

**FINAL**  
**SUPPLEMENTAL ARCHIVES SEARCH REPORT**

**VOLUME I of III**  
**ARCHIVES SEARCH REPORT AND**  
**APPENDICES A-F**

**PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS**  
**AT THE FORMER BLACK HILLS**  
**ARMY DEPOT, SOUTH DAKOTA**  
**SITE NUMBER B08SD000800**

Contract No. DACW-43-93-D0508

Prepared For:

U.S. Army Corps of Engineers  
St. Louis District  
St. Louis, Missouri 63103-2833

November 1993

9392

**TCT-ST. LOUIS**

1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700  
(314) 426-0880

# TCT - St. Louis

Consulting Engineers, Scientists and Analytical Services

1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700  
Phone (314) 426-0880  
Fax (314) 426-4212

November 11, 1993  
9392

U.S. Army Corps of Engineers  
St. Louis District  
CELMS-PM-M  
1222 Spruce Street  
St. Louis, Missouri 63103-2833

Re: Contract DACW-43-93-D0508  
Delivery Order Number 1  
Final Supplementary Archives Search Report and Appendices A-F  
Former Black Hills Army Depot  
South Dakota

Gentlemen:

The subject document is submitted in accordance with Section 3.2 of the Scope of Work. Aerial photographs, photographs, and Master Planning Documents collected during TCT-St. Louis' site visit were presented under separate cover entitled "Volume III, Photo Documentation and Master Planning Documents".

A Risk Assessment Code (RAC) form has been prepared and is included under separate cover entitled "Draft Supplementary Archives Search Report - Volume II, Conclusions and Recommendations".

Sincerely,

*Thomas M. Lachajczyk*

Thomas M. Lachajczyk  
Program Manager

*for Nancy M. Dickens*

Nancy M. Dickens  
Environmental Scientist

*Paul W. Shetley*

Paul W. Shetley  
Environmental Geologist

*T.L. for Mike Weber*

Mike Weber  
UXO Specialist

NMD/jam/NMD286/n  
Enclosure

cc: HFA (1)

FINAL

SUPPLEMENTAL ARCHIVES SEARCH REPORT

VOLUME I OF III  
ARCHIVES SEARCH REPORT AND  
APPENDICES A-F

PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS  
AT THE FORMER BLACK HILLS  
ARMY DEPOT, SOUTH DAKOTA  
SITE NUMBER B08SD000800

Contract No. DACW-43-93-D0508

Prepared For:

U.S. Army Corps of Engineers  
St. Louis District  
St. Louis, Missouri 63103-2833

Prepared By:

TCT-St. Louis  
1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700

November 1993

9392

**VOLUME I  
TABLE OF CONTENTS**

<b><u>Section No.</u></b>		<b><u>Page No.</u></b>
<b>1.0</b>	<b>EXECUTIVE SUMMARY</b>	<b>1-1</b>
1.1	Introduction	1-1
1.2	Objectives and Results of the Previous Preliminary Archives Search	1-2
1.3	Site Security	1-2
1.4	OEW and CWM at the Former BHAD	1-2
1.5	Closure and Decontamination	1-3
1.6	Potential Presence of CWM and OEW	1-3
<b>2.0</b>	<b>INTRODUCTION</b>	<b>2-1</b>
2.1	Objectives, Scopes and Approach	2-1
2.2	Information Sources	2-2
2.3	Objectives and Results of the Previous Preliminary Archives Search	2-4
2.4	Project Location	2-6
2.5	Physiography, Geology, Hydrogeology Soil and Topography	2-6
2.6	Former and Current Land Ownership and Uses	2-7
2.7	Site Security	2-7
<b>3.0</b>	<b>OEW AND CWM AT THE BHAD</b>	<b>3-1</b>
3.1	Introduction	3-1
3.2	General Facility Operations	3-1
3.3	Ordnance Operations	3-2
3.4	Closure and Decontamination	3-16
3.5	Potential Presence of CWM and OEW at the Former BHAD	3-17



## **VOLUME I LIST OF TABLES**

### **Table No.**

2-1	List of Contacts
3-1	Former BHAD Ordnance Operations
3-2	List of Ordnance Present During the Operation of the Black Hills Army Depot (BHAD)
3-3	Summary of Chemical Warfare Materials (CWM) Present During the Operation of the Black Hills Army Depot (BHAD)
3-4	Disposition of Chemical Ordnance Black Hills Army Depot

## **LIST OF FIGURES**

### **Figure No.**

2-1	Project Location Map
2-2	Facility Layout
3-1	6000 Area - Chemical Area
3-2	Burning Ground No. 1
3-3	Burning Ground No. 2
3-4	Ammunition Workshop Area
3-5	Chemical Plant and Incinerator Based on Early Plane Table Drawing
3-6	Chemical Area-Based on 1963 Facility Map

## **REFERENCES**

**VOLUME I  
LIST OF APPENDICES**

**Appendices**

- |   |   |
|---|---|
| A | Scope of Work   |
| B | Well Boring Logs, Wells No. 1 and No. 2   |
| C | Summaries of Interviews   |
| D | U.S. Army Environmental Health Laboratories, Industrial Hygiene Surveys 1951, 1952, 1954        |
| E | Report of Annual Lightening Protection System, Igloo Storage, September 4, 1945                 |
| F | Press Release "BHAD Demil Job Pays for Itself with \$365,912.00 to Boot", BHAD, January 3, 1966 |

## **SECTION 1**

### **1.0 EXECUTIVE SUMMARY**

#### **1.1 Introduction**

The U.S. Army Corps of Engineers, St. Louis District, contracted with TCT-St. Louis to perform supplementary archives searches and site visits at two former Department of Defense sites including the former Black Hills Army Depot (BHAD) under Contract DACW-43-93-D0508.

This work is a supplement to a preliminary archives search conducted by TCT-St. Louis (TCT) in 1992 and is part of the Department of Army's Defense Environmental Restoration Program (DERP).

##### **1.1.1 Project Objectives, Scope, and Approach**

The objective of this supplemental archives search was to further document, clarify, and expand, through archives searches and interviews, a previous 1992 study concerning the types of chemical warfare materials (CWM) and ordnance and explosive waste (OEW) that may exist on the former BHAD property. A revised Risk Assessment Code (RAC) and Conclusions and Recommendations are presented under separate cover.

The scope of the project was limited to a supplemental archives search and site visit based on a previous 1992 investigation entitled "Final Archives Search Report, Preliminary Assessment of Ordnance Contamination at the Former Black Hills Army Depot, South Dakota, October, 1992.[BHADB-1]"

In order to achieve the objectives within the scope, TCT-St. Louis performed a supplemental records review, which included visiting several repositories of information. The 1992 report is the primary reference document.

##### **1.1.2 Information Sources**

Several agencies/people, thought to have knowledge about the former BHAD, were contacted. Records were reviewed and/or obtained from several repositories of information. Of the places visited, the following maintained the most important or pertinent information: U.S. Army Chemical and Biological Defense Agency, Edgewood Arsenal, MD; National Personnel Records Center, St. Louis, MO; Washington National Records Center, Suitland, MD; St. Louis District Corps of Engineers.

Additional information concerning current land use, topography, and geology was obtained. New and previously obtained aerial photographs were reviewed and assessed. A bibliography of the information sources was compiled and is included at the end of the report.

## **1.2 Objectives and Results of the Previous Preliminary Archives Search**

The objective of the previous study was to assess the presence or absence of OEW at the former BHAD by performing an archives search and site visit.[BHADb-1]

The former ordnance depot is located in a remote area of southwestern South Dakota. The 21,095-acre facility operated from 1942 until its closure in 1967. Large and varying amounts of chemical and conventional munitions were stored, renovated, and destroyed at the BHAD.[BHADb-1]

Documents, maps, aerial photographs, and a site visit indicated the potential presence of OEW and/or CWM at Burning Grounds 1 and 2, the Chemical Plant, the Ammunition Workshop, and the Surveillance Area.[BHADb-1]

The former BHAD is currently used for cattle grazing and various salvage activities.[BHADb-1]

## **1.3 Site Security**

Security at the site is minimal. Portions of the site are fenced but gates are unlocked. Other areas are unfenced and open to the public. Currently, the number of people with access to the site is limited by the remoteness of the area and the sparse population.

## **1.4 OEW and CWM at the Former BHAD**

### **1.4.1 Chemical Warfare Materials**

**1.4.1.1 Types and Quantities of CWM** - The BHAD handled large quantities and varying types of chemical weapons during its operational history. These included chemical or incendiary shells, bombs, rockets, grenades, and cartridges filled with mustard, lewisite, cyanogen chloride, phosgene, hydrocyanic acid, chloroacetophenone, irritants, white phosphorous, smoke, and nerve agent.[BHADb-1, 24, 29, 54, 130, 154]

**1.4.1.2 Storage, Renovation, and Destruction of CWM** - Areas associated with the storage of chemical-filled ordnance and chemical agents include the storage igloos (primarily block C, D, F, G), the Chemical Area (6000 Area) and possibly some railroad aprons.[BHAD-19, BHADb-28, 53, 230] Locations of maintenance, renovation, and repacking operations varied depending on the task, but usually occurred within the storage igloos, Chemical Area, or the Ammunition Workshop Area (3000 Area).[BHADb-55, 59, 73, 95] Facilities designed for the destruction of unserviceable, outdated, or surplus chemical munitions included Burning Grounds 1 and 2, the Chemical Warfare Storage Area, and the Chemical Plant.

#### **1.4.2 Ordnance and Explosive Waste**

Limited additional information was encountered related to ordnance operation at the following locations: Combat Materials Area (1800 Area) and Ammunition Workshop Area (3000 Area). A 1945 aerial photograph revealed the potential presence of a fourth burn area. This suspected pit area may have been used during the facility's early years of operation as a disposal area for propellant or bulk explosives.[BHADb-225, 233]

#### **1.5 Closure and Decontamination**

Prior to closure of the BHAD, all ammunition was shipped out of the facility block by block. Igloos were cleaned and tested. Six weeks were required to perform a surface clearance of Burning Ground 2.[BHADb-227]

#### **1.6 Potential Presence of CWM and OEW**

Results of this study are similar to and support the findings of the initial 1992 investigation. Historical records and interviews have documented the presence of considerable quantities of CWM and OEW during the facility's existence.[BHADb-9, 29, 54, 83, 92, 127, 156]

Since the 1992 site visit, additional UXO were recovered from local individuals collecting historical memorabilia. Items most recently recovered and destroyed included a 105 mm smoke WP projectile, a 37 mm or 57 mm high explosive-filled projectile and miscellaneous fuzes. [BHADb-28]

The presence or absence of a mustard-filled drain line has not, as yet, been determined; however, the existence of subsurface lines at the Chemical Plant during its operation has been verified.[BHADb-202, 203]

During the site visit, a number of potentially hazardous (UXO) items were observed. These included base detonating fuzes, various types of bomb nose plugs, 37 mm, 40 mm, 75 mm, and 155 mm high explosive filled projectiles. The remaining items encountered, including 155 mm and 105 mm bursting chemical or white phosphorous projectiles were either empty, burned, or demilitarized.

Small nodules of suspected trinitrotoluene (TNT) were found on the surface at an explosive leaching bed in the wash-out area at the Ammunition Workshop.

Few of the areas are fenced, and both Burning Grounds 1 and 2 and a large percentage of the Chemical Area are public lands open to all.

## **SECTION 2**

### **2.0 INTRODUCTION**

The Department of the Army is responsible for administration of the DERP. The objective of this program is to identify and remediate environmental problems related to the presence of hazardous or toxic waste, OEW, CWM, and/or unsafe and unsightly debris at facilities formerly owned and/or operated by the Department of Defense (DOD).

The U.S. Army Corps of Engineers (CEMS), St. Louis District, contracted with TCT-St. Louis (TCT) in May 1993 to assess two former DOD sites for the presence of Chemical Warfare Materials (CWM) under Contract DACW-43-93-D-0508. TCT was requested to perform supplementary archives searches and site visits for two former DOD sites, including the former Black Hills Army Depot (BHAD), under Delivery Order No. 1 of the Contract. A previous archives search performed in 1992 identified potential sites of OEW contamination at a number of locations at the depot. This study provided a data base for further characterization and evaluation of the use, and disposal of chemical warfare agents (CWM) and chemical-filled ordnance at the BHAD.[Reference BHADb-1]

The former BHAD (prior to 1962 called Black Hills Ordnance Depot) operated from 1942 until its closure in 1967. The facility included approximately 21, 095 acres, which had consisted of homesteads and range land for cattle and sheep prior to DOD occupation. The former depot was located 8 miles southwest of Edgemont, South Dakota in Fall River County, South Dakota and is currently used for grazing and salvage activities [BHADb-1]. A site location map is presented in Figure 2-1.

The former BHAD was operated by the U.S. Army Ordnance Department as a reserve depot whose primary mission was to store, renovate, demilitarize, and destroy munitions. The types and quantities of ordnance present at the facility varied considerably and included small arms, conventional ammunition, bombs, grenades, mines, ammunition components, bulk explosives, and chemicals. Munitions contained either high explosive, incendiary, or chemical fillers. [BHADb-1] A revised facility layout map is presented in Figure 2-2.

According to the initial 1992 report, facilities designed for the disposal of chemical-filled ordnance or chemical warfare agents included: the Chemical Area (Area 6000); Chemical Burning Pit (Area 6000); and Burning Grounds 1 and 2. Areas associated with the storage or renovation of CWM included: the Chemical Warfare Outdoor Storage Area; the storage igloos (Blocks A-H and J); and the Ammunition Workshop (Area 4000).[BHADb-1]

### **2.1 Objectives, Scopes and Approach**

The objective of this supplemental archives search was to further document, clarify, and expand, through archives searches and interviews, information concerning the types of CWM potentially present at the BHAD including quantities, locations, current ownership of properties potentially contaminated with CWM, and accessibility of these properties to the public. Additional

information pertaining to physical site characteristics, ordnance operations and the presence of unexploded ordnance, which clarifies past activities at BHAD or affects future developments, was included in this report. A revised RAC presented under separate cover, contains the results of the evaluation of CWM-related safety hazards at the site.

The Scope of this project was limited to a records search and site visit based on the initial assessment of the BHAD and the resultant data base established. The initial TCT study entitled "Final Archives Search Report, Preliminary Assessment of Ordnance Contamination at Black Hills Army Depot, South Dakota, October 1992" was the primary reference document [BHADB-1] for this project. Additional historical records related to the presence of CWM and OEW not found during 1992, were obtained, reviewed, evaluated, and where pertinent, were included in this report. In order to achieve the objectives of the scope, TCT performed a records review which included visiting several repositories of information, telephone, and in-person interviews and the site visit (for the purpose of completing the records review and interviewing the local populace).

As required by the Scope of Work, a separate Supplementary Archives Search Report was designed for each project site. Master planning documents and maps obtained during this investigation are presented in Volume III, Photo Documentation and Master Planning Documents.

## **2.2 Information Sources**

Numerous information sources, were contacted by telephone, written correspondence, or personal visit. These information sources and results of information requests are summarized in Table 2-1.

Repositories visited in an effort to obtain relevant documents included: Corps of Engineers, St. Louis District and Missouri River Division; Regional Archives, Kansas City, MO; National Personnel Record Center, St. Louis, MO; Washington National Records Center, Suitland, MD; National Archives Suitland, MD; U.S. Army Chemical and Biological Defense Agency, Edgewood Arsenal, MD; State and U.S. Army Military History Institute, Carlisle Barracks, PA.

Former Ordnance Department and BHAD personnel were also contacted and interviewed including: John Campbell, former BHAD Safety Officer and Ordnance Department Field Safety Office; Lee Deans, former BHAD and Ordnance Department Surveillance Inspector; James Rickard; former BHAD Operations Direction and AMC depot personnel; Art Lawrence, former Renovator, Chemical Area worker and AMC depot personnel; Louis Reckard, former BHAD Fire Chief and Melvin Porter, former BHAD Renovator and Ammunition Handler. Additional information pertaining to past and present activities was obtained from Dave Henderson, Fire Chief, Edgemont, Dale Hedglin, and Bill Mitchell, property owners while in Edgemont, South Dakota.

Pertinent information was received from the following through telephone or written inquiries:

Army Chemical Material Center and contractor (SAIC), Aberdeen Proving Ground; Defense Explosive Safety Board, Alexandria, VA; United States Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD; John Campbell.

As a result of telephone or written inquiries and/or interviews, records, documents, or other information were obtained from the following repositories, organizations, and individuals pertinent to activities at the BHAD:

U.S. Army Corp of Engineers, Huntsville Division, Huntsville, AL; U.S. Army Chemical Material Center and Contractor (SAIC), Aberdeen Proving Ground, MD; Defense Explosive Safety Board, Alexandria, VA; U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD; John Campbell; Lee Deans; Dave Henderson; James Reckard; Art Lawrence; Louis Rickard; Dale Hedglin; Melvin Porter; and Matt Brown.

In addition to the surveys described above, TCT communicated in person or in writing with the following organizations or individuals who could provide no substantial or timely information concerning the presence of CWM or related subjects concerning BHAD:

Savanna Army Depot Activity, IL; U.S. Army Defense Ammunition Center and School, Savanna, IL; U.S. Army AMCCOM, Rock Island, IL; U.S. Army Environmental Center, Aberdeen Proving Ground; 28th CES/CED, Ellsworth AFB, SD; Pine Bluff Arsenal, Arkansas; Center for Military History, Washington, D.C., Chemical School Library, Ft. McClelland, AL; 94th EOD, Ft. Carson, CO; Former Ordnance Field Safety Office, Charleston, IN; Command General Staff Library, Ft. Leavenworth, KS; U.S. Army Garrison, Ft. Detrick, MD; National Archives Cartographic Branch, Alexandria, VA; Burton Hutton.

A number of facility maps and portions of a 1945 Ordnance Department aerial photograph were copied. A list of references documenting information sources for the Supplementary Archives Search is presented at the conclusion of this report. Documents referenced in this report primarily include those obtained during this effort. They are identified by the prefix "BHADb" in order to distinguish them from records utilized in the initial 1992 report which are designated by the prefix "BHAD".

TCT-St. Louis reviewed documents, files, publications, maps, and aerial photographs (1945, 1957, 1965, and 1971) in order to provide additional information related to the storage, usage and disposal of CWM at the BHAD. If requested by the Contracting Officer, copies of the documents will be provided and sent under separate cover.

A site visit of the former BHAD was conducted August 16 through August 20, 1993. The purpose of the visit was to gather additional information and observe current conditions at the site. The site visit was performed by Tom Lachajczyk, Paul Shetley, Nancy Dickens, and Mike Weber (UXO specialist).



## **2.3 Objectives and Results of the Previous Preliminary Archives Search**

### **2.3.1 Objectives**

The objective of the previous study was to assess the presence or absence of OEW at the former BHAD. TCT-St. Louis pursued these objectives through an archives search and site visit. Documents were obtained, reviewed and evaluated, interviews were conducted, and an RAC was presented. During the previous study, reviews of Record Group 175 was not performed. The work was performed under Delivery Order Number 1 of Contract DACA-87-91-D-0037. The Final Engineering Report was presented to the U.S. Army Corps of Engineers, Huntsville Division in October 1992. With the exception of the following summary of the findings of this report, information contained in the report was generally referenced rather than reproduced. All maps have been revised to reflect the new information obtained.

### **2.3.2 Site Characteristics**

The BHAD is located in a remote area of southwestern South Dakota. In general, this sparsely populated area is semi-arid, and highly dissected. Geology of the area is characterized by a thick sequence of sedimentary deposits of shale, evaporite beds, sandstone, and dolomite. Surface water is limited and the majority of drinking water is obtained from deep (greater than 2,000 feet) groundwater wells.[BHAD-1]

### **2.3.3 Results**

Results of the preliminary archives search are summarized below from the text of the original document.[BHAD-1]

The former Black Hills Army Depot operated from 1942 until 1967 and covered 21,095 acres near Edgemont, South Dakota (Figure 2-1). Throughout the BHAD's 25-year operational history large quantities and varying types of ordnance containing high explosive, chemical, or incendiary filler were present at the facility. Munitions were stored in storage igloos, the Combat Material Area, outdoor storage pads, and the Chemical Warfare Area. Facilities for renovation included the Ammunition Workshop, Bundle Packing Area, Normal Maintenance disassembly plant, and the Chemical Area. Disposal of surplus, unsafe or obsolete munitions, including chemical warfare agents and chemical-filled ordnance, was conducted at Burning Grounds 1, 2, and 3, the deactivation furnace, Chemical Plant, and the Chemical Burning Pit. Additional items may have been destroyed at the Surveillance Area. Small arms ammunition with tracer was tested at Burning Ground 2 and the Tracer Test Range.[BHADB-1] The BHAD is shown in Figure 2-2.

CWM present during operation of the BHAD included mustard (H), H-filled bombs (M70, M47) and projectiles (105 mm, 155 mm), cyanogen chloride (CK), CK-filled bombs (M78, M79), phosgene (CG), CG-filled bombs (M78, M79), hydrocyanic acid (AC), M-55 rockets filled with GB and VX nerve agent (which was only stored at the depot), white phosphorous (WP), WP-filled bombs and projectiles, and numerous types of smoke and tracer rounds.

Following closure in 1967, decontamination was conducted to the "most reasonable degree" with the consideration of land use restrictions. Buildings and structures were tested, washed, rinsed, retested, and where necessary, the process was repeated. Burning grounds were surface cleared where passable and the pits and trenches were flashed and covered. During decontamination, debris was not recovered from the pits; however, during the normal operations of the BHAD prior to closure, the majority of burned-out fragments, etc. were recovered, decontaminated, and salvaged. Leaching beds (Workshop Area and Burning Ground 3) were flashed or covered with limestone and covered with earthen material. Explosive residue was not excavated from the leaching pits. Several areas at the former BHAD were completely restricted from all land use. These included: Burning Ground 1, Burning Ground 2, Tracer Test Range, Chemical Plant, and the Chemical Burning Pit. Burning Ground 3 was restricted to surface use only. All the above locations were fenced and posted with signs.[BHADB-1]

In 1968, all land within the fenced area of the facility was sold to the City of Edgemont, South Dakota. Land outside the fence, which included Burning Grounds 1 and 2 and the Chemical Burning Pit and Chemical Warfare Area, was transferred to the U.S. Forestry Service.[BHADB-1]

Since 1968, the City of Edgemont has resold the land. Former BHAD property is currently owned by FHT Inc., Fall River Properties (Consolidated Management Corporation), Burton Hutton, and Eugene Erickson. A small residential area (five families) is also present in the northeast corner of the former depot. Current land use includes cattle grazing and salvage activities. In the past, studies were conducted at the former BHAD to investigate development of the area as disposal sites for low level radioactive wastes and incinerator ash. In addition, the State of South Dakota is considering expanding water lines within the area.[BHADB-1]

During the 1992 site visit, a number of potential UXO were found at the surface at several locations. Hundreds of fuzes and boosters were found within ravines at Burning Ground 2 and a large pile of empty bomb casings were found at Burning Ground 1. Other items encountered included 155 mm projectiles (one with burster), bursters and on M83 butterfly bombs.[BHADB-1]

No UXO or OEW were encountered at the surface at the Bundle Packing Area, deactivation furnace, disassembly plant, Normal Maintenance Area, or the Chemical Plant.[BHADB-1]

According to the 1992 report, exposed metal was observed in the Chemical Burning Pit and a buried 250-foot drain line potentially filled with mustard or sludge from the incinerator may be present in the Chemical Plant Area.[BHADB-1]

A 75 mm projectile with tracer was encountered at Building 3008 in the Ammunition Workshop; however, no other evidence of UXO was visually evident. According to the document, explosive leaching pits may be present in the subsurface in the Ammunition Workshop Area. An additional burn area, possibly used by the Surveillance Office, was found south of the Workshop Area. Spent igniter tubes and primers were found at the surface.[BHADB-1]

During the 1992 site visit, a number of ordnance items were recovered from local residents and ranchers by an ordnance detachment from Ft. Carson, Colorado. These items included an M61 rocket, 155 mm WP shell, an incendiary bomb (containing incendiary residue), a number of 75 mm shells with tracer and miscellaneous items. A number of individuals frequent the area, often with shovels, in search of war or depot memorabilia.[BHADb-1]

The 1992 study indicated the entire area was extremely susceptible to wind and stream erosion as a result of the climate, topography, and geology. The majority of the ordnance was present on the sides of ravines and most likely was exposed due to the forces of erosion. The number of people with access to the depot may be increased due to greater activity in the area resulting from extension of proposed water lines or the potential development of an ash disposal landfill area.[BHADb-1]

## **2.4 Project Location**

As shown in Figure 2-1, the former BHAD is located approximately 8 miles southwest of Edgemont, South Dakota. A revised map of the facility layout which further describes the BHAD is presented in Figure 2-2.

## **2.5 Physiography, Geology, Hydrogeology, Soil and Topography**

The previous report described, in detail, the physical characteristics of the site [BHADb-1]. Additional information uncovered through research for this Supplementary Archives Search Report (SASR) included the original well logs for the two drinking water supply wells installed during 1942 and 1943.[BHADb-223, 224] The logs have been reproduced and are presented in Appendix B. Information supplied by the logs substantiate and further define the geology and hydrogeology at the site.[BHADb-223, 224]

Depths and thicknesses of geologic units reportedly present at the BHAD are similar to those found on the logs. The Cretaceous Age Graneros Group is further subdivided on the logs to include the Belle Fourche Shale, Mowry Shale, Newsy Formation, and the Skullcreek Formation.[BHAD-117, BHADb-223, 224] The remainder of geology and hydrogeology depicted on the logs is essentially the same as that described in the 1992 report.[BHADb-1]

Well #1 was completed June 17, 1942 and was placed in production on June 21, 1942. Estimated capacity was 1,182 gal/min, however due to the pump capacity, output was only 506 gal/min. Depth of Well #1 is approximately 4,000 feet below ground level; however, two different depths, 3,990 feet and 4,000 feet, appear on the log.[BHADb-224] Well #2 was installed at a depth of 3,885 feet below ground level and was completed on November 26, 1943. Temperature of the water withdrawn from this well was 136°F. The precise date the well was placed into production was not noted; however, testing was conducted on December 19, 1943. Capacity of the well was 800 gal/min. [BHADb-223]

Five detailed drainage and topographic facility maps dated 1963 were also encountered during the supplementary archives search. These maps have been reproduced and are presented in Volume III, Photo Documentation and Master Planning Documents. The topography shown in the 1963 map is similar to the 1982 USGS topographic map used in the initial report; however, the number of small drainage and/or stock ponds present during 1963, appears to be much greater than shown in the 1982 map.[BHADb-1] A total of 55 surface water drainage ponds were present at the site in 1963.[BHADb-214]

No additional information was obtained related to the physical site characteristics of the project site.

## **2.6 Former and Current Land Ownership and Uses**

In 1962, during reorganization of the Ordnance Department, the BHAD was transferred to the control of the Army Munitions Command and prior to closure on April 1, 1967 the entire facility was placed under the direction of Pueblo Army Depot [BHAD-140].

At the present time, the permit for construction of an ash disposal facility within the confines of the BHAD has not been issued to Consolidated Management Corporation (Fall River Properties) by the State of South Dakota. This had delayed further development of the area until the potential safety hazards related to OEW at the facility are further assessed by the U.S. Army Corps of Engineers (USACE). Consolidated Management is expecting to receive approval in the near future to continue plans for development of the land.[BHADb-229]

No additional or revised information was obtained concerning former and current land ownership and uses.

## **2.7 Site Security**

In general, the number of people accessing the former BHAD is limited by the remoteness and sparse population of the area. With the exception of Burning Grounds 1 and 2, the Tracer Test Range, the Chemical Burning Pits, and the Chemical Warfare Storage Area, the majority of the former BHAD is surrounded by an 8-foot chain link fence. The above locations are fenced on one side. The main gate, however, is not locked. Within the fenced area, cattle gates, both locked and unlocked, and washed out bridges somewhat limit entry to the facility. Warning signs are generally not posted.

Burning Grounds 1 and 2, the Tracer Test Range, the Chemical Burning Pits, and the Chemical Warfare Outdoor Storage Area belong to the U.S. Forestry Service and, as such, are open to the public. These locations are extremely remote but access is not limited and warning signs are generally not posted. Warning signs are present on the perimeter fence along the northern boundary of Burning Ground 2. The Chemical Burning Pit is surrounded by a 3-4 foot barbed wire fence, which hampers, but does not prohibit access. Signs which read "Keep Out" and "Non-use" are posted on the fence.

## **SECTION 3**

### **3.0 OEW AND CWM AT THE BHAD**

#### **3.1 Introduction**

Detailed information pertaining to general and ordnance-related operations at the former BHAD is contained in the document "Final Report, Preliminary Assessment of Ordnance Contamination at the Former Black Hills Army Depot, South Dakota, October, 1992". Supplemental information on the use, disposal, and presence of CWM and OEW at the former depot provided in this section is based upon information gathered during the supplemental archives search and site visit. The literature review included: aerial photos, interviews with former employees, site maps and drawings, and historical documents. In addition, records collected from the 1992 study were reassessed for relevant information pertaining to CWM at the BHAD.

A site visit of the former depot was conducted August 16 through 20, 1993. The purpose of the visit was to gather additional information by obtaining documents and maps, conducting interviews and observing current conditions at the site. Selected photographs taken during the site visit which depict current conditions and a copy of the 1945 Ordnance Department aerial photo (Chemical Area) are presented in a separate documents entitled Photo Documentation and Master Planning Documents. Summaries of the interviews are presented in Appendix C. The site visit was performed by Tom Lachajczyk, Paul Shetley, Nancy Dickens, and Mike Weber (UXO Specialist) of TCT-St. Louis.

#### **3.2 General Facility Operations**

With the exception of the Master Planning Documents (Volume III, Photo Documentation and Master Planning Documents) and the facility well logs (Appendix B), no additional information was obtained related to the general operation of the BHAD. The information provided by the well logs is described in Section 2.5.[BHADB-213] Brief descriptions of the Administrative Area, Housing Areas, Hospital Area, Sewage and Waste Disposal Area, Mobilization Area, School Area, Utility Area, Railyard, Fire Station, Golf Course, and Security Buffer Zone are included in the excerpts of the Master Planning Documents. A summary of structures present at the site is also included in this documents.[BHADB-213]

Additional descriptions of general facility operations such as welding and painting activities are provided in the Industrial Hygiene Surveys conducted by the Army Environmental Health Laboratories in 1951, 1952, and 1954. These surveys are presented in Appendix D.[BHADB-25, 27, 60] With one exception, chemical warfare materials were not used for general facility operations. A 1976 report from the U.S. Army Toxic and Hazardous Materials Agency described the use of hydrocyanic acid (AC) in dormitories and barracks in order to eliminate bedbugs [BHADB-143].

### **3.3 Ordnance Operations**

#### **3.3.1 Types and Amounts of Ordnance**

Throughout the BHAD's operational history, large quantities of varying types of ammunition were stored, renovated, shipped, or destroyed [BHAD-1]. Specific areas at the BHAD concerned with ordnance operations are listed in Table 3-1 and are shown on Figure 2-2. A revised summary of the types of high explosive-filled ordnance is presented in Table 3-2 and a summary of the types of chemical-filled ordnance and chemical warfare agents present at the BHAD are listed in Table 3-3.

High explosive-filled ordnance present at the facility included small arms, conventional ammunition, bombs, mines, grenades, rockets, ammunition components, and bulk explosives. Chemical or incendiary munitions stored, renovated, or destroyed at the BHAD included projectiles, bombs, rockets, grenades, and cartridges filled with mustard (H, HT), lewisite (mustard-L), cyanogen chloride (CK), phosgene (CG), hydrocyanic acid (AC), chloroacetaldehyde (CN), irritants (CNB, CNS), white phosphorous (WP), smoke (HC, FS), and nerve agents (GB and VX) [BHADb-1 and referenced table].

Thousands of tons of ammunition were present throughout the BHAD at any given time [BHADb-1]. In 1954, the depot was at 86% of its capacity and ammunition on hand totalled 346,248 tons. Of this amount, 25,151 tons were Chemical Corps items [BHADb-59]. During a three-month period in 1957 when the depot's primary mission was the modification and destruction of ammunition, 285,161 fragmentation bombs were destroyed by burnout. In 1959, 669,993 M28 rifle grenades were detonated along with 100 lb tritonal bombs [BHADb-122, 123]. The following sections detail additional information pertaining to CWM and OEW at the BHAD obtained during the supplemental archives search.

#### **3.3.2 Chemical Warfare Materials**

**3.3.2.1 Types and Quantities of CWM** - In general, chemical-filled bombs stored at the BHAD were not assembled with their explosive components. Projectiles, however, were present as complete rounds and projectiles. Mustard and/or Lewisite-filled munitions (H, L, HT) included 4.2 inch mortars, 75 mm projectiles, 105 mm shells (M60), 155 mm shells (M110, MK11A1), 115 lb. (M70), and 100 lb. (M47A2) bombs.[BHADb-9, 11, 16, 82, 125, 154, 158]

In addition, documents referred to three types of mustard-filled containers present at the BHAD: 55 pound containers, M70 containers, and 1-ton containers. The difference between M70 containers and M70 bombs was not clearly documented.[BHADb-191, 196, 197] Based on interviews, M70 containers and 55 pound containers usually referred to M70 bombs without explosive components, fins, or burster attached. [BHADb-230]

In the documents, cyanogen chloride and phosgene-filled munitions were generally referred to together. Inventory numbers were not normally reported for each separately. Munitions filled with CK and CG included 500 and 1,000 lb. bombs (M78 and M79), 4.2 inch mortars (CG) and 7.2 inch rockets.[BHADb-9, 16, 54, 154] Bulk phosgene drained from bombs was also present from the transfer of agent from the 1-ton containers.[BHAD-80, 209]

Hydrocyanic acid was present in 4,000 lb. bombs containing high explosives and smoke agents and in the early 60s, 454 tons of GB and VX-filled M55 rockets were stored at the BHAD.[BHADb-127] Irritant (CNS, CNB)-filled 4.2 inch mortars were the only irritant-filled munitions documented in the facility archives. In contrast, as shown in Table 3-3, white phosphorous, smoke, and incendiary agents were present at the BHAD in many types of ordnance from small arms to 100 lb. bombs.[BHADb-29]

At the facility, the primary areas associated with operations concerning CWM were the Chemical Area (6000 Area), Burning Ground 1, Burning Ground 2, and, to a lesser degree, the Ammunition Workshop.[BHADb-27, 71, 76, 111, 122, 123, 154] These locations are shown in Figures 3-1 through 3-4.

Table 3-4 summarizes the disposition of chemical-filled ordnance at the BHAD. Amounts were obtained from the referenced documents and may not precisely reflect actual totals present or destroyed due to the constantly changing inventory, the varying reporting period (weekly, monthly, or quarterly), the methods of reporting, and/or the number of documents obtained (or missing). In addition, at certain periods of time, the facility records merely specified "chemical" weapons and did not identify the specific types of chemical munitions.[BHADb-90] The total number of CK and CG-filled bombs were generally not stated in the documents. The reporting officer listed the number of leaking or renovated bombs or projectiles for a given period of time. In some cases, amounts tallied at different periods within the same reporting year did not agree with one another. In addition, when the units are reported as pounds of agent present, it is not always clear whether the number represents bulk agent present or an estimate of the agent present in the bomb or projectile.[BHADb-81,79]

The projectiles present at the BHAD in largest quantities included the H-filled 105 mm and 155 mm projectiles, M70 bomb and M47A2 bomb, and the CK and CG-filled M78 and M79 bombs. The H-filled 100 lb. bomb, M47A2, and 105 mm and 155 mm projectiles were present in large amounts primarily during the World War II era while the M70 (H), M78 (CK and CG), and M79 (CK and CG) bombs were present throughout the BHAD's operational history. In general, these items were mentioned in nearly every historical summary. M70 (H)-filled bombs reached a maximum of 317,000 in 1947. Reportedly, the entire Chemical Corps inventory only totalled 400,000.[BHADb-181] By 1955 over 8 million pounds of mustard were stored at the BHAD in M70 containers.[BHADb-81, 157] During the closing years, approximately 5,200 CK-filled and 75,527 H-filled bombs were destroyed by incineration at the BHAD [BHADb-127]. Prior to closure of the facility, all chemical weapons and bulk chemical agents were either shipped to other facilities or destroyed [BHADb-227].

### **3.3.2.2 Storage, Renovation and Destruction of CWM**

**3.3.2.2.1 Storage** - At the BHAD, a number of locations were used for storage of CWM. The principal storage areas included: the storage magazines, open storage pads (covered and uncovered), and the railroad aprons. With some exceptions, storage of munitions within each area was based primarily upon compatibility classes.[BHADb-231]

### Igloo Storage

During the early and mid-forties, the bulk of chemical weapons, excluding leakers, were stored within the storage igloos [BHADb-45]. In 1945 some H-filled munitions were stored in outdoor storage (Plate 1, Photo Documentation). According to documents, CK and CG-filled munitions remained primarily in igloo storage throughout the facility's history except during periods of maintenance. [BHADb-50, 54, 89, 193]

In 1947, a long-term outdoor Chemical War Reserve Storage Area was established at the Chemical Area (Figure 3-1).[BHADb-140] At this time, all CK and CG-filled bombs were temporarily moved to this location for the purposes of venting and later returned to igloo storage. Venting was a process of opening a valve on the bomb to reduce internal pressure. [BHADb-76, 153]

By 1951, a large percentage of the chemical munitions, with the exception of leakers and mustard bombs, were still stored within the igloos.[BHADb-101, 161, 161] Covered storage space was, however, limited due to the large stocks of ammunition at the facility. During this period, high explosive rounds were stored in the open storage areas between the igloos containing chemical weapons and acceptable solutions to the storage problem were sought.[BHADb-89] A facility summary of storage locations for munitions in 1951 is presented in Appendix E.[BHADb-28] Group A chemicals included vesicants such as mustard and Group B chemicals included CK and CG-filled ordnance.[BHADb-231] Mustard munitions were located in Blocks D, G, F, and J while CK and CG-filled ordnance were stored primarily in Blocks B and C. [BHADb-28, 101, 161, 161]

By 1952, chemical weapons stored in igloos filled 62 of the 80-foot igloos.[BHADb-90]

Two instances of CK leakers within the igloos were reported in 1955 and 1956. In both cases, the leakers contaminated the entire igloo and the remaining bombs. In 1955, the structures and bombs were decontaminated with hot water, but by 1956, decontamination was accomplished by use of an exhaust system.[BHADb-129, 194] By the late 50s, the majority of the H-filled bombs and all chemical leakers were in outdoor storage. CK and CG round were located in Block C and the outdoor storage area.[BHADb-192, 230] According to Melvin Porter, Ammunition Handler, all chemical ordnance was removed from the facility prior to closure [BHADb-227].

