually no indication of product manufacturer or source. Returnable soft-drink bottles that have the bottling company name and location embossed on the bottle are reliable indicators of the source of the product distributor. However, it is unlikely that soft drinks were frequently brought in from any great distances, given that local bottlers and distributors were operating in El Paso, Texas, and Las Cruces, New Mexico.

4. Identifiable product refuse, that is, the packaged goods or tangible items sold at service establishments purchased for use or consumption, consisting of all items that are not considered to be returnable or disposable packaging. This category includes all five types of consumer goods, consumables and capital goods, as well as tangible items used or sold in the service industry.

5. Unidentifiable and general or nonsubarea specific refuse.

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APPENDIX B

SITE LA 106,155 ARTIFACT TOTALS

Site LA 106,155 Artifact Totals.

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Animal				
Animal Bone	Bone	Frag.	29	
Animal Bone	Bone	Whole	5	
Animal Hair	Hair	Frag.	1	35
Appliance				
Deflecting Damper Plate Adams Co./Diamond Dubuque IA	Metal	Frag.	1	1
Army Gov. Issued/Gear				
Ammunition or explosives box	Metal	Whole	1	
Bowl Stoneware	Ceramic	Frag.	1	
Shenango China; Similar to Items w/U.S.Q.M.C	Ceramic	Frag.	1	
Bowl Stoneware U.S.Q.M.C.	Ceramic	Frag.	1	
Bowl Stoneware U.S.Q.M.C.; Bailey-Walker China	Ceramic	Frag.	1	
Bowl Stoneware U.S.Q.M.C.; Hall China	Ceramic	Whole	1	
Bowl Stoneware U.S.Q.M.C.; McNicol China	Ceramic	Frag.	1	
Canteen	Metal	Frag.	1	
Canteen	Metal	Whole	1	
Canteen US Government Issued; Volpath	Metal	Frag.	1	
Cloth w/insignia US Government Issued	Multiple Class	Frag.	1	
Cup Stoneware United States Army Medical Depart.; Taylor Smith & Taylor	Ceramic	Whole	1	
Flashlight Part	Multiple Class	Whole	1	
Insignias, Coast Arty	Metal	Whole	49	
Mess Kit Government Supply Item	Metal	Whole	3	
Mug Shaving Shenango China; Similar to other items w/U.S.Q.M.C.	Ceramic	Frag.	4	
Mug Shaving U.S.Q.M.C.; McNicol China	Ceramic	Frag.	2	

Site LA 106.155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Army Gov. Issued/Gear (cont.)				
Plate Stoneware McNicol China; Similar to other items w/U.S.Q.M.C.	Ceramic	Frag.	1	
Tent Pole	Multiple Class	Frag.	1	
Utensil Fork	Metal	Frag.	1	
US Government Issued				
Utensil Fork	Metal	Whole	1	
US Government Issued; Silco				
Utensil Spoon	Metal	Whole	2	
US Government Issued				
Utensil Spoon	Metal	Whole	3	
US Government Issued; Silco				
Utensil Spoon US Government Issued; Wallace N.S.	Metal	Whole	1	81
Automobile				
Automobile Ignition Coil	Metal	Whole	1	
Automobile Motor Valve	Metal	Whole	2	
Automobile Part	Metal	Frag.	3	
Automobile Part	Fiberglass	Whole	1	
Automobile Part	Metal	Whole	3	
Automobile Spark Plug	Multiple Class	Whole	1	
Auto-Lite				
Automobile Spark Plug	Multiple Class	Whole	1	
Champion				
Automobile Tire Rim w/Spokes	Metal	Whole	1	
Automobile Wheel Hub	Metal	Whole	1	
Can Oil	Metal	Frag.	1	
Pennzoil				
Gasket Rubber	Rubber	Whole	1	
Gasket Rubber (2 pieces fit)	Rubber	Whole	2	
Gear	Metal	Whole	1	
Hose	Rubber	Frag.	2	22
Thermostat	Metal	Whole	1	
Building Material				
Asbestos Slabs	Building Mater	Frag.	11	
Brick	Building Mater	Frag.	7	
Brick	Building Mater	Whole	3	
Cement	Building Mater	Frag.	1	
Hinge	Metal	Whole	2	
Plaster	Building Mater	Frag.	16	
Sheet Metal	Metal	Frag.	3	
Sheet Metal (Cut)	Metal	Whole	1	

