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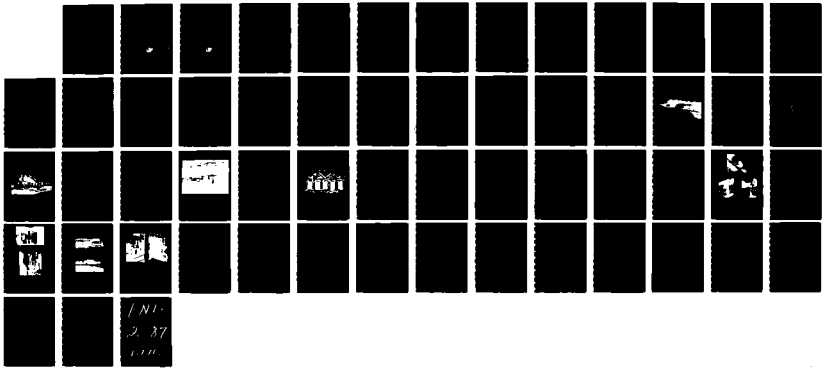

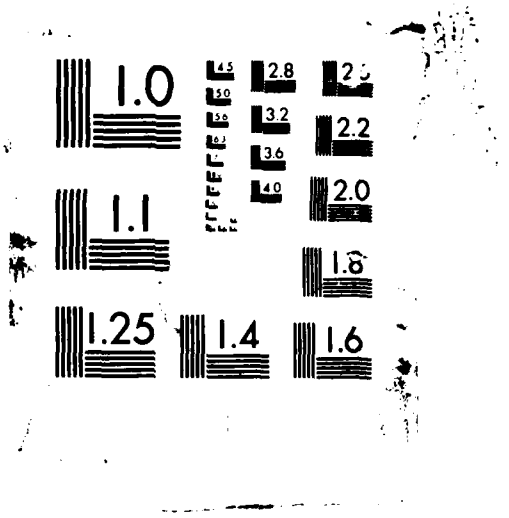
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HISTORIC PROPERTIES REPORT

LONE STAR ARMY AMMUNITION PLANT

TEXARKANA, TEXAS

FINAL REPORT

AUGUST 1984

This document was prepared by the MacDonald and Mack Partnership, Minneapolis, Minnesota, under Contract CX-0001-2-0033 between Building Technology Incorporated, Silver Spring, Maryland, and the Historic American Buildings Survey/Historic American Engineering Record, National Park Service, U.S. Department of the Interior.

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EXECUTIVE SUMMARY

The Lone Star Army Ammunition Plant (LSAAP), part of the Army's Armament, Munitions and Chemical Command (AMCCOM), was constructed in 1941-1942 to load, assemble, and pack a variety of types of conventional ammunition. LSAAP was one of 60 such plants constructed at the onset of World War II. The plant was renovated and reactivated during the Korean War, and has remained active since that time, carrying on production and modernization activities. Located on a 15,546-acre site near Texarkana, Texas, the facility presently comprises approximately 1160 buildings, some 609 of which date from World War II.

The architecture of the buildings is utilitarian in style. Many buildings have been altered, and most of the original production equipment has been replaced, during retooling to meet changing production requirements and to take advantage of new technology. There are no Category I, II, or III historic properties at LSAAP.

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PREFACE

This report presents the results of an historic properties survey of the Lone Star Army Ammunition Plant. Prepared for the United States Army Materiel Development and Readiness Command (DARCOM), the report is intended to assist the Army in bringing this installation into compliance with the National Historic Preservation Act of 1966 and its amendments, and related federal laws and regulations. To this end, the report focuses on the identification, evaluation, documentation, nomination, and preservation of historic properties at the LSAAP. Chapter 1 sets forth the survey's scope and methodology; Chapter 2 presents an architectural, historical, and technological overview of the installation and its properties; and Chapter 3 identifies significant properties by Army category and sets forth preservation recommendations. Illustrations and an annotated bibliography supplement the text.

This report is part of a program initiated through a memorandum of agreement between the National Park Service, Department of the Interior, and the U.S. Department of the Army. The program covers 74 DARCOM installations and has two components: 1) a survey of historic properties (districts, buildings, structures, and objects), and 2) the development of archaeological overviews. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, directed the program for the Army, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) directed the program for the National Park Service. Sally Kress Tompkins was program manager, and Robie S. Lange was

project manager for the historic properties survey. Technical assistance was provided by Donald C. Jackson.

Building Technology Incorporated acted as primary contractor to HABS/HAER for the historic properties survey. William A. Brenner was BTI's principal-in-charge and Dr. Larry D. Lankton was the chief technical consultant. Major subcontractors were the MacDonald and Mack Partnership and Jeffrey A. Hess. The author of this report was Robert Ferguson. The author gratefully acknowledges the help of Jerry Melito of the government staff, and of the many Day & Zimmermann, Inc., employees who provided information and research assistance; especially Jack Shellogg, who guided the field survey, and Bill Lumpkin, who provided access to historical documents.

The complete HABS/HAER documentation for this installation will be included in the HABS/HAER collections at the Library of Congress, Prints and Photographs Division, under the designation HAER No. TX-5.

Chapter 1

INTRODUCTION

SCOPE

This report is based on an historic properties survey conducted in December 1983 of all Army-owned properties located within the official boundaries of the Lone Star Army Ammunition Plant (LSAAP). The survey included the following tasks:

- Completion of documentary research on the history of the installation and its properties.

- Completion of a field inventory of all properties at the installation.

- Preparation of a combined architectural, historical, and technological overview for the installation.

- Evaluation of historic properties and development of recommendations for preservation of these properties.

Also completed as a part of the historic properties survey of the installation, but not included in this report, are HABS/HAER Inventory cards for 42 individual properties. These cards, which constitute HABS/HAER Documentation Level IV, will be provided to the Department of the Army. Archival copies of the cards, with their accompanying photographic

negatives, will be transmitted to the HABS/HAER collections at the Library of Congress.

The methodology used to complete these tasks is described in the following section of this report.

METHODOLOGY

1. Documentary Research

The LSAAP was one of several government-owned, contractor-operated facilities constructed during 1940-1942 for the manufacture and storage of conventional ammunition. Since the plant was part of a larger manufacturing network, an evaluation of its historical and technological significance requires a general understanding of the wartime munitions industry. To identify published documentary sources on American ammunition manufacturing during World War II, research was conducted in standard bibliographies of military history, engineering, and the applied sciences. Unpublished sources were identified by researching the historical and technical archives of the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) at Rock Island Arsenal.[1]

In addition to such industry-wide research, a concerted effort was made to locate published sources dealing specifically with the history and technology of the LSAAP. This site-specific research was conducted primarily at the AMCCOM Historical Office at Rock Island

Arsenal, the Texarkana Public Library, the historical archives of Red River Army Depot, and the LSAAP government and contractor files. The Texas State Historic Preservation Office (Texas Historic Commission, Austin) was also contacted, and provided photocopies of secondary source material on the installation.

Army records used for the field inventory included current Real Property Inventory (RPI) printouts that listed all officially recorded buildings and structures by facility classification and date of construction; the installation's property record cards; base maps and photographs supplied by installation personnel; and installation master planning, archaeological, environmental assessment, and related reports and documents. A complete listing of this documentary material may be found in the bibliography.

2. Field Inventory

Architectural and technological field surveys were conducted in December 1983 by Robert Ferguson. Following a general discussion with Jerry Melito of the Commander's Office, the surveyor was permitted access, with escort, to all exterior areas. Exterior and interior surveys of the major manufacturing buildings were conducted, with Jack Shellogg serving as guide.

Field inventory procedures were based on the HABS/HAER Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures.[2] All areas and properties were visually surveyed.

Building locations and approximate dates of construction were noted from the installation's property records and field-verified. Interior surveys were made of the major facilities to permit adequate evaluation of architectural features, building technology, and production equipment.

Field inventory forms were prepared for, and black and white 35 mm photographs taken of all buildings and structures through 1945 except basic utilitarian structures of no architectural, historical, or technological interest. When groups of similar ("prototypical") buildings were found, one field form was normally prepared to represent all buildings of that type. Field inventory forms were also completed for representative post-1945 buildings and structures.[3] Information collected on the field forms was later evaluated, condensed, and transferred to HABS/HAER Inventory cards.

3. Historical Overview

A combined architectural, historical, and technological overview was prepared from information developed from the documentary research and the field inventory. It was written in two parts: 1) an introductory description of the installation, and 2) a history of the installation by periods of development, beginning with pre-military land uses. Maps and photographs were selected to supplement the text as appropriate.

The objectives of the overview were to 1) establish the periods of major construction at the installation, 2) identify important events and individuals associated with specific historic properties, 3) describe patterns and locations of historic property types, and 4) analyze specific building and industrial technologies employed at the installation.

4. Property Evaluation and Preservation Measures

Based on information developed in the historical overviews, properties were first evaluated for historical significance in accordance with the eligibility criteria for nomination to the National Register of Historic Places. These criteria require that eligible properties possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that they meet one or more of the following:[4]

A. Are associated with events that have made a significant contribution to the broad patterns of our history.

B. Are associated with the lives of persons significant in the nation's past.

C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and

distinguishable entity whose components may lack individual distinction.

D. Have yielded, or may be likely to yield, information important in pre-history or history.

Properties thus evaluated were further assessed for placement in one of five Army historic property categories as described in Army Regulation 420-40:[5]

Category I	Properties of major importance
Category II	Properties of importance
Category III	Properties of minor importance
Category IV	Properties of little or no importance
Category V	Properties detrimental to the significance of adjacent historic properties.

Based on an extensive review of the architectural, historical, and technological resources identified on DARCOM installations nationwide, four criteria were developed to help determine the appropriate categorization level for each Army property. These criteria were used to assess the importance not only of properties of traditional historical interest, but also of the vast number of standardized or prototypical buildings, structures and production processes that were built and put into service during World War II, as well as of properties associated with many post-war technological achievements. The four criteria were often used in combination and are as follows:

1) Degree of importance as a work of architectural, engineering, or industrial design. This criterion took into account the qualitative factors by which design is normally judged: artistic merit, workmanship, appropriate use of materials, and functionality.

2) Degree of rarity as a remaining example of a once widely used architectural, engineering, or industrial design or process. This criterion was applied primarily to the many standardized or prototypical DARCOM buildings, structures, or industrial processes. The more widespread or influential the design or process, the greater the importance of the remaining examples of the design or process was considered to be. This criterion was also used for non-military structures such as farmhouses and other once prevalent building types.

3) Degree of integrity or completeness. This criterion compared the current condition, appearance, and function of a building, structure, architectural assemblage, or industrial process to its original or most historically important condition, appearance, and function. Those properties that were highly intact were generally considered of greater importance than those that were not.

4) Degree of association with an important person, program, or event. This criterion was used to examine the relationship

of a property to a famous personage, wartime project, or similar factor that lent the property special importance.