### Outdoor Storage

As early as 1945, some H-filled munitions were stored at outdoor locations. Aprons were used as storage sites and reportedly, chemical weapons were, at times, stored at these locations [BHADb-1, 19, 225].

After establishment of the Chemical Area for Chemical Corps War Reserve Storage, the USACE constructed three concrete storage pads designated 6043, 6045, and 6047 outside the perimeter fence as shown in Figure 3-1.[BHADb-140] These three structures were frequently referred to as "turkey sheds".[BHADb-36, 227, 230]



In 1951, a majority of the M70 H-filled bombs were transferred to the open storage location at the Chemical Area and by 1952, chemical weapons (primarily mustard-filled) were stored in 28 of the 29 open areas and the three concrete pads. The location of the open area which was not used was not specified in the document [BHADb-90, 113].

An outdoor leaker area was present at the BHAD; however, the date of establishment of an officially designated area is not known. In 1951, leaking chemical munitions were stored in an isolated area referred to as the Chemical Storage Leaker Area [BHADb-115, 140]. This area is believed to be located in the 6000 Area. Prior to this time, leakers may have been transported to the burning ground [BHAD-159].

A 1955 memo identified an area west of Storage Pad 38 and east of the barbed wire fence as the storage location of four 1-ton phosgene containers which had been at the BHAD since the forties. The location of "east" of the fence may have been in error. As shown in Figure 3-1, Pad 38 is located west of the fence [BHADb-76]. This same document identified the location of the mustard leaker area as "bounded on the north by Pad No. 37, east by Pad No. 35, and west and north of the barbed wire fence" [BHADb-76].

The facility requested fencing for the entire chemical storage area in 1955, but reportedly, the request was denied [BHAD-74]. Local ranchers were informed of the hazards present [BHAD-75]. Concerns about the security of the unfenced Chemical Storage Area resulted in the placement of leakers inside the fenced area near the Change House (Building 6000). [BHADb-128, 194, 195, 197] A 1963 facility map, (Photo Documentation Master Planning Documents), however, shows this area as being fenced. Notations on the map indicate some of the fencing was added in 1967 but does not identify those areas. [BHADb-26]

**3.3.2.2.2 Renovation and Maintenance** - According to Art Lawrence, normal maintenance and renovation (or modification) of chemical-filled ordnance was conducted by qualified Chemical Corps individuals only. Due to the hazardous nature of the munitions, when possible, normal maintenance was conducted without moving the items or with limited transport. [BHADb-232]

Cleaning, derusting, and some painting of all types of chemical-filled munitions were generally conducted at the storage location. [BHADb-40, 194] Some maintenance procedures and reworking required transport of the munitions.

#### **CK and CG-Filled Munitions**

CK and CG-filled munitions were pressure and agent quality tested twice a year. [BHADb-122, 157] According to documents, tests were conducted within the igloo; however, CK bombs were at least occasionally removed from the igloo for agent quality testing [BHADb-53, 54]. The agent was analyzed in Dunnage and Equipment Building, DE-7. [BHADb-194] The location of DE-7 is shown in Figure 2-2.

The stability of CK or CG bombs were measured by pressure of the gas inside the bomb. If the pressure was greater than 100 lbs/inch, the ordnance item required "venting" to lower the pressure. Pressure tests were performed weekly on munitions that had previously exhibited high

pressure readings to ensure that the agent was not degrading and generating excess CO<sub>2</sub>. [BHADb-52, 157] Approximately 3 to 24 pounds of agent were lost during venting procedures. During the 40s, venting was conducted at the burning ground, but in 1951, CK and CG bombs were removed from the igloos and transported to the "venting area". [BHADb-55, 114, 159] Munitions with high internal pressure, broken needle valves, and/or stuck nose plugs were vented and repaired at this location [BHADb-55]. The location of the venting area was not specifically identified, however, records indicate the most likely area was the Chemical Area [BHADb-140].

A frequently required repair, the replacement of needle valves, was also performed outside of the igloo storage area [BHADb-59, 75]. The majority of the repairs to CK and CG-filled leakers were relatively uncomplicated and most were serviceable, however, those that could not be repaired were either drained of their contents (and transferred to other containers) or destroyed by venting. All the empty casings were salvaged. [BHADb-46, 161, 167] Occasionally, CK and CG munitions required detonation. At such times, special precautions were taken and the area was well barricaded. [BHADb-230]

#### Renovation - Mustard-Filled Munitions

Normal maintenance on mustard-filled projectiles included cleaning, derusting, and degreasing. These operations were generally conducted in the outdoor storage areas [BHADb-109].

Renovations and modifications to the 105 mm and 155 mm H-filled projectiles were conducted at the Ammunition Workshop Area shown in Figure 3-4. Activities included uncrating, painting, replacing fuzes, primers and propellant powder and repacking [BHADb-27, 63, 79, 111]. In 1957, uncrating operations involving 105 mm H-filled projectiles at the 4000 Area resulted in mustard leaks and burns [BHADb-27].

Reportedly, during 1955, clothing lockers were requested at Building 3008 and 3038 for Chemical Corps workers modifying the M60 H-filled projectiles. Personnel performing the work were hanging their street clothes on nails in the buildings [BHAD-111]. During the same time frame, renovation of 105 mm M67 HEAT projectiles in Building 3046 was shut down in order to accommodate modification, reassembly, and repacking of M60 H-filled 105 mm projectiles. [BHADb-64, 77, 79]

According to documents, as a result of the reworking of 105 mm (H) projectiles concurrently with the assembly of M14 cartridge cases, low levels of mustard reportedly contaminated the cartridge cases. The Chemical Corps, however, determined the levels were not sufficiently high enough to warrant decontamination [BHADb-73].

Corroded burster well tubes were a common problem associated with the M70 H-filled bombs in long term outdoor storage. [BHADb-55, 100, 140] The extent of the corrosion resulted in a large number of leakers. Several instances of heavily contaminated storage sites resulting from leakers were reported in the documents. [BHADb-153, 158, 159, 160] Fabrication and installation of lead washers and gasketed nose plugs was performed on all M70 H-filled bombs to further reduce the potential for leakage. [BHADb-94, 95, 96, 97] Initially, the modification was completed at the outdoor storage site, but leakers sprayed agent upon opening of the nose

plug.[BHADb-54, 97, 86, 95] As a result, replacement operations on the leaking M70 bombs were conducted at a distance from the storage location and behind a barricade in order to limit injury and contamination.[BHADb-54, 86, 95] Due to the lack of water and inadequate facilities at the BHAD, bombs requiring new burster well tubes were shipped to Rocky Mountain Arsenal.

#### Shipment to Other Facilities

As shown in Table 3-4, from 1947-1953 thousands of chemical-filled bombs and projectiles were shipped to Rocky Mountain Arsenal for renovation.[BHADb-95, 98, 188; BHAD-8, 78, 79, 81, 82] In 1957 and 1958, a large number of corroded and leaking M70 bombs were present at the BHAD. One of the proposed solutions to the number of leakers was shipment to Rocky Mountain Arsenal; however, an incinerator was built as an alternative and the unserviceable munitions were destroyed.[BHADb-124, 179]

### 3.3.2.2.3 Disposal of CWM

#### Burning Ground 1

A 1946 historical summary from the 1992 study indicated that Burning Ground 1 was too close to the magazine area. As a result, a new burning ground (Burning Ground 2) was constructed in that same year.[BHAD-71, 76] Though not specifically stated in the records, prior to 1946, ordnance disposal operations at BHAD were most likely conducted at Burning Ground 1.

No additional information pertaining to Burning Ground 1 was obtained during the supplemental archives search.

#### Burning Ground 2

Very little additional information concerning the physical layout of Burning Ground 2 was encountered during the supplemental archives search. The site was constructed in 1946 and the majority of the buildings shown in Figure 3-3 were constructed in 1948 and 1949.[BHADb-10, 213; BHAD-64]

According to a 1948 rough sketch of the site, the Burning Ground was located in the northeast corner of the area. A detonation area identified as the "Demolition Area under the Bluff" was located in the southeastern corner.[BHADb-10] The demolition area corresponds to the location of the 12 large detonation craters identified in the 1992 report.[BHADb-1] The burning area corresponds to a small portion of the eastern half of the Burning Ground which contains numerous pits, trenches, and denuded areas.[BHADb-1] The small dimensions of the burning ground on this map indicate the area was greatly expanded during the years following 1948.

Reportedly, when originally constructed, the detonation craters were 35 feet deep. Additional excavation was never required because the blast kept the hole the required depth.[BHADb-230] Kickouts were frequently encountered and observers were posted at several locations in the southern portion of the facility to watch for burning fragments.[BHADb-104, 234]

Numerous documents describing the disposal of chemical-filled ordnance were obtained during the supplemental archives search. Earlier records suggest CG and CK filled-munitions were destroyed at Burning Ground 2 primarily by venting.[BHADb-154, 159, 161, 162, 166] This method involved the release of the gas contents of the munition into the air.[BHADb-230] Based on interviews with former employees, the previous study indicated that in addition to venting, CG and CK-filled rounds may have been drained into pits at the burning ground.[BHADb-1] Reportedly, under certain deteriorating conditions (extremely high pressure), these type of munitions were detonated at the burning ground. Special measures were required for safety reasons.[BHADb-230]

In addition to venting, records indicate that from 1945 to 1946, CG gas from leaking bombs was recovered and transferred to 1-ton containers.[BHAD-74, 76] According to Mr. Lee Deans, former ammunition inspector, draining was conducted at the burning ground.[BHADb-235] In 1945, a total of 62,275 pounds of CG was recovered. During this same time frame, 41 one-ton containers of CG were shipped to Desert Chemical Warfare Depot.[BHAD-64,74, 76] Four one-ton containers of CG remained in storage at the BHAD until their destruction by venting in 1957. [BHAD-197]

Prior to construction of the incinerator in 1959, H-filled munitions were destroyed by burning or draining.[BHADb-113, 154] Historical summaries from 1947 describe the early methods of burning. The burning pit described in the passage below was located on a hilltop position several miles upwind of buildings or personnel. The pit was constructed in February or March of 1947. A total of 7,228 mustard bombs (M47A2) and 100 tons of scrap lumber were transported to the burning ground for disposal [BHADb-154].

### **DESTRUCTION OF M-47A2 H BOMBS**

*The project of burning 7,228 Condition 6 H-filled M-47A2 bombs was completed 21 March 1947. These bombs were destroyed at the rate of approximately 500 per day in a burning pit, the dimension of which were 150 feet long by 20 feet deep by 15 feet wide. When all bombs had been burned there remained within the burning pit a void of approximately 4 feet. This void was completely filled with scrap lumber and the lumber burned. After burning the lumber, the void then remaining was heavily sprinkled with bleach. The sides of the burning pit were then caved in and the pit was further covered with dirt by means of a bulldozer.*

*The 7,288 M-47A2 H bombs, which were destroyed, were the entire amount of that type bomb at Black Hills Ordnance Depot. There are no more M-47A2 H bombs at this installation in Condition 6 or any other category.[BHADb-154]*

According to 1945 Ammunition Technical Manuals, Condition 6 refers to unserviceable ammunition. Munitions placed in this category were generally destroyed [BHADb-135, 231]. Conditions currently encountered at Burning Ground 2 are described in Section 3.5.

During destruction of the H-filled bombs, one-inch holes were punctured in the bombs using shape charges concurrently with the ignition of the dunnage. Prior to 1947, holes were punctured in the bombs, using rifle fire; however, this method frequently resulted in a spray of liquid mustard outside the limits of the burning area.[BHADb-153]

In 1949, approximately 20-25 H-filled bombs could be destroyed at each burn.[BHADb-168, 169] Due to the large number of leakers requiring destruction at the BHAD, the construction of three additional pits was recommended.[BHADb-170] The desired size of each pit was 100 feet x 16 feet x 12 feet (deep). Pits of this dimension would accommodate a double row of bombs. According to the report, use of each pit would be rotated every third day due to "the large amount of liquid mustard involved".[BHADb-170] Approximately 200 pounds of lime would be placed over the burned-out bomb bodies and the pit would be covered with dirt. This method would allow the destruction of 150 bombs per day.[BHADb-170] According to the Ordnance Department, burial of the bomb bodies with lime was not desirable. Use of proper protective clothing and decontamination of all equipment and tools during and following burn-out was required by the Ordnance Department [BHADb-171]. According to Lee Deans, Ammunition Inspector, 155 mm (H) projectiles were destroyed in a similar manner following the disassembly of the round and removal of the burster.[BHADb-36, 233]

On February 10, 1949, disposal operations of 155 mm H-filled projectiles resulted in one fatality. At that time, bursters were removed by chipping out the tetryl charge. Following the accident, the procedure was changed [BHADb-141].

During 1951, the disposal of large numbers of conventional ammunition at Burning Ground 2 restricted its use for the destruction of chemical weapons to one day a week. Chemical-filled bombs and shells were destroyed at a rate of 200 per burn or 450 per week [BHADb-87, 91].

Destruction of H-filled munitions by the burning pit method continued through the 1950s; however, due to the limited supply of wooden dunnage, water, and renovation facilities, and the large number of potential leakers, alternative measures were investigated. These methods included: shipment to Rocky Mountain Arsenal, transfer of mustard to 1-ton containers and construction of an incinerator.[BHADb-132, 145, 146, 179]

**3.3.2.2.4 Chemical Warfare Area (6000 Area)** - In 1947, the Chemical Area was established for the long term storage of chemical-filled ordnance. The 1945 aerial photo (Plate 1, Photo Documentation) indicated that materials were stored at this location early in the facility's history.[BHADb-225] The type of material stored in 1945, however, cannot be identified from the photo. Reportedly, H-filled munitions were in outdoor storage at that early date.[BHADb-113] In the early fifties, three covered concrete pads and 29 storage pads were constructed at this location.[BHADb-140]. As shown in Figure 3-5, an additional 22 gravel pads were added at a later date (Figure 3-1).

Mustard-filled M70 bombs were stored outside in covered sheds in order to provide extra protection from the heat.[BHADb-192]. By 1955, 165,000 M70 bombs were located in this area. The bomb casings were coated with heresite to protect them.[BHADb-187] A leaker area, described in Section 3.3.2.2.1, was also established at the Chemical Area outside the fence.

Due to the lack of fencing and the accessibility of the location, warning signs were posted and local ranchers were informed of the hazards. In 1958, the leaking bombs were moved inside the fence and placed near Building 6000.[BHADb-128, 194, 195, 197] Additional fencing was placed around the leakers.[BHADb-197, 198]

Reportedly, the venting area for CK and CG-filled bombs was most likely located in the 6000 Area.[BHADb-197, 198] Bombs requiring stabilization by releasing internal pressure and leakers and unserviceable munitions were vented in this area. Some (3-24 pounds) or all of the CK or CG contents were released to the atmosphere. A 1957 document states that telephones were required in the area in order to facilitate necessary movement of personnel in the Chemical Area during venting and transfer of agent operations.[BHADb-194]

Transfer of agent was first reported in the records in 1945, but the location of this operation was not identified, and according to former personnel, was believed to have been conducted at the burning ground.[BHADb-64, 235]

On May 10, 1957, mustard was transferred from the M70 "containers" to 1-ton containers at an unspecified location in the Chemical Area. This activity was an alternative method for the disposal of unserviceable mustard-filled bombs.[BHADb-76, 179] The process proceeded as follows: Containers were placed on a conveyor and directed to a small enclosure where 1/8-inch diameter holes were drilled in the bomb.[BHADb-145, 196] The enclosure extended into a small pit in the ground constructed to receive any seepage of agent from the bombs. A hand suction pump was attached and a sample was withdrawn for testing purposes. The agent was transferred to 1-ton type D containers using a gear pump. The hole was plugged with a wooden plug and the bomb/container was soaked in DANC and rinsed twice in vats of water. The transfer resulted in a 64% recovery rate of the agent (60 lb/bomb).[BHADb-145, 197]

During the 1957 transfer of mustard described above, a total of 9,600 pounds were transferred to four 1-ton containers. The agent in one lot of bombs had degraded to such a point that it resembled a sludge resulting in a limited transfer of 4-6 pounds.[BHADb-145]

Once deconned, the bomb casings were weighed and placed in open pits with dunnage and burned several days later (May 22 and 28). The pits were located in the Chemical Area. More than 14,000 pounds of scrap metal for salvage was obtained from the transfer.[BHADb-197, 145, 196] The small pit beneath the enclosure was decontaminated when transfer was completed [BHAD-145].

Photographs of the transfer indicate the location was slightly bermed. Personnel at the depot estimated agent from 4000 bombs could be safely transferred per year.[BHADb-145] The entire stock of mustard bombs was no longer required and was deemed unserviceable [BHADb-196]. According to former depot personnel, this rate however, was insufficient to demilitarize all the mustard bombs at the facility.[BHADb-230]

Shipment of large quantities of corroded M70 H-filled bombs to Rocky Mountain Arsenal was considered unfeasible.[BHADb-179, 230] Since 1947, depot personnel had suggested incineration as the best method of destruction of unserviceable H-filled ordnance. Late in 1957, Professors Willard, Sandwig, and Sundstrum from the South Dakota School of Mines and

Technology were contacted to develop plans for a kiln-type incinerator.[BHADb-197] A demonstration of a high-speed water cooled saw cutting through an M70 bomb was conducted in June of 1958, and additional experiments were conducted at the Depot in Building DE-7 (Figure 2-2).[BHADb-198]

The incinerator was in place in early 1959, however, problems associated with the saw were immediately apparent.[BHADb-131] A historical summary described the situation:

*The demilitarization of mustard gas in the M70 bomb containers was delayed due to difficulties encountered in perfecting the plant for disposal of the mustard. Three problem areas exist in the demilitarization plant. These problem areas are the cutting station, the conveyor system from the cutting station, and the conveyor system from the discharge head. The high speed in which the cold friction operates causes an aerosol of mustard. The heat from the kiln causes the aerosol to be a fire hazard. Several minor explosions have occurred at this point. The conveyor systems jam with cut pieces of bombs.*[BHADb-131]

For this reason, a hydraulic punch was developed to replace the original saw. The description of the process and a drawing of the kiln supplied by the U.S. Army Environmental Hygiene Agency was included in the 1992 report.[BHADb-1] According to Art Lawrence and James Rickart, former Depot personnel, the leaking bombs were loaded onto the conveyor and directed into the air lock and punching station where two holes were punched into each bomb. Windows were present and the punching could be observed. The bombs were then directed into the oil-fired kiln where the mustard was burned with a limestone slurry. Following burn out, the bombs exited on a conveyor system and were dipped in lime slurry; water rinsed in a 30 foot x 20 foot vat; and paddled onto another conveyor system. At the end of the line, the empty casings were tested for contamination. According to Art Lawrence, "if they tested positive for mustard, an "X" was placed on the container and they were decontaminated and sent through the process until they were clean". The empty casings were placed in gondola cars and sold as scrap. All casings were required to be certified as clean before they were sold as scrap. A wet scrubber system was installed to eliminate mustard fumes; however, at times the stack effluent was thick, dark and smelled.[BHADb-230]

A composite drawing of the incinerator shown in Figure 3-5 was constructed from an original plane table drawing and a later facility map (both undated).[BHADb-202, 203] Both drawings differ from a 1963 facility map shown in Figure 3-6 (Photo Documentation and Master Planning Documents). The later map may have been revised to include additional modifications to the incinerator or process.[BHADb-216]

Reportedly, the ground surface surrounding the Chemical Plant was graded and sloped to channel runoff into a leaching bed (Structure 6009). Water lines indicated the bed also received effluent from the change house and the demilitarization building (6005) (Figure 3-5). The bed was lined with limestone gravel. Due to the limited capacity of the nearby water in Well #3, a recycle pond containing reserve water was constructed west of Cottonwood Creek. Water was pumped from the pond into the hopper/scrubber system. Sludge and effluent from the 6 stage scrubber were discharged to the pond via a 6 inch x 12 inch flume and directed through a limestone rock filter for purification. A dam was constructed at the eastern end of the pond above a branch of Cottonwood Creek.[BHADb-230, 232, 235, 237]

A decontamination pit (Figure 3-5) was located north of the recycle pond and connected to the punch station of the incinerator with a 6-inch Orangeburg pipe. This may represent the sump tank (6006) depicted in Figure 3-7. Art Lawrence and James Rickard were uncertain of the use of this pit, but suggested it may have contained a limestone slurry for decontamination of leakers. Entire pallets may have been decontaminated at this location, then placed on the conveyor for burnout.[BHADb-230]

Figure 3-6, constructed from the 1963 facility map and Master Planning Documents (Photo Documentation and Master Planning Documents), shows different locations for some of the structures shown in Figure 3-5. Additional buildings and/or pits include a sump tank (6006), an 80 foot x 110 foot spray pond (6014), leaching bed (6016), and a condensate bed (6017).[BHADb-213] Former depot personnel described the spray pond as being located adjacent to the furnace. Water from the pond may have been sprayed onto the furnace as a cooling measure. According to the location on the map, however, the spray pond is located well away from the furnace and near the filter bed shown on the preceding map.[BHADb-230] The use of the condensate bed (6017) is unclear. Art Lawrence and James Rickard suggested the bed contained water from the valve connecting the scrubber and the stack, but the structure is located well south of the incinerator.[BHADb-230]

In addition, the location of the recycle pond (6015) and the filter bed (6009) in Figure 3-6 vary considerably from that shown on Figure 3-5. The structure identified as a 320 foot by 500 foot filter bed (6016) is located north of the incinerator and outside the fenced perimeter of the facility.[BHADb-202, 203, 213] The Demilitarization Building (6005) is not identified by number on the 1963 map. Incineration of all 206,508 M70 bombs present at the BHAD was completed in April of 1962.[BHAD-127, 211]

In 1965, reduction of the entire stockpile of the remaining chemical weapons present at the BHAD was followed by the modification of the incineration for destruction of cyanogen chloride (drained from 500 and 1,000 pound bombs).[BHADb-211, 230] The precise nature and extent of the modification is unknown. The total number of pounds of cyanogen chloride destroyed in the furnace is also unknown, but a January 6, 1966 press release states that 5,200 bombs (500 and 1,000 pound) were destroyed during the 1965 effort.[BHADb-211] A copy of the news release is presented in Appendix F and copies of photos (November 1965) of the event are presented in Volume III, Photo Documentation and Master Planning Documents.[BHADb-210]

CK-filled bombs were hoisted onto a conveyor belt where the shipping bands, fuze well liner and filler plug were removed. A ruptured disc and filler plug adapter were inserted into the bomb. The bombs were transferred to the furnace area and placed on a drain rack located on an 8-foot high platform. The disc was ruptured and the agent was transferred to a 500-gallon tank. The liquid was sprayed into the kiln and burned at 2000°F.[BHADb-210, 211] According to Art Lawrence the process did not generate an ash residue.[BHADb-232] The empty bomb casings were cleaned with compressed air, loaded into gondola cars and shipped to Rocky Mountain Arsenal for reuse with an explosive filler.[BHAD-210, 211]

According to Melvin Porter, ammunition handler during closure of the facility, all chemical weapons were removed from the Chemical Area in 1966 and shipped to other facilities [BHADb-227]. The Chemical Plant (Demilitarization Building) was dismantled January 6, 1967 and



buried in the burning pit.[BHADb-216, 230] The Decontamination Report indicated the presence of a 250 foot long mustard-filled drain line in the subsurface at the Chemical Plant.[BHADb-1] According to Art Lawrence, this line may have been the flume discharging effluent from the scrubber to the recycle pond, however, the flume is only 100 feet long. In addition, Mr. Lawrence did not believe the sludge was heavily contaminated with mustard.[BHADb-232] A 1976 summary of an interview with a former BHAD employee, Roger Yardley who was associated with construction and operation of the incinerator, indicated that an underground line about 7 feet deep had become clogged. The line carried wastewater from the washdown of equipment to the decontamination pit. Chlorinated lime was placed in the clogged line.[BHADb-236] The underground lines shown in Figure 3-5 leading to the decontamination pit or the leaching bed (6009) are also approximately 250 feet long. Modifications to the plant for incineration of cyanogen chloride may have further complicated the location of this drain line.[BHADb-202, 203]

**3.3.2.2.5 Incendiary-Filled Ordnance at the BHAD** - The types of incendiary, smoke, or tracer ordnance at the BHAD is listed in Table 3-3. Munitions filled with these agents were present in abundance at the BHAD throughout its operational history.

#### **White Phosphorous Burial Area**

According to documents and the 1992 report, a large fire occurred in 1946 within stacks of white phosphorous bombs stored outside within the Open Storage Area (later called Burning Ground 3). The burned out bomb casings were buried in two pits located south of the Tracer Test Range and north of Block J as shown on Figure 2-2 [BHADb-001].

Additional information on the white phosphorous fire was supplied by Lee Deans, former Ammunition Inspector. Mr. Deans recalled the location of the fire as being north of Lookout Road rather than south. The deteriorated WP bombs had been received from overseas with intact burster tubes. Not all of the bombs were destroyed in the fire. The remaining bomb bodies were inspected and the bursters removed. Bursters were destroyed at Burning Ground 2 by detonation and the white phosphorous was burned. The empty burned-out casings were buried adjacent to Block J just south of Lookout Road as shown in Figure 2-2.[BHADb-36]

#### **Flare and Tracer Test Range**

The Tracer Test Range is located north of Block J as shown in Figure 2-2. Little supplemental information concerning the tracer test range was encountered in the documents; however, a 1955 memo concerning Burning Ground 2 reported the presence of the Tracer Test Range within Burning Ground 2.[BHADb-165] Demolition and tracer tests were not conducted concurrently. A new test range was constructed in late 1958 at the location shown in Figure 2-2, and by early 1959, 105 lots of caliber .30 and caliber .50 small arms ammunition were trace tested [BHADb-122, 131]. In addition, a 1964 map indicates the construction of a Flare Test Range west of the Tracer Test Range (Figure 2-2). The range consists of three small concrete pads and a larger (20 foot x 20 foot) gravel pad aligned toward Igloo G-601.[BHADb-205] Igloo G-601 may have been an observation point located a required distance from the test area. The triangular shape of the Flare Test Range is visible in the 1965 aerial photo.[BHADb-1]

During operation of the BHAD contaminated clothing and the dismantled incinerator was placed in at least one pit.[BHADb-230] In 1957 however, documents reported that drained and empty M70 bomb casings were burned in "pits" at the Chemical Area.[BHADb-14, 196] The 75 foot x 150 foot fenced area is not large enough to cover more than one pit. On a 1965 and 1975 aerial photograph, two pits are discernable. A 1963 facility map (Figure 3-6), revised in 1967, indicates the presence of a small fenced rectangular area south of two structures. It is not known which of these are actually the pit or pits.[BHADb-216]

In the 6000 Area contamination with CWM is potentially present in the subsurface, but was not observed at the surface.

#### Ammunition Normal Maintenance - 8000 Area

The 8000 Area was located in the central portion of the BHAD (Figure 2-2). Maintenance of conventional ammunition was conducted at this location.[BHADb- ] Documents and results of interviews do not indicate the presence of chemical-filled ordnance or chemical agents at this location during operation of the facility.[BHADb-1] No additional information related to the presence of OEW was encountered during this investigation.

Contamination with OEW or CWM is not likely at this location.

#### Tracer and Flare Test Range

The Tracer and Flare Test Ranges are located north of Block J and outside the perimeter fence. The ranges were used for testing of .30 and .50 caliber tracer ammunition and flares and were constructed in the latter years of operation of the depot.[BHADb-122, 131]

With the exception of incendiary, smoke, or tracer-filled small arms ammunition or flares, documents do not indicate that CWM was tested at this location. During the 1992 site visit, a white filler was found in some of the projectiles and was believed to be inert or incendiary. The material was later identified as inert. No additional supplemental information concerning the presence of CWM or OEW at this site was found in the documents.

Contamination with OEW or CWM (incendiary or smoke only) is present in the surface and within the berm at this location.

#### 10000 Area (X Area) - Burning Ground

Burning Ground 3 is located in the north central portion of the BHAD (Figure 2-2). Prior to 1959, this location was an open storage site and in 1959 was converted to a burning ground and a disposal area for Air Force corrosives and oxidizers associated with rocket fuel.[BHADb-1]

The revised location of an acid leaching bed is shown on Figure 2-2. During the site visit, very little evidence was present indicating the area was ever a burning ground. A tail assembly, parabomb frag, M103 nose fuze, boosters, burned wooden debris, and 105 mm projectile fragments not believed to be UXO were found on the surface. No evidence was uncovered related to the presence of CWM at this location.

Contamination with CWM is not likely at this location and contamination with UXO in the subsurface is potentially present.

### Burning Ground 1

Burning Ground 1 is located along the south central perimeter of the BHAD (Figure 3-2). Conventional and chemical-filled munitions were destroyed at this location until a new site was constructed in 1946.[BHADb-1] During the site visit, all of the ordnance found within the area was located north of the large trash dump. The majority of the items were in the ravines on the west side of the road. Potentially hazardous items (UXO), base detonating fuzes, 40 mm HE, and 37 MM (HE) projectile, were encountered scattered along the sides and bottom of the western ravines. Additional burned-out or demilitarized items included a 20 mm cartridge, empty M70 bomb, and empty M47 series bomb casings. On the steep slopes on the eastern edge of the burning ground, empty 155 mm (HE) and empty 155 mm WP or bursting chemical projectiles were encountered. The ridge-top along the road was severely denuded. No additional supplemental information was found during this investigation.

UXO-related contamination is present on the surface and UXO and CWM are most likely present at this location in the subsurface.

### Suspected Pit Area

The Suspected Pit Area is located between Cottonwood Creek and Storm Road as shown in Figure 3-1. The area appeared on a 1945 Ordnance Department aerial photograph (Plate 1, Photo Documentation) as a disturbed area consisting of five individual areas resembling bermed storage or pit areas.[BHAD-225] Only faint traces of the site are visible on the 1954 aerial photograph [BHADb-1].

No references to this location were found in the historical documents. Based on information obtained through interviews, however, the area was most likely a burn area for propellant and/or explosives.[BHADb-233] The area was not observed during the 1993 site visit.

The probability of OEW or CWM related contamination at this location is not known.

## **TABLES**

**TABLE 2-1  
LIST OF CONTACTS**

<b>Organization</b>	<b>Contact Dates</b>	<b>Contact Name</b>	<b>Results</b>	<b>Status</b>
U.S. Army Military History Institute Attn: Research & Reference Branch Carlisle Barracks Carlisle Barracks, PA 17013-5008 (717) 245-3152 (717) 245-3631	Tele. 6/7/93 Tele. 6/8/93 Letter 6/22/93	Pam Cheney Randy Rakers	Received additional contacts. Letter received 7/6/93. Sent limited information. Have some CWM documents.	Visited 7/27/93 General Information Only
AMCCOM Headquarters AMSMC-HO Rock Island, Illinois 61299-6000 (309) 782-1276	Tele. 6/4/93 Letter 6/22/93	Dr. Herb LaPore	Additional contacts. Received letter 7/6/93. No information available.	No further contact required.
SAIC 1309 Continental Drive Suite F Abingdon, MD 21009 (410) 679-8014 Fax (410) 679-0356	Letter 6/23/93 Fax 6/23/93	Eric Azuma	Received documents 6/24/93.	Call if need additional assistance.
GSA-FOIA 18th and F Street Washington, DC 20402 Attn: Dick Stinson (202) 501-2069 (202) 501-2938	Tele. 6/4/93 Letter 6/23/93 Fax 6/23/93 Tele. 6/23/93 Tele. 7/7/93 Tele. 7/13/93	Gloria McDonald Leslie Carrington Mae Simms	Have done a thorough search. Have no records on NOP. Reviewed BHAD records in 1992. Later, on 7/13, additional records were identified.	Visited GSA 7/14/93 Reviewed additional GSA documents 7/17/93 and 7/26/93
Department of the Army Freedom of Information Office Headquarters USA-ISC-P (ASQNS-OP-F) Crystal Square, #2 Suite 201 1725 Jefferson Davis Highway Arlington, Virginia 22202 Attn: Ms. Edie Miley (703) 607-3452 Fax (703) 607-3450	Tele. 6/11/93 Letter 6/23/93 Fax 6/23/93 Tele. 6/23/93 Tele. 6/24/93 Tele. 6/28/93 Tele. 7/7/93	Steve Elldridge Marian Friend	Faxed master list of documents. Selected pertinent items. Will fax permission to review documents to Suitland 7/8/93.	Reviewed records week of 7/12/93.

**TABLE 2-1  
LIST OF CONTACTS**

<b>Organization</b>	<b>Contact Dates</b>	<b>Contact Name</b>	<b>Results</b>	<b>Status</b>
Chemical School Library ATZN-CM-FI Ft. McClelland, AL 36205-5020 (205) 848-5722 (205) 848-4414	Tele. 6/4/93 Letter 6/22/93	Dr. Dan Spector Dick Pastorett	Very unorganized documents. Will pass the names of sites to visiting contractors.	Contact as needed.
Commander U.S. Army Dugway Proving Ground Attn: JCP-I (Ron Stricklett) Dugway, Utah 84022 (801) 831-3565	Tele. 6/7/93 Letter 6/23/93	Steve Christiansen	Letter received 6/28/93. Four documents on BHAD are available.	Received first of documents 8/11/93. USACE will supply the two chosen
U.S. Army Chemical Material Agency Attn: SFIL-NSP Aberdeen Proving Ground Aberdeen, MD 21010-5410 (410) 671-1083	Tele. 6/23/93 Tele. 6/24/93 Letter 6/25/93	Mr. Skinner Wayne Jennings	Call Eric Azuma (401) 679-8014. Can ask and obtain access to the library.	Call if need additional assistance.
Suitland References (NNRI) National Archives Washington, DC 20409 (301) 763-7411	Tele. 6/23/93 Tele. 7/7/93	Mr. Giordano Becky Collier	Write letter requesting declassification of Box 18 and 179 Documents copied. 1-8 not found	Reviewed documents week of 7/12/93 and 7/26/93
28 CES/CED 2679 Quesada Drive Ellsworth AFB, SD 57706-4701 (605) 385-2880	Tele. 6/7/93	Master Sgt. Prosperi	Send letter	No Response Received
Former Surveillance Inspector, BHAD 616 Indian Wells Lexington, NC 27292 (704) 956-2331	Tele. 6/8/93 Letter 6/28/9 Letter 7/2/93 Tele. 7/8/93 Tele. 9/17/93	H.L. (Lee Deans)	Provided operational information. Received letter 7/6/93. Provided additional contacts.	Call as needed.
CEHND Safety Office (205) 955-4583	Tele. 6/11/93	Wayne Galloway	Supplied number for 94th EOD	Call as needed.

**TABLE 2-1  
LIST OF CONTACTS**

Organization	Contact Dates	Contact Name	Results	Status
94th EOD Ft. Carson, CO (719) 579-4242	Tele. 6/11/93	Master Sgt. Van Huss	New EOD/CT is 548th EOD in Ft. Lewis, WA. Does not have the number.	Call before going to the sites.
Commander U.S. Army Chemical and Biological Defense Agency AMSCB-CIH (Jeff Smart) Aberdeen Proving Ground Aberdeen, MD 21010-5423 (410) 671-4430	Tele. 6/24/93 Letter 6/25/93	Jeff Smart Cathy Chiofi	Copied numerous documents require letter requesting clearance from USACE. USACE will send letter	Visited 7/15/93
USACE, Omaha District Omaha, NE (401) 221-7851 (402) 221-7643 (402) 221-4395 (402) 221-3801	Tele. 6/25/93	Linda Wagner Jerry Smith Alice Daniel Bev Walling	25 volumes of real estate information on NOP. These records were reviewed on August 3, 1993. Documents copied	Central Park Plaza South Tower. 222 South 15th St. Room 302. Visited 8 _____
U.S. Army Environmental Hygiene Agency AHN-HSHB-CCI/Ms. Anders Building E 1570 Aberdeen Proving Ground, MD 21010-5422 (410) 671-4408	Tele. 6/28/93 Letter 6/28/93	Ms. Anders	Received several documents on both sites	No further contact
Ordnance Field Safety Office 1145 Highway 629 Charleston, IN 1711-966 (812) 284-7915	Tele. 6/24/93 Tele. 6/28/93	John Campbell	Safety Office no longer active.	No further contact required.
U.S. Army Environmental Center ENAEC-IR-D Aberdeen Proving Ground Aberdeen, MD 21010-5401 (410) 671-1534 Fax (410) 671-1548	Tele. 6/24/93 Letter 7/2/93 Tele. 7/6/93	Conrad Swan	Referred letter to Joe King. Records sent to CEHND.	No further contact required.