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Building Material (cont.)				
Sheet Rock	Building Mater	Frag.	13	
Shingles/Siding Exterior	Building Mater	Frag.	3	
Shingles/Siding Exterior	Building Mater	Whole	1	
Window Glass	Glass	Frag.	3	
Window Screen	Metal	Frag.	6	
Wire	Metal	Frag.	24	
Wire	Metal	Whole	2	
Wire Barbed	Metal	Whole	1	
Wire Coated	Chalk	Frag.	2	
Wire Coated	Multiple Class	Whole	1	
Wood	Wood	Frag.	94	194
Clothing				
Belt Buckle	Metal	Frag.	1	
Belt Buckle	Metal	Whole	1	
Belt Ferrule	Metal	Whole	1	
Cloth	Cloth	Frag.	3	
Eye Glasses	Multiple Class	Whole	1	
Shoe Sole	Rubber	Frag.	3	10
Conglomerate				
Cement w/Metal Cans	Metal	Frag.	1	
Cement w/Metal Cans	Multiple Class	Frag.	3	
Conglomerate (e.g., Metal/Glass)	Multiple Class	Frag.	20	24
Container Beverage				
Bottle Beverage 7-UP Brand, El Paso, TX	Multiple Class	Whole	1	
Bottle Beverage Barq's Brand, El Paso, TX	Glass	Whole	1	
Bottle Beverage Coca-Cola Brand	Glass	Frag.	24	
Bottle Beverage Coca-Cola Brand, Austin, TX	Glass	Frag.	1	
Bottle Beverage Coca-Cola Brand, Clovis, NM	Glass	Frag.	2	
Bottle Beverage Coca-Cola Brand, Dallas, TX	Glass	Frag.	1	
Bottle Beverage Coca-Cola Brand, Deming, NM	Glass	Frag.	1	
Bottle Beverage Coca-Cola Brand, El Paso, TX	Glass	Frag.	2	
Bottle Beverage Coca-Cola Brand, El Paso, TX	Glass	Whole	9	

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Container Beverage (cont.)				
Bottle Beverage Coca-Cola Brand, Hot Springs, AK	Glass	Whole	1	
Bottle Beverage Coca-Cola Brand, Las Cruces, NM	Glass	Frag.	6	
Bottle Beverage Coca-Cola Brand, Las Cruces, NM	Glass	Whole	26	
Bottle Beverage Coca-Cola Brand, Los Angeles, CA	Glass	Whole	1	
Bottle Beverage Coca-Cola Brand, Marfa, TX	Glass	Frag.	1	
Bottle Beverage Coca-Cola Brand, Roswell, NM	Glass	Frag.	3	
Bottle Beverage Coca-Cola Brand, San Antonio, TX	Glass	Whole	1	
Bottle Beverage Coca-Cola Brand, Tucson, AZ	Glass	Whole	1	
Bottle Beverage Coca-Cola Brand, Yuma, AZ	Glass	Whole	1	
Bottle Beverage Yucca Brand Coca-Cola Company; Las Cruces NM	Glass	Whole	1	
Can Beverage	Metal	Whole	2	
Bottle Milk Half Pint Price's	Glass	Frag.	1	
Bottle Milk Half Pint Price's; El Paso TX	Glass	Whole	3	
Bottle Milk One Quart	Glass	Frag.	3	
Bottle Milk One Quart	Glass	Whole	1	
Bottle Milk One Quart Price's; El Paso TX	Glass	Whole	1	
Cup Disposable Coca-Cola Brand	Paper	Frag.	1	67
Container Food				
Bottle Condiment Evangeline Peppersauce	Multiple Class	Whole	1	
Bottle Condiment Concentric Horizontal Rings	Glass	Whole	2	
Bottle Condiment Ketchup	Glass	Whole	1	