The majority of DARCOM properties were built just prior to or during World War II, and special attention was given to their evaluation. Those that still remain do not often possess individual importance, but collectively they represent the remnants of a vast construction undertaking whose architectural, historical, and technological importance needed to be assessed before their numbers diminished further. This assessment centered on an extensive review of the military construction of the 1940-1945 period, and its contribution to the history of World War II and the post-war Army landscape.

Because technology has advanced so rapidly since the war, post-World War II properties were also given attention. These properties were evaluated in terms of the nation's more recent accomplishments in weaponry, rocketry, electronics, and related technological and scientific endeavors. Thus the traditional definition of "historic" as a property 50 or more years old was not germane in the assessment of either World War II or post-war DARCOM buildings and structures; rather, the historic importance of all properties was evaluated as completely as possible regardless of age.

Property designations by category are expected to be useful for approximately ten years, after which all categorizations should be reviewed and updated.

Following this categorization procedure, Category I, II, and III historic properties were analyzed in terms of:

- Current structural condition and state of repair. This information was taken from the field inventory forms and photographs, and was often supplemented by rechecking with facilities engineering personnel.

- The nature of possible future adverse impacts to the property. This information was gathered from the installation's master planning documents and rechecked with facilities engineering personnel.

Based on the above considerations, the general preservation recommendations presented in Chapter 3 for Category I, II, and III historic properties were developed. Special preservation recommendations were created for individual properties as circumstances required.

5. Report Review

Prior to being completed in final form, this report was subjected to an in-house review by Building Technology Incorporated. It was then sent in draft to the subject installation for comment and clearance and, with its associated historical materials, to HABS/HAER staff for technical review. When the installation cleared the report, additional draft copies were sent to DARCOM, the appropriate State

Historic Preservation Officer, and, when requested, to the archaeological contractor performing parallel work at the installation. The report was revised based on all comments collected, then published in final form.

NOTES

1. The following bibliographies of published sources were consulted: Industrial Arts Index, 1938-1957; Applied Science and Technology Index, 1958-1980; Engineering Index, 1938-1983; Robin Higham, ed., A Guide to the Sources of United States Military History (Hamden, Conn.: Archon Books, 1975); John E. Jessup and Robert W. Coakley, A Guide to the Study and Use of Military History (Washington, D.C.: U.S. Government Printing Office, 1979); "Military Installations," Public Works History in the United States, eds., Suellen M. Hoy and Michael C. Robinson (Nashville: American Association for State and Local History, 1982), pp. 380-400. AMCCOM (formerly ARRCOM, or U.S. Army Armament Materiel Readiness Command) is the military agency responsible for supervising the operation of government-owned munitions plants; its headquarters are located at Rock Island Arsenal, Rock Island, Illinois. Although there is no comprehensive index to AMCCOM archival holdings, the agency's microfiche collection of unpublished reports is itemized in ARRCOM, Catalog of Common Sources, Fiscal Year 1983, 2 vols. (no pl.: Historical Office, AMCCOM, Rock Island Arsenal, n.d.).

2. Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures (unpublished draft, 1982).

3. Representative post-World War II buildings and structures were defined as properties that were: (a) "representative" by virtue of construction type, architectural type, function, or a combination of these, (b) of obvious Category I, II, or III historic importance, or (c) prominent on the installation by virtue of size, location, or other distinctive feature.

4. National Park Service, How to Complete National Register Forms (Washington, D.C.: U.S. Government Printing Office, January 1977).

5. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).

Chapter 2

HISTORICAL OVERVIEW

BACKGROUND

The Lone Star Army Ammunition Plant (LSAAP) is a government-owned, contractor-operated installation situated on a 15,546-acre site in Bowie County, Texas, about ten miles west of Texarkana (Figure 1). The plant was constructed largely in 1941-1942. The Lone Star Defense Corporation, a subsidiary of the B.F. Goodrich Company and operator of the plant, loaded, assembled, and packed ammunition, including medium- and major-caliber projectiles, bombs, grenades, fuzes, boosters, detonators, and artillery primers. Storage facilities were also included, but storage of finished ammunition was the primary mission of the adjacent Red River Ordnance Depot, constructed at the same time. The two installations were combined in 1945 under a single administration and renamed Red River Arsenal. For five years following World War II, the Lone Star Unit of Red River Arsenal demilitarized and renovated ammunition, and produced ammonium nitrate for fertilizer.

In 1951 the plant and the depot were again separated, and the Lone Star Ordnance Plant was reactivated to support the Korean War. (For the sake of clarity and brevity, this report will use the current name, Lone Star Army Ammunition Plant.) Operated since that time by Day & Zimmermann, Inc., the LSAAP has remained active, reducing production after the Korean Truce and increasing again in 1961-1968 in support of the Vietnam War.

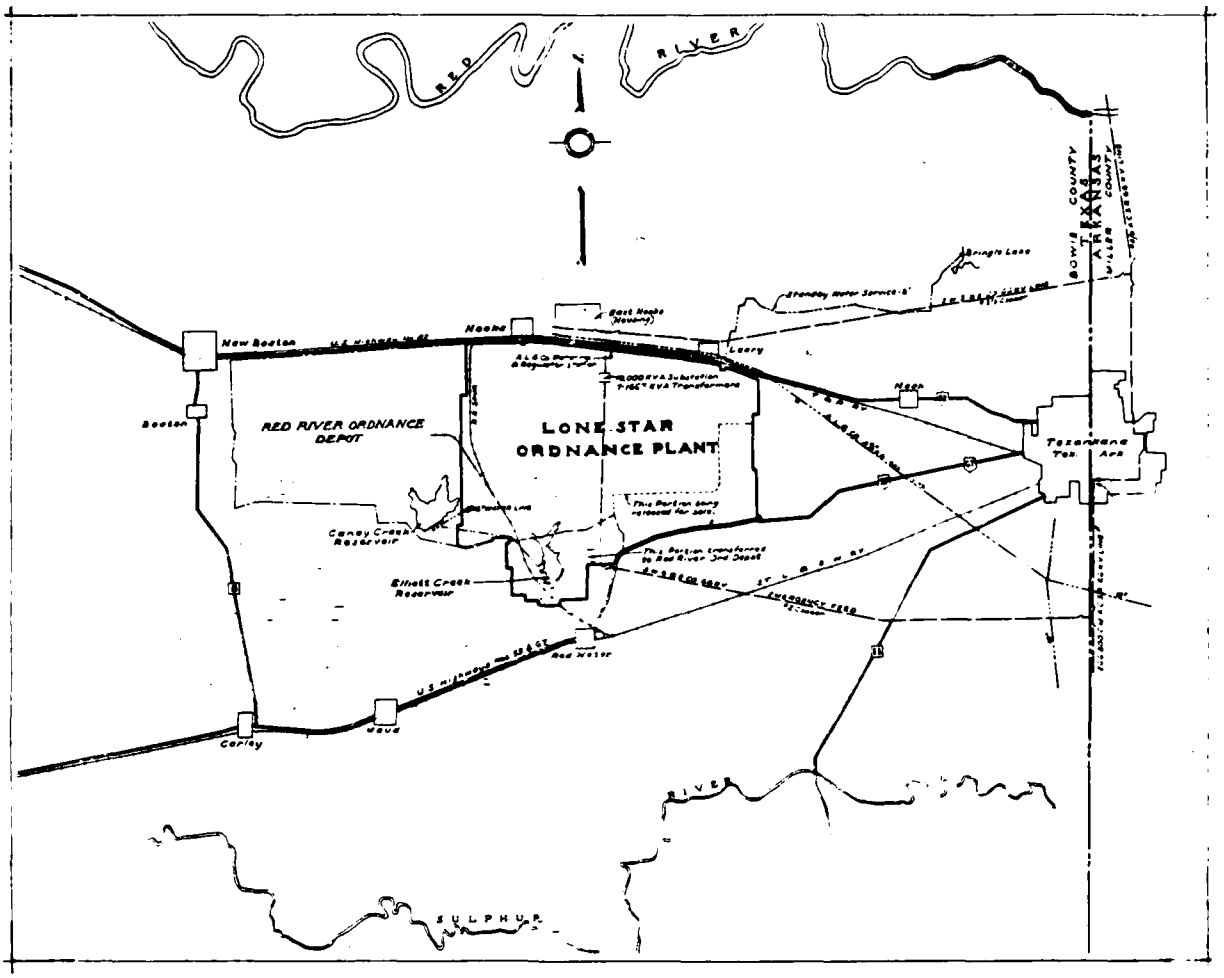


Figure 1: Lone Star Ordnance Plant, also showing Red River Ordnance Depot. Vicinity Map, dated 2-18-44, prepared by Prack & Prack, Architects, and The Chester Engineers. (Source: AMCCOM Historical Office, Rock Island Arsenal)

An extensive modernization and expansion program beginning in the late 1960s has resulted in LSAAP-developed innovations in various loading and waste-treatment processes.

At present, the LSAAP comprises approximately 1160 buildings, some 609 of which date from the original construction period. Although most major World War II-era production buildings remain, many have been altered, and nearly all of the plant's original production machinery has been replaced.

WORLD WAR II

When war broke out in Europe in the fall of 1939, the United States had virtually no industrial capacity for manufacturing military ammunition. As historians Harry C. Thomson and Lida Mayo observe in their authoritative work on American munitions production:

> Only a handful of small plants were making propellant powder and high explosives, and there were virtually no facilities for the mass loading and assembling of heavy ammunition. American industry was just beginning, through educational orders, to learn techniques for forging and machining shells and producing intricate fuze mechanisms. The only sources for new artillery ammunition were Frankford and Picatinny Arsenals, while a few ordnance depots were equipped to renovate old ammunition. Private (military) ammunition plants did not exist, and, because of the specialized nature of the process, there were no commmercial plants that could be converted to ammunition production.
>
> To meet this situation the Ordnance Department took steps in the summer of 1940 to create something new in American economic life -- a vast interlocking network of ammunition plants owned by the government and operated by private industry. More than 60 of these GOCO (government-owned, contractor-operated) plants were built between June 1940 and December 1942.[1]

The LSAAP was one of these plants.

Site Selection and Former Land Use

The selection of the LSAAP site was governed by basic criteria used in evaluating locations for all load-assemble-and-pack facilities. These considerations included:

(a) a non-coastal location as a defense against attack

(b) remoteness from large centers of population

(c) remoteness from other ammunition plants for reasons of security

(d) availability of large tracts of land to permit necessary safe distances between structures in production and storage areas

(e) availability of suitable labor

(f) proximity to main highways and railroad lines

(g) availability of adequate electrical power

(h) availability of natural gas for processing purposes

(i) ample supply of water for processing purposes.[2]

The LSAAP site satisfied these criteria. A large work force was available in the Texarkana area, and the property, located between the Red and Sulphur Rivers, had excellent rail and highway connections, with the Texas & Pacific Railroad and U.S Highway 82 forming the northern boundary. The land had been used primarily for agriculture, and was level and relatively inexpensive. A total of 24,300 acres were originally purchased.[3] When a major east-west artery, the Old Boston Road, was closed because it passed through the site, the town of Boston dwindled as New Boston grew up on Highway 82 to the north[4] (Figure 1).