**TABLE 2-1  
LIST OF CONTACTS**

<b>Organization</b>	<b>Contact Dates</b>	<b>Contact Name</b>	<b>Results</b>	<b>Status</b>
NCPMO National Records Center 9700 Page Avenue St. Louis, MO 63114 Attn: Mr. David Petree (314) 538-4216 Fax (314) 538-4005	Tele. 6/4/93 Letter 6/23/93 Fax 6/23/93 Tele. 6/23/93 Tele. 6/25/93 Tele. 6/28/93	Bill Siebert Wilson Sullivan	Documents on BHAD obtained. Five boxes of records on Offutt reviewed. Five folders shipping records on Offutt also reviewed. No information related to CWM disposal sites at NOP. Additional records reviewed 9/93.	Record Center Visit 6/29 - 7/1/93. Additional visit to review Air Force records on 8/10.
U.S. Army Corps of Engineers St. Louis District (314) 331-8787	Tele. 6/4/93 Tele. 6/28/93 Visit 6/28/93 Visit 7/2/93 Tele. 7/6/93	Captain Tom Murrell	Obtained contacts and provided necessary coordination, information requests, and letters of introduction.	Contact as needed.
Surety Office Headquarters AMCCOM Attn: AMSMC-SR Rock Island, IL 61299-600 (309) 782-2965	Tele. 6/23/93 Letter 6/23/93	Russell Hartwig (Safety Office)	No information available.	No further contact.
History Resources Branch The Center of Military History 1099 14th Street Northwest Washington, DC 20005-3402	Letter 6/22/93	Hannah Zeidlik	Received limited information	No further contact required
Defense Explosive Safety Board 2461 Eisenhower Alexandria, Virginia 22331 ( ) 325-0969	Tele. 6/7/93 Letter 6/22/93	Gene Clark	Received name of former BHAD Inspector H.L. Deans. Deans called 6/8/93.	No further contact required
Command General Staff Library Ft. Leavenworth, KS (913) 684-4035	Tele. 7/2/93	Tina Byers	Provide them with more detailed document information. Need the names of the documents required.	Cannot determine names of documents before hand.
National Archives Washington, DC (202) 501-5395	Tele. 6/4/93 Tele. 7/7/93 Tele. 7/19/93	Tab Lewis	No information. All information in accession #58A542 sent to Kansas City. May be some information in GSA Central Files.	Call when in Washington, DC



**TABLE 2-1  
LIST OF CONTACTS**

<b>Organization</b>	<b>Contact Dates</b>	<b>Contact Name</b>	<b>Results</b>	<b>Status</b>
Headquarters, US Army Garrison Public Affairs Office Ft. Detrick, Md. 301-619-8000	Tele. 7/13/93	Norman Covert Chief, Historian	He checked his file listing; they have nothing on these sites. His organization (formerly USABRDL) was mostly involved in biological R&D.	He suggested contacting Edgewood Arsenal.
SAF/AAIA 1610 Air Force Pentagon Washington, DC 20330-1610 703-614-3527 703-693-1713	Tele. 7-13-93 Fax 7-13-93 Tele. 7/19/93 Tele. 7/21/93	Grace Rowe	TCT requested access to five boxes of records at St. Louis Personnel Records Center. Received permission to review documents	Reviewed records 8/10/93
Private individual. 812-265-4190	Tele. 7-15-93 Tele. 8-12-93	John Campbell	Former Safety Director at BHAD 9/57 to 6/60. Provided information on chemical operations. Roger Yardley set up mustard demil at site. Provided info about safety to DOJ.	NMD contacted 8/12.
Private individual 406-453-4272	Tele. 7/15/93 Tele. 8/12/93	Woodrow Hipshire Formerly in charge of renovation at BHAD	No response to telephone calls.	No Answer
Pine Bluff Arsenal Office of the Commander Pine Bluff, Arkansas	Tele. 7-14-93	Patsy Milligan Secretary to the Commander last 26 years	Has no recollection of Doc Dehner as Commander. Will research her files to determine if he was ever stationed there. Received better-does not know about whereabouts of Doc Dehner	No further contact required
Private individual 815-591-2208	Tele. 7-13-93 Tele. 7/19/93 Tele. 8/3/93	Roger Yardley	No answer to phone calls. Phone is disconnected or no longer in service. The phone number is still listed directory	No contact possible.
National Archives Regional Archives Kansas City, Mo. 816-926-6272 816-926-6982 fax	Tele. 7-19-93 fax 7-15-93	Clara Rolan	She indicated records were available for review.	Records review was performed on August 2, 1993.

**TABLE 2-1  
LIST OF CONTACTS**

<b>Organization</b>	<b>Contact Dates</b>	<b>Contact Name</b>	<b>Results</b>	<b>Status</b>
Private Individual 605-662-7720	Tele. 7/21/93 Tele. 7/23/93 Tele. 7/30/93 Tele. 8/4/93	Matt Brown	OK to visit the BHAD. All coordination w/landowners and caretaker completed	Call as needed
Property Owner 303-622-4200	Tele. 8/3/93	Burton Hutton	Not available. Left message as to date of visit	No further contact needed
Former BHAD employee 605-745-6914	Tele. 8/3/93	William Bruce	Phone disconnected.	
Former BHAD employee 605-574-2617	Tele. 7/23/93 Tele. 8/4/93 Tele. 8/19/93 Tele. 9/17/93	James Rickard	Obtained information pertaining to Chemical Area.	Visited
Former BHAD employee 605-745-4742	Tele. 8/4/93 Tele. 8/18/93	Louis Rickard	Obtained information pertaining to BHAD.	Visited
Fire Chief, Edgemont, SD 605-662-7313	Tele. 8/2/93 Tele. 8/16/93 Tele. 8/19/93	Dave Henderson	Obtained very useful information.	Visited
Former BHAD employee 605-343-8644	Tele. 8/12/93 Tele. 8/19/93 Tele. 9/17/93	Art Lawrence	Obtained information pertaining to Chemical Area.	Visited
Former BHAD Employee	Tele. 8/19/93	Melvin Porter	Obtained information concerning closure.	Visited
USACE, MRD	Tele. 9/21/93	Bill Dorkin	Obtained information of permit status.	No further contact needed.
74th Ord. Det. EOD Ft. Riley, Kansas	Tele. 9/22/93	Sgt. Marks	Obtained information on prior visit to site.	No further contact needed.

TABLE 3-1		
FORMER BHAD ORDNANCE OPERATIONS		
Ordnance Operation	Area Designation	Function
Storage Igloos	Block A-H Block J	Munition storage
Combat Material Area	1800 and 2000 Area	Inert storage, small arms ammunition stored in 1800 Area
Ammunition Workshop Area	3000 Area	Munition storage, depriming, debanding, and TNT washout of munitions
Bundle Ammunition Packing Area Disassembly Plant, Deactivation Furnace	4000 Area	Small arms and ammunition packing, ammunition disassembly, burnout of small arms and ammunition components
Burning Ground 2	5000 Area	Destruction of ammunition, conventional and chemical-filled by detonation, burnout, and venting
Chemical Plant Chemical Warfare Area Chemical Burning Pit	6000 Area	Renovation, disassembly, destruction of chemical weapons, and storage of chemical weapons, including leaking
Ammunition Normal Maintenance Area	8000 Area	Renovation of munitions, conventional and chemical-filled munitions
Tracer Test Range, Flare Test Range	9000 Area	Test range for 30 and 50 caliber ammunition and flares
Outdoor Storage Area Burning Ground 3	X Area	Munition storage and destruction
Burning Ground 1	No number or letter designation	Destruction of ammunition, conventional and chemical-filled
Suspected Pit Area	No designation	Burn, storage, or decontamination area. Most likely bulk explosives and propellants.

TABLE 3-2

**LIST OF ORDNANCE PRESENT DURING THE OPERATION OF THE BLACK HILLS ARMY DEPOT (BHAD)**  
(Page 1 of 4)

Reference #	Specific Ordnance
BHAD-107	Fuze, M103A1
BHAD-107	Flare, Surface, Trip
BHAD-107	Powder, Prop.
BHAD-107	Cart, 76 mm, HE, M42A1
BHAD-107	Proj. HE, M114, F/240 mm
BHAD-107	Case, Cart, M5A1, 76 mm
BHAD-107	Case, Cart
BHAD-107	Cart, 57 mm, HE, M306, A1
BHAD-107	TNT, Flake
BHAD-107	Projectile, 8" HE, M106
BHAD-108	10,000 lb Tritonal GP Bomb
BHAD-108	30 Caliber Ball Ammunition
BHAD-112	260 lb Frag Bomb
BHAD-114	U.D.M.H., Nitric Acid, M-3 Fuel, Jet Fuel
BHAD-127	Mines
BHAD-127	40 mm
BHAD-127, BHADb-9	81 mm Mortar, HE M56
BHAD-127, BHADb-9	4.2" Mortar, HE
BHAD-127	3.5" Rocket
BHAD-127	120 mm HE
BHAD-127	105 mm RR
BHAD-127	155 mm HE
BHAD-127	750 lb bomb
EOD	M61 Pract Chem Rocket
EOD, BHADb-92	Wafer, frag bomb, 4 lb., M83 (butterfly)
EOD	M103 Bomb Fuze
PHOTOS	37 MM Shells
BHADb-59	Bomb, GP, 250 lb. AN-M57

\*For explanation of abbreviation see page 7 of Table 5-1.

TABLE 3-2

**LIST OF ORDNANCE PRESENT DURING THE OPERATION OF THE BLACK HILLS ARMY DEPOT (BHAD)**  
(Page 2 of 4)

Reference #	Specific Ordnance
BHADb-67	Projectile, AP MK18 for 12" gun
BHADb-67	Projectile, HE, MK11 for 16" gun
BHADb-67	Projectile, AP, MK2 for 16" gun, 2100 lb
BHADb-67	Cart, APC-T, M86, 57 mm
BHADb-67	Bomb, AP, Explosive D, 1600 lb, AN-MK-1
BHADb-70	Cart, .30 and .50 caliber
BHADb-70	Bomb, demo, 750 lb
BHADb-70	Bomb, SAP, 1000 lb
BHADb-70	Charge, propelling for 120 mm gun
BHADb-92	Shell, HE, M107, 155 mm Howitzer
BHADb-92	Shell, AP, 6" gun, 108 lb M1911
BHADb-125	Scrap Comp B
BHADb-29	2.25 rocket, MK3 Mod 2
BHADb-67, 156	Cart APC-T, 57 mm, 90 mm
BHADb-92	Bomb 2,000 lb
BHADb-92	Projectile, fixed APC-T, M61 for 75 mm gun
BHADb-82	Shell, fixed, APC-T, M62A1, Flashless, smokeless for 76 mm gun
BHADb-82	Cart, HE-7 comp B, flashless, smokeless for 90 mm gun
BHADb-83, 132	Rocket, HE, M32 (T160) Series 4.5"
BHADb-88	Blasting caps, cannon primers
BHADb-88	Nitrostarch
BHADb-18	JATO, smoke and illuminating
BHADb-18	Pyrotechnics - signal and photoflash cartridges and bombs
BHADb-9	5" rocket motors
BHADb-9	Charge, propelling, 155 mm gun
BHADb-9	Detonator, concussion type, M1
BHADb-9	Shell, proof T1E1, inert
BHADb-9	Mine, AP, Practice M8

\*For explanation of abbreviation see page 7 of Table 5-1.

**TABLE 3-2****LIST OF ORDNANCE PRESENT DURING THE OPERATION OF THE BLACK HILLS ARMY DEPOT (BHAD)**  
(Page 3 of 4)

<b>Reference #</b>	<b>Specific Ordnance</b>
BHADb-9	Mine, AP, M2, M3, and M7
BHADb-9	Shell, HE, 40 mm gun
BHADb-16	Signal, ground, high burst range
BHADb-16	Cart, HE-T for 40 mm guns
BHADb-16	Shell, HE, 81 mm mortar
BHADb-16	Cart, ball, cal. 22 long rifle
BHADb-16	Rocket HE AT, 3.5"
BHADb-20	Cart 106 mm
BHADb-34	Mine, antitank HE M15
BHADb-34, 156	Bomb, demoliton, 300 lb, 750 lb
BHADb-79	Shell, HE, AT 105 mm Howitzer
BHADb-133	Miscellaneous 12", 14", and 16" ammunition

\*For explanation of abbreviation see page 7 of Table 5-1.

TABLE 3-2

(Page 4 of 4)

**LIST OF ORDNANCE PRESENT DURING THE OPERATION OF THE BLACK HILLS ARMY DEPOT (BHAD)  
LIST OF ABBREVIATIONS**

Abbreviation	Definition
AP	Anti-personnel or armor piercing, pending reference to ordnance.
APC-T	Armor Piercing Carpet -Truct
AT	Anti-tank
BE	Base Ejection
CP	Concrete Piercing
G	Gasoline, aviation gasoline used as a fuel with a liquid propellant.
H	Mustard (2,2-dichlorodiethylsulfide) - a blister gas.
HE	High Explosive - characterized by the extreme rapidity with which detonation occurs.
JATO	Jet Assist Take Off
PD	Point Detonating Fuzes - an explosive train component that can be activated by impact.
RR	Recoilless Rifle
SAP	Semi-Armor Piercing
S/F	Semi-Fixed
TNT	2,4,6-trinitrotoluene - a constituent of such explosives as amatol, pentolite, tetrytol, tritonal, pickatol and Composition B; or can be used by itself as an explosive as a bursting charge, demolition charge or blasting charge.
UDMH	Unsymmetrical Dimethylhydrazine - a liquid rocket fuel.

Sources: BHAD-066,055,157

TABLE 3-3

**SUMMARY OF CHEMICAL WARFARE MATERIALS (CWM)  
PRESENT DURING THE OPERATION OF THE  
BLACK HILLS ARMY DEPOT (BHAD)**

Reference #	Specific Chemical Munition or CWM
<b><u>Lethal Chemical Agents</u></b>	
BHAD-002	Lewisite
BHAD-005	Captured German Chemicals*
BHAD-053	CN, AC
BHAD-054	HC Hexachloroethane
BHAD-063	White Phosphorous (WP)
BHADb-9	Shell gas, HT, M2, 4.2" mortar
BHADb-9, 29	Shell, gas, CG, M2, 4.2" mortar
BHADb-11, 125	Shell, semi-fixed, gas, persistent, (H), M60 for 105 mm Howitzer
BHAD-80, 137, 107	Bomb, gas, CK 500 lb, M78
BHAD-80, 137, BHADb-16	Bomb, gas, CK, 500 lb, M79
BHAD-107, 137, BHADb-16	Bomb, gas, CK, 1,000 lb M79
BHAD-80, BHADb-54, 61	Bomb, gas CG, 500 lb, M78
BHAD-107, 137, BHADb-54, 61	Bomb, gas, CG, 1,000 lb, M79
BHAD-73, 108, BHADb-16	Bomb, gas, persistent, Hor L, 115 lb, M70
BHADb-20	Mustard containers
BHADb-29	Shell, H, inert, 4.2" mortar, M2
BHAD-74, BHADb-80, 81	1-ton containers for CG
BHADb-133	Bomb, HE, AC, HC, 4,000 lb
BHADb-154	Bomb, H, 100 lb, M47A2
BHADb-154	Rocket, CG, 7.2 inch
BHAD-78, 73, BHADb-127, 158	Shell, H, 155 mm, M110, MK11A1
BHAD-5	Rocket, GB or VX, M55
BHAD-107, BHADb-81	CML, Mustard H-55 lb container
BHAD-82	Projectiles, H-filled, 75 mm
<b><u>Non-Lethal Chemical Agents</u></b>	
BHADb-29	Shell, gas, CNB, irritant, 4.2" mortar
BHADb-29	Shell, gas, CNS, irritant, 4.2" mortar

\*Information included in 1992 TCT Report from a government report, however, facility documents do not substantiate the presence of this item.



TABLE 3-3

**SUMMARY OF CHEMICAL WARFARE MATERIALS (CWM)  
PRESENT DURING THE OPERATION OF THE  
BLACK HILLS ARMY DEPOT (BHAD)**

Reference #	Specific Chemical Munition or CWM
<b><u>Incendiary and Smoke Agents</u></b>	
BHADb-59	Shell, fixed, HE, M48, HC, 75 mm gun
BHADb-67	Shell, smoke, WP, M64, 75 mm Howitzer
BHADb-9	Shell, smoke, WP, 60 mm mortar
BHADb-9	Shell, WP, M57, 81 mm mortar
BHADb-9	Shell, smoke, WP, 155 mm Howitzer
BHADb-19	Cart, incendiary 20 mm gun
BHADb-23	Shell, fixed, SF, smoke, WP, 75 mm Howitzer
BHADb-23, 34	Shell, SF, HC, BE, 105 mm, M-84
BHADb-24	Cart, incendiary, caliber 50
BHADb-29	Shell, FS, 4.2" mortar
BHADb-130	Projectile, WP smoke
BHAD-54	Smoke bombs (WWII), 10 lbs to 100 lbs, M67 (WP) bomb or M74 or M77
BHAD-54	100 lb M47A2 WP bomb
BHAD-127	60 mm WP
BHAD-127	57 mm smoke
EOD	M47A4 US incendiary bomb
EOD	155 mm, smoke, filled with red phosphorous
BHAD-48, BHAD-b-9	Grenade, rifle, smoke, WP
BHAD-64	Shell, WP, 105 mm

\*Information included in 1992 TCT Report from a government report, however, facility documents do not substantiate the presence of this item.

TABLE 3-3

**LIST OF CHEMICAL WARFARE MATERIALS (CWM) PRESENT DURING THE OPERATION OF THE  
BLACK HILLS ARMY DEPOT (BHAD)  
LIST OF ABBREVIATIONS**

<b>Abbreviation</b>	<b>Definition</b>
AC	Hydrocyanic acid - a blood and nerve poison, a gas.
BE	Base Ejection
CG	Phosgene - a choking gas.
CK	Cyanogen Chloride - a blood and nerve poison, a liquid until released into the atmosphere where it changes to a gas.
CML	No reference found.
CN	Chloroacetophenone - a training and riot control gas, a common tear gas.
CNB	Irritant
CNS	Irritant
GB	Sarin (methylisopropoxyfluorophosphine oxide) - a blood and nerve poison, a liquid.
H	Mustard (2,2-dichlorodiethylsulfide) - a blister gas.
HC	HC Mixture - a smoke generator which is formed by the combustion of aluminum with hexachloroethane and zinc oxide or High Capacity.
HE	High Explosive - characterized by the extreme rapidity with which detonation occurs.
HT	Mustard + T Mixture.
SF, S/F	Semi-Fixed
WP	White Phosphorous - a screening smoke and an incendiary agent, a liquid, ignites spontaneously on exposure to air and produces dense white smoke.

Sources: BHAD-066,055,157

\*Information included in 1992 TCT Report from a government report, however, facility documents do not substantiate the presence of this item.

TABLE 3-4

**DISPOSITION OF CHEMICAL ORDNANCE  
BLACK HILLS ARMY DEPOT**

Year	Ordnance	Action	Quantity	Remarks
1943	109/155 mm Chemical	Stored	155,376	Ref. BHAD-73
	115 lb, M-70, HD	Leaker	7	Ref. BHAD-73
	105 mm, M-60, H	Stored	5,178	Ref. BHAD-73
	155 mm, MK-II	Stored	60,025	Ref. BHAD-73
	115 lb, M-70, HD	Stored	29,511	Ref. BHAD-73
1944	155 mm, H	Stored	116,036	Ref. BHAD-74
	500 lb, CK	Leaker	91	Ref. BHAD-74
	1,000 lb, CG	Leaker	85	Ref. BHAD-74
	155 mm, HD	Stored	138,404	Ref. BHAD-74
	155 mm, HD	Leaker	20	Ref. BHAD-74
	Phosgene, CG	Recovered from bomb	6,464 lbs	Ref. BHAD-74
1945	115 lb, M-70, HD	Destroyed	7	Ref. BHAD-76
	500/1,000 lb bomb CG	Drained	7	Ref. BHAD-76
	SIGHA/SIGKA	Leaking	66	Ref. BHAD-76
	SIGHA/SIGKA	Stored	41,000	Ref. BHAD-76
	SIGNA (CG)	Drained/stored	5,415 lb (62275 lbs total or part)	Ref. BHAD-76
	100 lb, M-47A2, H	Stored	434	Ref. BHAD-76
	20,367 lbs GC	Transferred		
	25	Leaking & destroyed		
1946	CG	Recovered from leaking bomb	50,005 lbs	Ref. BHAD-61
	100 lb, M-47, WP	Stored	13,777	Ref. BHAD-61
	75 mm, M-64, CNS	Destroyed	2,886	Ref. BHAD-61
	155 mm, MK-II, CNS	Destroyed	1,780	Ref. BHAD-61
	1,000 lb, M-79, CG	Drained	168	Ref. BHAD-61
	100 lb, M-47, WP	Involved in fire	38,500	Ref. BHAD-61

TABLE 3-4

**DISPOSITION OF CHEMICAL ORDNANCE  
BLACK HILLS ARMY DEPOT**

Year	Ordnance	Action	Quantity	Remarks
1947	M70 H-filled	Stored	317,000	Ref. BHADb 157
	7, 2 CG chemical rockets	Destroyed by venting demolition area	500	Ref. BHADb 154
	M47A2	Destroyed by burning	7,000+	Ref. BHADb 153, 154
	M79 CG	Destroyed by venting	420,000 lbs	Ref. BHADb 159.162
	M70 H-filled	Moved to demolition area	270	Ref. BHADb 162
	M70 H-filled	Stored	293,975	Ref. BHADb 162
	155 mm, HD	Shipped to Rocky Mountain	233,812	Ref. BHAD-79
	500 lb, CK-M-78	Shipped to	4	Ref. BHAD-8
	500 lb, CG, M078		4	
	75 mm, H	Shipped to Rocky Mountain	100	Ref. BHAD-81
	105 mm, H	Shipped to Rocky Mountain	100	Ref. BHAD-81
	155 mm, H	Shipped to Rocky Mountain	100	Ref. BHAD-81
1948	M70 H-filled	Stored	307,740	Ref. BHADb 164
1949	M70 H-filled	Stored	302,187	Ref. BHADb 141
	75 mm, H	Shipped to Rocky Mountain	131,011	Ref. BHAD-82
1950	105 mm, H	Shipped to Rocky Mountain	33,128	Ref. BHAD-78
	155 mm, H	Shipped to Rocky Mountain	35,774	Ref. BHAD-78
1951	M70 H-filled	Destroyed by burning	10,863	Ref. BHADb 3, 4, 6,87, 99, 100, 101, 105, 107, 109, 110, 115
	M70 H-filled	Moved to burning ground	4135	Ref. BHADb 5, 101, 102, 108, 114
	M70 H-filled	Palletized for transport burning ground	11,343	Ref. BHADb 104, 107, 114
	M70 H-filled	Stored	304,000	Ref. BHADb 92
	M70 H-filled	Stored leakers	27,431	Ref. BHADb 183 Request for authorization to destroy
1952	Chemical	Stored	30,761 tons	Ref. BHADb 90
	M70 H-filled	Stored	299,682	Ref. BHADb 95

TABLE 3-4

**DISPOSITION OF CHEMICAL ORDNANCE  
BLACK HILLS ARMY DEPOT**

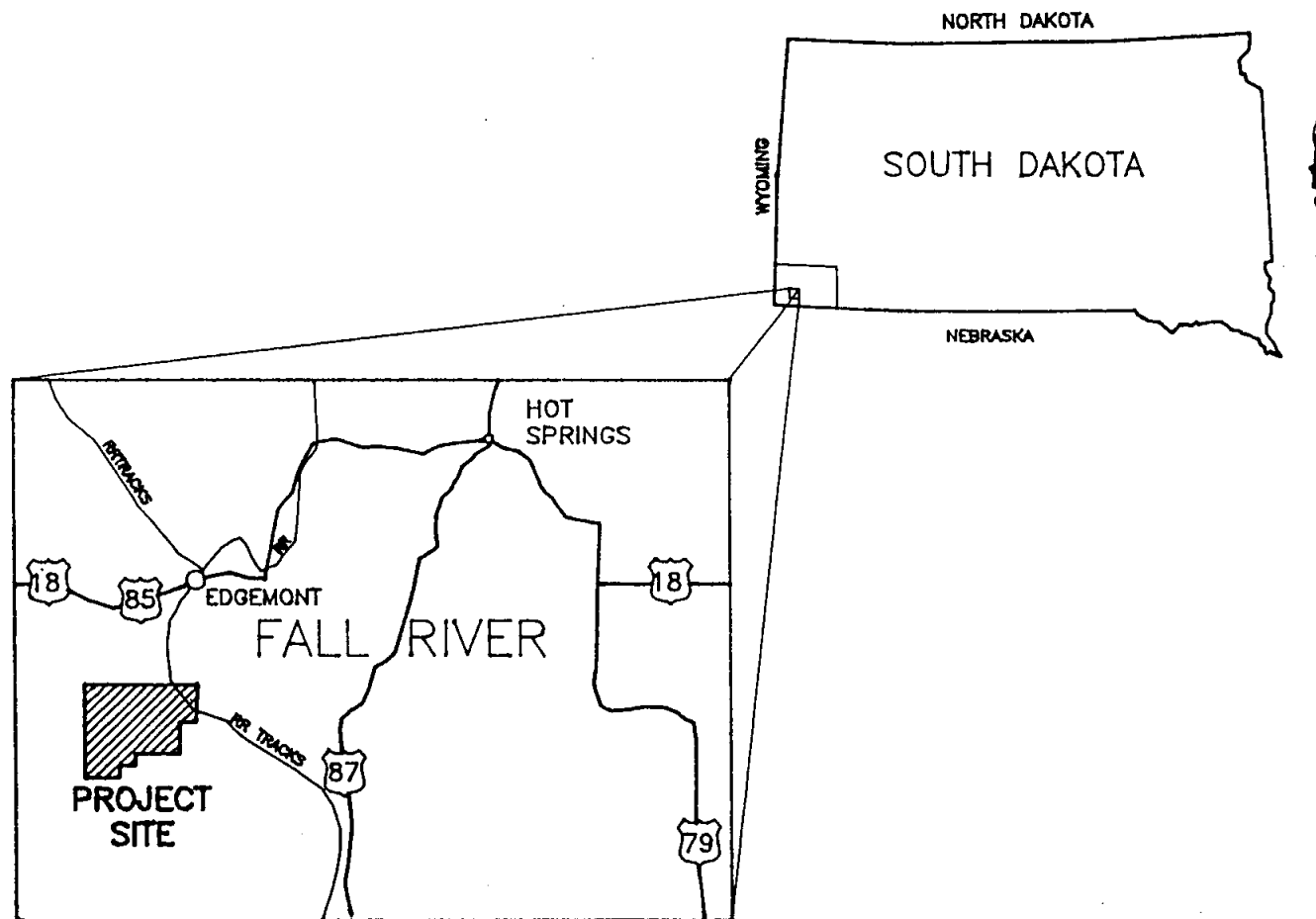
Year	Ordnance	Action	Quantity	Remarks
1952	M70 H-filled	Moved to RMA	3940	Ref. BHADb 95, 98
	M70 H-filled	Stored	302,187	Ref. BHADb 40
1953	Chemical	Stored	28,791 tons	Ref. BHADb 24
	M79 CG & CK	Destroyed	21	Ref. BHADb 94
	M70 H-filled	Moved to RMA	4,096	Ref. BHADb 188
	M70 H-filled	Moved to RMA	20,766	Ref. BHADb 189
	M70 H-filled	Destroyed	1,787	Ref. BHADb 189
	M70 H-filled	Stored	267,658	Ref. BHADb 189
	M70 H-filled	Stored	267,658	Ref. BHADb 189
	M70 H-filled	Moved to RMA	21,968	Ref. BHADb 189
1954	Chemical	Stored	25,151	Ref. BHADb 59
	CK H-Filled	Destroyed	4	Ref. BHADb 191
1955	M70 H-filled	Stored leakers	654	Ref. BHADb 76
	Bulk mustard	Stored	580,000 lbs.	Ref. BHADb 76
	Chemical	Stored	26,055 tons	Ref. BHADb 79
	1-ton CG containers	Stored	4	Ref. BHADb 80
	M70 H-filled	Stored (Navy)	59,469	Ref. BHADb 81
	M78 CG	Stored (Air Force)	286	Ref. BHADb 81
	M78 CK	Stored (Air Force)	5030	Ref. BHADb 81
	M78 CK	Stored (Air Force)	185	Ref. BHADb 81
	M79 CG	Stored (Air Force)	16,186	Ref. BHADb 81
	M79 CG	Stored (Air Force)	603	Ref. BHADb 81
	CG	Stored (Army)	4,790 lbs	Ref. BHADb 81
	H	Stored (Army)	8,168,215 lbs	Ref. BHADb 81
	H gas shells (05 mm)	Destroyed by burning	2,258	Ref. BHADb 129, BHAD-102
	M64 WP	Destroyed by burning	445	Ref. BHADb 130
	105 mm, H	Stored	61,444	Ref. BHAD-102
	Bomb, CK/CG	Stored	857	Ref. BHAD-102

TABLE 3-4

**DISPOSITION OF CHEMICAL ORDNANCE  
BLACK HILLS ARMY DEPOT**

Year	Ordnance	Action	Quantity	Remarks
1955	Bomb, H	Stored	98,179	Ref. BHAD-102
1956	M70 H-filled	Destroyed by burning	771	Ref. BHADb 128
	M79 CK	Destroyed by burning	6	Ref. BHADb 194
	M79 CG	Destroyed by burning	2	Ref. BHADb 194
	M70 H-filled	Destroyed by burning	224	Ref. BHADb 197
1957	M79 CG	Destroyed by burning	4	Ref. BHADb 197
	M70 H-filled	Emptied and destroyed by burning	160	Ref. BHADb 197
	1-ton containers	Emptied by venting	4	Ref. BHADb 197
1958	M70 H-filled	Converted to bulk mustard	All	Ref. BHADb
1959	M70 H-filled	Destruction of M70 H-filled held up by problems with kiln.	All	Ref. BHADb 131
1961	M70 H-filled	Destroyed, incinerated	130,000	Ref. BHADb 126
1962	M70 H-filled	Destroyed, incinerated	75,527	Ref. BHADb 127
	GB-VX	Stored	454 tons	Ref. BHADb 127
1965	500 & 1000 lb CK	Stored and needed to be destroyed	12,000	Ref. BHADb 127
1966	CK bombs	Destroyed, incinerated	5,200	Ref. BHADb-211