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Bottle Condiment (cont.)	Glass	Whole	1	
Mustard				
Bottle Condiment	Multiple Class	Whole	1	
Sloping Body				
Jar Wide-mouthed	Multiple Class	Frag.	12	
Jar Wide-mouthed	Glass	Whole	16	43
Container Liquid				
Bottle One Gallon	Glass	Frag.	1	
Bottle One Gallon	Glass	Whole	3	4
Container Liquor				
Bottle Barcardi	Glass	Whole	1	
Mexico D.F.				
Bottle Beer	Glass	Frag.	4	
Bottle Beer	Glass	Whole	6	
Bottle Beer	Glass	Frag.	1	
No Deposit No Return				
Bottle Beer	Glass	Whole	10	
No Deposit No Return				
Bottle Liquor	Glass	Frag.	4	
Bottle Liquor	Glass	Frag.	2	
FEDERAL LAW FORBIDS...				
Bottle Whiskey 4/5 Quart	Glass	Frag.	3	
Bottle Whiskey 4/5 Quart	Glass	Whole	3	
Bottle Whiskey 4/5 Quart	Multiple Class	Whole	2	
Bottle Whiskey 4/5 Quart	Glass	Frag.	3	
FEDERAL LAW FORBIDS...				
Bottle Whiskey 4/5 Quart	Glass	Whole	4	
FEDERAL LAW FORBIDS...				
Bottle Whiskey 4/5 Quart	Multiple Class	Whole	3	
FEDERAL LAW FORBIDS...				
Bottle Whiskey One Pint	Glass	Frag.	2	
Bottle Whiskey One Pint	Glass	Whole	4	
Bottle Whiskey One Pint	Multiple Class	Whole	2	
Bottle Whiskey One Pint	Glass	Whole	1	
FEDERAL LAW FORBIDS...				
Bottle Whiskey One Pint	Multiple Class	Whole	1	
Schenley				
Bottle Whiskey One Pint	Multiple Class	Whole	1	
Schenley;				
FEDERAL LAW FORBIDS...				
Beer Can	Metal	Frag.	5	
Beer Can	Metal	Frag.	1	63
American Can Co.				

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Container Misc.				
Bottle Cap	Metal	Frag.	4	
Bottle Cap	Metal	Whole	5	
Bottle Cap Plastic	Plastic	Whole	2	
Bottle Unknown	Glass	Frag.	50	
Bottle Unknown	Multiple Class	Frag.	1	
Bottle Unknown	Glass	Whole	26	
Bottle Unknown	Multiple Class	Whole	5	
Bottle Unknown ..I.S..,	Glass	Frag.	1	
Bottle Unknown Ar Winarick	Glass	Whole	1	
Bottle Unknown G.A.Larr../ME.../4/5	Glass	Whole	1	
Bottle Unknown L & F Prod. Corp USA	Glass	Whole	3	
Bottle Unknown 2 1/2 fl. oz.	Glass	Whole	1	
Can Fragment Unidentified	Metal	Frag.	234	
Can Fragment Unidentified	Metal	Whole	1	
Can Large Storage	Metal	Whole	1	
Container Enamel	Metal	Frag.	1	
Glass (Milk Glass) Miscellaneous	Glass	Frag.	1	
Jar Unidentified	Glass	Frag.	4	
Jar Unidentified	Glass	Whole	3	
Jar Unidentified	Multiple Class	Whole	1	
Pitcher Possible-Enamel	Metal	Frag.	1	
Shoe Polish (Possible) Bartons Dyanshine	Glass	Frag.	1	
Shoe Polish (Possible) Bartons Dyanshine	Glass	Whole	2	
Cap/Lid Metal	Metal	Frag.	1	
Cap/Lid Metal	Metal	Whole	1	352
Cosmetic				
Bottle Toiletry Avon	Glass	Frag.	1	
Bottle Toiletry Drene	Glass	Whole	1	
Bottle Toiletry Fitch	Glass	Frag.	3	
Bottle Toiletry Fitch	Glass	Whole	2	
Bottle Toiletry Fitch	Multiple Class	Whole	1	
Bottle Toiletry Jergens	Glass	Whole	1	