Of the various villages and farms that occupied the site, only eleven cemeteries remain. No buildings predating military use of the site still stand within the boundaries of LSAAP.

Construction

Construction of the LSAAP began on 19 August 1941. The operating contractor, the Lone Star Defense Corporation (a subsidiary of the B. F. Goodrich Company of Akron, Ohio), also acted as prime contractor for the design and construction of the plant, issuing subcontracts for architecture, engineering, and construction management services. Prack & Prack, Architects, of Pittsburgh, Pennsylvania, and The Chester Engineers of Dallas set up a combined office in Texarkana for the design work. Management and construction subcontracts went to a joint venture between the Winston Brothers Company, C. F. Haglin & Sons, Inc., the Missouri Valley Bridge and Iron Company, and the Sollitt Construction Company, Inc.[5]

The rapid construction of two large industrial plants (Lone Star and Red River) brought dramatic change to the LSAAP's rural surroundings. The population of Hooks, directly across Highway 83 from the northern boundary of LSAAP, "soared from 400 to 3,000;" the housing project built there to house plant workers, like that at New Boston, was larger than the town itself.[6] On 26 May 1942, less than a year after approval of the project, the first complete line at LSAAP began production. All construction was complete by 15 June.[7]

Generally, the buildings of the LSAAP were grouped by function into separate "Areas" laid out to facilitate transportation of raw materials and finished ammunition (Figure 2). The 14 ammunition production lines (Areas A, B, C, E, F, G, J, K, M, O, P, Q, R, S) were sufficiently separated to preclude the possibility of a catastrophic incident at one line causing sympathetic explosions and/or structural damage at adjacent lines.[8] Separation distances were calculated using standard spacing formulae, developed by the Ordnance Department, relating distances in feet to quantities of explosives in pounds. The storage areas (Areas T, U, V, W) and their earth-sheltered concrete "igloo"-type magazines (Figure 3) were similarly spaced according to standard formulae.[9]

Individual loading-line layouts, based on schematic designs developed by the Ordnance Department, reflected industrial production and concerns for safety. The typical configuration was an extended, linear arrangement of widely spaced buildings interconnected by enclosed "ramps" that housed conveying systems (usually overhead monorail). For example, Area C, designed for loading major-caliber shells and small bombs, had a cumulative length of about one-half mile (Figures 4, 5). Its major buildings included Inert Storage Warehouses (Buildings C-1, C-14), a (shell or bomb casing) Receiving and Painting Building (Building C-2), a Melt Loading Building (Building C-4 / Figure 6), a Cooling Building (Building C-9), and a Drilling and Shipping Building (Building C-12). Ancillary structures included Service Magazines (Buildings C-6, C-7) for receiving and storing

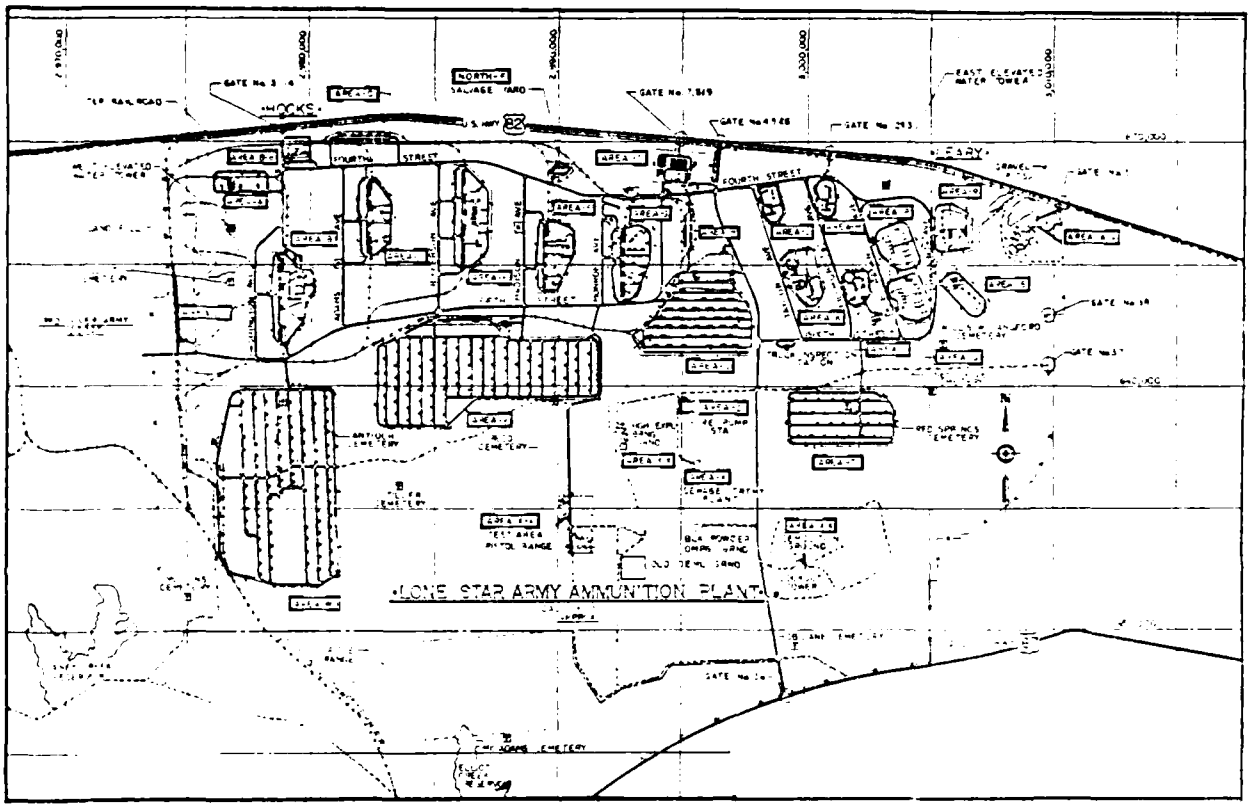


Figure 2: Lone Star Army Ammunition Plant. Current Site Plan, prepared by Day & Zimmermann, Inc., n.d. (Source: Contractor files, LSAAP)

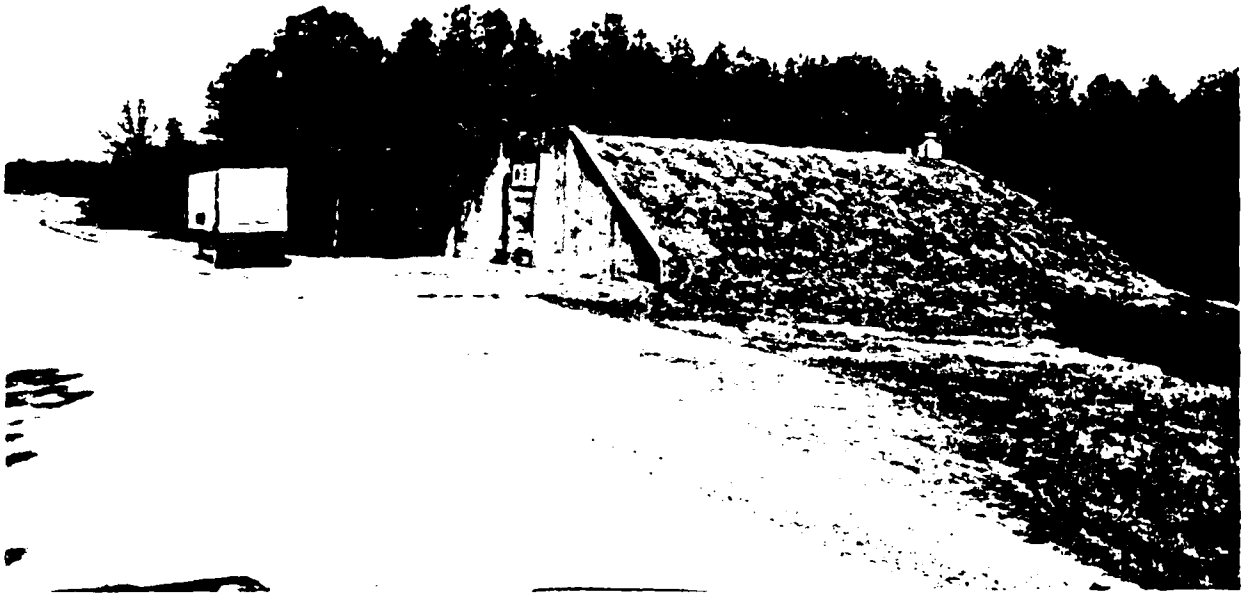


Figure 3: Building W-5-1 is typical of the LSAAP's earth-sheltered "igloo"-type storage magazines. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