## **FIGURES**



0 6 12 24

SCALE IN MILES

Figure 2-1

**TCT**

St. Louis

# PROJECT LOCATION MAP FORMER BLACK HILLS ARMY DEPOT

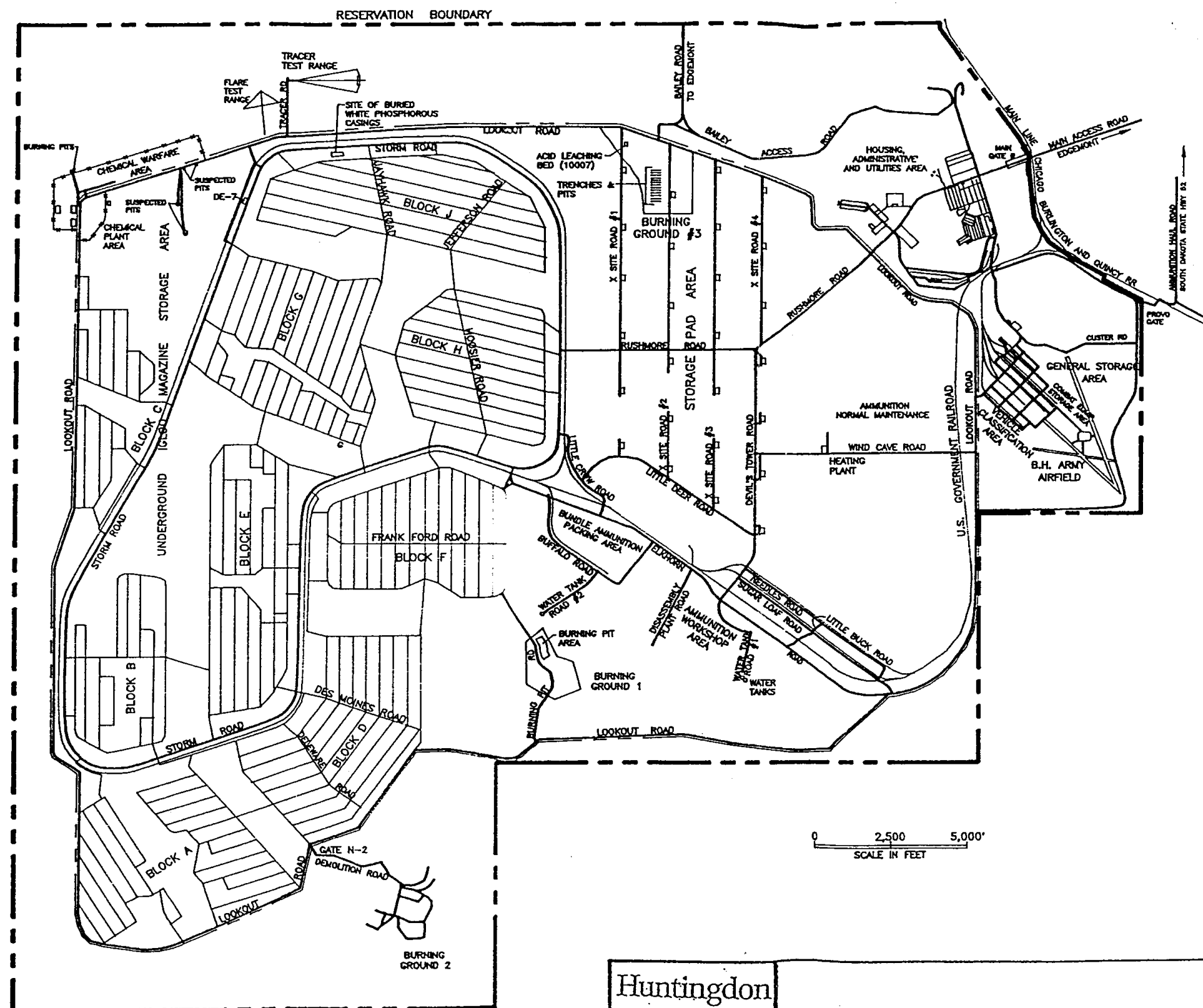
Project No. 9392

By: *[Signature]*

Chk'd By: *NMD*

Date: 8-11-92





Huntingdon  
**TCT**  
 St. Louis

FACILITY LAYOUT  
 FORMER BLACK HILLS ARMY DEPOT

Figure 2-2

Project No.	9392
Drawn By:	<i>[Signature]</i>
Chk'd By:	<i>NMD</i>
Date:	9-25-93

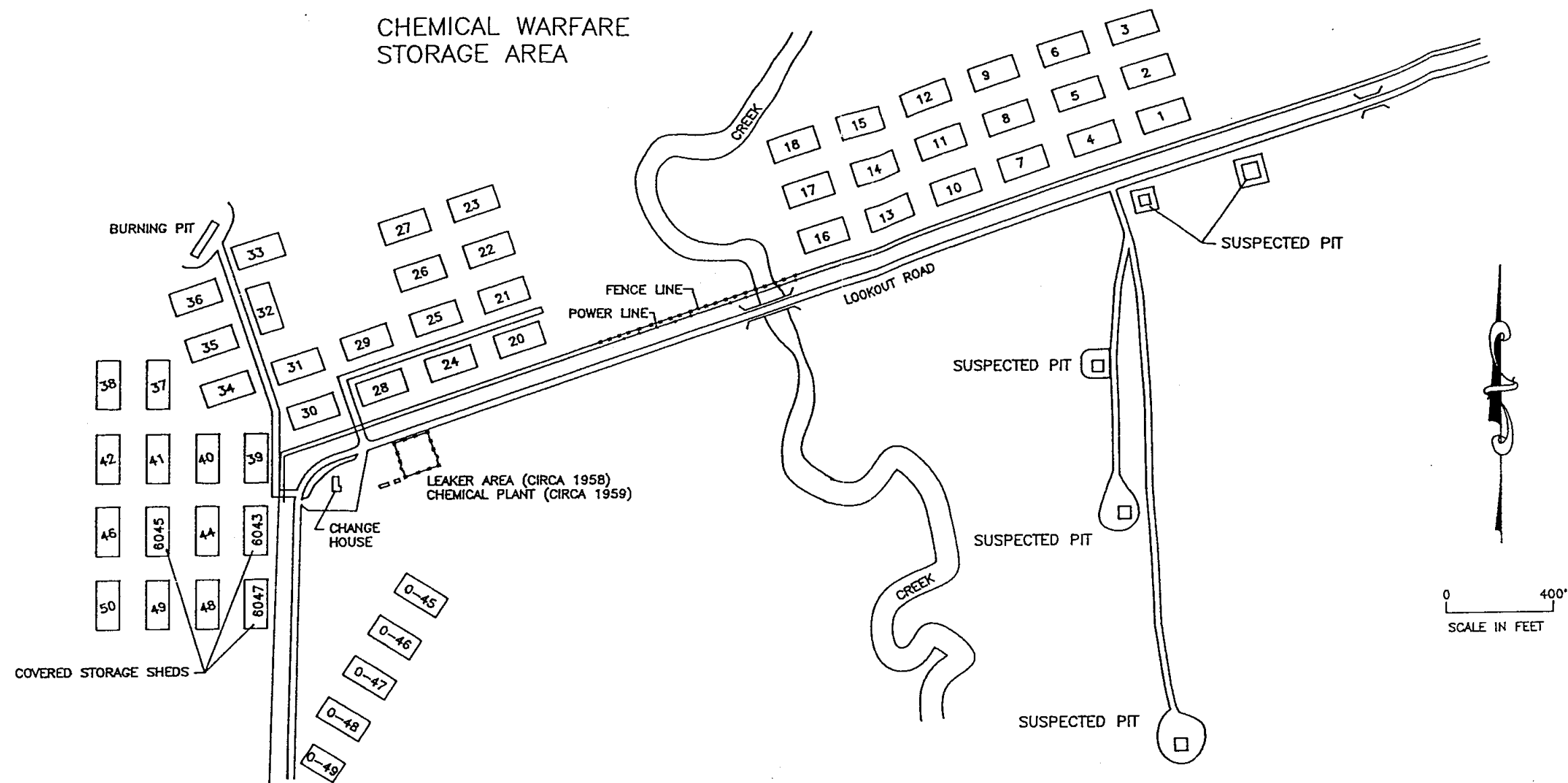


Figure 3-1

Huntingdon  
**TCT**  
St. Louis

6000 AREA - CHEMICAL AREA  
FORMER BHAD

Project No. 9392

Drawn By: *dm*

Chk'd By: *NMD*

Date: 9-25-93

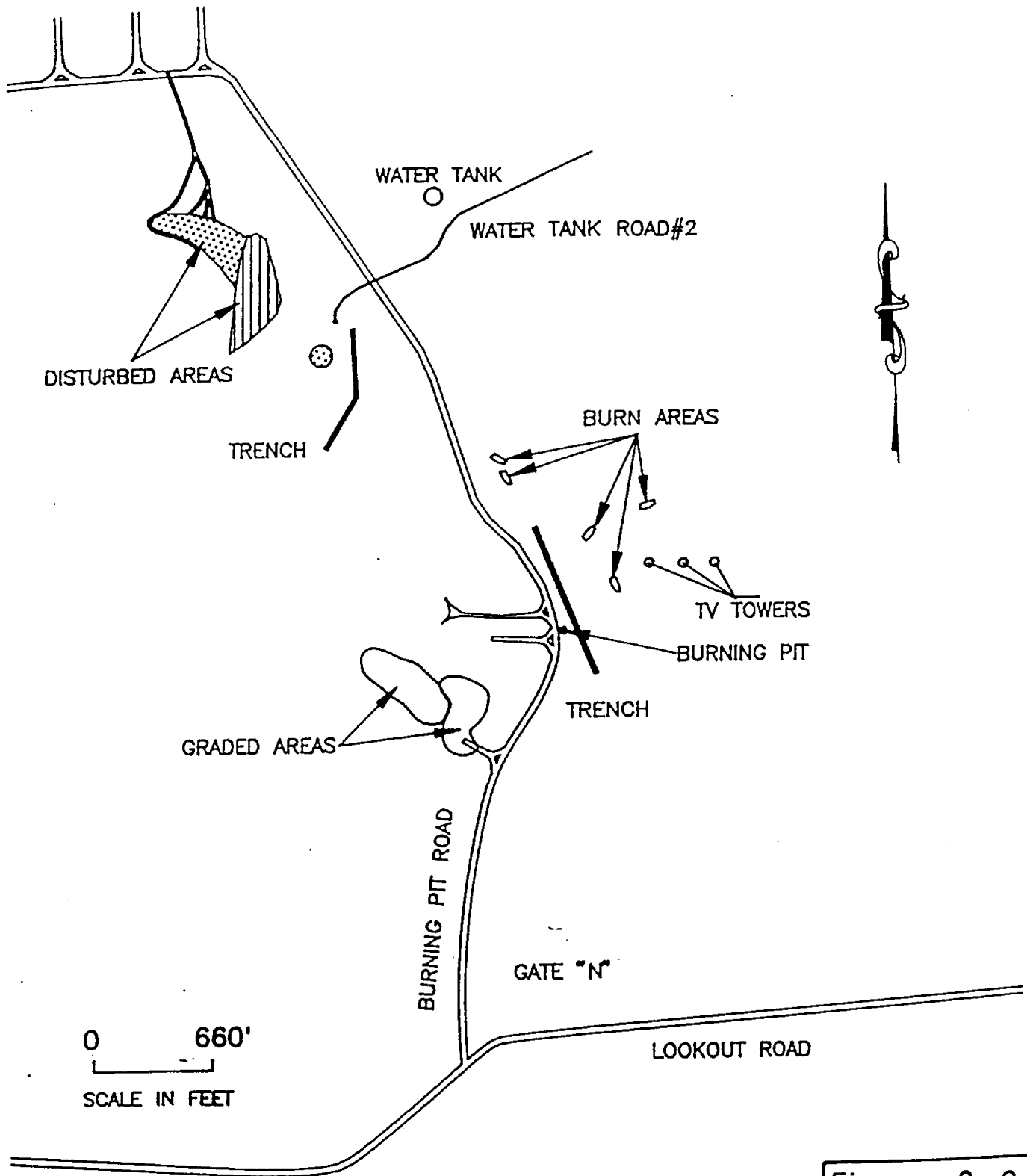


Figure 3-2

Huntingdon

**TCT**

St. Louis

BURNING GROUND NO. 1  
FORMER BHAD

Project No. 9392

By: DJ

Chk'd By: *MMK*

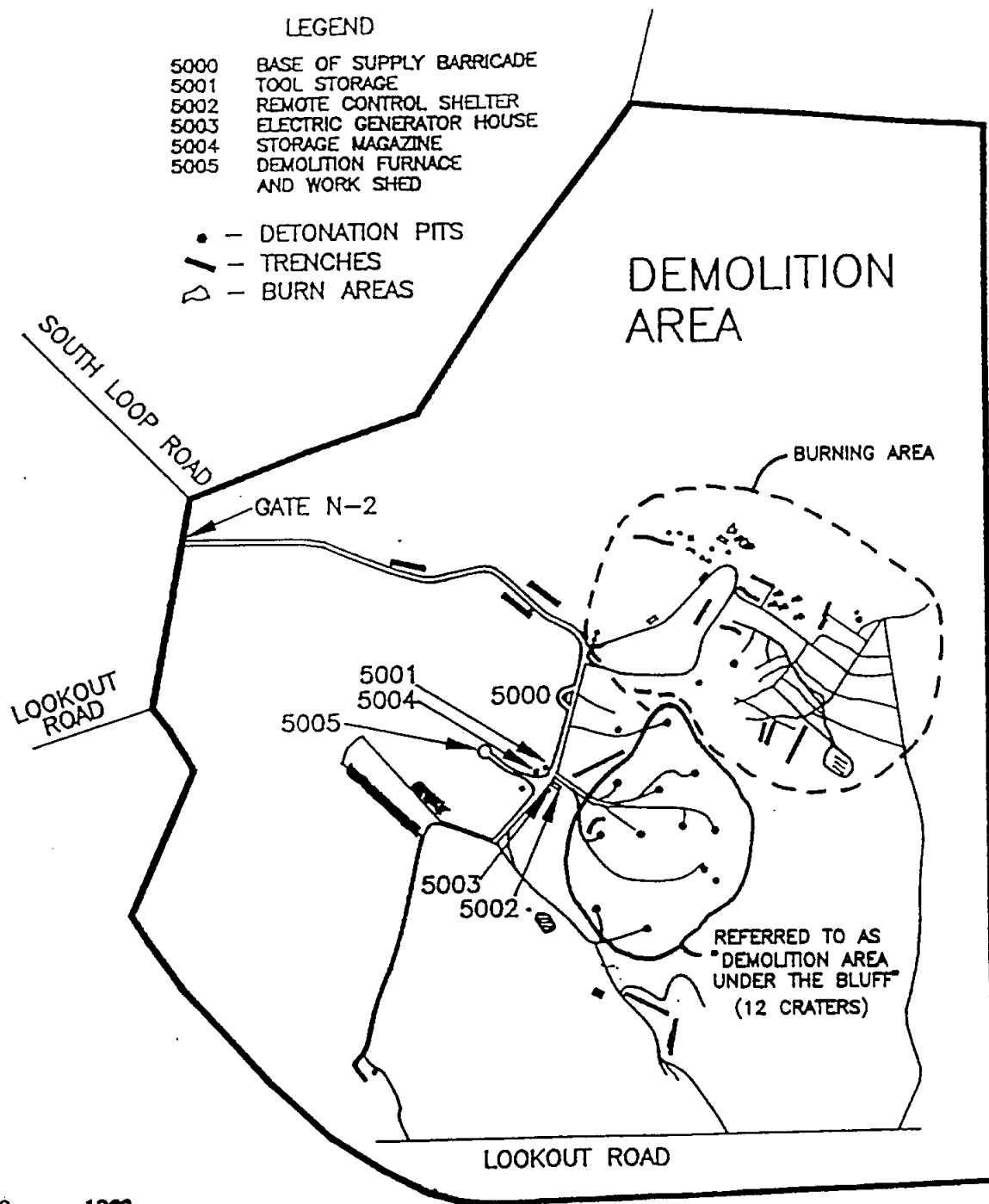
Date: 7-25-93



### LEGEND

- 5000 BASE OF SUPPLY BARRICADE
- 5001 TOOL STORAGE
- 5002 REMOTE CONTROL SHELTER
- 5003 ELECTRIC GENERATOR HOUSE
- 5004 STORAGE MAGAZINE
- 5005 DEMOLITION FURNACE AND WORK SHED

- - DETONATION PITS
- TRENCHES
- △ - BURN AREAS



0 1200  
SCALE IN FEET

Figure 3-3

Huntingdon  
**TCT**  
St. Louis

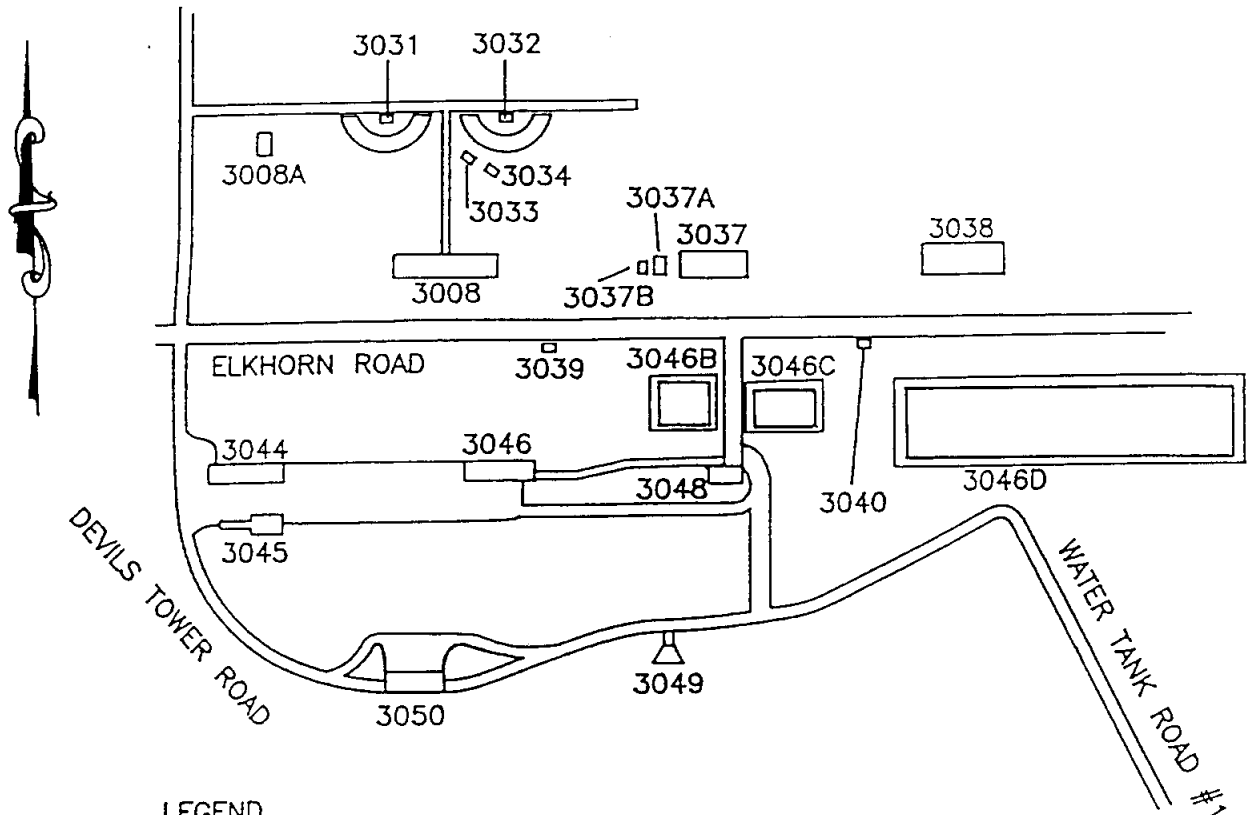
## BURNING GROUND NO. 2 FORMER BHAD

Project No. 9392

By: DJ

Chk'd By: *WMC*

Date: 9-25-73



#### LEGEND

3008	AMMUNITION RENOVATION	3044	BOILER RM CHANGE HOUSE & OFFICE
3008A	POWDER PROPELLANT STORAGE	3045	MACHINE SHOP & TOOL HOUSE
3031	SMOKELESS POWDER MAGAZINE	3046	TNT WASHOUT & FLAKER BUILDING
3032	SMOKELESS POWDER MAGAZINE	3046B	LEACH BED
3033	VACUUM UNIT PUMP HOUSE	3046C	LEACH BED
3034	VACUUM UNIT BARRICADE	3046D	LEACH BED
3037	DEBOND & DEPRIME BUILDING	3048	TNT STORAGE
3037A	EARTH BARRICADE	3050	WORK SHED
3037B	SERVICE MAGAZINE	3049	DEBOOSTING BARRICADE
3038	CLEAN & PAINT BUILDING		
3039	SERVICE MAGAZINE		
3040	SERVICE MAGAZINE		

SOURCE: BHADM-001  
DATED 1959

0 400  
SCALE IN FEET

Figure 3-4

Huntingdon

**TCT**

St. Louis

## AMMUNITION WORKSHOP AREA FORMER BHAD

Project No. 9392

By: DJ

Chk'd By: *AMD*

Date: 7-25-93

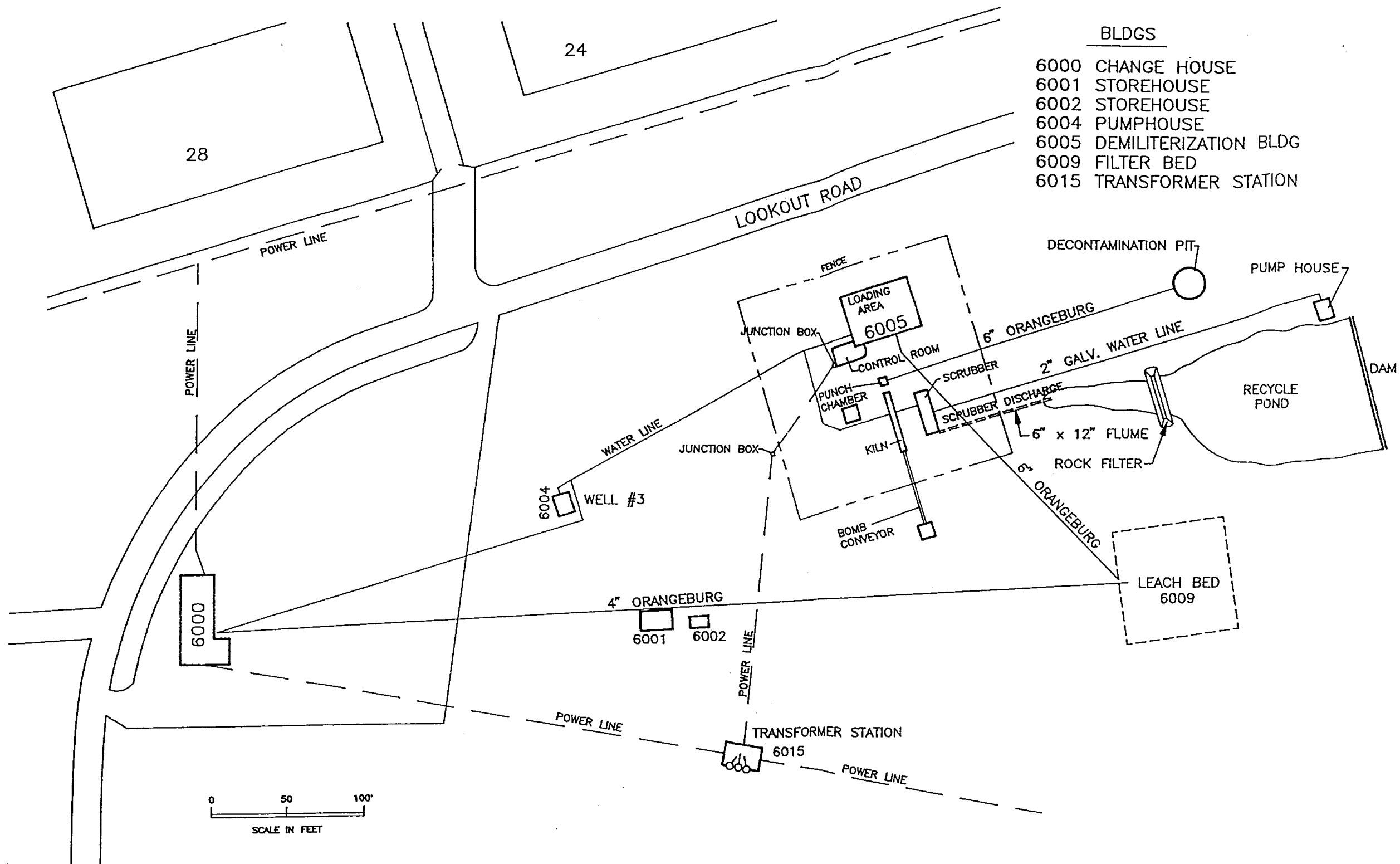


Figure 3-5

Huntingdon  
**TCT**  
St. Louis

CHEMICAL PLANT AND INCINERATOR  
BASED ON EARLY PLANE TABLE DRAWING  
FORMER BHAD

Project No. 9392

Drawn By: *[Signature]*

Chk'd By: *NMD*

Date: 9-25-93

# CHEMICAL AREA BASED ON 1963 FACILITY MAP

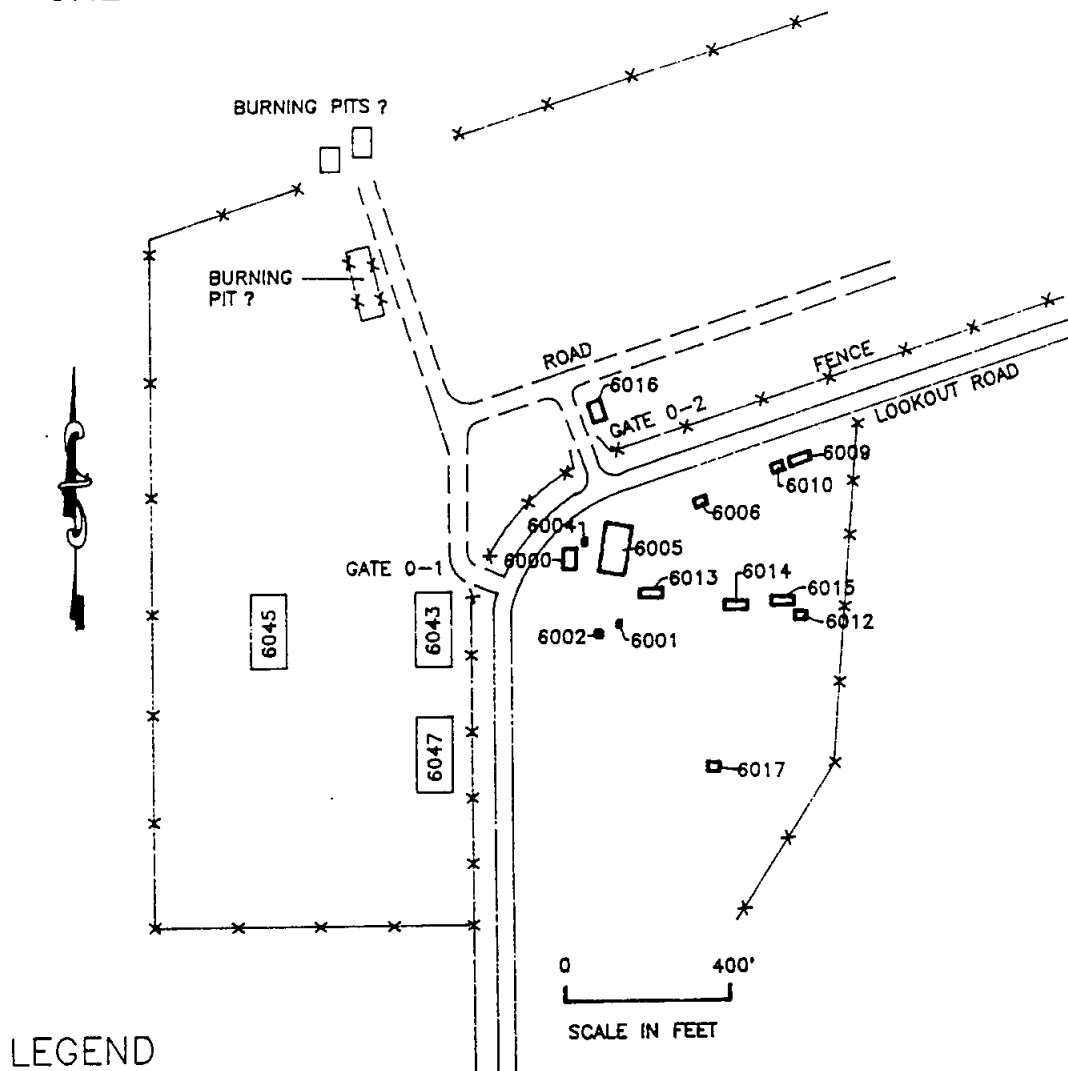


Figure 3-6

Huntingdon  
**TCT**  
St. Louis

CHEMICAL AREA-BASED  
ON 1963 FACILITY MAP  
FORMER BHAD

Project No. 9392

By: *E. J. [Signature]*

Chk'd By: *NIND*

Date: 9-25-93

## REFERENCES



<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-001	TCT-St. Louis, Final Report, Archives Search Report Preliminary Assessment of Ordnance Contamination at the Former BHAD, October 1992.
BHADb-002	Weapons Development and Engineering Laboratories, Edgewood Arsenal, Trip Report by Dean M. Dickey to BHAD Burning Site 2, July 21-27, 1971.
BHADb-003	Chemical Branch BHAD, Historical Report, April 1951.
BHADb-004	Chemical Branch BHAD, Historical Report, May 1951.
BHADb-005	Chemical Branch BHAD, Historical Report, October 1951.
BHADb-006	Chemical Branch BHAD, Historical Report, December 1951.
BHADb-007	U.S. Army Technical Escort Center, General and Chemical Shipment Information 1943-1959.
BHADb-008	BHAD, Pending Ammunition Receipts, January 8, 1954.
BHADb-009	Memos, BHAD, Disposal Demilitarization, Reworking of Ammunition at BHAD, October 1953.
BHADb-010	BHAD Demolition Area Layout, May 15, 1948.
BHADb-011	Ordnance Department Memo, Proposed Service Magazines for Demolition Ground, June 3, 1953.
BHADb-012	BHAD, Memo, Show Facilities, September 1, 1953.
BHADb-013	BHAD, Destruction of M600 Fuzes, February 2, 1953.
BHADb-014	BHAD, Decontamination, Chemical Area December 10, 1952.
BHADb-015	BHAD, Modification of Fuze, PD, M57, March 24, 1949.
BHADb-016	BHAD, Excerpts from Chemical Bomb Classification Report, May 28, 1953.
BHADb-017	BHAD, Disposal of Explosive Effluent, April 1, 1958.
BHADb-018	BHAD, Categories of Munitions at BHAD, January 16, 1953.
BHADb-019	BHAD, Suspended and Released Ammunition Lots, October 1952.
BHADb-020	BHAD, Normal Maintenance 1952, March 18, 1960.
BHADb-021	BHAD, Possible Mustard Burn Injuries, 1957.
BHADb-022	Raritan Arsenal, Priorities of Reworking at BHAD, March 2, 1953.
BHADb-023	Raritan Arsenal, Schedule and Progress Report Ammunition Repair, June 1, 1953.
BHADb-024	Sierra Ordnance Depot, Inspection of BHAD, July 15, 1953.
BHADb-025	Amy Environmental Health Laboratory, Industrial Hygiene Survey, BHAD, December 1952.
BHADb-026	BHAD, List of Surveillance Employees, 1953.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-027	Army Environmental Health Laboratory, Industrial Hygiene Survey, BHAD, June 1951.
BHADb-028	BHAD, Report of Annual Inspection of Lightening Protection Systems, September 1951.
BHADb-029	Ordnance Department Assignment of AIC Symbol and Item Stock Number List 33, BHAD, 1948, 1950.
BHADb-030	BHAD, Special Surveillance of 1,000 lb Gas CK Bomb, 1952.
BHADb-031	Raritan Arsenal, Disposition of Ammunition, September, 1953.
BHADb-032	BHAD, SOP, Demilitarization of 105 MM Shell.
BHADb-033	U.S. District Court, William Tanner vs. USA, circa 1979.
BHADb-034	BHAD, Ammunition Schedule and Progress Report (Ammunition Repair), circa 1952.
BHADb-035	Chief of Engineers, Owned, Sponsored and Leased Facilities, undated.
BHADb-036	Personal Communication with Lee Deans, 2 July 1993.
BHADb-037	U.S. Army Judge Advocate's Office, request for information concerning Tanner vs. U.S., July 28, 1981.
BHADb-038	Facility Map, BHAD, 1942.
BHADb-039	Facility Map, BHAD, 1961.
BHADb-040	BHAD Reports, 1950 and 1951 Supplied to Judge Advocates Office, 20 August 1981.
BHADb-041	Memo, "Special Surveillance of Bomb, Gas, CK, 1,000 lb, AN-M-79" from Depot Chemical Commander, from September 23, 1952, 1 page.
BHADb-042	Memo "List of Chemical Corps Ammunition Suspended from Issue", 1 page, memo only, no list. September 3, 1952.
BHADb-043	Directive "Surveillance of CK Bombs", Directs frequency of testing after evidence of deterioration is detected, August 25, 1952, 1 page.
BHADb-044	Operation Work Sheets "Remove Fuze from Mine Crate and Destroy", August 12, 1952, 5 pages.
BHADb-045	Inspection Reports "Item RIQIB-Shell, Semi-Fixed, Gas, Persistent, N, M60, with Fuse PD M97 for 105 mm HOW M2A1 and M4", 10 pages, September 4, 1951.
BHADb-046	Memo, "Shell Semi-Fixed, Gas, Persistent, H, M60" discusses storage of subject item, October 31, 1951, 3 pages.
BHADb-047	Demilitarization Analysis Report, September 10 & 12, 1951, 4 pages from Midwest Chemical Depot Subject Adapter Booster T3E1 used in Gas Bomb, Persistent HD 125 lb MC13.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-048	Surveillance Procedures for "Container One Ton", "Grenade, Hand, Smoke (WP) M15", "Persistent Agents H, HD, HN-1, HT, & L "Gas Marker", 17 pages undated.
BHADb-049	Operation Work Sheet "Wash Out Rejected Projectiles; Flake and Box TNT", March 15, 1951, 1 page.
BHADb-050	Memo, "Weekly Progress Report, Chemical Corps Activities". Reports progress on normal maintenance of 3965 M-78 or M-79, CD or CK Bombs, 1 page, May 1, 1951.
BHADb-051	SOP-Memo, "Destruction of M600 and M601 Chemical Fuzes by Mechanical Shock", January 23, 1953, 12 pages.
BHADb-052	Memo and Surveillance Reports, "Pressure Tests and Classification Reports, M-78 and M-79 CG-Filled Bombs", December 29, 1952, 3 pages.
BHADb-053	Memo, "Semi-Annual Pressure and Agent Quality Tests of CG and CK Filled Chemical Bombs", November 10, 1952, 1 page.
BHADb-054	Memo, "Quality Report of Inspection Activities", October 2, 1952, 2 pages.
BHADb-055	Memo, "Surveillance Reports, M-70 H-Filled Bombs", August 19, 1952. Report on persistent Gas Bombs stored at BHAD, 1 page.
BHADb-056	Memo and Surveillance and Classification Reports, M-70 H-Filled Bombs, August 12, 1952, 5 pages.
BHADb-057	Memos, "Pelletizing Processing and Destruction of M-70 H-Filled Bombs, 1951-1952, 7 pages.
BHADb-058	Memo, "Unserviceable M-79 CG or CK Bombs", July 9, 1951, 3 pages.
BHADb-059	Quarterly Report of Inspection Activities, January 20, 1954, 5 pages.
BHADb-060	"Report of Industrial Hygiene Survey No. 1765598-54", 7 pages. Identifies exposure to chemical warfare agents, memo.
BHADb-061	"Status of Certain Ammunition Items", July 13, 1954, 1 page, identifies quantities of CG M78 and M79 Gas Bombs.
BHADb-062	Memo, "Classification of chemical Corps Supplies (Bomb H, M70), June 22, 1954, 1 page.
BHADb-063	Schedule and Progress Report, Ammunition Repair, undated, 2 pages.
BHADb-064	Memo, "Request for Waiver", July 1955, requests permission to process ammunition containing blister agents with other items, 1 page.
BHADb-065	Memo, "Closure for the M11 Canister, June 13, 1955, 1 page.
BHADb-066	Black Hills Ordnance Depot "Ammunition Operating Facilities", June 8, 1955, 8 pages.
BHADb-067	Black Hills Ordnance Depot Workload, September, 1954.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-068	Memos, "Use of Gas Mask to Protect from Exposure to Mustard Gas", December, 1955, 5 pages.
BHADb-069	"Study-Retention of Mustard H in Bomb Casings, January 6, 1956, 5 pages.
BHADb-070	"Report of Ammunition Operations at Black Hills Ordnance Depot, November 18, 1955, 2 pages.
BHADb-071	Memo, "Report of Chemical Corps Station Liaison Visitation on Stock Control and Related Functions", November 15, 1955, 2 pages.
BHADb-072	Memo, "Sample Cartridge Cases, M12", December 16, 1955, 1 page.
BHADb-073	Memo, "Sample Cartridge Cases, M14", December 9, 1955, 1 page.
BHADb-074	Memo, "Storage of Bombs, Gas, Persistent, H, 115 lb., M70, Less Fuzing Components", October 12, 1955, 1 page.
BHADb-075	Memo, "Bomb, Gas, CK 1000#, Less Fuzing Components, AN-M79", September 13, 1955, 2 pages.
BHADb-076	Memos, "Stock Number R14-5-943 Bomb, Gas, Persistent, H, 115 lb., M70", August 4, 1955 and November 29, 1955, 2 pages.
BHADb-077	Memo, "Proposed Project and Personnel Projection Report for Black Hills Ordnance Depot, September 14, 1955, 2 pages.
BHADb-078	Memo, "Reclassification of Certain Ammunition Items", September 7, 1955, 1 page.
BHADb-079	Memo, "Inspection of Black Hills Ordnance Depot", June 28, 1955?, 9 pages.
BHADb-080	Report of Official Travel Black Hills Ordnance Depot, April 14, 1955, 2 pages.
BHADb-081	Table, Chemical Corps Stocks at Black Hills Ordnance Depot, Inspection 11-12 April 1955, 1 page.
BHADb-082	Memo, "OAC Safety Disposition", April 28, 1955, 2 pages.
BHADb-083	"Improvement Description" on Demilitarization of Rocket HE 1C2 (T160) Series 4.5, no date, 1 page.
BHADb-084	"Improvement Description" on Leveling Ditch, April 5, 1958, 1 page.
BHADb-085	Memo, "Programmed Objectives for Improvements in Storage Division - 1958, January 31, 1958, 1 page.
BHADb-086	Memo, "Quarterly Report of Inspection Activities", July 8, 1952, 2 pages.
BHADb-087	Memo, "Quarterly Report of Inspection Activities", no date, 3 pages.
BHADb-088	Memo, "Quarterly Report of Inspection Activities", October 3, 1951, 2 pages.
BHADb-089	Memo, "ASESB Safety Survey of Black Hills Ordnance Depot" October 29, 1952, 8 pages.
BHADb-090	Excerpt from "Inspection of Black Hills Ordnance Depot 8 April 1952, 2 pages.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-091	Untitled memo, November 10, 1952, 1 page.
BHADb-092	Appendix - Safety Inspection, Black Hills Ordnance Depot, Igloo, SD 24 thru 25 October 1951, October 30, 1951, 8 pages.
BHADb-093	Appendix - Safety Inspection, Black Hills Ordnance Depot, Igloo, SD 6 thru 8 June 1951, 1 page.
BHADb-094	Memo, "Historical Report, Chemical Branch, 1 Oct thru 31 Dec 1952", January 12, 1953, 2 pages.
BHADb-095	Memo, "Historical Report, Chemical Branch, 1 July thru 30 Sept 52", October 13, 1952, 3 pages.
BHADb-096	Memo, "Historical Report, Chemical Branch, 1 April thru 30 June 1952, July 10, 1952, 3 pages.
BHADb-097	Memo, "Historical Report, Chemical Branch, 1 March through 31 March '52", April 8, 1952, 2 pages.
BHADb-098	Memo, "Historical Report, Chemical, 1 February through 29 February" March 7, 1952, 1 page.
BHADb-099	Memo, "Historical Report, Chemical Branch, 1 November 1951 through 21 December 1951", January 10, 1952, 3 pages.
BHADb-100	Memo, "Historical Report, Chemical Branch, 1 Oct thru 1 Oct 1951", November 5, 1951, 1 page.
BHADb-101	Memo, "Historical Report, Chemical Branch, 1 September through 30 September 1951", October 4, 1951, 1 page.
BHADb-102	Memo, "Historical Report, Chemical Branch 1 August thru 31 August 1951", September 7, 1951, 1 page.
BHADb-103	Memo, "Historical Report, Chemical Branch, 1 June thru 30 June 1951", August 1, 1951, 2 pages.
BHADb-104	Memo, "Historical Report, chemical Branch, 1 June thru 30 Jun 1951", July 9, 1951, 2 pages.
BHADb-105	Memo, "Historical Report, Chemical Branch, 1 May thru 31 May 1951", undated, 2 pages.
BHADb-106	Memo, "Historical Report, Chemical Branch, 1 April thru 30 April 1951", May 9, 1951, 1 page.
BHADb-107	Memo, "Historical Report, Chemical Branch 1 March thru 31 March 1951", April 12, 1951, 1 page.
BHADb-108	Memo, "Historical Report, Chemical Branch, 1 Feb thru 28 Feb 1951", April 12, 1951, 2 pages.
BHADb-109	Memo, "Historical Report, Chemical Branch, 1 January thru 31 January 1951", April 10, 1951, 2 pages.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-110	Weekly Progress Reports, Chemical Corps Activities January 2 - April 20, 1951, April 23, 1951, 16 pages.
BHADb-111	Management Improvement Reports 1955-1956, 10 pages.
BHADb-112	Memo, "Grievance, Local 1549, American Federation of Government Employees", undated, 3 pages.
BHADb-113	Surveillance Report of M-70, H-Filled Bombs, August 1, 1951, 2 pages.
BHADb-114	Quarterly Report of Inspection Activities - Describes surveillance of 221,830 H-Filled Bombs and planned destruction of 2,294 H-Filled Bombs, July 6, 1951, 3 pages.
BHADb-115	Quarterly Report of Inspection Activities - Describes maintenance and/or destruction of H, CG, and CK Bombs, April 3, 1951, 2 pages.
BHADb-116	"Design Criteria 50-14 Ammunition Normal Maintenance Building", May 4, 1952, 1 page.
BHADb-117	Describes hygiene improvements for workers handling leaking M-70 H-Filled Bombs, undated, 2 pages.
BHADb-118	Memo, "Preparation of Chemical Corps Materiel for Shipment" - Describes shipping priorities, non-specific, October 10, 1952, 1 page.
BHADb-119	Memo, "Preparation of Chemical Corps Materiel for Shipment" - Quantifies CG and CK Bombs requiring maintenance, October 22, 1952, 1 page.
BHADb-120	List of "Permanent Buildings", undated, 2 pages.
BHADb-121	USACE, Findings of Fact, BHAD, undated.
BHADb-122	BHAD, Semi-Annual Historical Report, BHAD, January 1, 1957 - June 30, 1957.
BHADb-123	BHAD, Semi-Annual Historical Report BHAD, July 1, 1958 - December 31, 1958.
BHADb-124	BHAD, Semi-Annual Historical Report, BHAD, January 1, 1958 - June 30, 1958.
BHADb-125	BHAD, Excerpts from Semi-Annual Historical Report, BHAD, July 1, 1956 - December 31, 1956.
BHADb-126	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, July 1, 1961 - December 31, 1961.
BHADb-127	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1, 1962 - July 31, 1962.
BHADb-128	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1956 - June 30, 1956.
BHADb-129	BHAD, Excerpts from Semi-Annual Historical Report, BHAD, July 1, 1955 - December 31, 1955.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-130	BHAD Excerpts from Semi-Annual Historical Report, BHAD, January 1, 1955 - June 30, 1955.
BHADb-131	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1, 1959 - June 30, 1959.
BHADb-132	BHAD Excerpts from Semi-Annual Historical Report, BHAD, July 31, 1957 - December 31, 1957.
BHADb-133	BHAD, Production vs. Schedule, 1955.
BHADb-134	Technical Escort Detachment, Trip Report, BHAD, July 19, 1949.
BHADb-135	Department of the Army, Technical Manual, TM9-1900, General Ammunition, 1945.
BHADb-136	Excerpts from Community Fact Sheet, Edgemont, SD, circa 1967.
BHADb-137	Sgt. LaBarge, Technical Escort Unit, December 14, 1979. Notes on BHAD.
BHADb-138	U.S. Forest Service, South Dakota Plains Grassland, 1968.
BHADb-139	Information on Former BHAD Employees, undated.
BHADb-140	Ordnance Department, 1944. Excerpts from Surveillance Report, BHAD.
BHADb-141	Ordnance Department, 1951. Excerpts from Historical Summary BHAD, 1945-1951.
BHADb-142	BHAD, Emissions from the Mustard Incinerator, 1960.
BHADb-143	Correspondence concerning activities at the BHAD between DOD, South Dakota, and the Rapid City Journal, 1980s.
BHADb-144	Memos, notes, and correspondence concerning activities at the BHAD 1979-1981.
BHADb-145	Notes concerning BHAD, 1976.
BHADb-146	Notes concerning BHAD operation, undated.
BHADb-147	Ordnance Department, June 1, 1971 memo: Site Survey at the Former BHAD.
BHADb-148	Facility Map BHAD, Burning Ground 2, undated.
BHADb-149	Office of Assistant Secretary of Defense, Ammunition Color Coding, February 16, 1959.
BHADb-150	U.S. Army Chemical Corps Engineering Command, Shipping Regulations for Chemical Agents, Chemical Ammunition, Poison's and other Dangerous Articles.
BHADb-151	U.S. Army Chemical Corps Engineering Command, Disposal of Cyanide Waste and Chronic Acid.
BHADb-152	Weekly Chemical Branch Progress Reports and Memos, BHAD, January 1947.
BHADb-153	Weekly Chemical Branch Progress Reports and Memo BHAD, February 1947.
BHADb-154	Weekly Chemical Branch Progress Reports, BHAD, March 1947.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-155	Weekly Chemical Branch Progress Reports, BHAD, April 1947.
BHADb-156	Weekly Chemical Branch Progress Reports, BHAD, May 1947.
BHADb-157	Weekly Chemical Branch Progress Reports, BHAD, June, 1947.
BHADb-158	Weekly chemical Branch Progress Reports, BHAD, July 1947.
BHADb-159	Weekly Chemical Branch Progress Reports, BHAD, August 1947.
BHADb-160	Weekly Chemical Branch Progress Reports, BHAD, September 1947.
BHADb-161	Weekly Chemical Branch Progress Reports, BHAD, October 1947.
BHADb-162	Weekly Chemical Branch Progress Reports, BHAD, November 1947.
BHADb-163	Weekly Chemical Branch Progress Reports, BHAD, December 1947.
BHADb-164	Weekly Chemical Branch Progress Reports, BHAD, January 1948.
BHADb-165	Memo to Chief of Ordnance regarding Proposed Layout at Demolition and Explosives Burning Ground, BHAD, June 1955.
BHADb-166	Memo from U.S. Army Environmental Hygiene Agency to BHAD, Mustard Demilitarization Plant, September 30, 1960.
BHADb-167	Memo from U.S. Army Environmental Hygiene Agency to BHAD, Disposal of CK Gas, February 5, 1945.
BHADb-168	Memo from ORD Chemical Officer to Chief, Supply and Procurement Division Office, Chief Chemical Corps, Washington, D.C, 12/2/49. Subject: M70 H-Filled Bombs. Quantifies H-filled bombs, leakers describes disposal method by burning 20 at a time; cost and time frame, 2 pages.
BHADb-169	Memo from Department of the Army, OC Cml C, Washington, D.C. to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota, dated 12/19/49. Subject: M70-H-Filled Bombs, permission to destroy all leaking M70 H-filled and request for greatest quantity that could be destroyed in one day, 1 page.
BHADb-170	Memo from H.S. Hewhall Lt. Col. Ord. Dept. to Chief, Chemical Corps, Washington, D.C., Inspection Division, undated. Subject: Rate of destruction M70-H-filled bombs, up to 150 per working day by constructing 3 new pits, 2 pages.
BHADb-171	Memo from J.M. Richardson, Major, Ord. Dept. Assistant to Chief, Chemical Corps dated 2/14/50, 1 page. Subject: Comments concerning decontamination of M70 H-filled bombs.
BHADb-172	Memo from Lt. Col. C.P. Holm, Chief Safety Officer to Chief of Ordnance, Washington, D.C. dated 4/17/50, 2 pages. Subject: M70 H-Filled Bombs, including PPEs for workers. Also SOP for rupturing bomb case.
BHADb-173	Memo from S.E. Purnell, Maj., Ord. Dept. Assistant to Office, Chief Chemical Corps, Washington, D.C. dated 5/4/90, comments on previous memo regarding disposal methods, 1 page. Subject: M70 H-Filled Bombs Disposal.