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Cosmetic (cont.)				
Bottle Toiletry Listerine	Glass	Whole	2	
Bottle Toiletry Lucky Tiger	Glass	Frag.	1	
Bottle Toiletry Lucky Tiger	Glass	Whole	1	
Bottle Toiletry Mennen	Glass	Whole	1	
Bottle Toiletry Vitalis	Glass	Whole	4	
Bottle Toiletry Wildroot	Glass	Frag.	1	
Bottle Toiletry Wildroot	Glass	Whole	3	
Bottle Toiletry Ringed neck	Glass	Whole	1	
Bottle Toiletry Small Bore	Glass	Frag.	5	
Bottle Toiletry Small Bore	Glass	Whole	13	
Comb Handle (Possible)	Plastic	Frag.	1	
Jar	Glass	Frag.	1	
Jar Noxzema	Glass	Whole	5	
Jar Noxzema	Glass	Frag.	3	
Jar Milk Glass	Multiple Class	Frag.	1	
Jar Milk Glass	Glass	Whole	2	
Mug Shaving	Ceramic	Frag.	12	
Mug Shaving	Ceramic	Frag.	3	
Mug Shaving Carr China	Ceramic	Frag.	2	
Shaver/Razor Victor	Metal	Frag.	2	
Shaving Mug	Ceramic	Whole	1	
Toothbrush Corning	Multiple Class	Whole	1	
Tube Aluminum-Beard Softener Johnson & Johnson Barbasso	Metal	Whole	1	76

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Electrical				
Battery	Carbon	Frag.	1	
Battery	Multiple Class	Frag.	4	
Battery	Multiple Class	Whole	1	
Battery	Multiple Class	Whole	2	
Burgess				
Battery	Multiple Class	Whole	1	
Ray-O-Vac				
Battery Cables	Metal	Frag.	1	
Battery Cables w/Fittings	Metal	Frag.	1	
Battery Interior Portion	Carbon	Frag.	9	
Cable	Metal	Frag.	22	
Cable Insulated/Cord	Multiple Class	Frag.	2	
Electrical Box	Metal	Whole	1	
Electrical Conduit Flexible	Metal	Frag.	3	
Electrical Conduit Flexible	Metal	Whole	1	
Electrical Fitting	Multiple Class	Whole	1	
Electrical Fuse	Multiple Class	Whole	1	
Electrical Fuse	Multiple Class	Frag.	1	
Pyrex				
Electrical Fuse Plug	Multiple Class	Whole	2	
Electrical Insulator For				
Light Bulb	Ceramic	Whole	1	
Electrical Insulator Spool	Ceramic	Whole	1	
Electrical Light Bulb	Metal	Frag.	1	
Electrical Light Bulb	Multiple Class	Frag.	2	
Electrical Light Bulb	Multiple Class	Frag.	1	
Mazda; General Electric Co.				
Electrical Light Bulb	Multiple Class	Whole	2	
Mazda; General Electric Co.				
Electrical Light Bulb Base	Multiple Class	Frag.	1	
Electrical Part	Multiple Class	Whole	2	
Electrical Part w/Cable	Metal	Frag.	1	
Electrical Socket For Light Bulb	Plastic	Frag.	1	
Electrical Tape	Plastic	Whole	1	
Electrical Vacuum Tube	Multiple Class	Whole	1	
Electrical Vacuum Tube	Multiple Class	Whole	2	
RCA (Radio Corporation of				
American)				
Radio Resistor (Possible)	Multiple Class	Frag.	1	72
Gun				
Gun Shell Casing	Metal	Whole	1	1