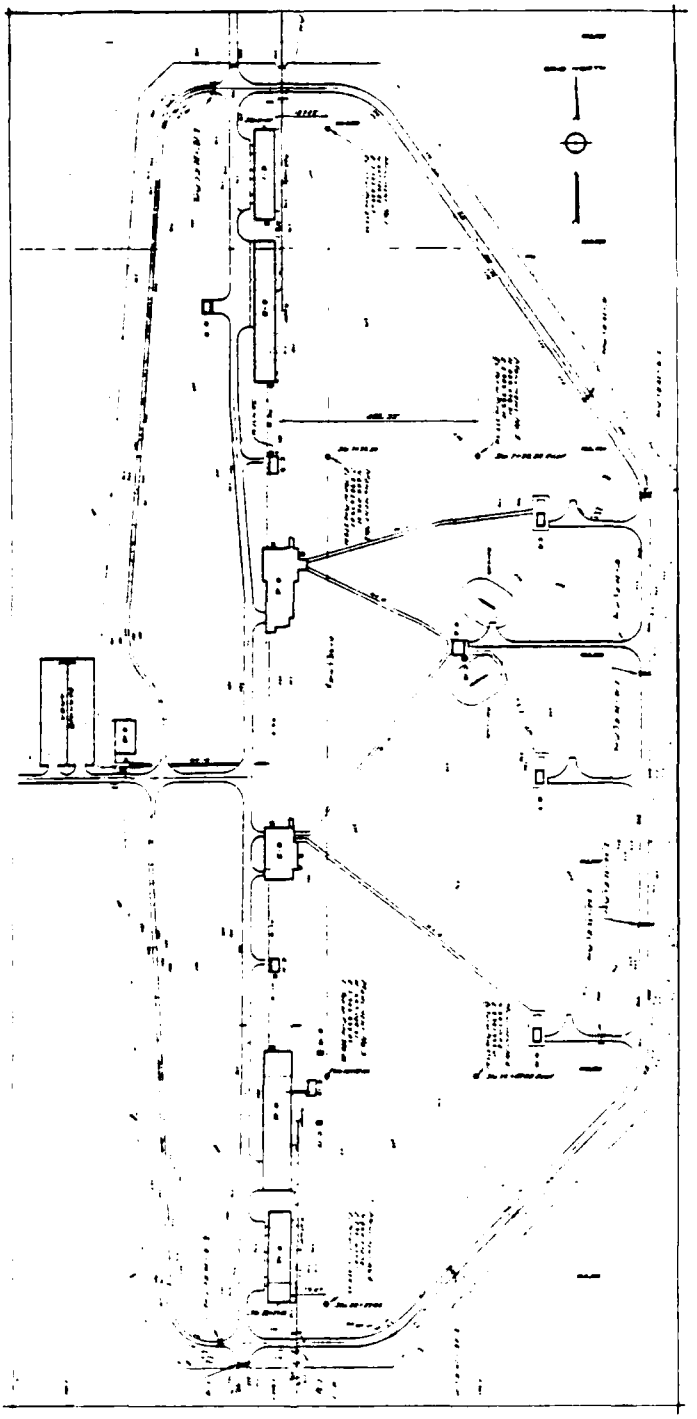
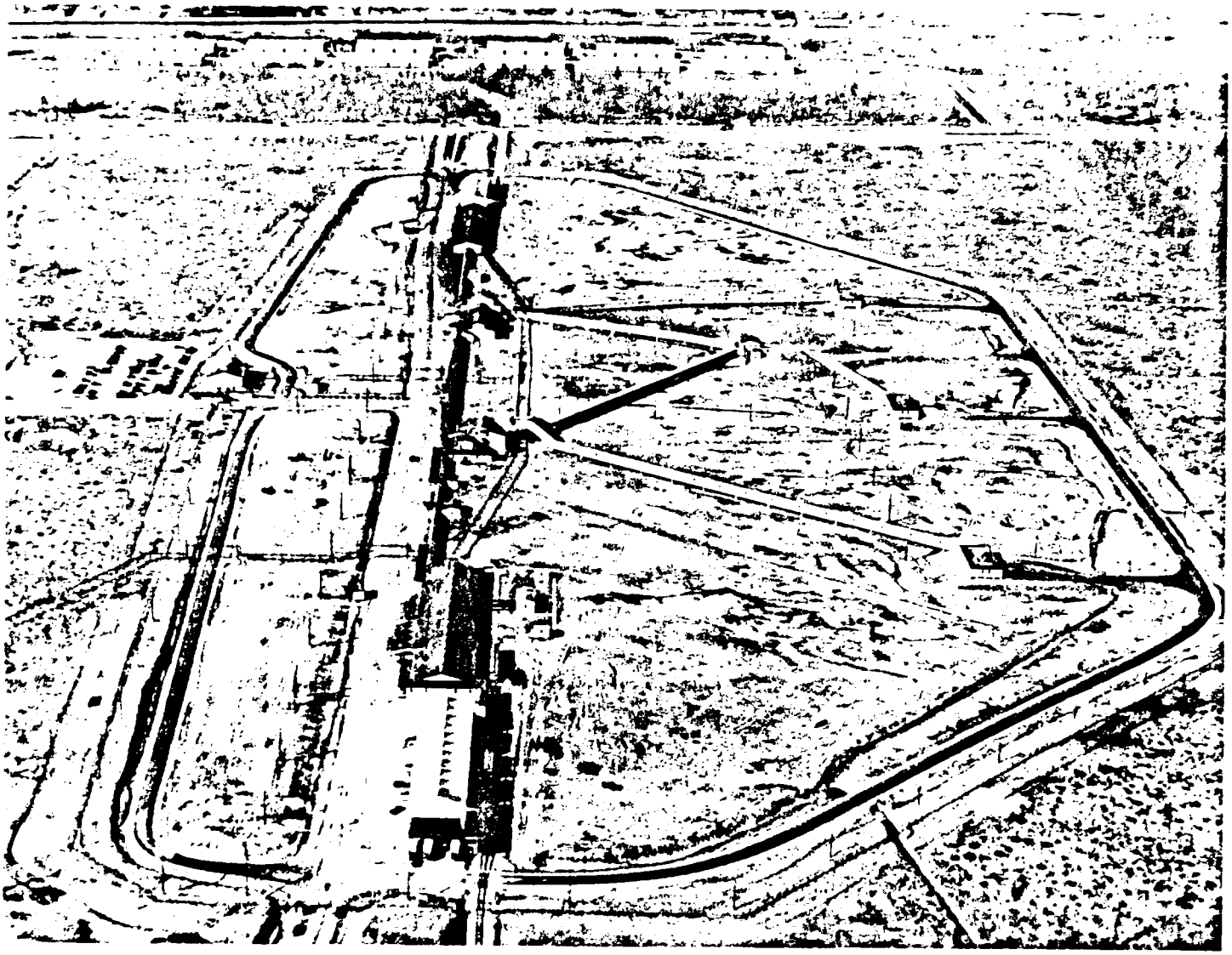


Figure 4: LSAAP, Area C. Site Plan, dated 6-24-42, prepared by Prack & Prack, Architects, and The Chester Engineers. (Source: AMCCOM Historical Office, Rock Island Arsenal)



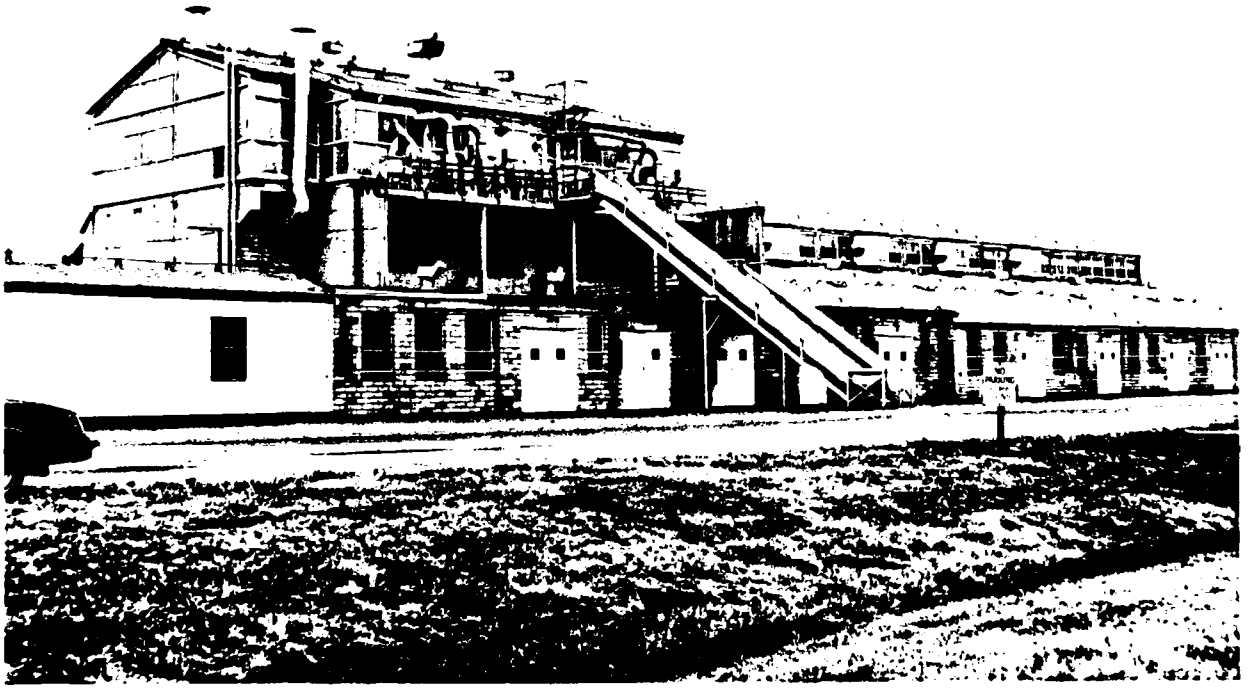


Figure 6: Melt Loading Building (Building C-4). View looking southeast. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

explosives, a Screen House (Building C-5) for preparing the explosive, and a Change House (Building C-15) for the employees. The buildings were joined by ramps up to 650 feet in length.

Since Area E produced ammunition with cartridges containing propellant charges, a Propellant Charge Building (Building E-17) and Smokeless Powder Magazine (Building E-18) were also included; in other respects Area E and Area B, designed for bomb-loading, were similar in scale and arrangement to Area C. Areas F and G, designed to load minor-caliber shells, were also similar, but smaller in scale. Both lines had press-loading facilities (Buildings F-15, G-15) as well as small Melting and Pouring Buildings (Buildings F-18, G-18).

Fuze, booster, primer, and detonator production required a less extensive industrial plant (large-scale melt/pour facilities were not necessary) and involved far smaller quantities of explosives. Areas J, K, M, O, P, Q, R, and S were therefore still more closely spaced and smaller in scale (Figures 7, 8). Connecting ramps were open and conveyance was by hand carts; shipping and receiving were by truck rather than rail.

The LSAAP's one other production line, Area A, was not a loading facility, but an ammonium nitrate plant. The area had three production units, each consisting of a Pan House (e.g., Building A-4) and a Kettle House (e.g., Building A-7), with accessory pump houses and storage tanks.