<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-174	Memo from C.J. Merrill, Lt. Col., Cml C, Asst. Chief, Supply and Procurement Div. to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota dated 5/9/50, answers to comments in BHADb-173 regarding disposal methods, 1 page. Subject: Disposal of H-Filled Bombs.
BHADb-175	Memo from Carl E. Grant, Lt. Col., Cml C Assistant, Supply & Procurement Div. to Commanding Officer, Black Hills Ordnance Depot dated 5/17/50. Subject: Maintenance of M70 H-Filled Bombs, involving the testing of 500 H-filled M70 bombs to determine general condition of lot numbers. Recommend that action be taken to provide sufficient burning pits for the disposal of 30,000 M-70 H-filled bombs per year. 7 pages.
BHADb-176	Memo from Carl E. Grant, Lt. Col., Cml C Chief, Supply Division to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota dated 2/7/51, 5 pages. Subject: Destruction of M-70, H-filled bombs, Burning Ground procedure. Approval given for bomb destruction and procedure for Burning Ground #2 of 619 M-70 H-filled 115 bombs.
BHADb-177	Memo from Carl E. Grant to Commanding Officer, Black Hills Ordnance Depot dated 11/15/49, 2 pages. Subject: M70 H-filled bombs, Plan to dispose certain lots stored for the Department of the Navy.
BHADb-178	Memo from Stephen M. Wondrasek, Captain, Cml C, Depot Chemical Officer to Commanding Officer, Black Hills Ordnance Depot dated 12/11/51, 4 pages. Subject: Report to Trip to GC Cml C Supply Division. Theoretical discussion of best methods for H-Filled bomb disposal, i.e., agent burned in furnace and cases melted down; removal and replacement of burster well tube, agent burned in fuel oil or lumber, pressure testing of CG & CK bombs. Recommendations were made for investigating a special furnace.
BHADb-179	Memo from Fred J. Delmore, Colonel, Cml C Commanding to Chief Chemical Officer, Washington, D.C. dated 11/21/51, 3 pages. Subject: Demilitarization alternatives for disposal of large quantities of M-70 H-Filled Bombs at Black Hills Ordnance Depot. Determination that a destruction rate of 25,000 per year by burning would be hazardous. Alternatives given of shipment to Rocky Mountain Arsenal or construction of facilities at Black Hills Ordnance Depot.
BHADb-180	Memo from Martin F. Massoglia, Major, Chemical Corps, Acting Chief, Inspection Division to Commanding Officer Deseret Chemical Depot, Tooele, Utah dated 11/2/51, 2 pages. Subject: Special Test of Bomb, Chemical, H. M70, rough handling test of 50 bombs from 4 lots.
BHADb-181	Memo from H. Walmsley, Colonel, Cml C, Deputy Commander, Materiel Command to Chief Chemical Officer dated 11/30/51, 1 page. Subject: Disposition - Bomb, Gas, Persistent, H115-lb. M-70, request that a decision regarding disposal or renovation of 60,000 bomb be made.
BHADb-182	Report on M-70, H-Filled Bombs, undated, 2 pages. Quantities of bombs, leakers, method of disposal. Recommendation that leakers be destroyed by pit method at Black Hills. All others be renovated at Rocky Mountain Arsenal.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-183	Memo from H.S. Newhall, Colonel, Ord Corps Commanding, to Chief, Chemical Corps, Washington, D.C., January 26, 1951, 2 pages. Subject: Destruction of M-70, H-filled bombs. Request to destroy 27,431 bombs considered leakers or potential leakers with cost estimate.
BHADb-184	Memo from Raymond C. Morris, Lt. Colonel, Cml C Chief, Supply Division, to Commanding Officer, Black Hills Ordnance Depot, January 31, 1952, 1 page. Subject: Disposition Instructions for Bomb, Gas, Persistent, H, 115-lbs, M70. Changes to memo dated 27 December 1951.
BHADb-185	Special Orders from Frank P. Duley, Captain, Cml C, January 4, 1952, 1 page. States that Board will make recommendations to Chief Cml Officer and change of date for Board recommendations.
BHADb-186	Photo - employees with gas masks, undated, 2 pages.
BHADb-187	Minutes of Meeting - Chemical Corps M-70 Bomb Disposal Board Recommendations on Disposal, 3 pages, December 18, 1951. Costs for renovation of bombs. Classification of bombs.
BHADb-188	Memo from Stephen M. Wondrasek, Depot Chemical Officer to Office of Chief Chemical Officer, Chief Historical Officer, February 11, 1952, 10 pages. Subject: Historical Reports, Chemical Branch, 1 January through 31, January 1952. Maintenance performed on M-70, H-filled bombs; lead washers installed. Maintenance and repair performed on M-78 CG and M-79 CK bombs. 4,000+ bombs shipped to Rocky Mountain Arsenal for renovation.
BHADb-189	Memo from Stephen M. Wondrasek, Drapeu, Southworth, Chemical Officers, April 13, 1953, 9 pages. Subject: Historical Reports, Chemical Branch, 1 January thru 31 March 1953. Describes CG, CK, H-filled bombs. Maintenance and repair performed on M-70, M-78 and M-79 bombs. 20,000+ M-70 bombs shipped to Rocky Mountain Arsenal. Shipments to Rock Mountain discontinued.
BHADb-190	Memo from W710 Technical Service Unit Cml, Technical Escort Detachment, Army Chemical Center, Maryland to Office of the Chief, Chemical Corps, Gravelly Point, Virginia, June 28, 1950, 2 pages. Subject: Trip Report - does not pertain to BHAD.
BHADb-191	Memo from John P. Drapeau, Depot Chemical Officer to Office of Chief Chemical Officer, Chief Historical Officer, Washington, D.C., April 19, 1954, 8 pages. Subject: Historical Reports, Chemical Branch, 1 January thru 31 March 1954. Ck, CG, H bombs. 481 M-70 bombs found leaking and labeled for disposal.
BHADb-192	Memo from John Drapeau, Depot Chemical Officer to Office of Chief Chemical Officer Chief, Historical Officer, Washington, D.C., April 6, 1955, 11 pages. Subject: Historical Report, Chemical Branch, 1 January thru 31 March 1955. 1,300+ M78 and M79 bombs found to need repair. 500+ M-70 leakers labeled for destruction. Radiac detection equipment issued.
BHADb-193	Memo from William J. Allen, Jr., Colonel, Cml C Commanding to Commanding Officer, Black Hills Ordnance Depot October 14, 1955, 2 pages. Subject: Valve, Needle, AN-M1. Defective needle valves incidence twice as high for CK bombs compared to CG bombs.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-194	Memo from Elwood T. Jones, Captain, Cml C, Chemical Supply Storage Officer to Chief, Chemical Officer, Washington, D.C., April 16, 1956, 18 pages. Subject: Historical Report of Chemical Corps Operations for Quarter Ending 31 March 1956. Commercial weed killer to be used in mustard gas storage areas. 600+ CK and CG bombs repaired. 700+ H gas bombs, 6 CK and 2 CG bombs transferred to burning area.
BHADb-195	1956 Photos of bomb bunker, storage and movement, 5 pages.
BHADb-196	Photos and Captions on H decontamination, removal and testing of H-gas. Decon procedures, May 10, 1957, 15 pages.
BHADb-197	Memo from Col. Ordnance Corps, Black Hills Army Depot, to Chief Chemical Officer, Washington, D.C., April 15, 1957, 19 pages. Subject: Quarterly Historical Reports of Chemical Corps Operations for Quarter Ending 31 March 1957. Four one-ton containers of H gas sent to Rocky Mountain Arsenal for tests. Repair of 2,000+ CG and CK bombs. 200+ leaking H gas bombs transferred to burning ground. Empty bomb casings from 160 M-70 bombs were burned in pits in chemical storage area. Proposal for destruction of M-70 bombs in kiln furnace.
BHADb-198	Memo from Elwood T. Jones, Captain, Cml C, Chemical Supply Storage Officer to Chief Chemical Officer, Washington, D.C., July 17, 1958, 10 pages. Subject: Quarterly Historical Report of Chemical Corps Operations for Quarter Ending 30 June 1958. Repair of 1200+ CK and CG bombs. Observed miniature kiln operation. 6000+ CK and CG bombs repaired. All M-70 H gas bombs converted to bulk mustard.
BHADb-199 Drawing	Black Hills Army Depot Igloo SD Longitudinal Sections Explosives Washout Plant, April 14, 1964.
BHADb-200 Drawing	Ammunition Workshops Plot Plan Proposed Filter Bed, March 14, 1957.
BHADb-201 Drawing	Black Hills Army Depot Igloo SD Enclosure of Furnace at Bldg. 6005, May 15, 1964.
BHADb-202 Drawing	Plane Table Sheet Chemical Warfare Area 29, August 1958.
BHADb-203 Drawing	Black Hills Army Depot Igloo SD Chemical Warfare Area Record Drawing 22, September 1964.
BHADb-204 Drawing	Storage for 115 lb. M-70 Chemical Bombs for Pallets in 80 ft. Igloo, December 6, 1944.
BHADb-205 Drawing	Black Hills Army Depot Igloo SD Flare Test Range, 24 February 1964.
BHADb-206 Drawing	Black Hills Army Depot Igloo SD Fencing Contaminated Area, July 11, 1966.
BHADb-207 Drawing	Black Hills Army Depot Igloo SD Elevations and Plan View Explosives Washout Plant, April 14, 1964.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-208 Drawing	Black Hills Army Depot Igloo SD Reservation Map, 15 December 1963.
BHADb-209	Letter from Lt. Col. Jack Carstarphen, BHAD, 11 January 1966, to Mr. Adelbert Hedglin, transmitting photos of CK demilitarization operation.
BHADb-210	Eleven 8 x 10 photocopies of photos with captions, CK demilitarization.
BHADb-211	Press Release, Nr. 117-65, 3 January 1966, BHAD, "BHAD Demil Job Pays for Itself with \$365,912.00 to Boot", 2 pages. Documents demilitarization of 5,000 500-lb and 200 1000-lb cyanogen chloride (CK) bombs in approximately 1965. Also states 206,508 H (mustard) gas bombs were demilitarized at BHAD in approximately 1962.
BHADb-212	"Analytical Report" BHAD, Igloo, S.D., Revised August 24, 1962, pages I-1 thru I-6, II-1 thru II-10, III-1 thru III-7.
BHADb-213	"Master Plan Analysis of Existing Facilities Black Hill Army Depot" pages I-1 thru I-2, II-1 thru II-16, III-1-1 thru III-1-2, III-4-1, III-4-3, III-4-4, III-4-8 thru III-4-11, III-8-1, III-8-21 thru III-8-26, III-8-31 thru III-8-67. Includes index. Describes areas including Ammunition Normal Maintenance, Open Ammunition Storage Pad, Magazines, Ammunition Workshops, Ammunition Disassembly, Bundle Ammunition Parking, Igloos, Burning Grounds 1, 2, & 3, Toxic Chemical Storage Area, Tracer Test Firing Range, etc. Provides outline description of each building by number including size, use, capacity, etc.
BHADb-214	Sheet 7 of 53 General Storm-Drainage & Tree-Cover Map.
BHADb-215	Sheet 8 of 53 General Site Map Storage Area 1.
BHADb-216	Sheet 9 of 53 General Site Map Storage Area 2.
BHADb-217	Sheet 24 of 53 General Site Map Warehouse and Airfield Area.
BHADb-218	Sheet 25 of 53 General Site Map Aboveground Magazine Area.
BHADb-219	Black Hills Army Depot Chemical Area 6000 Block Plans (3 Sheets).
BHADb-220	"Fire Fighting Plan for Chemical Area - VX - GB". 26 February 1963. Index card. 1 page. States "storage of VX and GB is confined to G block area".
BHADb-221	"Fire Fighting Plan Involving Nuclear Weapons", 3-1-63, index card, 1 page.
BHADb-222	Black Hills Army Depot Igloo, SD Chemical Area Block Plans (17 Sheets).
BHADb-223	Black Hills Army Depot Igloo, SD Provo Water Well #2, Well Log (3 Sheets).
BHADb-224	Black Hills Army Depot Igloo, SD Provo Water Well #1, Well Log (4 Sheets).
BHADb-228	Personal communication, Sgt. Marks, 74th ORdnance Detachment, Ft. Riley, Kansas, September 22, 1993.
BHADb-229	Personal communication, Bill Dorkin, CEMRD, September 21, 1993.
BHADb-230	Personal communication, Art Lawrence and James Rickard, Former BHAD Employees, August 19, 1993.

<b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b>	
BHADb-231	Department of the Army, Technical Manual TM9-1904, Ammunition Inspectors Guide, 1945.
BHADb-232	Personal communication, Art Lawrence, September 17, 1993.
BHADb-233	Personal communication, Lee Deans, Former BHAD Employee, September 17, 1993.
BHADb-234	Personal communication, Louis Reckard, Former BHAD Employee, August 18, 1993.
BHADb-235	Personal communication with James Rickard, September 17, 1993.
BHADb-236	Ordnance Department, 1976. Memos regarding Residual Contamination at the BHAD.
BHADb-237	USATHAMA, February 1980. Black Hills Depot Historical Operations.
BHADb-238	USATHAMA, Draft Archives Search Report, 1980.

**REFERENCES  
FROM  
1992 REPORT**

## **REFERENCES BLACK HILLS ARMY DEPOT**

BHAD-001	USATHAMA, Archives Search 1980
BHAD-002	Information from Army Material Center, undated. Provided by CEHND 5/92.
BHAD-003	Findings and Determination, BHAD, DERP 1985.
BHAD-004	List of BHAD records transferred to Archives, May 1978.
BHAD-005	OEW Risk Assessment, CEHND-ED-SY, undated.
BHAD-006	Site Survey Summary, Findings and Determination and Preliminary Assessment, COE, 1985. Includes Statement of Clearance 1967 and OEW Risk Assessment CEMRD.
BHAD-007	Investigation into Chem-Nuclear Study, Technical Information Project, 1985. Included Documents BHAD-007-1 through BHAD-007-12.
BHAD-008	Contaminated Area Analysis Report, Igloo, South Dakota, Chem-Nuclear, 1981.
BHAD-009	Field Investigation of Uncontrolled Sites, USEPA, 1981.
BHAD-010	Photographs, BHAD, undated.
BHAD-011	Report on Excess Real Property at BHAD to GSA, CEMRDO.
BHAD-012	Property Ownership Information. CEMRDO Real Estate Records.
BHAD-012-1A	Quit Claim Deed, City of Edgemont, 1975.
BHAD-012-1B	Purchase Agreement between GSA and Edgemont, 1968.
BHAD-012-1C	Quit Claim Deed, City of Edgemont, 1983.
BHAD-012-2A/B	Deeds from Edgemont to Security Industries, 1976.
BHAD-012-3A	Ownership Documents, Burton Hutton and FHT, 1983.
BHAD-012-3B	City Deed from Edgemont to Burton Hutton, 1983.
BHAD-012-3C	Property Owned by Hutton's and Property Dispute, 1984.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-012-4A/B	Ownership Information, FHT, 1983.
BHAD-012-5A	Ownership Information, Igloo Subdivision, 1981-1984.
BHAD-012-5B	Igloo Subdivision Owners, Circa. 1975.
BHAD-012-6	Ownership Information, Tract Igloo, 1975.
BHAD-012-7A/B	Ownership Information, Robert Vallejas, 1984.
BHAD-012-8	Quit Claim Deed, Edgemont to Black Hills, Freeport, 1970.
BHAD-012-9	Warranty Deed from Black Hills Industrial Freeport to Texas Calf Palace, 1970.
BHAD-012-10	Deed from Security Industries to Circle P Farms, 1976.
BHAD-012-11	Deed from Security Industries to Southern Hills Bank, 1984.
BHAD-013	Ownership Information Including Tract Maps (some are copies of the above documents).
BHAD-014	Letter from South Dakota Department of Environment and Natural Resources to CEHND, 1991.
BHAD-015	Thompson, C.T. and L. Mays. Experts from The Ordnance Department; Procurement and Supply, Office of the Chief of Military History 1960.
BHAD-016	Green, C.L.; H.C. Thompson; P.C. Roots. Experts from The Ordnance Department: Planning Munitions for War, Office of the Chief of Military History, 1955.
BHAD-017	Meyer Michael, A Summary of South Dakota's Groundwater Information Resources, Data Management Efforts and Data Needs, USEPA and SEA, 1986.
BHAD-018	Owned, Sponsored, and Leased Facilities at BHAD, 1983.
BHAD-019	Temporary Storage of AMMO at BHAD from Chief of Ordnance, 1946.



**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-020      Personal Communication, Charlene Hillgran, May 20, 1992.
- BHAD-021      Groundwater quality data, BHAD, South Dakota Department of Water and Natural Resources, May 1991.
- BHAD-022      Mineral and Water Resources of South Dakota, USGS and South Dakota geological survey, July 1975.
- BHAD-023      Reconnaissance Investigation of Water Quality, Bottom Sediment and Biota Associated with irrigation in the Angostura Reclamation Unit, Southwestern S.D. 1988-1989, USGS, 1990.
- BHAD-024      Schoon Robert, Geology and Hydrology of the Dakota Formation in South Dakota, South Dakota Geological Survey 1971.
- BHAD-025      Rothrock, E.P. Structures South of the Black Hills, South Dakota Geological Survey, 1959.
- BHAD-026      Personal Communication, Marilyn Mitchell-Thompson, Pueblo Depot Activity, May 20, 1992.
- BHAD-027      Personal Communication, Marilyn Mitchell-Thompson, Pueblo Depot Activity, May 20, 1992
- BHAD-028      Personal Communication, Vernon Ichimura, Chem-Nuclear Systems Inc., May 28, 1992.
- BHAD-029      Edgemont, South Dakota, Southwestern Gateway to the Black Hills, Edgemont Chamber of Commerce, Circa 1990.
- BHAD-030      Environmental Hygiene Survey, Black Hills Ordnance Depot, U.S. Environmental Hygiene Agency, April 26, 1961.
- BHAD-031      Potential Mustard Exposure, BHAD, U.S. Environmental Hygiene Agency, February 13, 1981.
- BHAD-032      Comprehensive Use Plan from the City of Edgemont to GSA February 25, 1966.
- BHAD-033      Monthly Inactivation Progress Report, '64, '65, '66.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-034	Phamplet, Welcome to BHAD, Igloo South Dakota.
BHAD-035	Ordnance Installation and Activity Information Brochure, 6/15/60.
BHAD-036	Historical Background, up to 1955.
BHAD-037	Additional Personnel Requirements, August 20, 1964.
BHAD-038	Closing and Reduction of Certain Army Installations, April 23, 1964.
BHAD-039	Workload Data Presentation - FY'56 from Headquarters in Joliet, Illinois to Commanding Officer in BHAD, September 27, 1955.
BHAD-040	Renovation and Demilitarization Activities, January 1, 1956 - June 30, 1956.
BHAD-041	Operating Instructions for Radioactive Test Sample, July 13, 1956.
BHAD-042	Demilitarization of Bombs, January 1, 1957 to June 30, 1957.
BHAD-043	Statistical Report of Depot Operations, July 1, 1957 to December 31, 1957.
BHAD-044	Accu-Lab Test Report of Radioactivity Samples at Henderson & Igloo Wells, Collected April 4, 1992.
BHAD-045	Soil Survey of Fall River County South Dakota 1982. USDA Soil Conservation Service and Forest Service.
BHAD-046	Igloo: A History of the Black Hills Ordnance Depot, 1984. Igloo Area History Committee, Fall River County Historical Society.
BHAD-047	Request for use of Igloos at BHAD for Explosive Tests, July 1967. Omaha District, Corps of Engineers and U.S. Army Material Command.
BHAD-048	Property Summary, Circa 1967, General Services Administration.
BHAD-049	Quit claims deed, City of Edgemont, South Dakota from GSA, November 15, 1982.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-050	Inspection Report, 1965. GSA
BHAD-051	Commercial value of mineral deposits, BHAD, July 11, 1968. Jon Paul Gries, Consulting Geologist.
BHAD-052	Water Analysis, City of Edgemont, Well #2, February 22, 1951. South Dakota State Board of Health.
BHAD-053	Preliminary Decontamination Report, July 22, 1965. BHAD
BHAD-054	Study Plan of the BHAD, Provo South Dakota, 1980, USEPA.
BHAD-055	Transcript of taped conversation of Kenneth O. Flag of Chem-Nuclear concerning BHAD, 1984.
BHAD-056	Memos from Omaha District pertaining to BHAD, Circa November 1984 to January 1985.
BHAD-057	Newspaper clippings on Chem-Nuclear, 1985.
BHAD-058	CFR Judgements against CFR Chem Waste Management, Volume 50, No. 31, Thursday, February 14, 1985.
BHAD-059	GSA Interpretation of deed restrictions BHAD, GSA, 1985 and 1986.
BHAD-060	Information Packet, BHAD Site, 1984, Chem-Nuclear
BHAD-061	Special Inspection Report, BHAD, 1985. GSA
BHAD-062	Correspondence with City of Edgemont Pertaining to Posting of Signs. 1985 GSA
BHAD-063	BHAD, Land-lease History, Volume 9, Part 2. March, 1943 - December, 1944.
BHAD-064	BHAD Historical Reports, January, 1946 - June, 1946.
BHAD-065	Completion Report BHAD, 1942. U.S.A Army Corps of Engineers.
BHAD-066	Demilitarization of Chemical Agents Munitions and other Material, 1948. U.S. Army Chemical Corps.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-067	Tracer Loading and Components, observed at Wolf Creek Ordnance Plant 1943. Ordnance Department.
BHAD-068	Ammunition Supply Branch 1943. Ordnance Department.
BHAD-069	Memos relating to white phosphorous fire at BHAD, 1946. Ordnance Department.
BHAD-070	Memos relating to Industrial Hygiene Surveys, BHAD, 1946.
BHAD-071	Demilitarization of Selected Types of Ammunition at BHAD, 1946 Ordnance Department.
BHAD-072	Summary of BHAD Facility, Undated. Ordnance Department.
BHAD-073	BHAD Quarterly Restorical Reports, January to December 1943. Ordnance Department.
BHAD-074	BHAD Quarterly Historical Reports January to December, 1944. Ordnance Department.
BHAD-075	BHAD Quarterly Historical Reports, October 1941 to Oct 1942, Ordnance Department.
BHAD-076	BHAD Quarterly Historical Reports, January to September 1945. Ordnance Department.
BHAD-077	Decomposing Waster High Explosives 1945. Ordnance Department.
BHAD-078	Trip reports and transportation manifests shipments of mustard gas ordinance Rocky Mountain Arsenal, 1950. Army Chemical Center.
BHAD-079	Trip Reports of Shipments of Mustard Gas Ordnance to Rocky Mountain Arsenal, 1948. Army Chemical Command.
BHAD-080	Trip reports and transportation manifests of shipment of chemical munitions to Alberta, Canada, 1948. Army Chemical Center.
BHAD-081	History of the Technical Escort Detachment, January to June 1947. Army Chemical Center.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-082	History of the Technical Escort Detachment, 1949. Army Chemical Center.
BHAD-083	Monthly Report of the Technical Escort Detachment, February 1952. Army Chemical Center.
BHAD-084	Instructions for using gas identification sets, 1943. Chemical Warfare School.
BHAD-085	Decontamination Procedures 1945. War Department Supply Bulletin SB5-52.
BHAD-086	Typical Procedures for renovation of fragmentation grenades, 1951. Ordnance Ammunition Center.
BHAD-087	Trip Report Evaluation Safety Issues of GB Filled Munitions, 1952. Army Chemical Center.
BHAD-088	Report of Explosives Safety Inspections of BHAD, 1950. Ordnance Department.
BHAD-089	Waivers and Exemptions, 1950-1953. Armed Services Explosive Safety Board and Structures.
BHAD-090	Correspondence related to land transferred to the Department of Agriculture, 1968. GSA
BHAD-091	Finding of fact and Inventory Report, 1985, Omaha COE.
BHAD-092	Press Release From Deb Rogers, 1985.
BHAD-093	Correspondence Pertaining to Deed Restriction Violations, 1985. CEMRD
BHAD-094	Correspondence Pertaining to Chem-Nuclear, 1985. CEMRD
BHAD-095	Correspondence from Bureau of Land Management to COE, 1990.
BHAD-096	William J. Bangsund, 1985. Hydrogeology of Upper Cretaceous Shales and Surficial Depots, Igloo Area. South Dakota School of Mines and Technology.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-097	Supplement Report of Excess Real Property, Undated, GSA.
BHAD-098	Property Purchased by USDA Undated, Department of Agriculture.
BHAD-099	Correspondence Relating to USDA and Other Property Owners at BHAD, 1968. USDA
BHAD-100	Correspondence relating to USDA Property Dispute, 1970. USDA
BHAD-101	Black Hills Industrial Freeport Marketing Brochure, 1968.
BHAD-102	Historical Reports, BHAD. 1955-1958. Ordnance Department.
BHAD-103	Improvements Reported for Demilitarization of 8" shells, 20lb Fragmentation Bombs and M28 Rifle Grenades, 1958. Black Hills Ordnance Depot.
BHAD-104	General Provisions for Operation of Burning Ground #2, 1958. Black Hills Ordnance Depot.
BHAD-105	Demilitarization, January to June 1959. Black Hills Ordnance Depot.
BHAD-106	List of Restricted Areas, BHAD, July 17, 1959.
BHAD-107	Demilitarization, July to December 1959. Black Hills Ordnance Depot.
BHAD-108	Supply Operations with Photos, July to December 1960, Black Hills Ordnance Plant.
BHAD-109	Demilitarization and Maintenance, January to June 1961. Black Hills Ordnance Plant.
BHAD-110	Management Improvements with photos, January to June 1958. Black Hills Ordnance Plant.
BHAD-111	Photos of Ammunition and Renovation, 1943. Black Hills Ordnance Plant.
BHAD-112	Photos of Demolition and Renovation, 1960, Black Hills Ordnance Plant.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-113 Michael Meyer, 1984. Evaluation of Groundwater Resources in Western South Dakota. South Dakota Department of Water and Natural Resources.
- BHAD-114 Excerpts from Daily Duty Logs, BHAD Fire Department, 1950 to 1968, Black Hills Ordnance Plant.
- BHAD-115 Site Characterization for the Fall River Project, 1991. Johnson Environmental Concepts and EIC Corporation.
- BHAD-116 Occurrence and Characteristics of Groundwater in the Denver-Julesburg Basin Wyoming Volume 7 A and B, 1981. Water Resources Research Institute, Wyoming.
- BHAD-117 Jack Keen. Groundwater resources of the western half of Fall River County, South Dakota, South Dakota Geological Survey, Report-of Investigation No. 109, 1973.
- BHAD-118 John Foster Sawyer. Depositional Environment of the Turner Sandy Member of the Carlile Shale near provo, South Dakota. South Dakota School of Mines and Technology, 1990.
- BHAD-119 Personal Communication with Matt Brown, Former Mayor of Edgemont, South Dakota, June 29, 1992.
- BHAD-120 Personal Communication with Merle Hollaway, Salvage Operator, BHAD, June 29, 1992.
- BHAD-121 1990 Census Report, U.S. Bureau of Census.
- BHAD-122 Edgemont Centennial, 1989.
- BHAD-123 Chemical Division Depot Report, BHAD, 1949-1950.
- BHAD-124 Decontamination Procedures, War Department Supply Bulletin, SB5-52, July, 1945.
- BHAD-125 Personal Communication with Francis Finkel, Former Demolition Foreman. BHAD, June 2, 1992.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-126      Personal Communication with Louis Rickard, Former Fire Chief, BHAD, June 2, 1992.
- BHAD-127      Personal Communication with Dave Henderson, Edgemont Fire Chief, June 29 - July 3, 1992.
- BHAD-128      Personal Communication with Russell Anderson, Salvage Operator and Igloo Resident, June 30 - July 2, 1992.
- BHAD-129      Personal Communication with Merle Holloway, June 30, 1992.
- BHAD-130      Personal Communication with Matt Brown, June 30, 1992.
- BHAD-131      Personal Communication with Leonara Pederson, Provo Resident, July 2, 1992.
- BHAD-132      Personal Communication with Woodie Markey, former BHAD Ordnance Transporter, July 2, 1992.
- BHAD-133      Personal Communication with Frank Manke, Mayor of Edgemont and Rancher, July 2, 1992.
- BHAD-134      Personal Communication with Bill Chaney, Local Rancher, June 29, 1992.
- BHAD-135      Personal Communication with James Rickard, Former Ammunition Division Chief, BHAD, July 4, 1992.
- BHAD-136      White Phosphorous Fire, Edgemont Tribune, July 3, 1946.
- BHAD-137      Disposal of cyanogenchloride at BHAD, Edgemont Tribune, June 6, 1966.
- BHAD-138      "BHOD is Born", the Bhodian, April, 1945.
- BHAD-139      Fuze dropped on foot, BHAD, Edgemont Tribune, April 25, 1956.
- BHAD-140      Personal Communication with Edgemont Police Department, April 1992.



**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-141      Personal Communication with Bob Hodorf, U.S. Forestry Service, June 29, 1992.
- BHAD-142      94th Ordnance Detachment Incident Report, June 30, 1992.
- BHAD-143      Chemical Division Depot Report, BHAD 1951.
- BHAD-144      Chemical Division Depot Report, BHAD 1952.
- BHAD-145      Chemical Division Depot Report, BHAD 1953.
- BHAD-146      Chemical Division Depot Report, BHAD 1954.
- BHAD-147      Chemical Division Depot Report, BHAD 1955.
- BHAD-148      Chemical Division Depot Report, BHAD 1956.
- BHAD-149      Chemical Division Depot Report, BHAD 1957.
- BHAD-150      Chemical Division Depot Report, BHAD 1958.
- BHAD-151      Ellsworth AFB South Dakota Incident Report, BHAD 1980 to present.
- BHAD-152      Personal Communication with William Bruce, Former Millright BHAD, July 30, 1992.
- BHAD-153      Personal Communication with Dwight Lackey, son of Perry Lackey (Salvage Operator at former BHAD), August 3, 1992.
- BHAD-155      Personal Communication with Eugene Erickson, Landowner, August 3, 1992.
- BHAD-156      Arnold H. Witcomb. Groundwater Resources and Geology of Neobrara County, Wyoming, Wyoming Geological Survey Water Supply Paper 1788.
- BHAD-157      Personal Communication and Correspondence with Tom Yancy, UXO International, July 21 and July 23, 1992.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-158	Personal Communication with Joe Trotter, Rancher during operation of BHAD, August 3, 1992.
BHAD-159	Fate of Chemical Weapons in the Environment, USATHAMA, 1989.
BHAD-160	Disposal of Explosive Effluent at BHAD, 1953. Ordnance Ammunition Center, Joliet, Illinois.
BHADM-001	Facility Drawings, 1959.
BHADM-002	Facility Map, undated.
BHADM-003	Tract Map, CEMRD, 1942.
BHADM-004	General Geologic Map of South Dakota Series 1, South Dakota Geological Survey.
BHADM-005	Physiographic Divisions of South Dakota, South Dakota Geological Survey.
BHADM-006	Topographic Map (7.5 Minute) Provo Quadrangle Fall River County, South Dakota 1982.
BHADM-007	Topographic Map (7.5 Minute), Phister Ranch Quadrangle, Fall River County, South Dakota, USGS, 1982.
BHADM-008	Hazardous and contaminated areas map, May 24, 1965. Office of the post Engineer.
BHADM-009	Late 40's early 50's Additions. 1940s Additions, Layout Plan, 1942.
BHADM-010	Soil Conservation Map, Ownership Map, 1992.
BHADM-011	U.S. Forestry Map, Forestry Ownership and Leases, 1992.
BHADM-012	Fall River County Tax Assessor's Office, Current Ownership Map, 1992.
BHADM-013	Restricted Areas Map, January 27, 1967, PE-1004-1.
BHADM-014	1954 aerial photographs, Department of Agriculture.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

<b>BHADM-015</b>	<b>1957 aerial photographs, Department of Agriculture.</b>
<b>BHADM-016</b>	<b>1965 aerial photographs, Department of Agriculture.</b>
<b>BHADM-017</b>	<b>1971 aerial photographs, Department of Agriculture.</b>
<b>BHADM-018</b>	<b>Soil Horizon Map, Soil Conservation District, 1982.</b>
<b>BHADM-019</b>	<b>Hazardous &amp; contaminated Area Map, BHAD, March 27, 1963.</b>

**APPENDIX A**  
**SCOPE OF WORK**

## **SCOPE OF WORK**

### **SUPPLEMENTAL ARCHIVES SEARCH REPORTS AND SITE VISITS, FORMER DOD SITES CHEMICAL WARFARE MATERIALS**

#### **1.0 BACKGROUND AND GENERAL STATEMENT OF WORK**

**1.1.** The work required under this Scope of Work (SOW) falls under the Defense Environmental Restoration Program (DERP). Ordnance and explosive waste (OEW) including Chemical Warfare Materials (CWM) may exist on property that was formerly owned by the Department of Defense (DOD). This SOW covers the sites described in Section 1.3.

**1.1.1.** OEW is a safety hazard and constitutes an imminent and substantial endangerment to site personnel and local populace. During the performance of this SOW, it is the government's intent that the contractor telephonically report all OEW, including CWM, encountered to the Contracting Officer (CO).

#### **1.2 Definitions:**

**1.2.1 OEW.** Bombs and warheads, guided and ballistic missiles; artillery and mortar and rocket ammunition; antipersonnel and antitank land mines; demolition charges, pyrotechnics; grenades; torpedoes and depth charges; containerized or uncontainerized high and low explosives and propellants; nuclear materials; chemical agents; and all similar or related items or components, explosive in nature or otherwise designed to cause damage to personnel or material. Soils with explosive constituents will be considered OEW if the concentration is sufficient to present an imminent safety hazard.

**1.2.2 Unexploded Ordnance (UXO).** An item of OEW which has failed to function as designed or has been abandoned or discarded and is still capable of functioning causing damage to personnel or material.

**1.2.3 UXO Specialist.** A graduate of the U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, Maryland with at least 10 years experience in military EOD assignments.

**1.2.4 Access Procedures.** Those actions taken to locate exactly and to gain access to UXO.

**1.2.5 Diagnosis Procedures.** Those actions taken to identify and evaluate UXO.

**1.2.6 Recovery Procedures.** Those actions taken to recover UXO.

**1.2.7 Chemical Warfare Materials.** Chemical Warfare Materials to be researched under this SOW are munitions, storage containers, dispersal devices, and test (demonstration) kits which contain lethal chemical agents. Munitions include normal ordnance systems of delivery such as projectiles, grenades, bombs, land mines, and rockets. Listed below are the lethal chemical agents which could be contained in any of the CWM.

### **Lethal Chemical Agents**

#### **Nerve Agents**

GA Tabun  
GB Sarin  
GD Soman  
GF  
VX  
V-Sub X

#### **Blister Agents**

CX phosgene oxime  
ED ethyldichloroarsine  
H Levinstein mustard  
HJ  
HL mustard + Lewisite  
HD distilled mustard  
HN-1 nitrogen mustard  
HN-2 nitrogen mustard  
HN-3 nitrogen mustard  
HS mustard gas  
HT mustard + T mixture  
L Lewisite  
M-1 Lewisite  
M-2 Lewisite  
MD methyldichloroarsine  
PD phenyldichloroarsine

#### **Blood Agents**

AC/HCN Hydrogen cyanide  
CNC1/CK cyanogen chloride  
SA arsine

#### **Choking Agents**

BA bromoacetone  
CG phosgene  
DM adamsite  
DP diphosgene

#### **Incapacitating Agent**

BZ

## **Defoliant Agents**

Agent Blue    organic arsenical acid  
Agent Orange  
Agent Purple  
Agent White    Tordon 101

The contractor will also record any testing or experimentation with lethal chemical agents performed at the subject sites.

Certain chemical agents, generally considered non-lethal, were not the primary focus of the searches. However, references to these non-lethal agents encountered during the searches should be recorded for possible future use. The non-lethal agents include: riot control agents, tear agents, vomiting agents, and incendiary and smoke agents.

## **Non-Lethal Chemical Agents**

### **Riot Control Agents**

CN1  
CR  
CS1

### **Tear Agents**

BBC/CA    camite  
CN  
CNS  
CS

### **Vomiting Agents**

DA  
DC/CD  
PS chloropicrin

### **Incendiary and Smoke Agents**

BS  
FM  
FS  
GS  
HC    hexachoro-ethane  
IM  
NP    napalm  
NP3  
PT  
PT1  
PWP    plasticized white phosphorous  
RP    red phosphorous  
RS

## Incendiary and Smoke Agents (continued)

SGF1/SGF2/SGF3 fog oil

TEA

TH

TH3/Th4

TM thermite

TPA

WP white phosphorous

### 1.3 Description of Sites.

**1.3.1 Former Nebraska Ordnance Plant (B07NE003701).** The former Nebraska Ordnance Plant (NOP) near Mead, Nebraska, included 17,250 acres. It was used by the DOD for bomb loading, booster assembly, and ammonium nitrate production during World War II. After World War II, this site was used for explosives storage and demilitarization and ammonium nitrate production. From 1952-1956, the plant was operated by National Gypsum and produced a wide variety of weapons. The site was declared excess in 1959 and has since been dispersed to organizations including U.S. Air Force, Department of Commerce, University of Nebraska, and various corporations and private individuals.

The document "Preliminary Assessment of Ordnance Contamination at the Former Nebraska Ordnance Plant, Mead, Nebraska," April 1991, shall be considered a primary reference document for this site. In this document, twelve potential OEW contamination areas were identified. Visual surveys, geophysical surveys, excavations, soil sampling, wipe sampling, and chemical analyses were performed. The 1991 Engineering Report presents the results of the Contamination Evaluation and the Risk Assessment Code.

*when  
was  
performed* [Information obtained during the 1991 contamination evaluation indicated potential presence of "canisters or bombs filled with a chemical warfare agent (mustard)" at Site 8, the Wastewater Treatment Plant Landfill. This was not confirmed through written documentation. No walk-over surveys were performed at Sites 8, 11 (Detention Pond), or 12 (Booster Assembly Area).

In the 1991 Engineering Report, recommendations for Site 8 included a) landfill activities be halted; b) the area be fenced; c) warning signs be posted; d) the presence of mustard gas be verified; e) geophysical survey be performed to establish the boundaries of the landfill; and f) sampling and analysis be performed.