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Hardware				
Chain	Metal	Frag.	1	
Clamp	Metal	Whole	1	
Latch Trunk	Metal	Whole	1	
Metal Cap with Valve	Metal	Whole	1	
Metal Plug	Metal	Frag.	1	
Nail/Bolt	Metal	Frag.	21	
Nail/Bolt	Metal	Whole	37	
Ring Metal	Metal	Frag.	2	
Ring Metal	Metal	Whole	1	
Safety Hasp	Metal	Whole	1	
Spring	Metal	Frag.	1	
Spring	Metal	Whole	3	
Washer	Metal	Whole	3	74
Household Item				
Ash Tray	Glass	Frag.	1	
Ash Tray Nomisser	Glass	Whole	1	
Jug Miniature Design similar to Albany/ Bristol Slip	Glass	Whole	1	3
Kitchenware				
Bowl Milk Glass	Glass	Frag.	2	
Bowl Milk Glass Corning	Glass	Frag.	1	
Bowl Stoneware	Ceramic	Frag.	7	
Glass Tumbler	Glass	Frag.	2	
Glass Tumbler	Glass	Whole	4	
Plate Stoneware	Ceramic	Frag.	8	
Pot Lid-Enamel	Metal	Whole	1	
Salt Shaker	Glass	Whole	1	
Salt Shaker	Multiple Class	Whole	1	
Stoneware Unknown Vessel	Ceramic	Frag.	4	
Utensil Handle	Metal	Frag.	1	
Utensil Knife	Metal	Frag.	1	
Utensil Spoon	Metal	Whole	1	
Utensil Spoon Avon, Plated	Metal	Frag.	1	35
Medical				
Bottle Medicine Over-the-Counter Listerine		Glass	Whole	1
Bottle Medicine Over-the-Counter Squibb		Glass	Whole	2

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Medical (cont.)				
Bottle Medicine Prescription Bromo-Seltzer	Glass	Whole	1	
Bottle Medicine Prescription 1-Dram	Glass	Frag.	1	
Bottle Medicine Prescription 1-Dram	Glass	Whole	2	
Bottle Medicine Prescription 1-Dram; Suri Glass	Glass	Whole	3	
Bottle Medicine Prescription 1/2-Dram	Glass	Whole	3	
Bottle Medicine Prescription 2-Dram	Glass	Frag.	1	
Bottle Medicine Prescription 2-Dram	Multiple Class	Frag.	1	
Bottle Medicine Prescription 2-Dram	Glass	Whole	4	
Bottle Medicine Prescription 3-Dram	Glass	Whole	1	
Bottle Medicine Prescription 4-Dram	Glass	Frag.	1	
Bottle Medicine Prescription 4-Dram	Glass	Whole	4	
Bottle Medicine Prescription 4-Dram; Graduated Marks	Glass	Whole	1	
Bottle Medicine Prescription 4-Dram; Graduated Marks	Multiple Class	Whole	1	
Bottle Medicine Prescription Graduated Marks	Glass	Whole	1	
Bottle Medicine Prescription Graduated Marks Dram/CC	Multiple Class	Whole	1	
Bottle Medicine Prescription Sterile Sealed	Multiple Class	Whole	1	
Bottle Medicine Prescription Sterile Sealed	Glass	Whole	4	
Bottle Medicine Prescription Sterile Sealed	Multiple Class	Whole	1	
Glass Droppers	Glass	Frag.	2	
Glass Droppers	Glass	Whole	2	
Glass Rod w/Rubber Stopper	Multiple Class	Whole	1	
Glass Tube	Glass	Whole	1	
Medicine Over-the-Counter Vick's Nasal Decongestant; Aluminum	Metal	Whole	1	
Vial	Glass	Whole	1	
Vial Halco	Glass	Whole	2	45