Most of the production buildings at LSAAP were of semi-permanent, fire proof construction, with concrete foundations and floors, internal concrete

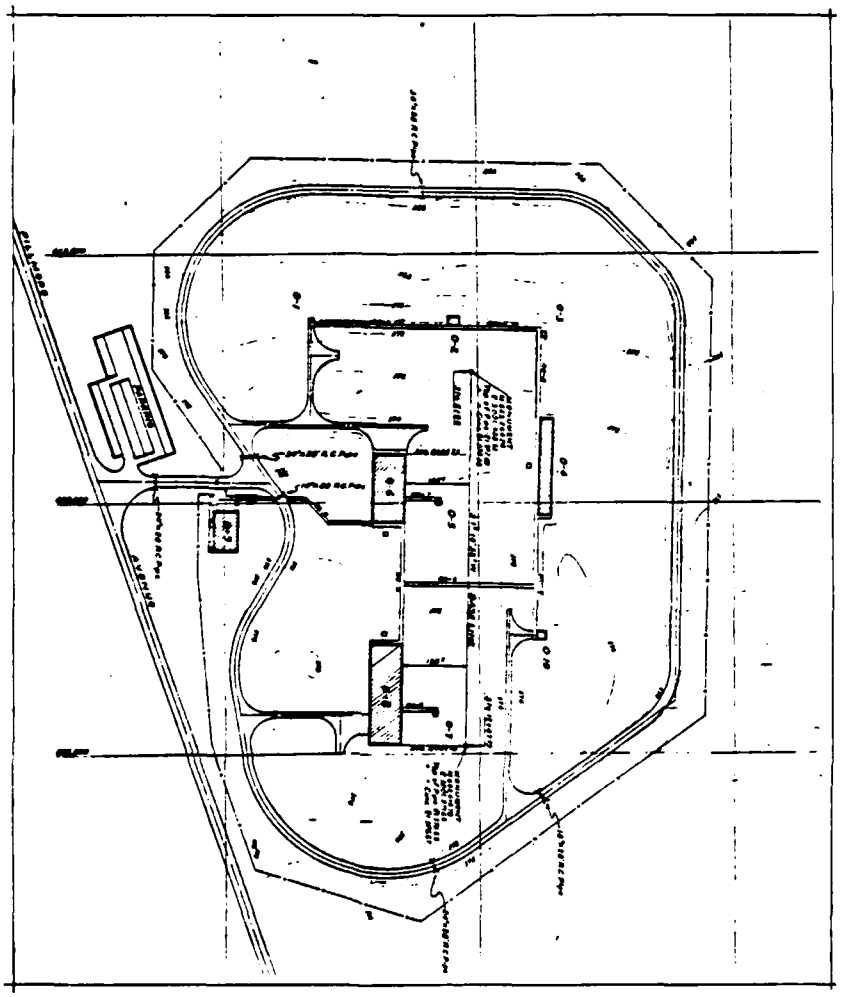


Figure 7: LSAAP, Area O. Site Plan, dated 6-19-42, prepared by Prack & Prack, Architects, and The Chester Engineers. (Source: AMCCOM Historical Office, Rock Island Arsenal)

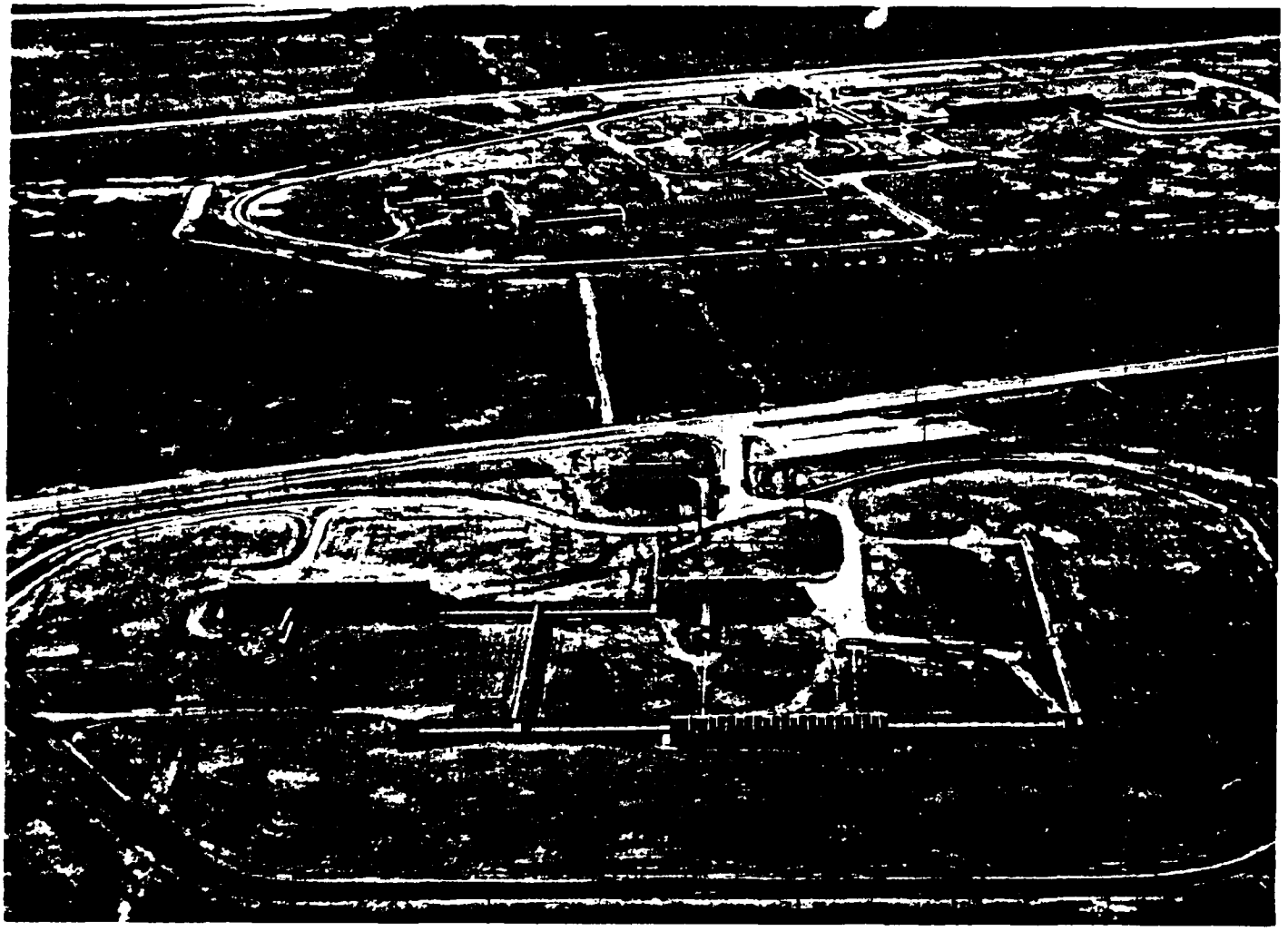


Figure 8: LSAAP, Area O. Aerial photograph, looking west, 1944. Area K is in the background. (Source: AMCCOM Historical Office, Rock Island Arsenal)

explosion walls, steel framing, and infill walls of structural clay tile (Figures 6, 8, 9). Roofs on buildings and ramps were corrugated asbestos (transite), corrugated sheet metal, or asphalt. Porches and galleries (and, in the administration and staff housing areas, entire buildings) were framed in wood. Throughout the plant, only such details as the returned eaves on the Administration Building (Building I-5) and the "V for Victory" in the tilework of certain Change Houses (Figure 9) betray attention to architectural appearance.

Technology

In the early days of planning for the national munitions network, engineers at Picatinny Arsenal and the Ogden Ordnance Depot had prepared typical plans and equipment lists for production lines, along with manuals on shell- and bomb-loading procedures. These documents, along with details of plants already constructed (loading buildings and equipment at LSAAP were based largely on those at Joliet AAP, Elwood, Illinois[10]) were made available through the Office of the Chief of Ordnance, which had the responsibility of coordinating production among the various plants then in the planning stages. The operating contractor's history of one of the early plants (Ravenna AAP, 1940) goes on to explain:

> As the work of designing these loading plants progressed, the Ordnance Department adopted a policy of specializing on certain given items of ammunition at certain given plants or . . . of distributing the loading program among the various loading plants in such manner as to require only two, three, or four of the indicated items to be loaded in any individual loading line.[11]

The large number and varying design of the lines at LSAAP allowed production of a wide variety of items, including 20-lb., 100-lb., 300-lb.,

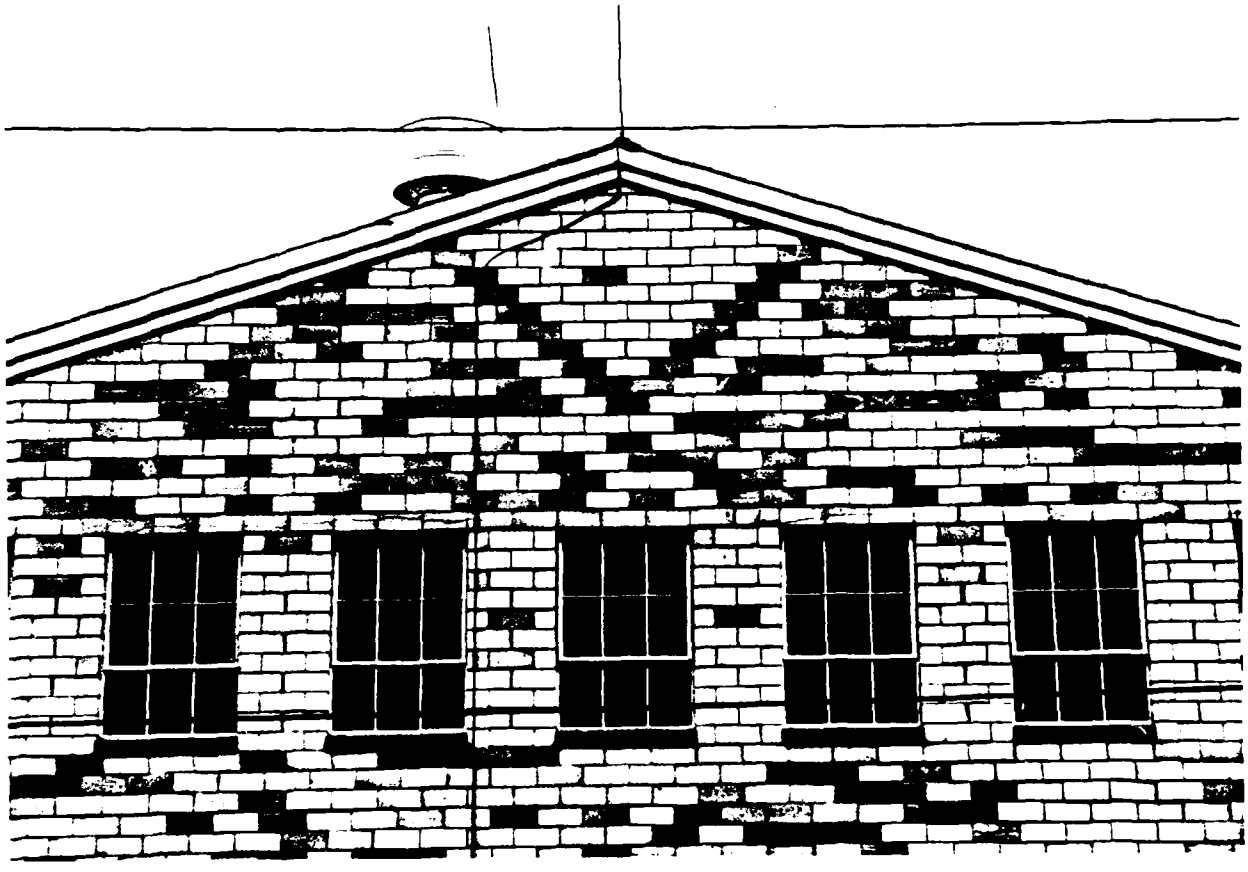


Figure 9: Change House (Building K-19), detail of north facade. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

500-lb., 1000-lb., 2000-lb., 4000-lb. and 6000-lb. bombs; 20-mm, 37-mm, 81-mm, 90-mm, 105-mm, 155-mm, and 8" shells; anti-tank mines; hand grenades; four kinds of fuzes, two kinds of boosters, two kinds of artillery primers, and detonators.[12]