In Appendix J, page 5 of the Final Engineering Report referenced above, CEHND commented "Site 8: totally agree with this recommendation based on the suspected presence of Chemical Surety Material (CWM). CWM should be located, brought under DOD control, and dealt with under the provisions of AR50-6. Once this is accomplished, this may become an HTW site".

**1.3.2 Former Black Hills Ordnance Depot, South Dakota** The report "Final Archives Search Report Preliminary Assessment of Ordnance Contamination at the Black Hills Army Depot, South Dakota" shall be considered the primary reference document for this site.



The former BHAD consisted of approximately 21,095 acres. It was owned and operated by the U.S. Ordnance Department and provided for the maintenance, storage, renovation, and demilitarization of ordnance, ordnance components, and bulk explosives containing high explosive, incendiary, or chemical fillers. BHAD was also known as Black Hills Ordnance Depot (BHOD) during portions of its history. It was closed in 1967. The property was dispersed to the City of Edgemont, South Dakota, U.S. Forestry Service, and subsequently to several corporations and individuals.

In Section 5 of the primary reference document, potential OEW contamination was evaluated at twelve areas of the former BHAD. CWM identified as present during BHAD operations include AC (hydrocyanic acid); CG (phosgene); CK (cyanogen chloride); CN (chloroacetophenone); H (mustard); L (Lewisite). Rockets containing nerve agents VX and GB were reportedly stored in Storage Igloo Block G. Conventional ammunition with mustard filler were maintained, modified, renovated, and demilitarized at the Ammunition Workshop Area. Burning Ground 2 was used for ordnance disposal by burning as well as seepage. Some of this ordnance contained H, CN, L, CK, CG, and AC Chemical Surety Materials. Area 6000 was used for the disposal of H, CK, and CG bombs and related chemicals. Burning Ground 1 was used for destruction of H (mustard) bombs.

## **2.0 OBJECTIVES.**

The objective of this SOW is to further document, through archives searches and interviews, information concerning the types of chemical agents (CWM) potentially present at each site, their quantities, locations, depths (no intrusive work), current ownership of properties potentially contaminated with CWM, and accessibility of these properties to the public. Separate Supplemental Archives Search Reports (SASRs) will be provided for each of the sites described below, detailing any evidence or lack of evidence of chemical ordnance (CWM).

## **3.0 DESCRIPTION OF SERVICES.**

### **3.1 (Task 1) Records Review, Evaluation, and Site Visit.**

**3.1.1.** The A-E shall obtain, review, and evaluate the primary reference documents identified in Section 1.3.1 and 1.3.2. The A-E shall evaluate bibliographies, lists of references, contacts, and information sources used to compile the primary reference documents identified. The A-E shall solicit additional information from sources knowledgeable about presence of CWM at each site and shall evaluate and if necessary, contact and visit additional resources of information not previously contacted to further define the presence of CWM at the two sites identified.

The A-E shall obtain, review, and evaluate existing records, studies, and data concerning the above two sites. Data available within Huntsville Division and any other U.S. Army Corps of Engineers (USACE) offices shall be copied by the contractor as necessary. Other data may exist in the files of Government agencies such as USACE, Kansas City District, St. Louis District, Omaha District, U.S. Army Defense Ammunition Center and School, Savanna, Illinois, local historical societies, county courthouses, Federal Records Center, Army Historical Center,

General Services Administration, military explosive ordnance disposal (EOD) detachments. National Records Center (Record Group 175), Suitland, Maryland; U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Grounds, Maryland, and other appropriate agencies shall be contacted and visited if appropriate. Points of contact will be provided by the CO to the A-E as a starting point. Visits are authorized to Aberdeen, Maryland, and the Washington, DC area.

**3.1.2.** A visit to each project area is authorized to complete the records review and interview the local populace. An approved site-specific safety plan is necessary for these site visits. The site visit team shall include one UXO Specialist.

**3.1.3.** No access or recovery of UXO or CWM is to be accomplished during site visits. If UXO or CWM is encountered, the CO shall be notified who will in-turn contact military EOD or CWM for appropriate disposition.

**3.1.4.** The following information is provided for trip planning:

<u>Location</u>	<u>People</u>	<u>Days</u>	<u>Trips</u>
Edgewood Arsenal, Aberdeen, MD	2	2	1
Records Center	1	3	1
Washington, DC	2	10	1
Sites (each)	4	5	2

## **3.2 (Task 2) Supplementary Archives Search Report.**

**3.2.1.** The contractor shall submit separate Supplementary Archives Search Reports (SASRs) on each of the two sites. The SASRs shall refer to the primary reference documents, which document basic information about site history, geology, demographics, and ordnance contamination. The SASRs shall provide improved, updated, more complete, or supplemental information on these topics, if available. The SASRs shall primarily focus on a detailed evaluation of the presence of CWM at each site.

**3.2.2.** The SASR shall consist of 8-1/2 by 11-inch pages. Maps or other Figures may be on 11 x 17 inch pages if appropriate. A report title page shall identify the A-E, the Corps of Engineers, Huntsville Division and the St. Louis District, the date and the site name. Photographs or high quality photo copies shall accompany each copy of the SASR where appropriate. All site drawings shall be of engineering quality with sufficient detail to show interrelations of major features on the site map. The report covers shall be durable binders which hold pages firmly while allowing easy removal, addition, or deletion of pages.

## **APPENDIX B**

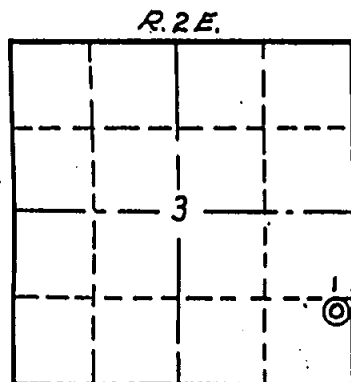
### **WELL BORING LOGS, WELLS NO. 1 AND NO. 2**

# PROVO WATER WELL # /

## BLACK HILLS ORDNANCE DEPOT

### SECTION 3, TOWNSHIP 10 SOUTH, RANGE 2 EAST, B.H.M. FALL RIVER COUNTY, SOUTH DAKOTA

SE 1/4 SE 1/4 (SEC. 3) T10S R2E



Company - United States War Dept.  
Contractor - Manning & Martin  
Location - 1060.1' NSL, 304.7' WEL.  
SE 1/4 Sec. 3 - T.10S., R.2E.  
Elevation  
Top of Kelley Bushings 3664.5  
Top of Rotary Table 3663.6  
Concrete Base-Ground 3655.1  
Drilling Commenced Apr. 5, 1942  
Drilling Completed June 17, 1942  
Put on Production June 21, 1942  
Total Depth 3990' from ground.

#### CASING RECORD

16" O.D. Casing (518.24 feet) set at 521.56' below ground, Top 2' above bottom of 5.32' cellar; cemented with 328 sacks cement from bottom at 521.56' to bottom of cellar at 5.32'

8 5/8" O.D. 32" and 36" Casing (3111.07') Bottom of 3628.07'. Top of 517' or 12.84' up inside 16" casing Cemented in 3 stages from bottom to top Using Temperature Survey & Gunperforator. Total of 860 Sacks Cement and 1300 # aquajel

#### WATER SANDS

Name of Sand	Depth to Top	Thickness	Result of Test	Character of Water
Newcastle	870	20	No Test	Unknown
Dakota	1088	122	Water Level at 415'	Potable
Lakota	1275	175	Water Level of 610'	Potable
Red Sundance	1725	75	Water Level at 475'	Brackish
Basal Sundance	1955	82	Artesian Flow	Brackish
Converse	2560	115	Small Volume	Brackish
Leo	3030	30	show Oil & Gas	None
Basal Leo	3230	80	No Test	Unknown
Madison			Artesian	Hard br
Pahasapa	3600	370	Flow	Potable
Deadwood	3890	15	No Test	Unknown

#### FORMATION LEGEND



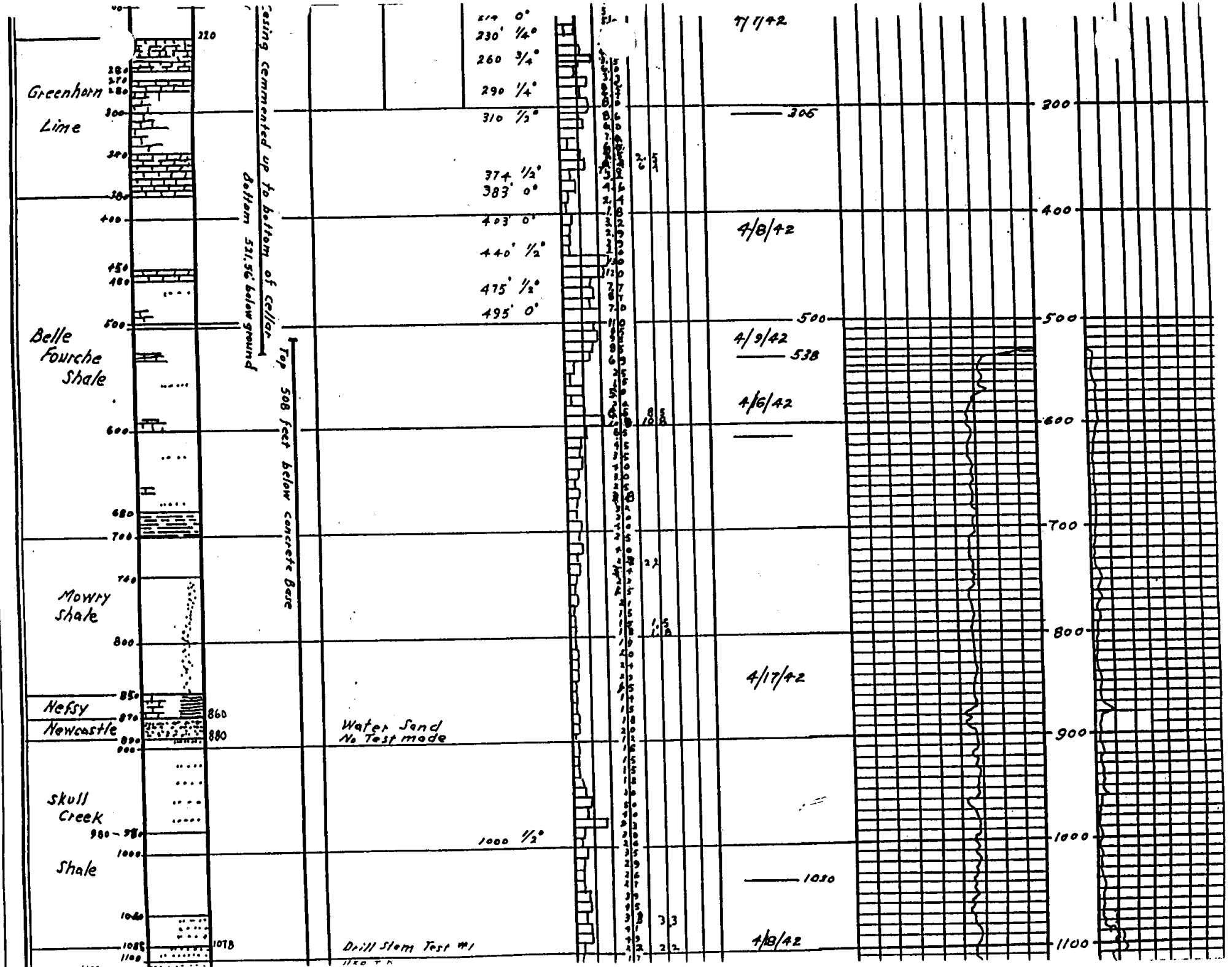
Sand

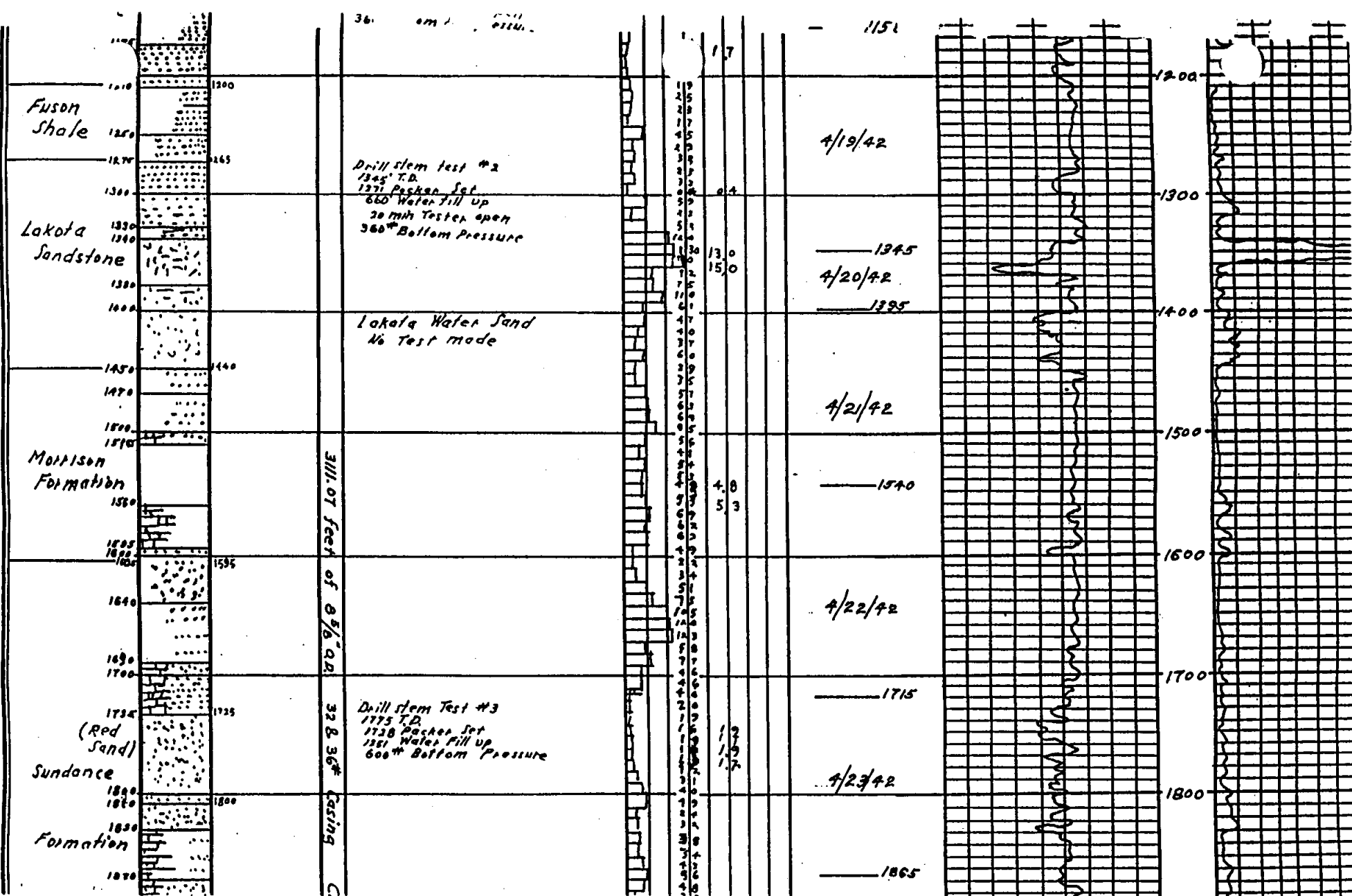


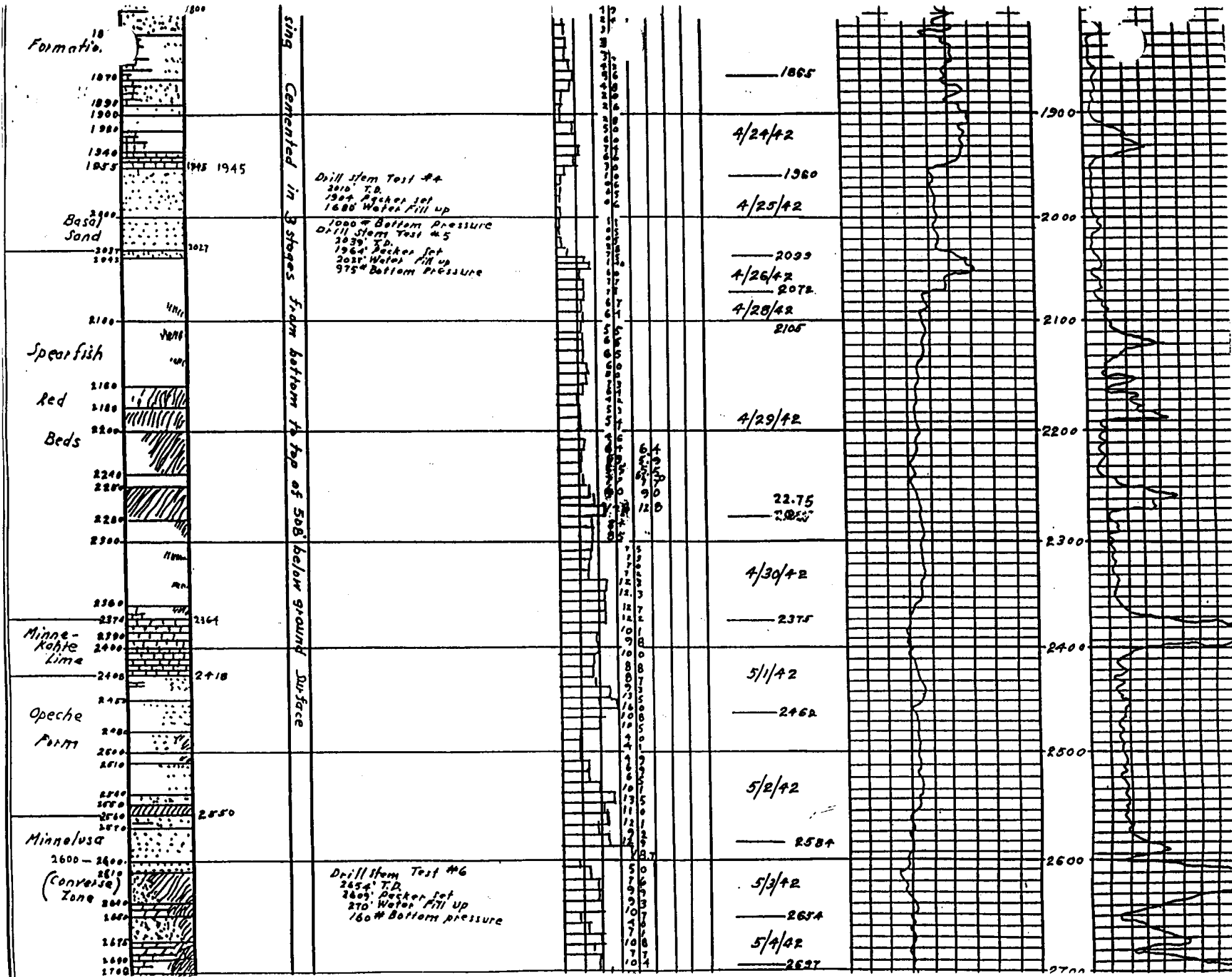
Coarse Sand

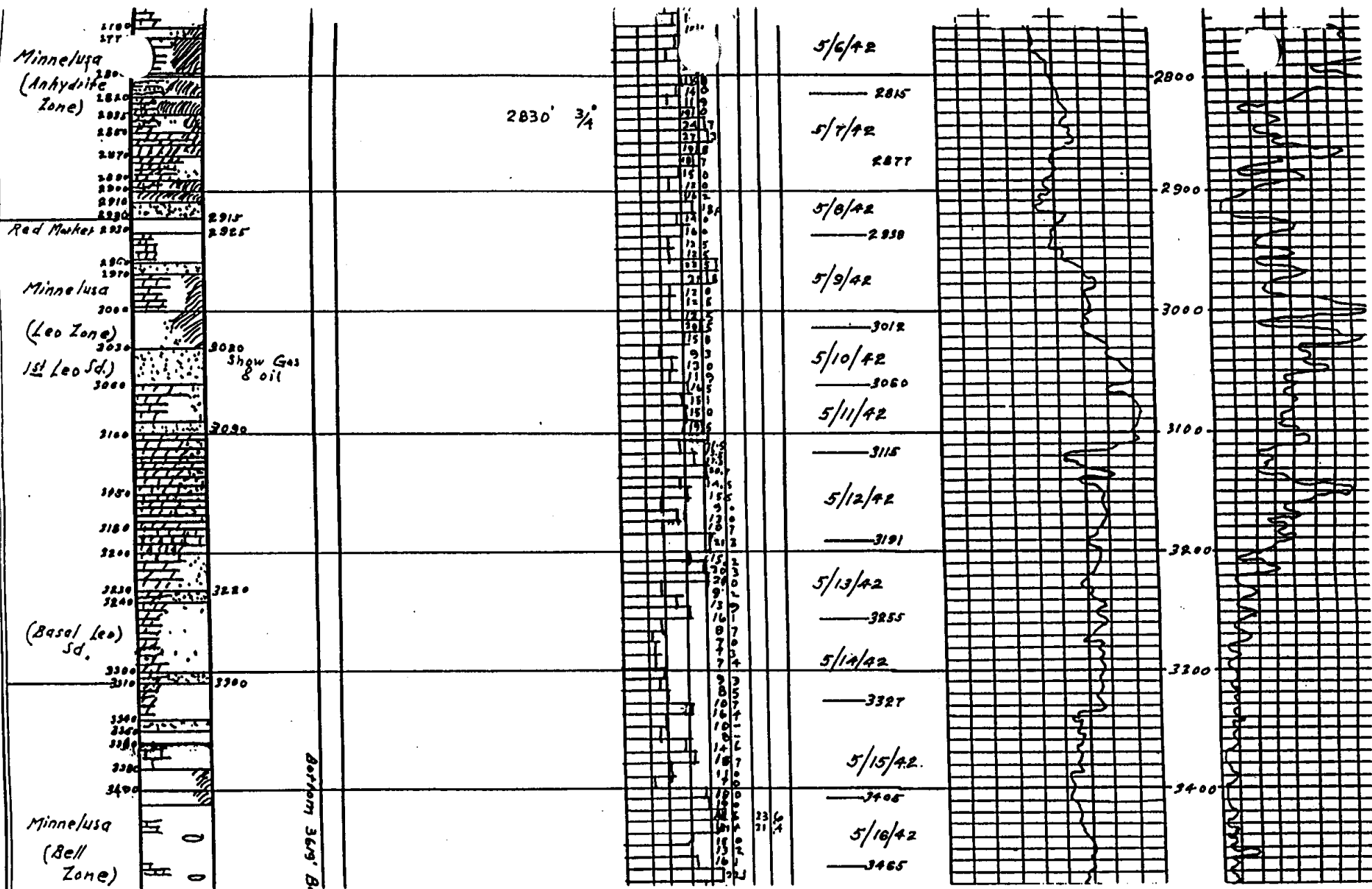


Con













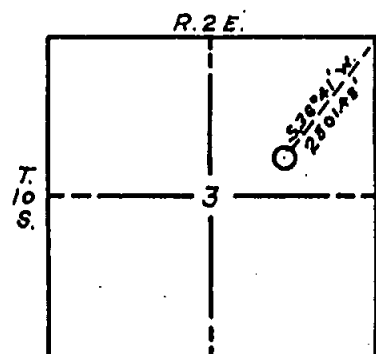
# PROVO WATER WELL #2

## BLACK HILLS ORDNANCE DEPOT

### SECTION 3, TOWNSHIP 10 SOUTH, RANGE 2 EAST, B.H.M.

### FALL RIVER COUNTY, SOUTH DAKOTA

S. 36° 41' W. 2501.48 ft.



COMPANY - U.S. War Dept.

CONTRACTOR - Manning & Brown

LOCATION - S. 36° 41' W. 2501.48 ft.  
from NE. Cor. Section

ELEVATION - Kelly Bushings - 3664.0  
Ground Surface - 3655.0

Drilling Commenced Oct. 12, 1943

Drilling Completed Nov. 26, 1943

Tested for Production Dec. 10, 1943

Total Depth 3855 from Kelly Bushings

#### CASING RECORD

394.54 feet of 16" OD 55# Casing

Top 4.68' and bottom 399.22'

below floor. Cemented to  
top with 325 Sacks cement.

3199.34 feet of 8 7/8" 32# Casing

Top 379.51' and bottom 3578.85'

below floor. Cemented in

3 stages with 1252 Sack Cement.

#### FORMATION LEGEND



Sand



Coarse Sand



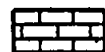
Conglomerate



Marine Shale



Non-Marine Shale



Limestone



Dolomite



Bentonite



Anhydrite





emented to top in 3 Stages with 152.50

Mowry  
Shale

Nesby Sh.

Newcastle Sd.

Skull  
Creek  
Shale

Dakota  
Sand

Fuson  
Formation

Lakota  
Sand

Drill Stem Test #1  
Packer @ 1051.0 Depth 1032  
Tester open 54 min.  
Water flow within 95' of top

Drill Stem Test #2  
Packer @ 1198 Depth 1203  
No Test  
Packer did not hold

Drill Stem Test #2A  
Packer @ 1188 Depth 1203  
Tester open 10 minutes  
Very Little Water

Drill Stem Test #3  
Packer @ 1310 Depth 1340  
No Test - Packer did not hold

Drill Stem Test #3A  
Some depths. No water

Drill Stem Test #4  
Packer @ 1350 Depth 1380  
Tester open 10 minutes  
No water

Drill Stem Test #5  
Packer @ 1393 Depth 1423  
Tester open 35 minutes

657

10/23/43

965

10/24/43

1263

10/25/43

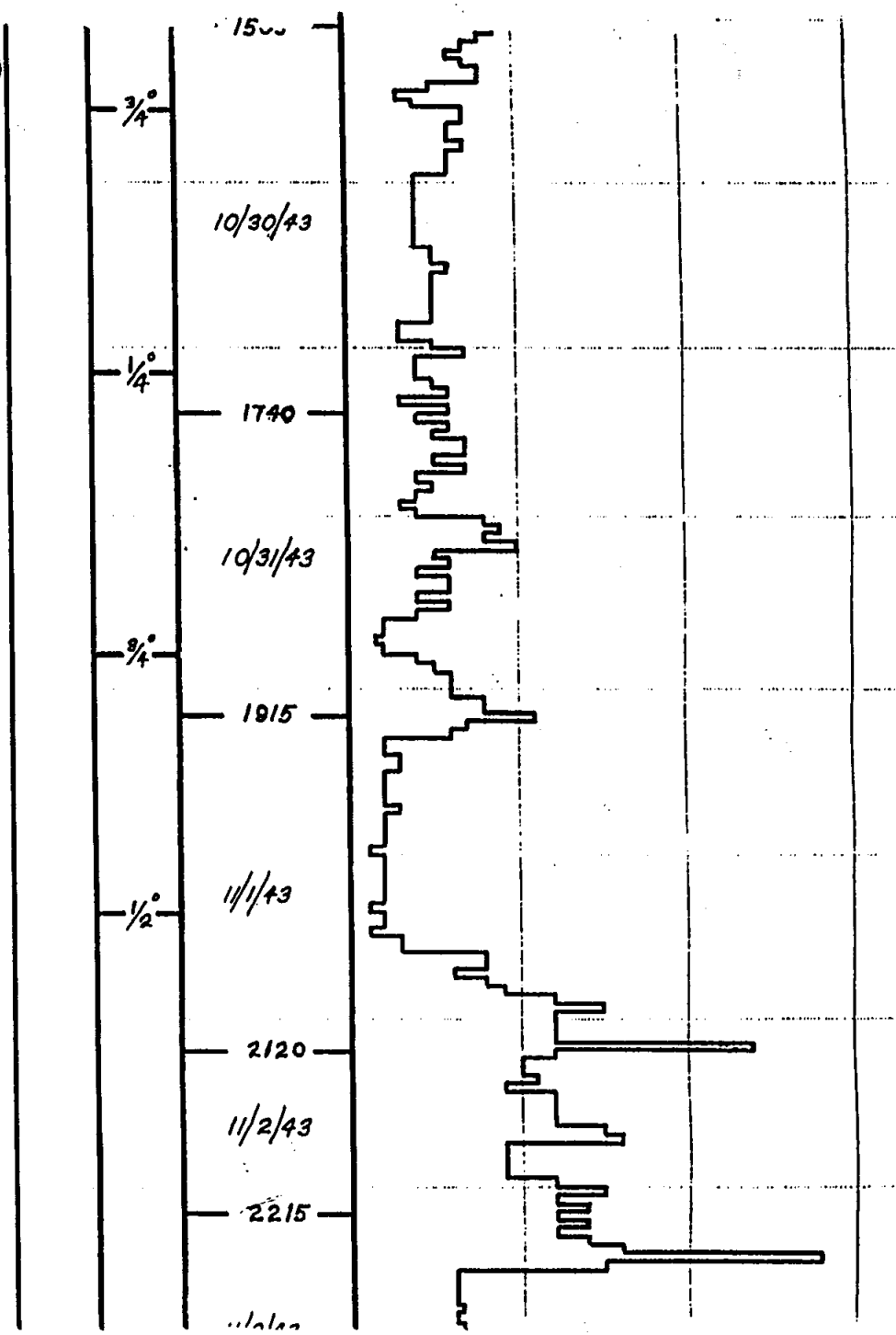
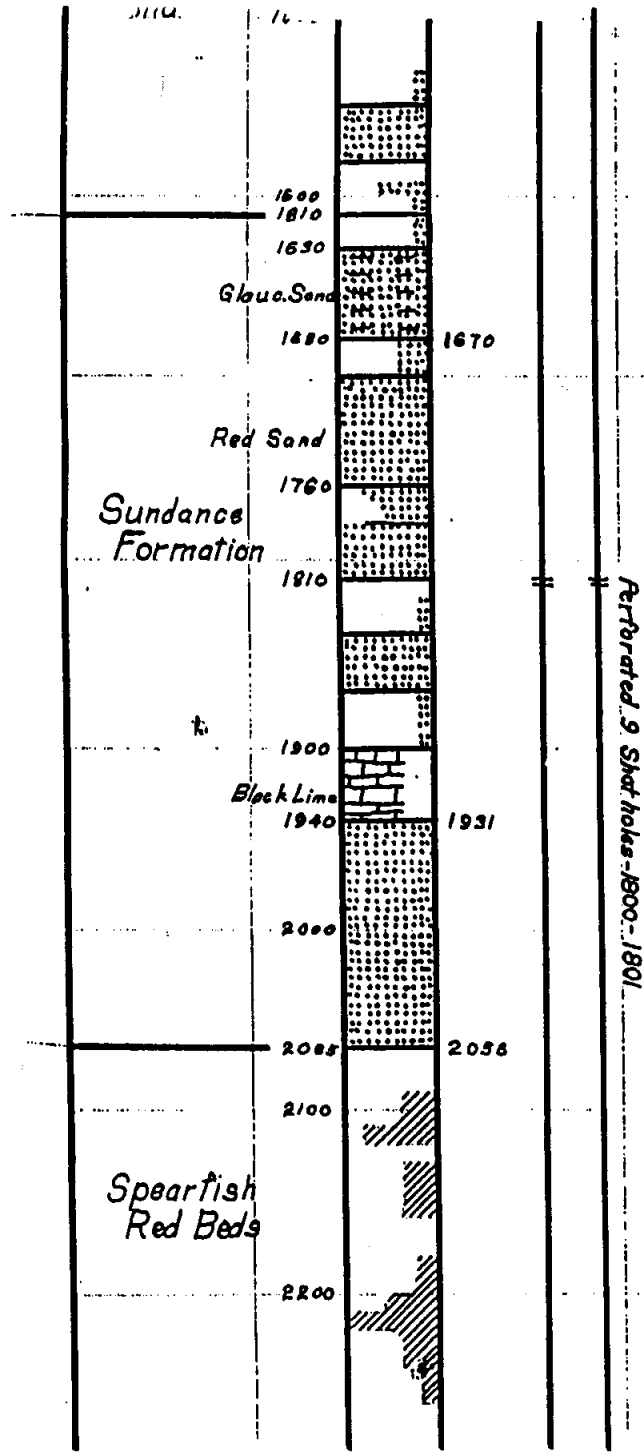
1318

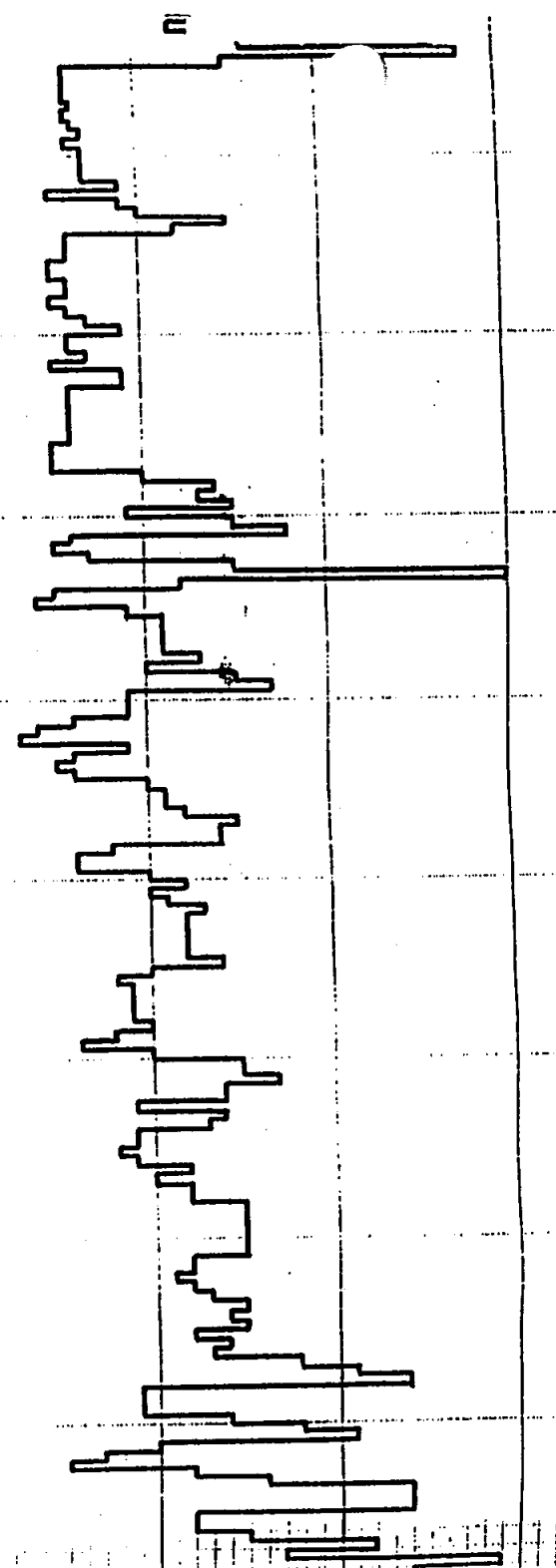
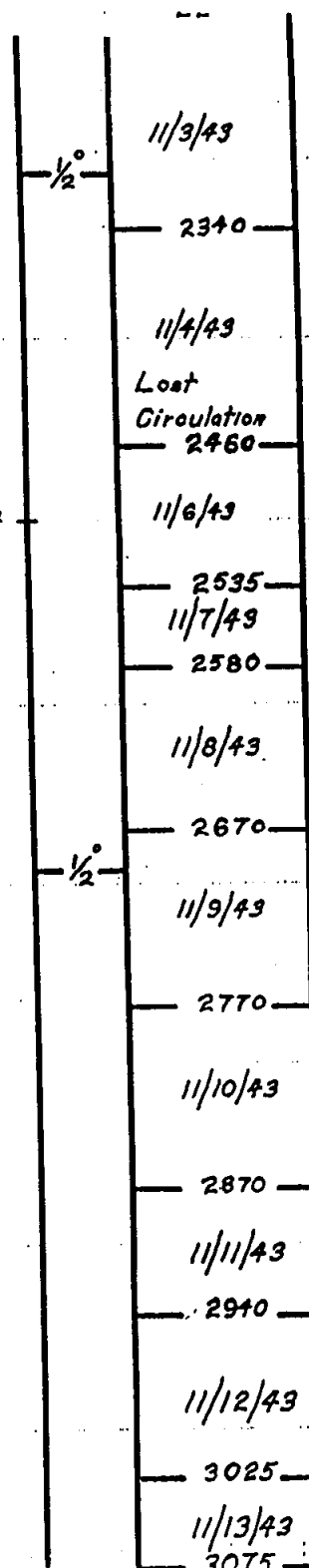
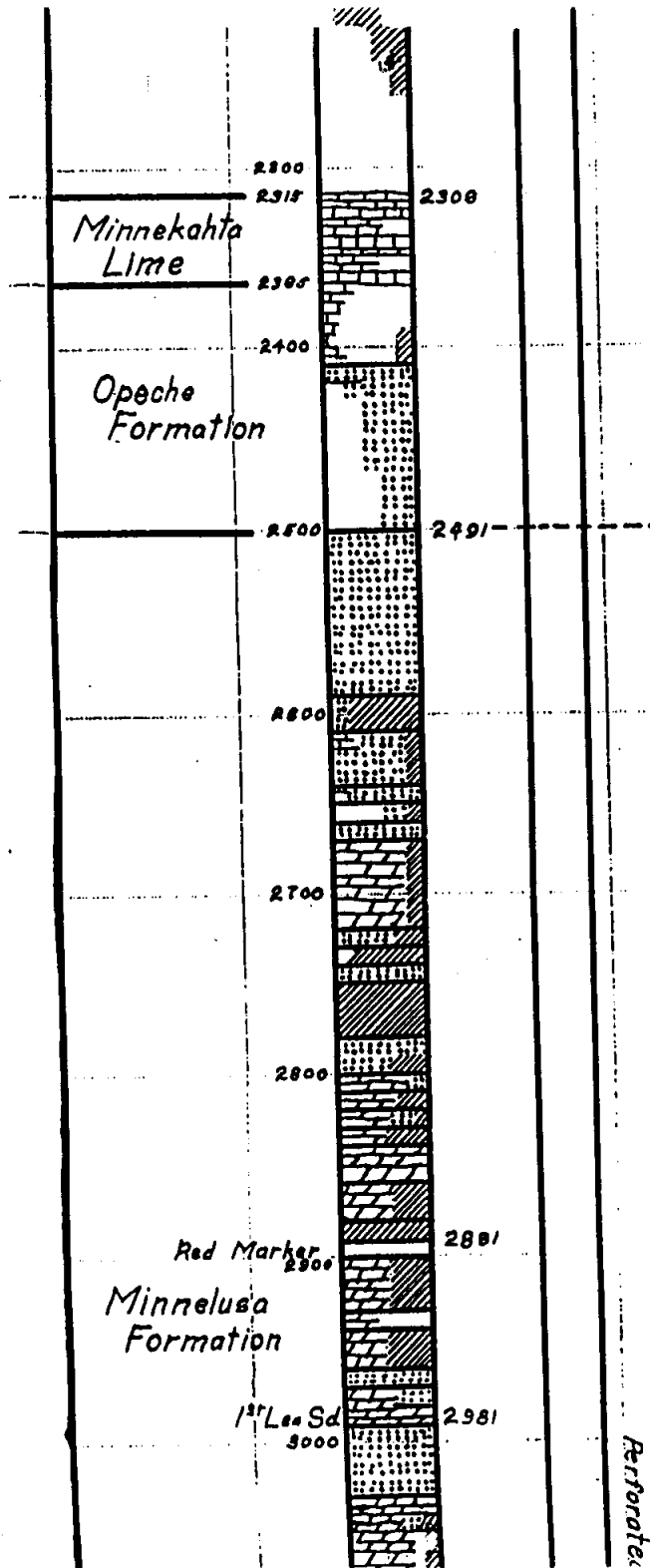
10/26/43

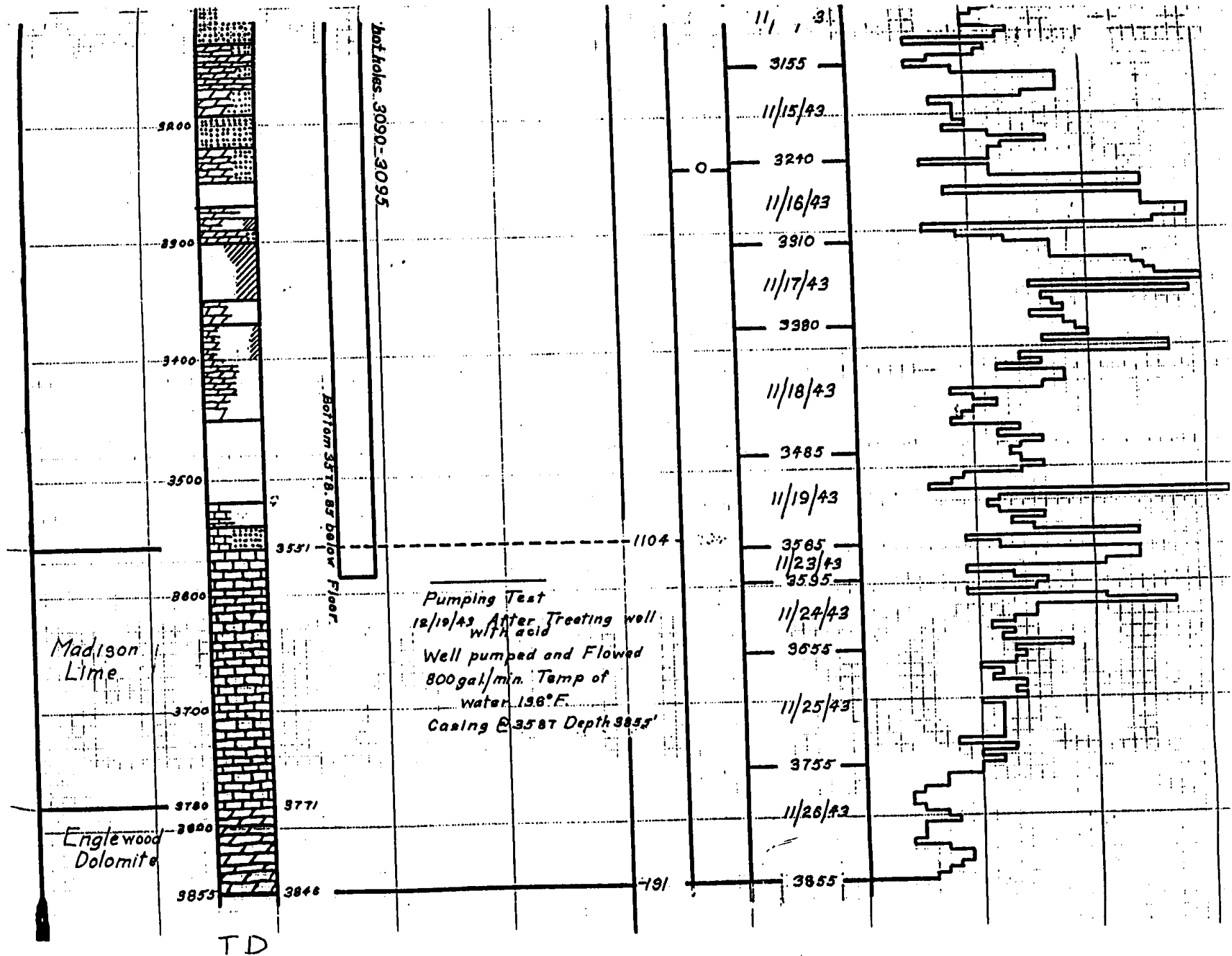
1394

10/27/43

1430







**APPENDIX C**  
**SUMMARIES OF INTERVIEWS**



**SUMMARY OF TELEPHONE INTERVIEW WITH H.L. DEANS**  
**DATE: JULY 8, 1993**

Mr. Deans was an ammunition inspector at BHAD from 1946-1947. Following his BHAD job, Mr. Deans became a Surveillance Inspector (Explosive Safety) for the Ordnance Corps and traveled to a number of ordnance sites for over 40 years.