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Misc. Metal				
Bar Flatten Metal	Metal	Whole	2	
Brace/Plate Metal	Metal	Frag.	1	
Brace/Plate Metal	Metal	Whole	1	
Bracket Metal	Metal	Whole	2	
Copper Handle	Metal	Frag.	1	
Galvanized Steel Cut	Metal	Frag.	1	
Pan Metal-Rectangular	Metal	Whole	1	
Rod	Metal	Whole	3	12
Newspaper				
Newspaper	Paper	Frag.	8	8
Office				
Bottle Ink	Glass	Frag.	4	
Bottle Ink	Multiple Class	Whole	1	
Bottle Ink	Glass	Whole	1	
Keuffe & Esser Co.				
Bottle Ink	Glass	Whole	2	
Parker				
Film	Plastic	Frag.	6	
Pen Fountain	Multiple Class	Whole	1	
Watermans				
Tripod	Metal	Whole	3	18
Packaging				
Bag (Leather and Plastic)	Multiple Class	Frag.	1	
Bag (Plastic)	Plastic	Frag.	1	
Hostess				
Packaging	Paper	Frag.	2	
Packaging Decorative	Multiple Class	Frag.	1	
Packaging Misc.	Multiple Class	Frag.	1	
Strap Metal	Metal	Frag.	37	
Strap w/Screws	Multiple Class	Frag.	1	44
Plumbing				
Commode Stoneware	Glass	Frag.	1	
Fitting (Copper)	Metal	Whole	1	
Pipe	Metal	Frag.	7	
Pipe	Metal	Whole	4	
Pipe Flange	Metal	Whole	1	
Pipe P-Trap	Metal	Frag.	1	
Pipe Sewage	Ceramic	Frag.	3	
Sink	Ceramic	Frag.	1	
Sink Handle	Metal	Frag.	1	
Sink Handle	Metal	Whole	1	
Water Heater Part (Possible)	Metal	Whole	1	22

Site LA 106,155 Artifact Totals (cont.).

Group Type/Artifact Type	Material	Portion	Count	Subtotal
Professional				
Dental Pick	Metal	Whole	1	
I.D. Tag	Metal	Whole	1	
Hair Cutter Electrical	Metal	Whole	1	3
Recreational				
Horseshoe	Metal	Whole	1	1
Samples				
Chalk	Chalk	Frag.	2	
Coal	Sample	Frag.	9	
Mineral Sample Granite	Sample	Frag.	1	
Mineral Sample Mica	Sample	Frag.	1	13
Specialty Item				
Canister Torpedo Shaped	Metal	Whole	1	
Control Panel	Wood	Frag.	2	
Cut Round Window Glass	Glass	Frag.	1	
Cut Round Window Glass	Glass	Whole	1	
Sign Wood	Wood	Frag.	1	6
Tool				
File	Metal	Frag.	1	
Pick	Metal	Frag.	1	2
Unknown				
Glass Unknown	Glass	Frag.	3	
Metal Unknown	Metal	Frag.	14	
Metal Unknown	Metal	Whole	4	
Metal Unknown-Flat Spring Snap	Metal	Whole	2	
Metal Unknown-Metal Glob	Metal	Frag.	2	
Paper Unknown	Paper	Frag.	1	
Sheet Fiberglass	Fiberglass	Frag.	1	
Sheet Plastic	Paper	Frag.	1	28
Total				1,379

APPENDIX C

FAUNAL ANALYSIS FROM SITE LA 106,155

Jack Bertram

November 1, 1995

David Kirkpatrick
Human Systems Research, Inc.
Las Cruces, New Mexico

Dear Dr. Kirkpatrick:

This letter reports observations and results of my examination of the bone materials collected by HSR staff from LA 106,155 (the Headquarters Commissary Dump Site) at WSMR, Doña Ana County, New Mexico, in the course of HSR Project 9428. This collection was not systematic, due to the complexity of recovery in a potentially hazardous dump deposit, but the materials recovered were thought to be at least taxonomically representative. The deposits contained acids, heavy metal and ferrous salts and oxides, and other corrosive substances. Many bones displayed acid or metalloacidic damage, etching, erosion, or staining, and a few had adhering fragments of what appeared to be rust still in place at the time of analysis. Preservation was variably fairly good to very poor.

OBSERVATIONS AND INTERPRETATIONS SUMMARY

Fully identifiable taxa in this collection included *Gallus gallus* small (domestic chicken of the bantam/gamecock group), *Bos taurus* (domestic cattle), and *Ovis aries* (domestic sheep). Unidentifiable materials were all consistent with these three taxa. The only other taxon which might be represented by partially identifiable material was *Capra hirca* (domestic goat), but that taxon was unattested from good material and may in fact be entirely absent from the collection. Pertinent examples are described below as *Ovis/Capra*.