The load-assemble-and-pack process at LSAAP consisted primarily of the final assembly of component parts and materials into complete ammunition. This process, common to all load-assemble-and-pack facilities, has been described in the following way:

> The explosives, shell or bomb casings, cartridge cases, fuzes, primers, boosters, and detonators are received from outside manufacturers [or, as at LSAAP, from other areas of the same plant]. They are then inspected and stored, until required, in the loading departments. The loading and assembling of these materials is carried on as an assembly-line process. Various departments or so-called "load lines" are maintained for the processing of each particular type of ammunition. Thus, a plant may have, in addition to one or more shell- or bomb-load lines, separate lines for loading such component parts as detonators, fuzes, primers, and boosters. . . . .
>
> The main loading operation for shells and bombs is generally performed by either the melt-load or the press-load process. On the load line, the shell or bomb casings are cleaned, inspected and painted. Largecaliber shells and bombs are usually filled by the melt-load process, the major operation of which consists in screening, melting, and pouring the main explosive or bursting charge into the shell or bomb cavity. The most commonly used bursting charge is TNT, which is readily melted either alone or with ammonium nitrate. After the TNT has hardened, the booster and fuze are inserted. Some large-caliber shells are shipped to combat zones unfuzed, and the fuze is assembled in the field prior to firing the shell. In the case of fixed and semifixed rounds of ammunition, the projectile is assembled to the cartridge case, which contains the propellant charge and artillery primer. The final operations involve labeling and packing or crating for storage or shipment. Inspection is carried on continuously at each stage of the operation.
>
> The operations performed on the lines loading shells by the press-load process differ somewhat from those where the melt-loading process is used. The main explosive charge is

> loaded into the projectile in a dry, rather than molten state, and consolidated in to the shell by means of a hydraulic press. Press loading is most generally applied to smaller-caliber shells, such as those used in 20-mm and 40-mm cannon.
>
> The process of loading such component parts as fuzes, boosters, detonators, and primers is largely confined to very simple assembly work. Artillery primers, the bodies of which are metal tubes filled with a specified amount of black powder, are generally loaded on a volumetric loading machine. The heads, containing a small percussion element which ignites upon friction from the firing pin, are staked to the loaded bodies. Most of the operations on the primer-load lines are mechanized.
>
> The method of loading detonators, fuzes, and boosters varies somewhat from plant to plant, but in general the operations involve a large amount of bench assembly work. On the booster-loading line, for instance, each minute task is performed at long tables having numerous stations. Although most of the operations are performed by hand, small crimping and staking machines are used at the tables to assemble the various parts.[13]

Detonators, fuzes, and boosters were loaded at LSAAP at Areas P and Q, J and M, and O, respectively. The press-loading facilities (Buildings F-15, G-15) on the minor-caliber lines at Areas F and G loaded both incendiary materials for tracers and tetryl, a high explosive similar to TNT but too sensitive to melt. Tetryl was used in fuzes, boosters, and detonators as well. In addition, the detonator lines at Areas P and Q used lead azide and mercury fulminate, still more sensitive explosives.[14]

The only explosive actually manufactured at the LSAAP was ammonium nitrate. Due to a shortage of TNT throughout the first years of the war, most shells and bombs were loaded with amatol, a mixture (usually 50/50) of TNT and ammonium nitrate, as a bursting charge. Like most other loading plants, the LSAAP had facilities for producing crystalline ammonium nitrate from ammonia and nitric acid (Area A). Early in 1943, with increased availability of TNT, most loading plants closed their ammonium nitrate

facilities. Area A at LSAAP, however, remained in production through the end of World War II.[15]

On 15 August 1945, immediately after the Japanese surrender, the government ordered the LSAAP to cease production. The Lone Star Defense Corporation decontaminated all buildings and equipment (except Area A, which remained in production), placed them in "standby" condition, and turned the plant over to the Army. The Army merged the plant with the adjacent Red River Ordnance Depot under the new name of Red River Arsenal, and remodelled Areas C, E, F, G, and O for the renovation and demilitarization of ammunition. Prack & Prack and The Chester Engineers again designed and supervised the construction work, which included the X-Ray Building (Building E-10) in Area E.[16]

Renovation and demilitarization remained the LSAAP's chief activities until 1951. The ammonium nitrate plant also remained active until 1947, producing fertilizer for the government's foreign aid program. While the Army performed the ammunition-related projects directly, it contracted the ammonium nitrate production to the Lion Oil Company, operating through the Silas Mason Company of Shreveport, Louisiana. Silas Mason, which carried on similar operations at other ammunition plants during this period, placed Area A in standby after production ended.[17]

KOREAN WAR

Anticipating a growing need for war materiel for use in Korea, the Army began to renovate the LSAAP early in 1950. The Corps of Engineers and the

Ordnance Corps handled the "first wave" of renovation, involving Areas B, C, E, F, and G. It was not long, however, before the Army determined that the full production capacity of LSAAP would be needed, and returned the plant to contract operation. Day & Zimmermann, Inc., of Philadelphia, served as architect-engineer for the "second wave" of renovation, and on 1 May 1951 signed a contract to operate the plant. The LSAAP was separated from Red River Arsenal on 1 November and again became an independent plant (designated Lone Star Ordnance Plant).[18]

The J. M. Brown Construction Company of Shreveport, Louisiana, performed the construction work for both waves of rehabilitation. Most of this work focused on rehabilitation of existing buildings. Among the few new buildings constructed between 1951 and 1953 were the Machine Shop (Building I-30) and Central Stores Warehouse (Building I-32) in the Administration Area (Area I).[19]

The major difficulty encountered during rehabilitation involved production machinery. After World War II, much of the LSAAP's equipment had been either transferred to other loading plants or converted for demilitarization and renovation use. Often, only badly worn World War II-vintage machines were available as replacements, and even these were difficult to obtain. The problems were compounded by administrative conflicts with Red River Arsenal which, in some cases, prevented access to equipment and buildings already on site. For example, rehabilitation of Area B, scheduled for completion in April 1951, was delayed until 1953.[20]

Nonetheless, Area F was ready to begin production on 18 June 1951, and Areas E, M, and P followed by October. Eventually, all production lines except Areas B, J, and S were reactivated. Products and techniques were similar to those of the World War II period. Supplementary charges, a new addition to some types of artillery shells, were produced at Area F; Supplementary Charge Magazines (Buildings B-34 and C-42) were added to the lines requiring them.[21]

Although the Army did not deactivate the LSAAP after the end of the Korean War (27 July 1953), it reduced production immediately. Day & Zimmermann, Inc. continued to operate the plant and maintained inactive areas in layaway as production requirements were further reduced during the next seven years.[22]

VIETNAM WAR TO THE PRESENT

The LSAAP began to produce munitions for use in Vietnam in 1961; increasing demands eventually required reactivation of all of the plant's production lines.[23] Most products remained similar to those for which the plant was originally designed, but technological developments significantly increased the safety of some production processes.

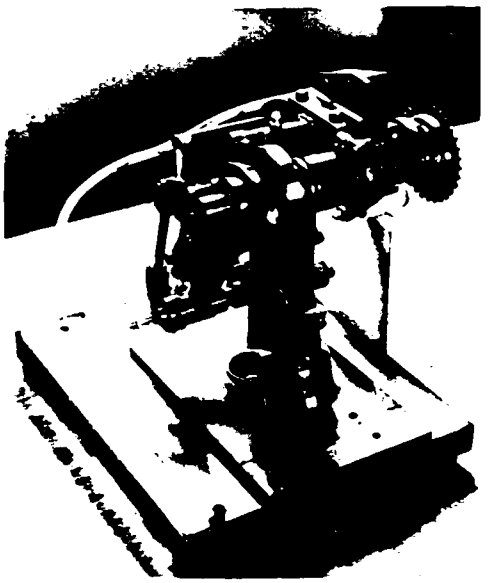
Detonator production, in particular, was extremely hazardous as originally performed (see "World War II Technology," above). To minimize the risks in handling highly sensitive initiating explosives manually, Day & Zimmermann engineers Jimmy Cargile and Don Chamlee designed and patented devices to measure and transport the required small amounts of explosive. The

mechanical Cargile Scooper, developed in 1965, and the pneumatic Chamlee Loader, introduced in 1966, replaced manual operations on the detonator lines (Areas P and Q) at LSAAP. These innovations were adopted throughout the explosives industry[24] (Figure 10).

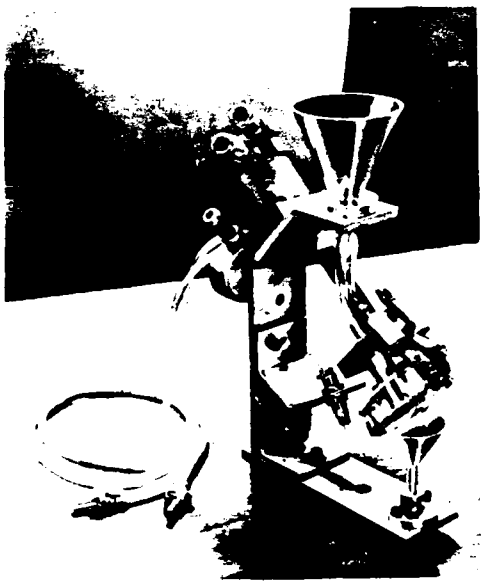
In the early 1970s, LSAAP engineers also developed equipment for loading a new product. The ICM -- Improved Conventional Munition, or "cluster bomb" -- consisted of a 155-mm shell loaded not with a single bursting charge but with a number of "bomblets," or grenades, which dispersed over a wide area while the shell was in flight. In the Pelleting Building (Building B-46), the grenades were loaded with TNT-based Composition A-5 in remote-controlled presses -- another instance of separation between workers and explosives for safety reasons. The loaded and fuzed grenades were then mechanically packed into projectiles in the Assembly Building (Building B-13). Milan AAP, in Tennessee, and Mississippi AAP built subsequent generations of the ICM loading equipment.[25]

The Pelleting Building (Building B-46), another Assembly Building (Building B-44), and the Drying House (Building B-40) were added to Area B in 1962. Also added during the Vietnam War was the Primer Loading Building (Building R-38) in Area R. Its half-mile-long production line was based on a much smaller prototype built in the old Loading Building (Building R-9); the basic principle, again, was mechanization of tasks previously performed by hand. Conveyance on this line utilized the first "car-track" system in the ammunition industry: a rotating shaft in the center of the track drove a variable-pitch wheel on the material-carrying car, providing stability and speed control (see Figure 13). With this