At BHAD, the labor force was mainly Sioux Indian.

In 1946, 100 pound napalm bombs were sent to BHAD from Europe for reworking and disposal. Bombs were stored on the outside storage pads. There was an electrical storm in July of 1946 and a fire began on the storage pads. The episode began on July 4. The mess was cleaned up and the casings were burned and buried.

Small arms ammunition was stored in the warehouse area. No quantity distance requirements were in effect at that time for small arms. Small arms were destroyed by burning with scrap and wooden dunnage 30-50 caliber ammo was bulldozed into pits with waste oil and burned. Steel mats were placed over the pits to contain fragments. This method was call popping.

155 mm projectile disposal - the nose plugs were taken out and the shells were laid in rows of as many as 50 shells. Wind direction was very important. The base of the projectile face into the wind to prevent confinement of the TNT. Initially, the 155 mm TNT and Comp B filled shells did not have deep well cavities, later deep well cavities were used for supplementary charges and fuzes. If deep well cavities and bursters were present, the supplementary charge was removed first, prior to disposal.

The chemical projectiles had burster wells that were very long and filled with one of the following: 1) tear gas (CS); 2) smoke (HC); or 3) mustard gas (H). The nose plugs were removed at the maintenance area (demilitarization area) and the bursters were taken out at the demolition area.

Mustard rounds were stored at BHAD and when required were demilitarized at the disassembly plant before being sent to the burning ground. At the disassembly plant, fuzes and nose plugs were removed. The rounds were then sent to the burning ground. The casings were broken with a small explosive charge and then burned.

Propellants at the site included single, double, and triple based and rocket propellant.

May want to talk to Col. Vernon "Doc" Dehner who was in charge of the chemical area and later worked at Pine Bluff Arsenal. John Campbell in Madison, Indiana would be another good contact.

**SUMMARY OF TELEPHONE INTERVIEW WITH JOHN CAMPBELL**  
**DATE: AUGUST 12, 1993**

John Campbell was in the Safety Office at BHAD from 1957-1960.

During that period mustard bombs were stored in outside storage and within some of the igloos. Most of the H-filled ordnance stored outside was in covered sheds. CK and CG bombs were stored primarily within the igloos.

Surveillance and testing of chemical weapons was conducted in the Chemical Area and the Surveillance Area. The leakers were isolated and always placed in an isolated area.

Mr. Campbell believes the semi-circular area in the Chemical Area may have been used to dispose of liquid propellant. In 1957, UDMH was destroyed next to the Chemical Area.

Mr. Campbell didn't recall the destruction of chemical ordnance at Burning Ground 2. High explosives, projectiles, and propellant were definitely destroyed at #2. He did not recall the venting of chemical filled ordnance.

Some WP rounds were destroyed at #2. Demolition crews worried about WP rounds crusting over. This would not allow complete destruction of the WP.

Excelsior may have been used in the pit located near the Chemical Area. Does not recall the transfer of the H to the containers. An incinerator was built in the Chemical Area for the disposal of H. The U.S. Army Environmental Hygiene Agency came out but did not really want to get near the incinerator. Eventually they did suit up and sample. There was a diked area outside the building used as a leaching area and a washout facility to the east. Residue from the process in the leaching area was allowed to soak into the ground but he did not believe any contamination got out of the system.

The red tags found in the Chemical Area most likely came from chemical munitions. All of the chemical munitions had tags with similar warnings. During operations within the area, a heap of tags were generated as items were demilitarized.

**-SUMMARY OF INTERVIEW WITH LOUIS RICKARD**  
**DATE: AUGUST 18, 1993**

Louis Rickard worked at the BHAD from 1946-1967. During that time he worked two years with the Post Engineers and the remaining time he was a fireman.

Mr. Rickard didn't remember any disposal of munitions at Burning Ground #1. All leakers were taken to #2.

In 1946, the WP rounds were not stored outside the fence, but were stored in what TCT called Burning Ground #3. He did not know about disposal of the WP casings after the fire. Throughout his time at BHAD, WP rounds were shipped in and out of the facility. Sometimes WP was sold to industries.

He never stood standby at the incinerator during startup. The turkey sheds were for the mustard gas rounds. Mr. Rickard did not believe the circular berms near the chemical area were for hazardous materials and didn't recall any outdoor storage (except the turkey sheds) near Area 6000.

Bombs were disposed of at the Burning Ground #2. All chemical rounds went to Burning Ground #2. Does not remember if munitions were destroyed at other areas. A tracer test range for 50 caliber ammo was also present at #2. No additional testing of large caliber shells with cannons, etc., was ever conducted at BHAD. One fatality involving a mustard round occurred at #2. A round blew up in a persons face.

Mr. Rickard had never heard of an incinerator for cyanogen chloride or the storage or disposal of foreign chemical-filled ordnance.

An additional fatality occurred at the popping furnace.

Though most are dead, additional contacts include: Reihnhold Krien at Pueblo; Hugh Hutchinson in Gregory, SD; and Woodrow Hipsher in Wyoming. Firemen were trained to handle any situation and Mr. Rickard could not remember any serious accidents involving mustard burns or spills. Firemen brought all their own equipment with them when called to an incident. Fire extinguishers were in all the buildings, including the turkey sheds, but does not remember their presence at the mustard incinerator.

Had a dunnage yard for scrap. Metal scrap was also present in the southwest portions of the BHAD near Burning Ground #2 (indicated an area near the railroad tracks between Burning Grounds #2 and #3. Mr. Rickard didn't remember too much about it and didn't remember any burning at Burning Ground #1.

(Discussion of the dimensions of the bomb cradles for 10,000 and 12,000 pound bombs.)

During WWII an Italian prisoner of war camp was present at the BHAD and a larger number of military personnel were stationed at the BHAD. Following the war, the majority of the BHAD personnel were civilian including the Provost Marshal.

**SUMMARY OF INTERVIEW WITH ART LAWRENCE AND JAMES RICKARD**  
**DATE: AUGUST 19, 1993**

James Rickard worked at the BHAD from 1942-1966. He was absent from the depot for 3 years during and after World War II. During his early years he was in the depot Property Office. He was the 20th ordnance employee. In 1943, Mr. Rickard was sent to the Ammunition School for surveillance and demolition work. From 1949-1964 he wrote and approved all of the depot SOPs. In 1964, he was promoted to Chief of Administration and Planning and in 1965 acquired the job of Chief of Storage. In 1966, Mr. Rickard was transferred to Pueblo Depot and then to Savanna Depot where he retired from the Ordnance Department.

Mr. Art Lawrence worked at the BHAD from 1952 until 1965 when he was transferred to Savanna Ammunition Depot. At the BHAD, Mr. Lawrence worked in renovation as an explosive operator crew leader. He worked in the 4000 and 8000 Area and spent some time at the washout facility. When the mustard gas incinerator was constructed Mr. Lawrence was transferred to the Chemical Area.

Both individuals indicated that Mr. Roger Yardley was the best contact for information concerning the incinerator. He basically designed the system and later went on to design the incinerator at Johnson Atoll.

According to Mr. Rickard, Burning Ground #2 consisted of 12 pits originally 35 feet deep. The ordnance was placed in the pit and detonated. They never had to dig the pits deeper because detonations keep the pits at least 35 feet deep. There were some kickouts. Scrap was retrieved where possible and sold. Burned out fuzes may have been buried. In 1971, while he was in Provo, Mr. Rickard heard an explosion which he believed came from #2. He did not know what caused the explosion.

While at the Chemical Area, Mr. Lawrence would monitor the incinerator process. There were windows set up at three different doors and he could watch the punching process. No one could enter the area for any reason without prior authorization.

According to James and Art, lime was used for neutralization. The burned out shells were dipped in lime after burnout, water-rinsed, and paddled onto a conveyor belt. At the end of the conveyor, they were checked for contamination. If they tested positive for mustard, an X was placed on them and they were decontaminated and sent through the process until they were clean. The clean empty casings were placed in gondola cars and sold as scrap. All casings were to be certified as clean before they were sold as scrap. The decontaminating agent was actually a lime slurry.

The incinerator contained a scrubber system which was designed to contain H contamination. Sometimes they had problems with the smoke coming out of the incinerator. All workers wore rubber suits.

According to Mr. Rickard, Burning Ground #3 was used to destroy primarily fragmentation bombs. In 1946, prior to the fire, WP rounds were stored at this location.

Neither knew what location records referred to as "the venting area". The CK and CG bombs were not destroyed just by venting. CG gas was sometimes sold to vendors. Both believed the CK rounds were vented in the Chemical Area.

Twenty turkey sheds were present west of Area 8000. High explosives and anything that needed storage was stored in this area. The area between the igloos was also used for open storage.

Frequently, fragmentation bombs in outdoor storage would have to be defuzed in place. Mice would cut off the tap that held the fuzes in place.

If CK or CG bombs developed very high pressure, the bombs were detonated at the Burning Ground. The trucks were barricaded during the process.

Rocky Mountain Arsenal had the idea of transferring leaking mustard rounds to the arsenal. This was not cost-effective and the idea was abandoned. The Ordnance Department wanted to destroy all of the mustard bombs. It was decided not to have them in the stockpile any more. Not many leakers were actually present at the BHAD. Generally H leaked around the fuze well. These leakers were sent to the burning ground and were destroyed from the control barricade. In general, holes were blown in the casing. Igniters and dunnage was used in the process. Everything was blown all together.

The deactivation furnace was barricaded and used to destroy primers detonators and other components. The furnace heated hot and was actually a rotary kiln. The device had flights and rotated.

A popping furnace was present at Burning Ground 2 for small caliber ammunition.

The igloos in C Block and the turkey sheds were used for the storage of chemical filled ordnance. During World War II, they ran out of storage space and went to outdoor storage.

According to Art Lawrence, the H incinerator was modified for incineration of CK. The CK was vented, the base plate was removed then the ordnance went to the kiln. The casings were put in the kiln with the plug intact. The plug was blown out in the incinerator. Nothing was outside of the chain link fence. Some storage pads were to the south of the incinerator.

According to Art and James, canisters and bombs were the same thing. The canisters had no fuzes while the bombs still had them. The one-ton containers probably had something to do with Rocky Mountain Arsenal.

The pit present at the Chemical Area was used for the disposal of contaminated clothing and equipment. Kenny White might know more about that, but didn't know where he lived or if he was still living.

According to James Rickard, Burning Ground 1 was never used for ordnance, but Ellsworth may have burned UDMH there. More than likely, the chemical rounds found at the site are empty. Usually the bursters and the fuzes on the chemical rounds were removed. Bursters and fuzes were stored separated in a separate igloo.

One mustard round which contained a burster and fuze resulted in a fatality at BG #2. A worker attempted to defuze it with a hammer and chisel. The round exploded on him and covered him with mustard. He contaminated the emergency vehicles and personnel involved in the rescue. Several persons had H burns from the incident.

Salvage was placed on the railroad aprons especially on the western edge of the facility.

Paintings and some names on the igloos were placed there by the Italian POWs.

Vents, etc., on the igloo doors were for fire prevention. Vents could be closed and limited oxygen would be available to fuel a fire. When trying to destroy 2 igloos the vents were propped open. The fire however went out. The ventilation chimney was cut and once again, the fire went out. The igloo finally did blow and all but one wall fell in upon itself. Had to bulldoze the remaining wall.

Roger Yardley took movies of a lot that went on. Savanna Depot should have a lot of this information.

GB and VX rockets were stored at the BHAD. Storage only. 155 mm VX filled shells were not present at the Depot.

No known German chemical rounds were on site.

Discussed the various ponds, etc., associated with the incinerator:

- 6015 - Recycle pond - water recycled and purified before spraying (150 x 165')
- 6014 - Spray pond - water to cool the furnace. Pond was directly next to the furnace (85 x 110')
- 6017 - Condensate bed - may be from the valve going from the scrubber to the stack.

Leaching bed - the entire area was graded and sloped into the leaching bed to prevent contamination from runoff. The bed was lined with limestone gravel.

A decontamination area for leakers (may have been circular area described to them near the diked area) - contained the lime slurry. Whole pallets could be deconned here, then they were placed on the conveyor.

At the end of the kiln the casings were placed in a 30' x 20' vat. A chain conveyor would put them onto another track where they would be checked for contamination.

Large area with a limestone bed was for scrubber water and spraying equipment. The scrubber water was tested first then pumped into the scrubber. A dam was across the area. This area provided a reserve of water. The well couldn't pump as much as was needed.

An acid leaching bed was present in the X Area (10000 Area). During World War II they ran out of storage space and went to outdoor storage.

**SUMMARY OF INTERVIEW WITH MELVIN PORTER**  
**DATE: AUGUST 19, 1993**

Melvin Porter was a Munitions Handler and boiler man at the BHAD from 1965-1967. He also worked at the site during the initial construction from 1941-1942.

During the initial construction there were problems associated with the water. Initially, they trucked it to the site. Later water was provided at the BHAD but it was hot and tasted very bad.

When he worked at the facility from 1965-1967, Mr. Porter loaded ammunition out of the igloos and sent them off to other places. Small arms were also moved out. He moved a lot of big bombs. The chemical rounds were located in the turkey sheds. The nerve agent was already gone. All munitions were moved out block by block. Most of the ammunition was loaded onto box cars and was sent out by train.

There were no accidents when he was there. The ammunition workshop was still in operation. The igloos were blown up before he came to work at BHAD.

Francis Finkel did most of the detonation at Burning Ground #2.

Contaminated wood and big motors were put into big piles and open burned at Burning Ground #3. Not very much ordnance was disposed of at #3 while he was there. Mr. Porter didn't remember anyone dumping UDMH at this location.

Down in the renovation area powder was taken out of the shells. The powder was placed in cans, the lid placed on top, and sealed. All the powder was shipped out of the depot. All of the ammunition was shipped out of the facility.

Most of the salvage was put on the aprons near the railroad tracks. Chemical munitions were stored on dirt pads and were the first to be moved out.

The tracer test range was not used very much when he was there and the popping furnace was not used at all.

In general, when he was at the BHAD, he cleared the bombs out of the igloos and placed them in piles. Someone else hauled them away. They were basically trying to phase everything out when he was there. Everything was moved out and everything was cleaned. The igloos were swept with saw dust and checked for contamination.

Six people (including him) were used to clear Burning Ground #2. They worked in strips for 6 weeks. Nothing, including frag, was left on the surface to his knowledge. He never worked at Burning Ground #1.

The depot closed on June 30, 1967. Grain was stored at the depot after it closed. Few people are left out there.

**APPENDIX D**

**U.S. ARMY ENVIRONMENTAL HEALTH LABORATORIES  
INDUSTRIAL HYGIENE SURVEYS 1951, 1952, 1954**



OFFICE OF THE SURGEON GENERAL  
ARMY ENVIRONMENTAL HEALTH LABORATORY  
Building 330  
ARMY CHEMICAL CENTER, MARYLAND

GFS/gld

MEDEI 726.2  
(Black Hills Ordnance Depot)

INDUSTRIAL HYGIENE SURVEY NO. 765S171-51  
BLACK HILLS ORDNANCE DEPOT  
IGLOO, SOUTH DAKOTA  
13-14 JUNE 1951

1. Authority

a. AR 40-220, paragraphs 3c and 6a (4)(a); and SR 40-220-5, paragraph 4b.

b. Letter, Headquarters, Fifth Army, file AG 726.2 (ALFMD-P), subject: Industrial Hygiene Surveys, dated 23 May 1951, to Army Environmental Health Laboratory; and first indorsement, this Laboratory, file MEDEI 726.2, dated 28 May 1951.

c. CTA 1615, Headquarters, Army Chemical Center, Maryland, dated 31 May 1951.

2. Purpose and Scope

a. Purpose. To determine the presence and extent of any health hazards resulting from exposures incident to operations performed at the installation.

b. Scope. General industrial hygiene inspection of all activities; determination of the extent of exposures by means of material and atmospheric sampling; determination of existing control measures and their adequacy; recommendations as to methods of eliminating or controlling existing hazards.

3. Current Activities. Current activities at the installation, which employed approximately 1300 Civil Service workers, were chiefly those incident to receiving, inspecting, storing, identifying, segregating, reprocessing, preserving and packaging returned Ordnance general supplies; repairing, modifying and performing maintenance of Ordnance automotive vehicles; storing, inspecting, maintaining and issuing all classes of ammunition and explosives, including toxics; demilitarizing unsafe, obsolete and surplus ammunition and ammunition components.

BHADB-BHADB-27

#### 4. Findings and Recommendations

a. At the following operations it was judged that exposures were either too limited to constitute a health hazard or that other control measures in force were adequate to protect the health of the workers. No recommendations for improving conditions at these operations were considered necessary at the time of the survey.

<u>Location</u>	<u>Operation</u>	<u>Exposure</u>	<u>Controls</u>
Bldg. 1913	Sandblasting	Free silica	Mechanical general ventilation, BM-approved air-supplied sandblaster's helmets.
	Degreasing	Trichlorethylene	Slot type local exhaust ventilation, intermittent exposure, soda ash solution for cleaning sludge from tank.
	Cleaning metal parts	Stoddard solvent	Natural general ventilation, intermittent exposure.
Bldg. 1805	Stencilling	Organic vapors	Natural general ventilation, intermittent exposure, protective creams.
Bldg. 4008	Stencilling	Organic vapors	Natural general ventilation, applied by brush, protective creams.
	Cleaning threads of shells	TNT	Natural general ventilation, thread wiped with rag dipped in acetone.
Bldg. 4001	Woodworking	Wood dust	Local exhaust ventilation and dust collector.
Bldg. 4000	Charging batteries	Acid and alkali mists	Natural general ventilation, intermittent exposure, washing facilities, protective clothing.

<u>Location</u>	<u>Operation</u>	<u>Exposure</u>	<u>Controls</u>
Bldg. 3008	Break down of bombs	Tetryl dust	Gloves, protective clothing, natural general ventilation, washing facilities.
Bldg. 3032	Spray painting (2 booths)	Paint mist, thinner vapors	Water-curtain booth with local exhaust ventilation (operation not being performed at time of survey).
Apron 7	Spray painting bombs	Paint mists and thinner vapors	Out-of-doors, painter upwind from point of generation.
Toxic Gas Yard	Testing bombs for leakers	Mustard	Out-of-doors, impervious clothing, gas masks, deluge tank, calcium chloride, rotation of workers (every half hour on hot days), first aid kit.
Toxic Renovation Area	Spray painting	Paint mists and thinner vapors	BM-approved airline respirators, out-of-doors, intermittent operation.
Burning Ground	Destruction of contaminated bombs	Mustard	Isolated, out-of-doors, intermittent exposure, impregnated clothing and gas mask when wiring charges, remote control when firing.
Bldg. 2005	Spray painting vehicles and MHR	Paint mists and thinner vapors	BM-approved airline respirators, 3 wall exhaust fans, 4 intakes.
Bldg. 2003	Steam cleaning	Alkali mists	BM-approved airline respirators, mechanical general ventilation.

<u>Location</u>	<u>Operation</u>	<u>Exposure</u>	<u>Controls</u>
Bldg. 2003	Testing and tuning engines	Carbon monoxide	Mechanical general ventilation, intermittent exposure.
	Battery charging	Sulfuric acid and acid mists	Mechanical general ventilation, protective clothing, intermittent exposure, washing facilities.
Bldg. 2012	Arc and acetylene welding	Metal fumes, oxides of nitrogen, ultraviolet, infrared and intense visible radiation	Natural general ventilation, face shields, goggles, protective clothing, portable screens, intermittent exposure.
	Forging	Metal fumes, carbon monoxide	Gravity exhaust stack, intermittent exposure.
Bldg. 2031	Woodworking	Wood dust	Local exhaust ventilation, dust collector.
	Cleaning refrigerator parts	Carbon tetrachloride	Small amounts used (2 gal/year), natural general ventilation.
	Arc and acetylene welding	Metal fumes, oxides of nitrogen, ultraviolet, infrared and intense visible radiation	Natural general ventilation, intermittent exposure, face shields, goggles, protective clothing.
	Brush painting	Paint pigments, thinner vapors	Natural general ventilation, intermittent exposure, washing facilities.
	Disposal of fluorescent tubes	Beryllium phosphor	Buried in sanitary fill, intermittent exposure.

<u>Location</u>	<u>Operation</u>	<u>Exposure</u>	<u>Controls</u>
Bldg. 2009	Warming Diesel locomotives	Oxides of nitrogen, carbon monoxide, aldehydes	Gravity exhaust stacks, intermittent exposure of short duration.
	Cleaning metal parts	Diesel fuel	Natural general ventilation, protective cream, intermittent exposure.
	Cleaning electrical parts	Carbon tetrachloride	Natural general ventilation, intermittent exposure, small amounts used.

b. Operations at which it was judged that control measures were inadequate, or that detailed studies were necessary to ascertain their adequacy, are listed below. Appropriate discussion of inadequacies and studies conducted, including recommendations for corrective action where indicated, are given for each operation listed.

(1) Location: Building 1813

Operation: Spray painting fin assemblies.

Exposure: Paint mists and thinner vapors.

Findings: The operation was performed in a commercial water-fall type paint booth, the face dimensions of which were approximately 8 by 10 feet. The fin assemblies were carried through the booth on a monorail, but because of the fin size, the sides of the booth had been removed. The rate of air-flow in the breathing zone of the operator was found to be 80 feet per minute instead of the recommended minimum velocity of 150 feet per minute. It was reported that this operation would be completed by 13 June 1951 at which time the sides of the booth would be replaced. It was planned to have only a narrow opening on either side of the booth for the monorail and the small items that would be suspended from it while they were being spray painted. For respiratory protection the painter was wearing a chemical cartridge type respirator.

Discussion: The chemical cartridge type respirator does not provide adequate protection from toxic pigments that may be contained in the paint. The Chemical Corps assault type gas mask will provide adequate protection since it contains an adequate mechanical filter which removes paint pigments and also a charcoal filter for removal of organic vapors, but it is uncomfortable to wear and the lenses become covered with paint spray which interferes with visibility.

**FINDINGS:** Ammunition cans, carried by monorail conveyor, were dip-painted with rust inhibiting paint, then pre-dried in a ventilated oven. Drying was completed in an unventilated infra-red oven. Atmospheric tests made in the area were generally low excepting near the painting tank (see Table attached). Personnel were not working over the tank, and the concentration of vapor was nil at the nearby air-jet drying station. The end doors were opened frequently to load and unload trucks and fresh air entered to dilute the vapors. However, this also resulted in cooling the air to the point of discomfort for workers located near these doors.

**DISCUSSION:** Under the present conditions no health hazard was judged to exist. However, a hazardous condition may arise when modifications in the building are made in order to conserve heat unless lateral exhaust ventilation is provided for the tank.

**RECOMMENDATION:** When the building is modified to conserve heat, the paint tank should be provided with a lateral exhaust system such that 50 cfm of air per square foot of tank surface area will be exhausted or the operators of the dip tank should be provided with M-approved chemical cartridge respirator.

(2) **LOCATION:** Building 3038

**OPERATION:** Spray painting, stencilling and drying ammunition boxes

**EXPOSURE:** Thinner vapors

**FINDINGS:** Atmospheric tests were made of the concentration of solvent thinner vapor in building 3038 produced by the paint drying ovens and stencilling of ammunition boxes (see Table attached). These concentrations were generally low because the paint thinner contained a large percentage of slow drying petroleum hydrocarbons of relatively low toxicity and there was a high rate of air dilution produced by two ventilated spray painting booths being used there.

Airflow measurements were made of the spray painting booths to determine their performance. It was found that the velocity of the air flowing into the faces of the two 8 ft. by 8 ft. painting booths averaged 100 fpm whereas the recommended minimum was 150 fpm. Two possible errors in design were noted which might account for the low airflow in these booths. It was observed that the weather canopies were installed too close to the top of the exhaust ducts. It is good practice to place canopies a minimum distance of between two-thirds to one diameter of the duct above the top. Excessive pressure loss results when they are placed less than this distance. However, it did not appear that correction of this error would have resulted in sufficient improvement in airflow to correct fully the deficient velocity. It must therefore be concluded that either the booth was not designed for 150 fpm air velocity, or if this was intended, no provision was made in design to compensate for the altitude.

Velocity measurements were made of vapor contaminated air being discharged from conveyor openings in two tunnel-type drying booths. Each booth was equipped with two horizontal propeller type unit heaters which forced room air into the booths. A common stack equipped with a damper exhausted a portion of the contaminated air to the outside by gravity. The remainder of the air returned to the room. In one booth both unit heaters were operating, while in the other only one was operating. The average velocity of air coming from three conveyor openings located near operating unit heaters was 210 fpm. The velocity was 115 fpm from the opening near the non-operating unit heater. No measurements were made of the air velocity in the exhaust stack. It would be advisable to control the contaminated air coming from the drying booths by installing hoods to recirculate the air.

RECOMMENDATIONS: FIRST, increase the airflow in the spray painting booths to produce an average air velocity through the faces of 150 fpm. To do this, raise the weather canopies a minimum distance of two-thirds to one pipe diameter above the top of the exhaust ducts, and increase the speed of the exhaust fans to compensate for the higher altitude. If necessary install larger motors and fans. SECOND, install sheet metal hoods around conveyor openings and connect them to plenum enclosures over the unit heaters to recirculate air and control vapor. To do this, make slots two to three inches wide on the inside of the hoods around the openings in the oven. The air velocity in these slots should be about 1000 to 1500 fpm. The velocity in the hoods and duct work should be 1000 to 1200 fpm. AEHL Plate No. 259 is inclosed showing a proposed method whereby this can be done.

(3) LOCATION: Building 6000

OPERATION: Handling chemical ammunition

EXPOSURE: Mustard gas

FINDINGS: In the mustard gas area W70 bombs were prepared for shipment to a renovation line located at a Chemical Corps installation. Arster wells in these bombs were corroded and needed replacing. Care was therefore required in handling and workers were furnished gas masks and protective clothing to wear. Special procedures were used in handling defective leaking bombs and decontaminating chemicals were available for use in emergencies. However, a number of burns had been reported. Change house facilities in building 6000 were minimal. Water supply was brought in by five gallon cans hence showers and wash basins were lacking. Outhouses served for toilet facilities.

RECOMMENDATION: Furnish a properly equipped portable or fixed change-house provided with washing and shower facilities. Provide adequate Chemical Corps equipment for handling defective ammunition and decontamination work.

6. Future Projects. Facilities were being prepared in Building 3046 to demilitarize 105mm shells filled with amatol. Standard Ordnance Corps

Black Hills Ord Depot) Sur #1315S365-52 dtd 16 Dec 52  
drawings were being followed in the construction of this installation.  
The washout tank would be provided with a hood and it would be ventilated.  
Three settling tanks following it would be open. Final disposal of waste  
water would take place on a settling pond located near the building.

7. If engineering assistance is desired in the design of ventila-  
ting systems for the control of industrial hazards, or in the control  
and disposal of industrial waste, it will be given upon request through  
channels. Assistance may also be obtained in the same way upon an  
occupational vision program.

1 Incl  
Plate #259

CHRISTIAN F. BERGHOUT  
Engineer, Industrial Hygiene

APPROVED:

WESLEY C. COX  
Colonel, MC  
Commanding



5011412-1000  
INDUSTRIAL HYGIENE SURVEY NO. 1765S98-54  
BLACK HILLS ORDNANCE DEPOT  
IGLOO, SOUTH DAKOTA  
4-5 AUGUST 1954

1. Authority

- a. Paragraphs 3c and 6a (4) (a), AR 40-220; and paragraph 4b, SR 40-220-5.
- b. Letter, MEDEI 726.2, Army Environmental Health Laboratory, dated 22 March 1954, subject: "Industrial Hygiene Surveys", to the Commanding General, Fifth Army; and indorsements thereto.

2. Purpose and Scope

The purpose of this survey was to determine the presence and extent of any health hazards resulting from exposures incident to operations performed at the installation. The survey included general industrial hygiene inspection of all activities; determination of the extent of exposures, where indicated, by means of collection and analysis of appropriate samples and other tests; and determination of existing control measures and their adequacy. Recommendations for eliminating or controlling existing hazards are given in this report.

3. Current Activities

Operations at the depot were being carried on by approximately 800 civilian employees and 12 military personnel. Current activities included bulk storage of general Ordnance supplies and ammunition including certain Chemical Corps items; renovation of ammunition; surveillance function testing of lot samples of ammunition to establish their degree of serviceability; and normal administrative and maintenance operations.

4. Abbreviations. The following abbreviations of technical and other terms are used in this report:

- a. BM-approved - approved by the United States Bureau of Mines.
- b. MHE - materials handling equipment.

2. Survey of the operations listed in this part of the report indicated that the measures shown in the column headed CONTROLS PRESENT were adequate to protect the health of the workers against the exposures noted. Therefore, no recommendations for improving conditions at these operations were considered necessary at the time of the survey.

LOCATION AND OPERATION	EXPOSURES	CONTROLS PRESENT
Bldg. 209 - Round House Repair and maintenance of Diesel locomotives	Greases, oils	Washing facilities.
Metal cleaning	Stoddard solvent	Natural ventilation, intermittent exposure, washing facilities.
Operating Diesel engines	Sulfur dioxide, carbon monoxide, aldehydes, oxides of nitrogen	Gravity exhaust stacks to out-of-doors, inter- mittent exposure.
Filling sand boxes	Siliceous dust	Intermittent exposure, enclosed operation, BW-approved all dust respirator.
Bldg. 1812 - Engineer Heavy Equipment Shop Repair and maintenance of heavy Engineer equipment	Greases, oils; Stoddard solvent	Washing facilities; natural ventilation, intermittent exposure.
Arc and acetylene welding	Ultraviolet, infra- red, and intense visible radiations; oxides of nitrogen, metal and flux fumes	Screens, goggles, face shields, gloves; natural ventilation, intermittent exposure.
Operating gas and Diesel engines	Carbon monoxide, sulfur dioxide, aldehydes, oxides of nitrogen	Flexible tailpipe extensions to the outdoors. Intermittent exposure.
Bldg. 3008 Pull apart of 75 mm projectiles	Nitro cellulose	Powder uniforms, local exhaust ventilation.
Removing primer from casing	Black powder dust	Powder uniforms, gloves, natural ventilation.
Fuze removal	Explosive D (ammonium picrate)	Natural ventilation, gloves, powder uniforms.

Bldg. 3038

Spray painting bombs

Paint mists and thinner vapors

Spray paint booth with exhaust ventilation through water curtain.

Drying painted parts

Thinner vapors

Hot air drying oven with gravity exhaust stack.

Abrasive cleaning

Paint and metal dusts

Exhaust ventilated cabinets.

Bldg. 6045 (Semi Open)  
Segregation of leaking bombs

Mustard gas

Gas mask, impregnated clothing, boots and gloves.

Burning Ground  
Disposal of leaking bombs

do.

Personal protective clothing, gas masks, outdoors.

Bldg. 2001 - MHE Shop  
Repair and maintenance of MHE

Greases, oils;  
Stoddard solvent

Washing facilities, intermittent exposure, natural ventilation.

Operating gasoline engines Carbon monoxide

Mechanical general exhaust ventilation in each bay.

Acetylene welding

Ultraviolet and intense visible radiations, metal and flux fumes, oxides of nitrogen

Goggles, natural ventilation, intermittent exposure.

Bldg. 2003 - Automotive Maintenance Shop  
Light machining

Greases, oils

Washing facilities.

Testing and tuning gasoline engines

Carbon monoxide

Mechanical general exhaust ventilation in each bay.

Repair and maintenance of automotive vehicles

Greases, oils;  
Stoddard solvent

Washing facilities; natural ventilation, covered tank for solvent.

Acetylene welding

Ultraviolet and intense visible radiations, metal and flux fumes, oxides of nitrogen

Goggles, natural ventilation, intermittent exposure.

Battery charging

Sulfuric acid, acid mists

Soda solution, goggles, gloves, apron, local exhaust ventilation.

# LOCATION AND OPERATION

## EXPOSURES

## CONTROLS PRESENT

Bldg. 2003 - Automotive  
Maintenance Shop (cont'd.)  
Filling batteries

Sulfuric acid and  
acid mists

Enclosed operation,  
natural ventilation.

Bldg. 2037  
Steam cleaning

Steam, alkali mist

Boots, gloves, apron,  
natural ventilation.

Bldg. 2012 - Machine Shop  
General machining

Greases, oils,  
coolants

Washing facilities.

Arc and acetylene  
welding

Ultraviolet, infra-  
red and intense  
visible radiations;  
oxides of nitrogen,  
metal and flux fumes

Screens, goggles, face,  
shields, gloves, apron,  
natural ventilation.

Washing parts

Stoddard solvent

Natural ventilation,  
covered tank,  
intermittent exposure.

Bldg. 2005 - Body Shop  
Vehicular body repair

Lead and other  
metal dusts

Natural ventilation,  
intermittent exposure.

Spray painting  
(touch-up work)

Paint mists and  
thinner vapors

Chemical Corps X5 paint  
spray respirator, inter-  
mittent exposure.

Acetylene welding

Ultraviolet and  
intense visible  
radiations, metal  
and flux fumes,  
oxides of nitrogen

Intermittent exposure,  
goggles and natural  
ventilation.

Bldg. 4001 - Carpenter Shop  
Woodworking

Wood dust

Local exhaust ventilation  
of all machines.

Bldg. 4000  
Charging Edison type  
batteries

Alkali mist

Running water,  
natural ventilation.

Igloo Area  
Maintenance, inspection, CW agents  
testing and sampling  
of chemical ammunition

Personal protective  
equipment and gas masks,  
exhaust fan attached to  
ventilator when required.

...with gravity exhaust ventilation, and the operators were wearing powder uniforms and gloves. The present operating procedure required the manual handling of the explosive, resulting in skin contact.