Cow elements recognized were: head and shaft sections of anterior (numbers 2-6) ribs, with both left and right elements identified; fragments of posterior (numbers 4-6) cervical vertebrae; fragments of left shoulder and elbow joints; and a single right foreshank. One to three individuals are represented; these are all small full-sized but young (circa 2.5 to 5 years based on epiphyseal fusion and diaphyseal ossification) except for the foreshank, which appears to be that of a large calf or small/medium yearling. All elements displayed variable but mild to moderate thermal alteration (roasting, cooking, baking, boiling), overlain by delamination, erosion, and root-etching; some items may have lain exposed on the surface for a considerable period of time. Butchering and processing marks are consistent with modern practices; tools used included steel saw, metal knife, and some metal chopping tool (axe, cleaver, etc.). The saw may have been either manual or mechanical.

Sheep and sheep/goat elements included: left hindshank; left shoulder; and one lumbar (saddle) vertebra fragment. The vertebra was calcined; the other items were less profoundly altered by heat but had probably been boiled or baked. One or more individuals, all older yearlings or young adults, are represented. No fully identifiable butchering or processing marks were seen.

Chicken elements were dominated by foot parts of four or more individuals, but a right thigh and right shoulder (baked, roasted, or fried) were also present. All individuals were small, relatively mature birds; all or most were hens. Portions of one left and one right foot were calcined. All other foot parts may have been boiled, but this last form of thermal alteration is difficult to identify with certainty. No identifiable butchering or processing marks were seen; what was at first thought to have been a disarticulation cut is now thought to have been excavational damage.

This assemblage indicates the consumption of beef that may have been processed elsewhere, mutton that may have been butchered on-post or elsewhere, and chickens that were brought in alive or as carcasses retaining feet. Calcined materials may have been discarded unburned, becoming burned later in sanitation fires. Most of the less profound thermal alteration was probably the result of processing for consumption. Chicken feet may have been boiled for soup, a standard EuroAmerican practice until urbanization and modern processing made them unobtainable. If so, they were discarded before boiling had caused disarticulation, since the burned feet are represented by toe bones and claw cores along with tarsometatarsi. Mutton and cow processing and consumption are essentially modern, indicating consumption of mutton shoulder and loin roasts (and perhaps of mutton leg or soup therefrom derived) and of beef brisket and shoulder roasts or of stews/soups/barbecues using these cuts.

DETAILED NOTES (IN SPECIMEN NUMBER ORDER)

95.4.LA106155.00064:

This collection contains two *Bos* bones. The first is a left scapula distal half, of near-mature form, having one transverse knife cut on the ventral surface; it is severely eroded and root-etched, with little evidence of thermal alteration. The second is a complete right radius, refitted from two fragments, of an immature (large calf size). The distal is unfused, and the proximal is underossified. The shaft is delaminating; it was burned after decollagenation (hence after boiling or after long exposure, probably the former).

95.4.LA106155.00116:

This collection contains a large mammal rib in two fragments, an ovicaprid vertebra, and chicken parts including a femur, a humerus, and two tarsometatarsi. The refitted proximal rib is consistent with *Bos;* it is a right 4th

4th and 6th and probably from a large immature, but it is so eroded and corroded (acids? that further identification is unjustifiable. The ovicaprid vertebra is a calcined 3rd to 5th lumbar anterior arch fragment. Remnants of the anterior apophyseal suture show it was unfused. The *Gallus* parts include a nearly complete right femur from a mature, small bird, probably roasted, with the distal end lost in excavation. The *Gallus* right proximal humerus was probably roasted and is root-etched; it is quite consistent in all regards with the femur. The two tarsometatarsi are both also rights, near-complete, from mature hens or capons of small to medium bantam size (no spurs); they differ by about 8% in size.

95.4.LA106155.00313:

This sample has only one element, a near-complete left *Gallus* tarsometatarsus, eroded and root-etched, from a mature hen intermediate in size between the two individuals from FS# 116.