A. Measuring explosive by hand.



B. The Cargile Scooper, 1964.



C. The Chamlee Loader, 1965.

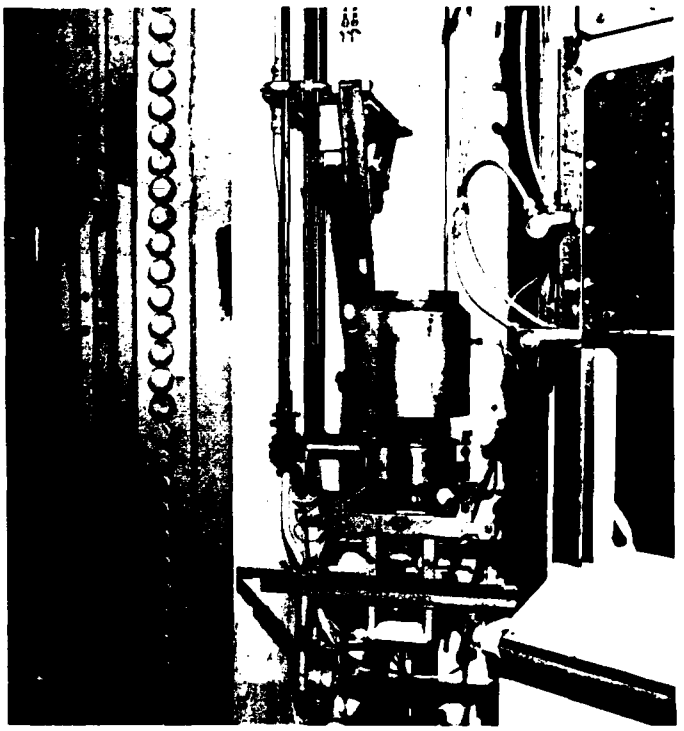
Figure 10: Automation of Initiating Explosive Handling, I.
(Source: Field inventory photographs, Robert Ferguson, MacDonald and Mack Partnership, 1983)

project, completed in 1972, the LSAAP became one of the first of many munitions plants to participate in the Army's Plant Modernization and Expansion Program, a program that continues to the present.[26]

While Vietnam War-related production at the LSAAP declined steadily after 1968, modernization activities continued to increase, and the LSAAP has remained active. Major new projects have concentrated on automation of production processes and toxic waste treatment; in both areas plant personnel have developed unique or prototype equipment. New equipment for several kinds of fuze assembly operations was installed in Area K in 1981.[27] Further developments in the detonator-loading process have focused on bulk handling of the initiating explosives, which are now unwrapped and divided by remote-controlled machinery in explosion-proof cubicles in the Process Building (Building P-76 / Figure 11). The building was completed in 1978; final prove-out and initial production on the new machinery occurred in late 1983.[28] Also completed in 1983 was the 105-mm Melt/Pour facility in Area E. Located in earth-sheltered Building E-123, this completely automated, computer-controlled production line is unique in the industry[29] (Figures 12, 13).

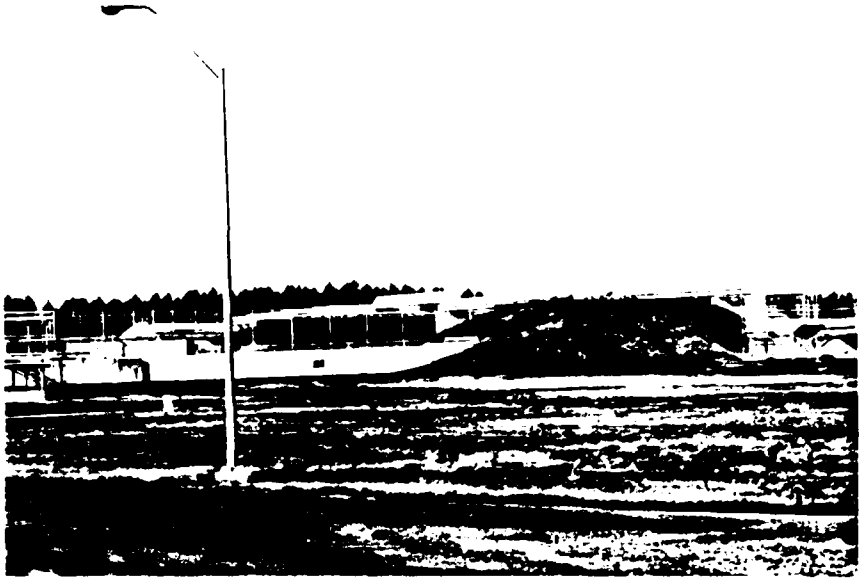
Recent developments in toxic waste treatment include the first lead-removal facility at a government-owned, contractor-operated (GOCO) plant (Building P-78, completed in 1977), and a unique electrochemical precipitation/ ultrafiltration treatment plant for pyrotechnic/heavy metal-contaminated waste water (Building G-130, completed in 1982). The 1983 closure of pinkwater ponds south of Area O was the first closure-in-place of soil contaminated with TNT-based explosives.[30]

A. The Line Engineer opens a processing cubicle. (Source: Field inventory photograph, Robert Ferguson, MacDonald and Mack Partnership, 1983)

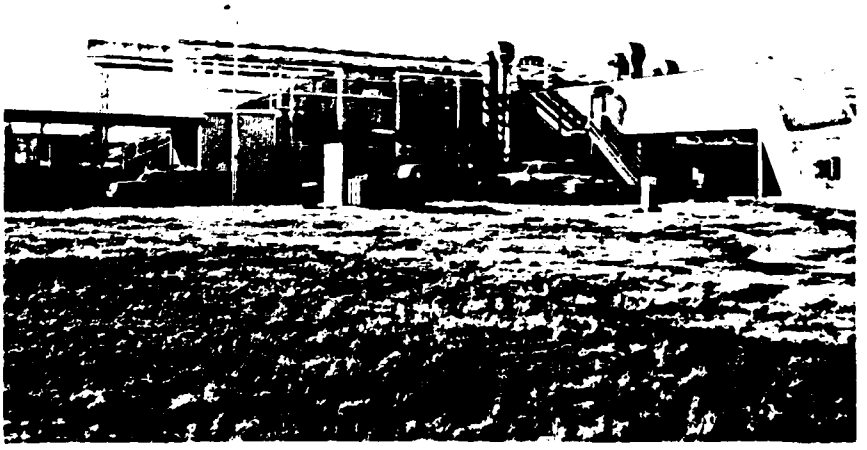


B. Explosive-processing equipment inside the cubicle. (Source: Contractor files, LSAAP)

Figure 11: Automation of Initiating Explosive Handling, II. (Detonator Loading, Building P-76)

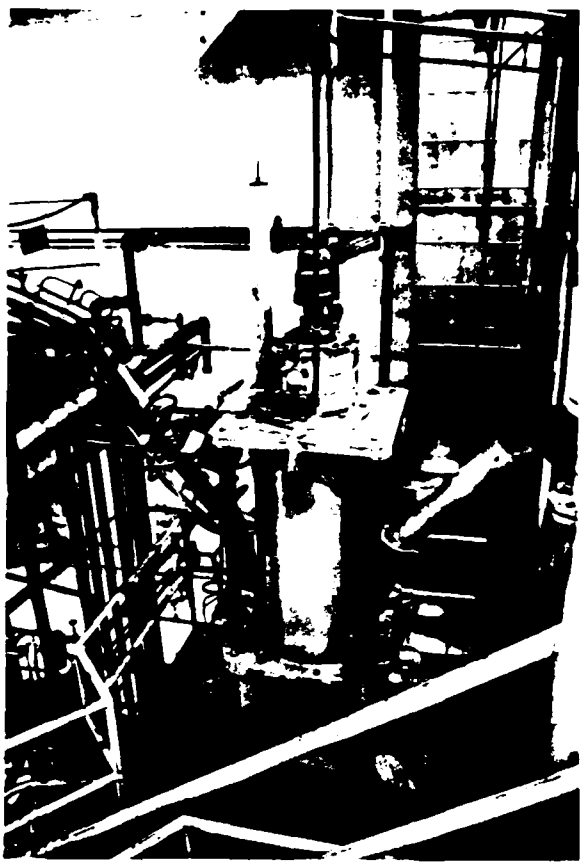


A. View from southeast.

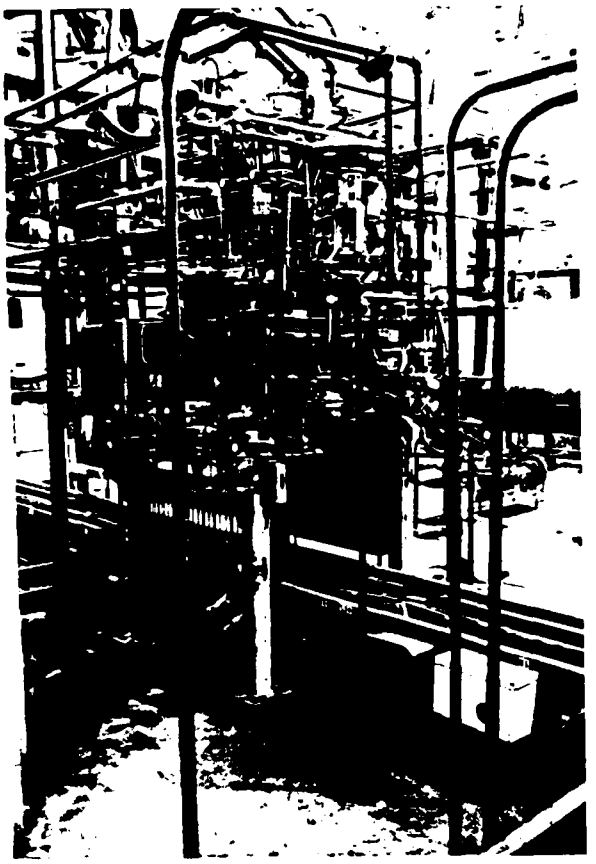


B. View from northeast.

Figure 12: Melt/Pour Building (Building E-123) extends three stories underground. (Source: Field inventory photographs, Robert Ferguson, MacDonald and Mack Partnership, 1983)



A. Top of melt unit.



B. Pour unit. The car track runs underneath the pouring machine.

Figure 13: Melt/Pour equipment in Building E-123. (Source: Field inventory photographs, Robert Ferguson, MacDonald and Mack Partnership, 1983)

NOTES

1. Harry C. Thomson and Lida Mayo, The Ordnance Department: Procurement and Supply (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1960), pp. 104-105.

2. Thomson and Mayo, p. 108.

3. William Voight, Jr., "The Ordnance Organization in World War II" (unpublished report prepared for the Ordnance Department, 1945), p. 194. After World War II, various tracts were sold off through the Army Corps of Engineers. The Army's Real Property Inventory for 31 December 1981 shows the plant's acreage at 15,546.

4. According to E. J. (Jack) Shellogg, of Day & Zimmermann, Inc., during a tour of LSAAP on 12 December 1983.

5. War Department Industrial Facilities Inventory: Lone Star Ordnance Plant, Texarkana, Texas (unpublished report prepared by Prack & Prack, Architects, and The Chester Engineers, for U.S. Army Corps of Engineers, March 1944), Foreward, p. 7.

6. State of Texas Historical Marker at Hooks; Voight, pp. 195-196; Facilities Inventory, Utility Location Map.

7. Facilities Inventory, p. 435.

8. According to the Ordnance Department's Safety Officer, "the guiding principles which were followed in laying out [a] plant are: 1. Hazardous operations have been separated from each other by barricades or by placing them in separate buildings. 2. Operating buildings have been separated from each other by safe distances to prevent the spread of fires or explosions. 3. Operating buildings have been grouped into separate production lines whose sizes and capacities are based on efficient and economical operation. Examples are fuze-loading manufacturing lines, complete rounds loading lines, and anhydrous ammonia manufacturing lines. The lines are separated from each other by distances which not only will give protection against the spread of fires and explosions, but also will prevent explosions in one line from structurally damaging buildings in other lines. 4. Equipment layouts in operating buildings have been made with a view toward eliminating hazards from electrical installations, mechanical or static sparks, and fires from lightning or other causes. 5. Change houses and bomb proof shelters have been provided where necessary for the comfort and safety of operating personnel." [Major George D. Rogers, "Military Explosives," National Safety News, 44 (July, 1941), 22].

9. A discussion of the design and spacing of magazines is presented in LTC. C. H. Cotter, "Naval Ammunition Depot Near Hawthorne, Nev., Built to Serve the Pacific Coast," Engineering News-Record, 105 (November 20, 1930), 803-805. Igloos at the LSAAP were the single barrel vault,

"Standard Underground Storage Magazine." They were constructed of reinforced concrete with an earth cover and varied in dimensions. A discussion of similar igloo construction is presented in Paul Nissen, "Igloos of Concrete," Pacific Builder and Engineer, 47 (September, 1941), 40-44.

10. The load-assemble-and-pack plant at Joliet AAP, then called Elwood Ordnance Works, was built in 1940-1941. The similarity of buildings was noted by the author, who surveyed both sites, and verified by inspection of working drawings for LSAAP in the Facilities Inventory, which cite the "Ellwood job."

11. "History of the Operating Contractor's Organization and Operation of the Ravenna Ordnance Plant" (unpublished report, prepared by the Atlas Powder Co., Wilmington, Delaware), Vol. I (August 28, 1940-June 30, 1943), p. 50. This discussion of the planning process is based on pp. 45-50.

12. Facilities Inventory, pp. 438-439.

13. "Hourly Earnings in the Ammunition-Loading Industry, 1944," Monthly Labor Review, 60 (April, 1945), 840-841.

14. The "sensitivity" of an explosive is its tendency to detonate under shock, friction, or high temperature. At LSAAP, the phrase "Mind your Ps and Qs" has a highly specific meaning. On the uses and relative sensitivities of various explosives, see Rogers. Functions of individual lines and buildings during World War II were determined from Facilities Inventory, pp. 438-439 and the Area Site Plans, which include building lists.

15. "History of Lone Star Ordnance Plant, Texarkana, Texas, 2 September 1945 - 30 June 1951" (unpublished report prepared by Day & Zimmermann, Inc., 1951), p. 6; "[Lone Star Army Ammunition Plant] Annual Historical Review, Fiscal Year 1982" (unpublished report prepared by Day & Zimmermann, Inc., 1982), p. 7.

16. "History, 1945-1951," pp. 9-28. Details of the remodelling and new construction are found in War Department Industrial Facilities Inventory, Supplement No. 1: Lone Star Ordnance Plant, Texarkana, Texas (unpublished report prepared by Prack & Prack, Architects, and The Chester Engineers, for the U.S. Army Corps of Engineers, Tulsa, Oklahoma, January 1946).

17. "History, 1945-1951," pp. 18-20.

18. "History, 1945-1951," pp. 62-73; "Annual Historical Review, FY 82," p. 8.

19. "History, 1945-1951," pp. 64-68; U.S. Army Real Property Inventory: Lone Star AAP (unpublished computer printout, 12/31/81 and 31 Mar 82); Plant Data Book: Lone Star Army Ammunition Plant (unpublished tabulation prepared by Day & Zimmermann, Inc., 8th Revision, September 30, 1979).

20. "History, 1945-1951," pp. 64, 71-73; William W. Cooper, "History: Lone Star Ordnance Plant, May 1, 1951-December 31, 1951" (unpublished report prepared for Day & Zimmermann, Inc., May 6, 1952), pp. 118-119; "Annual Historical Review, FY 82," p. 9.

21. Cooper, pp. 119, 121-131; Plant Data Book; Real Property Inventory; R. J. Hammond, Profile on Munitions, 1950-1977 (unpublished report prepared for the Ordnance Department, n.d., on microfiche, AMCCOM Historical Office, Rock Island Arsenal), p. 52. Cooper describes the supplementary charge on p. 124.

22. "An l Historical Review, FY 82," pp. 9-10.

23. "Annual Historical Review, FY 82," p. 10.

24. This information was obtained in an interview with Don Chamlee, H. E. (Buddy) Hinton, and Jack Shellogg, on 12 December 1983. Ladd Miller, Assistant Superintendent of Areas P and Q, demonstrated the machines in the Tool Room of Area Q on 14 December.

25. "Annual Historical Review, FY 82," pp. 10-11. Technical information was obtained during a tour of the facility on 14 December 1983, guided by Jack Shellogg and Don Bateson, Engineering Supervisor of Area B.

26. Emmet Singleton, Superintendent of Area R, showed the author the prototype primer-loading equipment on 14 December 1983, demonstrating, with the aid of several employees, the differences between old and new methods. Don Chamlee, Buddy Hinton, and Jack Shellogg explained the significance of the project and the car-track system on 12 December 1983. Building names, numbers, and construction dates are correlated in Real Property Inventory and Plant Data Book. LSAAP participation in the Modernization Program is discussed in "Annual Historical Review, FY 82," pp. 10-11.

27. "[Lone Star Army Ammunition Plant] Annual Historical Review, 1 October 1980 through 30 September 1981 [FY 81]" (unpublished report prepared by Day & Zimmermann, Inc., 1981), pp. iii, 45-47. Danny Johnson and Jack Shellogg guided the tour of Area K on 14 December 1983.

28. "Annual Historical Review, FY 82," pp. 39-44; tour of the facility with Jack Shellogg, 14 December 1983.

29. The line also uses a car-track conveying system. Final prove-out was on 14 December 1983; the author and Jack Shellogg were in the building minutes prior to the introduction of explosive. See "Annual Historical Review, FY 81," p. 52.

30. According to Jack Shellogg, 12-14 December 1983 and 23 February 1984. Building G-130 and the ponds are discussed in "Annual Historical Review, FY 81," p. ii; and "Annual Historical Review, FY 82," p. 35.

Chapter 3

PRESERVATION RECOMMENDATIONS

BACKGROUND

Army Regulation 420-40 requires that an historic preservation plan be developed as an integral part of each installation's planning and long-range maintenance and development scheduling.[1] The purpose of such a program is to:

- Preserve historic properties to reflect the Army's role in history and its continuing concern for the protection of the nation's heritage.
- Implement historic preservation projects as an integral part of the installation's maintenance and construction programs.
- Find adaptive uses for historic properties in order to maintain them as actively used facilities on the installation.
- Eliminate damage or destruction due to improper maintenance, repair, or use that may alter or destroy the significant elements of any property.
- Enhance the most historically significant areas of the installation through appropriate landscaping and conservation.

To meet these overall preservation objectives, the general preservation recommendations set forth below have been developed:

Category I Historic Properties

All Category I historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for

nomination regardless of age. The following general preservation recommendations apply to these properties:

a) Each Category I historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category I historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b) An individual preservation plan should be developed and put into effect for each Category I historic property. This plan should delineate the appropriate restoration or preservation program to be carried out for the property. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulation. Until the historic preservation plan is put into effect, Category I historic properties should be maintained in accordance with the recommended approaches of the Secretary of Interior's Standards for Rehabilitation and

Revised Guidelines for Rehabilitating Historic Buildings[2] and in consultation with the State Historic Preservation Officer.

c) Each Category I historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[3] When no adequate architectural drawings exist for a Category I historic property, it should be documented in accordance with Documentation Level I of these standards. In cases where standard measured drawings are unable to record significant features of a property or technological process, interpretive drawings also should be prepared.

Category II Historic Properties

All Category II historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

a) Each Category II historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category II historic properties should not be altered or demolished. All work on such properties shall be performed

in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

b) An individual preservation plan should be developed and put into effect for each Category II historic property. This plan should delineate the appropriate preservation or rehabilitation program to be carried out for the property or for those parts of the property which contribute to its historical, architectural, or technological importance. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulations. Until the historic preservation plan is put into effect, Category II historic properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings[4] and in consultation with the State Historic Preservation Officer.

c) Each Category II historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level

II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.[5]

Category III Historic Properties

The following preservation recommendations apply to Category III historic properties:

a) Category III historic properties listed on or eligible for nomination to the National Register as part of a district or thematic group should be treated in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800). Such properties should not be demolished and their facades, or those parts of the property that contribute to the historical landscape, should be protected from major modifications. Preservation plans should be developed for groupings of Category III historic properties within a district or thematic group. The scope of these plans should be limited to those parts of each property that contribute to the district or group's importance. Until such plans are put into effect, these properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised

Guidelines for Rehabilitating Historic Buildings[6] and in consultation with the State Historic Preservation Officer.

b) Category III historic properties not listed on or eligible for nomination to the National Register as part of a district or thematic group should receive routine maintenance. Such properties should not be demolished, and their facades, or those parts of the property that contribute to the historical landscape, should be protected from modification. If the properties are unoccupied, they should, as a minimum, be maintained in stable condition and prevented from deteriorating.

HABS/HAER Documentation Level IV has been completed for all Category III historic properties, and no additional documentation is required as long as they are not endangered. Category III historic properties that are endangered for operational or other reasons should be documented in accordance with HABS/HAER Documentation Level III, and submitted for inclusion in the HABS/HAER collections in the Library of Congress.[7] Similar structures need only be documented once.

CATEGORY I HISTORIC PROPERTIES

There are no Category I historic properties at the Lone Star Army Ammunition Plant.

CATEGORY II HISTORIC PROPERTIES

There are no Category II historic properties at the Lone Star Army Ammunition Plant.

CATEGORY III HISTORIC PROPERTIES

There are no Category III historic properties at the Lone Star Army Ammunition Plant.

NOTES

1. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).
2. National Park Service, Secretary of Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings, 1983 (Washington, D.C.: Preservation Assistance Division, National Park Service, 1983).
3. National Park Service, "Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines," Federal Register, Part IV, 28 September 1983, pp. 44730-44734.
4. National Park Service, Secretary of the Interior's Standards.
5. National Park Service, "Archeology and Historic Preservation."
6. National Park Service, Secretary of the Interior's Standards.
7. National Park Service, "Archeology and Historic Preservation."

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