95.4.LA106155.00385:

This sample included portions of the (articulating?) distal left humerus (refit from 3 fragments) and proximal left ulna of a large adolescent or young mature *Bos*. The humerus bears near-complete fusion, and it has spotty burning over general mild thermal alteration. The ulna is unfused and is entirely consistent with the humerus. Both are delaminating, eroded, and root-etched; all major breaks are either excavational or indefinite in age.

95.4.LA106155.00411:

This sample included two *Ovis aries* left limb bones, both nearly complete; they are a metatarsus and a humerus. The humerus lacks the proximal epiphysis (unfused) but retains the distal epiphysis (partly fused). It is eroded and root-etched and was probably boiled or roasted. The metatarsus is too eroded to judge fusion and is severely delaminated, indicating either boiling or long exposure.

95.4.LA106155.00444:

This sample includes only one item, a cf. *Bos* left 4th or 5th rib shaft segment. It was metal-sawn distally, but the proximal separation is too damaged to diagnose. Although it is eroded and root-etched, it retains evidence of wet roasting or boiling, and it also has remnants of transverse cut marks (steel knife) on both interior and exterior aspects.

95.4.LA106155.00493:

This collection included elements from one left and one right *Gallus* feet, possibly from different individuals, and all calcined white. Elements include a left distal tarsometatarsus, fragments of a right tarsometatarsus, seven complete or near-complete intermediate phalanges with examples pertaining to

both feet, two terminal phalanges (claw cores), and six shaft splinters probably belonging to one or both of the ankle bones. No butchering marks were seen. Also present were numerous tiny charcoal flecks and a very small flake from a glass jar.

95.4.LA106155.00643:

This sample included fragments of a large mammal rib and of one or two large mammal vertebrae; all of these are most consistent with *Bos*. The rib is a shaft segment (refit from two fragments) from a right 2nd or 3rd rib. It was chopped distally and bears gnawing marks (probably canid but possibly human) proximally. At least one transverse steel knife cut is present on the interior aspect. The bone was wet-roasted or baked. The two vertebral fragments appear to be of posterior cervical vertebrae; they may be different elements. They probably had been sectioned lengthwise in butchering, but erosion, delamination, and possibly surface-exposure weathering are so advanced that even this basic observation is insecure. Almost no exterior compactum survives on either fragment.

Sincerely yours,

Jack Bertram

APPENDIX D

FIRE FIGHTERS AND OTHER PERSONNEL INVOLVED IN DUMP EXCAVATION

Fire Fighters and Other Personnel Involved in Dump Excavation.

Name	Title
James E. Harris	Environmental Engineer
John R. Hyndman	Acting Chief, Regulartory Compliance Office
Construction Staff	
Ignacio A. Loera	Supervisor
Rudy Holguin	(deceased) coordination
Tommy Hale	Loader
Ray Earl	Grader
George Dill	Loader
Jon C. Benz	Crane
George Medina	Loader: water tank, dump truck, backhoe
Randy Bonney	Dump Truck
Robert Medrano	Supervisor
Luis Rivera	Crane
Joe Lara	Crane
Benjamin Lucero	Maintenance Worker Helper
Henry Martinez	Vehicle Operator
Edward Ortegon	Loader: water tank, dump truck, backhoe
Pete Morales	Equipment Operator
Herb Morse	Equipment Operator
Afredo Gamboa	Supervisor, Roads & Grounds
Louie Serna	Equipment Operator
Fire Fighters	
Larry Burns	Division Chief
Robert Valles	On-site supervisor
Guillermo Rendon	Fire Fighter
Paul Self	Fire Fighter
Raymond Martinez	Fire Fighter
Linzy Hall	Fire Fighter
Gilbert Flores	Fire Fighter
Jose Olayo	Fire Fighter
Frederico Sanchez	Fire Fighter
NRES-E	
Bobby Meyers	Archaeological Assistant
Joe Cook	Archaeological Assistant
Celestine Mayaseca	Archaeological Assistant
Hector Mayallenes	Coordinator
Robin Smith	Coordinator

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