**RECOMMENDATION:** If feasible, modify the operation to eliminate the need for continuous manual tapping and pouring, thus avoiding skin contact with Composition B.

6. If engineering assistance on ventilation or review of plans is desired on projects for the control of toxic or irritating materials, it will be furnished by this laboratory upon request through channels.

CHRISTIAN F. BERGHOUT  
Engineer, Industrial Hygiene

J. ROBERT HEARD  
2nd Lt., MSC  
Industrial Hygienist

APPROVED:

JOSEPH H. MENDICH  
Colonel, MC  
Commanding

TO: Commanding Officer, Chemical Corps Materiel Command, 200 West  
Baltimore Street, Baltimore 1, Maryland

1. In compliance with request in basic communication an inspection has been completed on all lots involved in the Bombs listed in paragraph 1. The inspection reveals all lots to be in Condition Reservation Code 4.
2. All quantities on hand are in balance with listed Bombs in paragraph 1 with the exception of item RL4-5-945. Four Bombs were destroyed due to hazardous condition leaving a balance of 7,523.

FOR THE COMMANDING OFFICER:

WOODROW W. HIPSHER  
Assistant

**APPENDIX E**

**REPORT OF ANNUAL LIGHTENING PROTECTION SYSTEM,  
IGLOO STORAGE, SEPTEMBER 4, 1945**

SUBJECT: Report of Annual Inspection of Lightning Protection Systems  
(RCS OADOU-6)

THRU: Ordnance Field Safety Office  
U. S. Army  
Box 600  
Jeffersonville, Indiana

TO: Chief of Ordnance  
Washington 25, D. C.  
ATTN: OADOU

REFERENCE: OADM 7-224, dtd 4 Sep 1951, per 521a

1. In compliance with reference listed above, the following report is submitted covering the annual testing of lightning protection systems for buildings and magazines in the restricted area of this depot.

<u>BLDG. NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST. (IN GRMS)</u>	<u>REMARKS</u>
A-104	5-4-53	S/T Am	Air terminal #1	11	Repair
A-503	"	Mortar Shell	Air terminal #1 missing		Replace
A-903	"	Frag. Bomb	Air terminals #1, 2, 3 and 4	14	Repair
B-602	5-11-53	"	Air terminals #1, 2, 3, 4, and 5	18	"
B-603	"	Empty	Air terminal #1	13	"
B-606	"	Group B, Chemical Am	Air terminals #1, 2, and 5	12	"
B-701	5-12-53	"	Air terminals #2, 4 and 5	14	"
B-702	"	"	Air terminal #1	18	"
B-705	"	"	Air terminals #3, 4 and 5	12	"

- BHAD6-28



SUBJ: Report of Annual Inspection of Lightning Protection Systems  
(HCS OADGU-6)

<u>BLDG. NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST. (IN OHMS)</u>	<u>REMARKS</u>
B-706	5-12-53	Group B, Chemical Am	Air terminal #2	11	Repair
B-708	5-13-53	"	Roof vent	Open circuit	"
C-203	5-15-53	Group B, Chemical Am	Air terminal #4	"	"
C-306	5-18-53	"	Air terminal #4 and 5	"	"
C-307	"	"	Air terminal #1, 2 and 3	23	"
E-206	5-29-53	GP, Bombs	Door vent	Open circuit	"
E-208	"	Fixed Am	Air terminal #4	"	"
E-212	"	GP, Bombs	"	"	"
E-213	"	Bulk, TNT	"	"	"
E-214	"	GP, Bombs	Air terminal #4, Roof vent	12 12	" "
E-308	"	Prop. Chgs.	Air terminal #1	11	"
E-309	"	GP, Bombs	Air terminal #2	Open circuit	"
E-407	"	Fixed Am	Roof vent	"	"
E-415	"	"	Air terminal #4 Roof vent	11 11	" "
E-506	6-1-53	Frag. Bombs	Air terminal #2	11	"
F-207	6-4-53	Fixed Am	Roof vent	Open circuit	"

<u>BLDG. NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST. (IN OHMS)</u>	<u>REMARKS</u>
G-608	6-10-53	Bulk Propel- lant	Roof vent	Open Cir- cuit	Repair
G-808	6-11-53	"	Air terminal #2 and 4	"	"
G-1001	6-12-53	"	Air terminal #2 and 3	"	"
G-1003	"	Group A. Chemical Am	Air terminal #2	"	"
G-1006	"	"	Air terminal #1 and 2	"	"
G-1008	"	"	Air terminal #4	"	"
G-1011	"	"	Roof vent	"	"
G-1202	"	"	Air terminal #4	12	"
G-1302	"	Prop. Chgs.	Air terminal #4 Roof vent	Open Cir- cuit	"
H-302	6-15-53	Fixed Am	Roof vent	"	"
H-307	"	"	Air terminal #2 and 3	"	"
H-409	"	"	Air terminal #2	"	"
H-506	"	GP. Bombs	Roof vent	"	"
H-606	"	Practice Rockets	"	"	"
H-703	6-16-53	Fixed Am	Door vent	"	"
H-706	"	Prop. Chgs.	Roof vent	"	"
H-710	"	Fixed Am	Air terminal #4	"	"

ORDKC-1  
SUBJ: Report of Annual Inspection of Lightning Protection System  
(HCS ORDCU-6)

<u>BLDG. NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST. (IN OHMS)</u>	<u>REMARKS</u>
H-803	6-16-53	GP. Bombs	Roof vent	Open circuit	Repair
H-807	"	Bulk Propellant	Air terminal #2	"	"
H-1007	"	Fuzes	Roof vent	"	"
J-105	6-18-53	Demo. blocks	"	"	"
J-203	"	"	Air terminals 1, 2 and 3	"	"
J-207	"	Fixed Am	Roof vent	"	"
J-210	"	Separate loading shell	Air terminal #2	"	"
J-217	"	HE, Rockets	Air terminal #3 Roof vent	"	"
J-218	"	Fixed Am	Air terminal #2	"	"
J-308	"	Prop. Chgs.	Roof vent	"	"
J-312	"	"	Air terminal #2	"	"
J-314	6-19-53	"	Air terminal #3 Door vent	"	"
J-317	"	HE, Rockets	Roof vent	"	"
J-318	"	Empty	Air terminal #4	"	"
J-402	"	Fixed Am	Air terminal #2	"	"
J-404	"	Prop. Chgs.	Door vent	"	"
J-405	"	S/T Am	Roof vent	"	"
J-415	"	Prop. Chgs.	"	"	"

<u>BLDG. NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST. (IN OHMS)</u>	<u>REMARKS</u>
J-416	6-19-53	Group A, Chemical Am	Door vent	Open Cir- cuit	Repair
J-417	"	Frag. Bombs	Air terminal #4	"	"
J-502	"	Separate loading Shell	Door vent	"	"
J-503	"	"	"	"	"
J-507	"	Frag. Bombs	Air terminal #4 Roof vent	" "	" "
J-513	6-22-53	Fuses	Air terminal #3	"	"
J-609	"	Prop. Chgs.	Air terminal #2	"	"
J-707	"	Fixed Am	"	"	"
J-708	"	Fuses	Air terminal #4	"	"
S-108	"	SAA	Lower vent #8 Lower vent #14	" "	" "
S-201	6-23-53	"	Vertical drain #4	"	"
S-208	"	"	Vertical drain #1	"	"
3031	"	Work Shop	Mast #1	24	"
3033	"	"	Mast #2	11	"
3039	"	"	Mast #2	11	"
3037	"	"	Mast #1	13	"
3048	"	"	Mast #1	13	"

2. The test on all other lightning protection systems in the restricted area resulted in readings of less than 10 Ohms.

3. It is advised that necessary action has been taken to correct the deficiencies as listed.

ROY B. SOUTHWORTH, JR  
Lt Col, Ord Corps  
Commanding

CONCURRENCES:

Dictator: hds

Ch. AIO: abc

ORDKC-L600-25/27/56

Igloo,

XXXXXX

SUBJECT: Report of Annual Inspection of Lightning Protection Systems  
(PCS OREGU-6)

THRU: Ordnance Field Safety Office  
U. S. Army  
Box 600  
Jeffersonville, Indiana

TO: Chief of Ordnance  
Washington 25, D. C.  
ATTN: OREGU

REFERENCE: ORDM 7-224, dtd 4 Sep 1951, par. 321a

1. In compliance with reference listed above, the following report is submitted covering the annual testing of lightning protection systems for buildings and magazines in the restricted area of this depot.

# IGLOG MAGAZINES

BLDG NO.	DATE OF INSPECT.	CONTENTS	IDENT. OF PART OF SYSTEM	RESIST- ANCE (IN OHMS)	REMARKS
A-201*	5-5-52	TNT	Roof vent	Open circuit	Repair
A-404*	"	"	" "	" "	"
A-703*	"	Hvy AT, HE, Mines	Air terminal #3	" "	"
A-1407*	5-6-52	Frag Bombs	Roof vent	" "	"
A-1408*	"	Hvy AT, HE Mines	Roof vent air terminal	" "	"
B-401A	5-7-52	Aircraft Par- achute Flares	Roof vent	" "	"
C-604**	5-12-52	Chem Bomb Group B	Air terminal #2	----	Replace
C-615B	5-13-52	Safety Fuse	Roof vent	Open circuit	Repair
D-310*	"	Hvy AT, HE Mines	Door	" "	"

SUBJ: Report of Annual Inspection of Lightning Protection Systems  
(RCS ORDGU-6)

<u>BLDG NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST- ANCE (IN OHMS)</u>	<u>REMARKS</u>
D-503*	5-15-52	Hvy, AT, HE, Mines	Air terminal #2	15 ohms	Repair
D-606**	5-20-52	Chem Shell Group (A)	" " "	Open circuit	"
D-609**	"	"	Air terminals #3, #4. Roof vent	27 ohms	"
D-712*	"	Block demo	Roof vent	"	"
E-107***	5-21-52	Prop Chg	Air terminals #2, #3.	30 ohms	"
E-109*	"	Frag Bomb	Roof vent	Open circuit	Repair
E-204*	"	"	" "	" "	"
E-212*	5-26-52	GP Bomb	Air terminal #2 missing	----	Replace
E-301***	"	Prop Chg	Air terminal #1 missing	Open circuit	Repair
E-310	"	Empty	Air terminal #3 missing	----	Replace
E-316*	"	G.P. Bomb	Air terminal #2 missing	Open circuit	Repair
E-508*	5-27-52	8" Shell HE.	Door & air terminal #1	12 ohms	"
"	"	"	Air terminal #2	24 ohms	"
E-601***	"	Prop Chg	Air terminal #1	Open circuit	"
E-606***	"	"	" " "	12 ohms	"
"	"	"	Air terminal #2	Open circuit	"
F-202*	5-28-52	75mm HE	Air terminal #3	" "	"
F-505*	"	Hvy Mines	" " "	" "	"
F-904*	5-29-52	75mm	Air terminal #2	" "	"

**SURJ: Report of Annual Inspection of Lightning Protection Systems**  
(RCS OFDGU-6)

<u>BLDG NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST- ANCE (IN OHMS)</u>	<u>REMARKS</u>
F-1007*	5-29-52	Frag Bomb	Air terminals #3, #4, roof vent.	Open circuit	Repair
F-1105*	"	75mm, HE	Roof vent	" "	"
F-1107*	"	Frag bomb	Air terminal #1	" "	"
F-1202*	"	75mm, HE	Roof vent	" "	"
F-1203*	"	Rifle Grenade	Air terminal #4	" "	"
F-1204	6-2-52	Empty	Air terminals #2, #3, #4.	12 ohms	Repair
F-1304*	"	Frag Bomb	Door, all air terminals & roof vent	Open circuit	"
G-102***	"	Bulk pwr	Air terminal #3	" "	"
G-601***	6-6-52	"	Air terminals #2, #3, #4	16 ohms	"
G-605***	"	Prop Chg	Roof vent	Open circuit	"
G-707	"	Empty	Air terminals #1, #3, #4, #5, roof vent	12 ohms	"
G-708*	"	GP Bomb	Air terminal #1	Open circuit	"
G-801**	"	Chem, Shell, Group A	Door	24 ohms	"
"	"	"	Air terminal #1	12 ohms	"
G-804*	"	GP Bomb	Air terminals #1, #2, #3, #4, #5.	12 ohms	"
"	"	"	Roof vent	26 ohms	"
G-1101**	6-13-52	Chem, Shell, Group A	Door	24 ohms	"
"	"	"	Air terminal #3	20 ohms	"



SUBJ: Report of Annual Inspection of Lightning Protection Systems  
(ECS ORDGU-6)

<u>BLDG NO.</u>	<u>DATE OF INSPECT.</u>	<u>CONTENTS</u>	<u>IDENT. OF PART OF SYSTEM</u>	<u>RESIST-ANCE (IN OHMS)</u>	<u>REMARKS</u>
G-1103**	6-13-52	Chem, Shell, Group A	Door & air terminal #1	14 ohms	Repair
"	"	"	Air terminals #2, #3, #4, #5. Roof vent	16 ohms	"
G-1104**	"	"	Door	14 ohms	"
"	"	"	Air terminal #1	18 ohms	"
G-1105**	"	"	Air terminal #2	14 ohms	"
H-110*	"	Frag Bomb	Air terminal #3	Open circuit	"
H-202*	"	"	Air terminal #1	" "	"
H-207*	"	75mm HE	Air terminal #3	" "	"
H-209	"	Empty	Roof vent	" "	"
H-401*	6-16-52	Bomb Fuse	Air terminals #2, #3, #4.	" "	"
H-411	"	Bulk Pwdr.	Air terminal #3	" "	"
H-505*	"	75mm HE	" " "	" "	"
H-508	"	Empty	" " "	" "	"
H-908****	6-17-52	20mm Inc.	Air terminal #2 missing	----	Replace
J-611*	6-18-52	Frag Bomb	" " "	----	"
"	"	"	Air terminal #1	Open circuit	Repair
J-709*	"	Fuses	Roof vent	" "	"
S-101*****	"	SAA	Doors #1 & #2	12 ohms	"
"	"	"	Air terminal #6	"	"

SUBJ: Report of Annual Inspection of Lightning Protection Systems  
(RCS ORDGU-6)

- \* High explosive storage
- \*\* Chemical ammunition storage
- \*\*\* Propellant storage
- \*\*\*\* Incendiary ammunition storage
- \*\*\*\*\* SAA storage
- A Pyrotechnics
- B Safety fuse

2. The test on all other lightning protection systems in the restricted area resulted in readings of less than 10 Ohms.

3. It is advised that necessary action has been taken to make repairs and/or replacements.

F. C. FAVILTON  
Colonel, Ord Corps  
Commanding

CONCURRENCES:

Dictator: *Harry L. Myttinger*  
Ch, Ammo Insp Ofc: *C. C.*  
Exec O:

*CM*

**APPENDIX F**

**PRESS RELEASE "BHAD DEMIL JOB PAYS FOR  
ITSELF WITH \$365,912.00 TO BOOT",  
BHAD, JANUARY 3, 1966**

3 January 1966  
For Release - Immed  
Release Nr. 117-65

**BHAD DEMIL JOB  
PAYS FOR ITSELF WITH  
\$365,912.00 TO BOOT**

Black Hills Army Depot has just completed the demilitarization of 5000, five hundred pound and 200, thousand pound cyanogen chloride bombs, much to the relief and elation of project director Lieutenant Russell E. Walden and his "men from Mars."

In announcing the completion of the project, Lt Colonel Jack Carstarphen, depot commanding officer, said the job was accomplished through top technical skill and amazing ingenuity. He also stated that salvage of the bomb casings, following destruction of contents, not only paid for the entire operation but also saved \$365,912.00 as well. The 5,200 bomb casings were shipped to another defense installation to be loaded with a conventional type explosive.

"The 260 pound steel casings," he said, "were fabricated over twenty years ago and cost \$104.00. They would probably cost twice that much today."

During World War II large stocks of poison gas were held in reserve by the United States, and other nations involved in the global struggle, to be used when and if the enemy chose to utilize this lethal medium of destruction in violation of the international ban on chemical warfare.

Demilitarization of gas bombs, at best, poses some measure of safety hazards which must be rectified before a project may be started.

Over three years ago BHAD successfully demilitarized 206,508 mustard gas bombs, at a saving of over \$1.5 million, without jeopardizing the life or health of the workers assigned to the project.

A rather complex plant, embodying many safety features, was fabricated at the depot but the bomb casings were destroyed by puncturing them to drain off the liquid mustard gas.

When Lieutenant Walden was given the job of demilitarizing the CK bombs, he was told to save the casings. A graduate of the Georgia Institute of Technology and

an industrial engineer with Eli Lilly prior to entering the Army, Lt Walden was faced with a king-sized job. Under his supervision, however, an open air plant was constructed and the project was safely executed.

Brought to the plant by truck from the igloos, fork lifts were used to position the bombs on a conveyor type line where the first phase of shipping band and fuze well liner removal was accomplished.

Following removal of filler plug with a 2 1/2 inch drive impact wrench, a gasket, rupture disc and filler plug adaptor were placed in the bomb.

Taken to the kiln unit the bombs were hoisted to an eight foot high platform and placed in a drain rack, the rupture disc of the bomb was punctured and the cyanogen chloride liquid was drained into a 500 gallon tank.

Pumped from the tank into the round, steel, 20~~0~~ foot long by 4 feet in diameter kiln, the highly inflammable liquid was sprayed and ignited. The 2,000 degree Fahrenheit heat accomplished the destruction of the lethal liquid.

After draining, the bomb casings were put on a roller conveyor to be picked up by fork lift and taken to decontamination site. Placed in rows, the casings were decontaminated with high pressure compressed air hoses.

Following decontamination the bomb casings were taken to a rail siding and loaded onto railroad gondola cars, by the depot's huge magnetic crane, for shipment to Rocky Mountain Arsenal.

Colonel Carstarphen said Lt Walden, who recently was recipient of the Army Commendation Medal for "exceptionally meritorious conduct in the performance of outstanding services," accomplished the demil project with a crew of only 24 men, headed by foremen James Lanphear and Adelbert Hedglin.

Other officials responsible for the trickey project were: Woodrow Hipsher, director for supply and transportation, James Rickard, chief, ammunition division, Wallace Erickson, chief administrative branch, Odean Olson, chief maintenance branch and Francis Finkle, munitions demilitarization foreman, all of ammunition division.

**FINAL**  
**SUPPLEMENTAL ARCHIVES SEARCH REPORT**

**VOLUME II OF III**  
**CONCLUSIONS AND RECOMMENDATIONS**

**PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS  
AT THE FORMER BLACK HILLS  
ARMY DEPOT, SOUTH DAKOTA  
SITE NUMBER B085D000800**

**Contract No. DACW-43-93-D0508**

**Prepared For:**

**U.S. Army Corps of Engineers  
St. Louis District  
St. Louis, Missouri 63103-2833**

**November 1993**

**9392**

**TCT-ST. LOUIS**

**1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700  
(314) 426-0880**

**FINAL**  
**SUPPLEMENTAL ARCHIVES SEARCH REPORT**

**VOLUME II OF III**  
**CONCLUSIONS AND RECOMMENDATIONS**

**PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS**  
**AT THE FORMER BLACK HILLS**  
**ARMY DEPOT, SOUTH DAKOTA**  
**SITE NUMBER B085D000800**

**Contract No. DACW-43-93-D0508**

**Prepared For:**

**U.S. Army Corps of Engineers**  
**St. Louis District**  
**St. Louis, Missouri 63103-2833**

**Prepared By:**

**TCT-St. Louis**  
**1908 Innerbelt Business Center Drive**  
**St. Louis, Missouri 63114-5700**

**November 1993**

**9392**

## **VOLUME II**

### **TABLE OF CONTENTS**

<b><u>Section No.</u></b>		<b><u>Page No.</u></b>
<b>1.0</b>	<b>CONCLUSIONS</b>	<b>1-1</b>
1.1	Introduction	1-1
1.2	Risk Assessment Code	1-1
1.3	Summary of Conclusions	1-4
<b>2.0</b>	<b>RECOMMENDATIONS</b>	<b>2-1</b>
2.1	Personnel	2-1
2.2	Visual and Geophysical Surveys	2-1
2.3	Chemical Contamination	2-3
2.4	Summary of Recommendations	2-3

### **LIST OF TABLES**

<b><u>Table No.</u></b>	
2-1	Summary of Recommendations

### **LIST OF FIGURES**

<b><u>Figure No.</u></b>	
1-1	Suspected Areas of CWM and/or OEW Contamination
2-1	Geophysical Survey Location Chemical Area-Based on 1963 Facility Map
2-2	Geophysical Survey Location Suspected Burn Pit Area

### **REFERENCES**

### **LIST OF APPENDICES**

#### **Appendices**

<b>A</b>	Risk Assessment Code (RAC)
<b>B</b>	Section 2.0 Recommendations Final Archives Search Report, Preliminary Assessment of Ordnance Contamination at the Former Black Hills Army Depot South Dakota, October 1992



**VOLUME II**  
**TABLE OF CONTENTS**  
**(Continued)**

**Aerial Photos**

Plate 1, Suspected Burn Pit, 1945

**Site Photographs, Site Visit**

Former Black Hills Army Depot, August 16 - August 20, 1993

Excerpts, Master Plan Basic Information, Analysis of Existing Facilities,  
Black Hills Army Depot, Igloo, South Dakota

Master Plan Basic Information Maps, 15 December 1963, Drawing 29-02-02

BHADb-214 Sheet 7 of 53 General Storm-Drainage & Tree-Cover Map

BHADb-215 Sheet 8 of 53 General Site Map Storage Area 1

BHADb-216 Sheet 9 of 53 General Site Map Storage Area 2

BHADb-217 Sheet 24 of 53 General Site Map Warehouse and Airfield Area

BHADb-218 Sheet 25 of 53 General Site Map Aboveground Magazine Area

Chemical Area 6000 Block Plans (3 Sheets)

## **SECTION 1**

### **1.0 CONCLUSIONS**

#### **1.1 Introduction**

Under the requirements set forth in the Scope of Work, TCT-St. Louis prepared a government furnished revised Risk Assessment Code (RAC) form for the former Black Hills Army Depot (BHAD). This form (Appendix A) summarizes some of the results of the Supplemental Archives Search Report. The RAC values assigned reflect the hazards that may be present at the former BHAD based upon information obtained during the previous (1992) and supplemental archives searches. Score results calculated for this report are identical to the findings of the 1992 investigation. Remarks footnoted and the associated narrative reflect present conditions as well as land use and expected development of the site. The RAC form is a method of summarizing conclusions into a numerical format to rank sites by the Hazard Severity and Hazard Probability.

#### **1.2 Risk Assessment Code**

No additional information pertaining to decontamination and deed restrictions following closure and sale of the BHAD was obtained. Findings are unchanged from the 1992 investigation. Prior to the sale of the BHAD, contaminated areas were known. In the property deeds, usage of these areas was restricted and the Government's liability limited. According to a General Services Administration (GSA) document, the Government had prior knowledge and therefore assumes some responsibility.[BHADb-1]

The site scored a RAC I (Severity Category I, Catastrophic, Probability Level II, probable). An explanation for the values selected on the RAC form is presented below.

##### **1.2.1 Hazard Severity**

According to documents, millions of tons of conventional-filled and chemical-filled ordnance passed through the former BHAD. The types of ordnance listed in the RAC, Part I, Section A (Hazard Severity) were all present at the BHAD. Large quantities of chemical weapons and agents were documented to have been stored, renovated, and destroyed at the BHAD. Types of chemical-filled munitions included mustard (H, HT, HD), cyanogen chloride (CK), phosgene (CG), and hydrocyanic acid-filled bombs, projectiles, mortars, and rockets. Bulk mustard and phosgene, M55 rockets filled with nerve agent (GB and VX), and irritant-filled mortars were also present at the facility. In addition, smoke (HC, FS) and incendiary-filled (white phosphorous-WP) projectiles, mortars, cartridges, bombs, and rifle grenades were present in abundance throughout the depot's history.[BHADb-9, 11, 16, 82, 125, 154] During TCT's site visit, burned-out and/or empty chemical munitions were found at the surface and included: M70 (H) bomb, 155 mm and 105 mm bursting chemical or WP projectiles, and M47 series bomb casings. The 74th Ordnance Detachment (EOD), Ft. Riley, Kansas, investigated the mud-filled 105 mm bursting chemical or WP projectiles and determined the items were empty.[BHADb-228]

Types of conventional ordnance and ammunition stored, renovated, or destroyed at the BHAD included small arms (all types), conventional ammunition (20 mm - 240 mm) flares, bombs (4 lbs - 12,000 lbs), grenades (hand and rifle), mines (anti-tank and anti-personnel), and rockets.[BHADb-1, 29, 59, 122, 123, 127, 154] Types of potentially live conventional ordnance encountered during the site visit included: 20 mm cartridges, base detonating fuzes (HE), 40 mm, 75 mm, and 155 mm (HE) projectiles, M60 fuze lighter, parafrag bomb (10 or 20 pound), and various types of bomb nose fuzes. Additional items found that were believed to be burned-out or demilitarized included M48 or M51 series point detonating fuzes, igniters, parachute flares, M83 fragmentation bombs, and time superquick and time proximity fuzes. Previous to the site visit, live conventional ordnance recovered by the Ordnance Detachment from souvenir collectors included 37 or 57 mm HE projectiles and miscellaneous fuzes.

Large quantities of bulk explosives were documented as present at the BHAD in the 1992 report.[BHADb-1] During the site visit, small nodules of suspected TNT were found at the explosive leaching beds in the Ammunition Workshop Area.

Of the pyrotechnics listed in Part I, Section B of the RAC, all were present at the BHAD. A Flare Test Range and Tracer Test Range were present. During the site visit, empty and burned parachute flares were encountered at Burning Ground 2. The local Fire Chief was in possession of a 105 mm smoke (WP) projectile which was destroyed by the ordnance detachment a month previous.[BHADb-228].

Propellants were documented as present in the 1992 report and based on interviews, a potential propellant burning area may have existed during the early years of the facility's operation.[BHADb-235]

A RAC score of 61 was obtained for the Hazard Severity and was unchanged from the 1992 report. This was translated into "Category I - Catastrophic".

### **1.2.2 Hazard Probability**

The first section of Part II of the RAC (Part II, A) is Locations of Contamination. Findings are unchanged from the 1992 report. Evidence of the presence of conventional, chemical or incendiary-filled munitions was found at the surface at Burning Grounds 1 and 2 and the Ammunition Workshop Area. Documents and interviews with former depot personnel indicate the potential presence of ordnance at depth [BHAD-154, 230].

Accessibility, current land use and the distance to the nearest inhabited structure have not changed since 1992. A score of 25 was obtained for the Hazard Probability. This was translated into "Level B Probable".

### **1.2.3 Assessment of Ordnance Contamination**

Assessing ordnance contamination or the hazard risk to people has its limitations based on an archives search without benefit of field activities or surveys. To assess the presence and hazard

of UXO, the information obtained thus far should be reviewed. The 1992 report determined that throughout the BHAD's 25-year operational history large quantities and varying types of ordnance containing high explosive, chemical, or incendiary filler were present at the facility.[BHADb-1] This supplemental archives search substantiated the findings of the 1992 report and further assessed the possible the presence of CWM at the BHAD. Chemical-filled munitions and bulk agent were stored and maintained in the storage igloos, storage aprons and the Chemical Warfare Storage Area.[BHADb-36, 76, 90] Limited renovation of chemical-filled munitions occurred within the Ammunition Workshop.[BHADb-29] At the BHAD, disposal of CWM including, burn-out, venting, demolition, and transfer of chemical agent was conducted at Burning Grounds 1 and 2 and the Chemical Area.[BHADb-1, 145, 154, BHAD-76] Incineration of mustard and cyanogen chloride was performed exclusively at the Chemical Plant located in the Chemical Area.[BHADb-131] Conventional munitions were stored in storage igloos, the Combat Material Area, and outdoor storage pads, and renovated at the Ammunition Workshop, Bundle Packing Area, and Normal Maintenance Disassembly Plant. Disposal of surplus, unsafe or obsolete conventional munitions was conducted at Burning Grounds 1, 2, and 3, the deactivation furnace, the Ammunition Workshop Area, Tracer Test Range, and Surveillance Area.[BHADb-1] Additional disposal/testing areas identified during the supplemental archives search included the Flare Test Range and the suspected burn pits. The BHAD is shown in Figure 1-1.

Decontamination was conducted from 1966-1967. All ammunition was moved out of the facility block by block and the Chemical Plant was dismantled in January of 1967. According to an eye witness account, buildings and structures were cleaned, swept, tested and retested as needed. Burning Ground 2 was cleared of all surface debris.[BHADb-227] Additional decontamination procedures are described in the 1992 report. The Burning Grounds, Chemical Area, and Tracer Test Range were fenced, placarded, and restricted from use. Burning Ground 3 was restricted to surface use only.[BHADb-1]

During the site visit, additional evidence of the potential presence of CWM was found at Burning Grounds 1 and 2. Empty 155 mm bursting chemical or WP projectiles were found at both locations. M70 and M47 bomb casings were identified at Burning Ground 1 and empty 105 mm chemical bursting or WP projectiles were encountered at Burning Ground 2. A 105 mm smoke (WP) projectile was found by a local resident at Burning Ground 2. Potentially live conventional ordnance and ordnance components, including potentially hazardous fuzes, boosters, and projectiles, were observed at both locations. Miscellaneous demilitarized projectiles, components and metal debris was encountered at all three burning grounds.

At the Ammunition Workshop, small pea or gravel size nodules of suspected TNT and stained soil were found at the surface in the explosive leaching beds.

No visual and limited documented evidence of the existence of a buried 250-foot mustard-filled drain line within the Chemical Plant Area was obtained during the supplemental archives search. Facility maps do, however, confirm the presence of subsurface lines discharging effluent from the incinerator to pits and leaching beds.[BHADb-202, 203] The length of two of these lines is approximately 250 feet. According to a 1976 interview with a former BHAD employee, the potentially buried line may be as shallow as 7 feet.[BHADb-236]

Live ordnance items, including a 105 mm smoke projectile, a 27 mm or 57 mm HE projectile and miscellaneous fuzes were recovered from local residents by an ordnance detachment prior to the site visits.[BHADB-228] Local individuals continue to frequent the area in search of items, including ordnance, of historical significance.

CWM and OEW contamination exist at the surface and are likely present in the subsurface at Burning Ground 2. OEW contamination exists at the surface and is likely in the subsurface at Burning Ground 1 and the Ammunition Workshop Area. At the Chemical Area, evidence of CWM was not found at the surface, but is likely to exist in the subsurface.

### **1.3 Summary of Conclusions**

Based on the site visit and the supplemental archives search, the findings are summarized as follows:

- 1) The hazard severity and probability of an explosive incident at the BHAD was categorized as Category I - Catastrophic; Level B - Probable.
- 2) Visual and historical evidence of the presence of CWM in the surface and potentially large volumes in the subsurface at Burning Grounds 1 and 2 indicate the areas are extremely hazardous.
- 3) Visual and historical evidence confirm the presence of large quantities of UXO on the surface and in the subsurface at Burning Grounds 1 and 2. These areas are extremely hazardous.
- 4) A 250-foot drain line filled with mustard may be present in the subsurface at the former Chemical Plant; however, its existence is less certain. No visual and very limited historical evidence (one decontamination document and a 1976 interview) indicates the drain is present in the Chemical Area.
- 5) At least one burning pit, 2-2 filter beds, one sump/decontamination pit and several ponds were present in the Chemical Area. CWM is not evident on the surface at the Chemical Area, but mustard residue may exist in the subsurface at these locations.
- 6) Small amounts of OEW exist on the surface of the explosive leaching beds at the Ammunition Workshop Area. It is unknown if OEW exists in the subsurface at this location; however, based on historical records, its presence is likely.
- 7) Suspect burn pits were present east of the Chemical Area during early operation of the facility. The presence of CWM or OEW at these locations is unknown.
- 8) No evidence was encountered suggesting the presence of OEW or CWM in the surface or subsurface at the projected location of an ash disposal landfill.

- 9) Access to hazardous areas is virtually unrestricted. Access should be severely limited at Burning Grounds 1 and 2 and the Chemical Area.

## **SECTION 2**

### **2.0 RECOMMENDATIONS**

Based on the results of the former BHAD supplemental archives search and site visit, the findings are, in general, unchanged from the 1992 report. TCT-St. Louis concluded that CWM (smoke - WP) and OEW are present at disposal areas at the former depot. Based on a risk assessment that took into consideration the hazard severity and hazard probability, TCT recommends installation of fencing, placarding of hazardous areas, and performing a remedial investigation to determine the extent, location, quantities and types of CWM and OEW contamination. Fencing should surround the Chemical Area and burning and demolition area. UXOs containing HE and pyrotechnics have been collected from Burning Grounds 1 and 2 and bursting chemical or WP projectiles, though empty, have been found at the surface in both areas.

With the exception of the Chemical Area, the acreage recommended for the visual survey is unchanged from the 1992 report. During the visual survey all UXO encountered should be destroyed. A revised summary of the recommended action is presented in Table 2-1. TCT-St. Louis suggests contacting the Commander, HHC, 52nd Ordnance Group (404-362-3099) prior to initiating survey and excavation activities.

Recently, the U.S. Army Corps of Engineers, Huntsville Division (CEHND) conducted a remote survey of the facility. Survey grids, maps, and findings of the remote survey can be obtained by contacting CEHND. TCT recommends further visual surveys; however, the geophysical surveys recommended in the 1992 report should be conducted only as a supplement to the remote survey to further define the contaminated areas or clarify anomalies when results of the remote survey appear unreliable or indistinct. In addition, TCT suggests confirming the results of the remote survey at one or two critical locations such as the Chemical Area.

In contrast to the 1992 report, TCT recommends the use of electromagnetic surveys due to the abundant presence of ferrous and non-ferrous metal on the surface and in the subsurface.

#### **2.1 Personnel**

Personnel performing the field work or removal action must be trained and certified in accordance with 40 CFR 1910.10. Due to the potential for chemical exposure, all personnel must be identified by a physician as fit to wear a respirator. In addition, respirator fit testing should be current.

#### **2.2 Visual and Geophysical Surveys**

Recommendations are virtually unchanged from those identified in the 1992 report (Appendix B). Revisions to those recommendations are summarized in Table 2-1 and described below.

### **2.2.1 Burning Ground 1**

With the exception of the change to an electromagnetic survey, there are no changes to the 1992 recommendations shown in Appendix B.

### **2.2.2 Burning Ground 2**

With the exception of the change to an electromagnetic survey, there are no changes to the 1992 recommendations shown in Appendix B.

### **2.2.3 Burning Ground 3**

With the exception of the change to an electromagnetic survey, there are no changes to the 1992 recommendations shown in Appendix B.

### **2.2.4 Chemical Area**

Due to the various locations of decontamination pits, sumps and lines and the presence of a leaching bed outside the perimeter area, the size of the survey area should be increased, as shown in Figure 2-1, in order to fully identify the hazards in the subsurface in the Chemical Area. Survey lanes should be 50 feet apart. Surface soil samples should be collected from denuded areas and tested for the presence of mustard. There are no other revisions to the 1992 recommendations shown in Appendix B.

### **2.2.5 Burial Site - White Phosphorous**

With the exception of the change to an electromagnetic survey, there are no changes to the 1992 recommendations shown in Appendix B.

### **2.2.6 Flare and Tracer Test Range**

The Flare Test Range is located west of the Tracer Test Range. In addition to the 100% visual survey of the Tracer Test Range, a 25% visual survey of the Flare Test Range should be conducted.

### **2.2.7 Surveillance Area**

With the exception of the change to an electromagnetic survey, there are no changes to the 1992 recommendations shown in Appendix B.



### **2.2.8 Ammunition Workshop Area**

At this location suspected TNT was encountered on the surface in the area of the explosive leaching beds. Excavations and field screening should be conducted as described in Appendix B.

### **2.2.9 Disassembly Plant**

There are no changes to the 1992 recommendations presented in Appendix B.

### **2.2.10 Suspected Burn Pit**

CWM or OEW may be present at the suspected burn pits shown in Figure 2-2. Little evidence of this location is visible on subsequent aerial photos. If this location was included in the remote survey, potential hazards can be assessed from the information obtained.

A survey of the area using electromagnetometry is suggested as shown in Figure 2-2. Locations of these areas in the field may, however, prove difficult. Survey lanes should be 50 feet apart.

## **2.3 Chemical Contamination**

Based on the amounts and types of explosives and chemical warfare agents present at the BHAD, and the presence of suspected TNT at the Ammunition Workshop Area, ordnance-related chemical contamination is most likely present in the soil, surface water, and groundwater at the former depot. Mustard, nitroaromatic and metal compounds are noted for their persistence in the environment; however, extensive transport and migration would be limited by the relative impermeable nature of the soils at the site.

In addition, the potential for non-ordnance related chemical contamination also exists at the BHAD. Frequently, a number of non-ordnance related activities requiring the use of chemicals such as degreasers were conducted at the BHAD.

Locally, use of shallow groundwater aquifers is limited to usage by livestock. Drinking water is obtained from aquifers generally greater than 1,000 feet in depth.

## **2.4 Summary of Recommendations**

The recommendations described above are summarized as follows:

- 1) Fence and placard all burning grounds and the Chemical Area. Access to the public should be restricted.
- 2) Conduct visual surveys of the hazardous areas as shown in Table 2-1 and dispose of all UXO encountered.

- 3) Based on the results of the remote geophysical survey conducted by the USACE, perform additional electromagnetic surveys of the hazardous areas to further define the contamination.
- 4) Excavate test pits and conduct field screening for nitroaromatics at the Ammunition Workshop Area.
- 5) Collect surface soil samples from denuded areas at the Chemical Area and field test for the presence of mustard.
- 6) Following a review of the geophysical results, assess selected locations for the presence of ordnance and non-ordnance related chemical contamination.

## **TABLES**

**TABLE 2-1  
SUMMARY OF RECOMMENDATIONS  
BLACK HILLS ARMY DEPOT**

			Geophysical		
Location	Emergency Action	Visual Survey (Acres)	Type	Acres	Excavation
Burning Ground 1 (495 acres)	Fencing <sup>1</sup> , placarding, non-use	74 <sup>2</sup>	Electromagnetic	17	Based on geophysics
Burning Ground 2 (965 acres)	Fencing <sup>1</sup> , placarding, non-use	270 <sup>2</sup>	Electromagnetic	65	Based on geophysics
Burning Ground 3 (675 acres)	Fencing <sup>1</sup> , placarding, surface use only	32.6	Electromagnetic	7.3	Based on geophysics
Chemical Area, Chemical Plant (1.1 acres)	Fencing <sup>1</sup> , placarding, non-use	None	Electromagnetic	6.9	Excavate <sup>3</sup> drain line, field test for mustard
Chemical Area, Chemical Burning Pit (26 acres)	Fencing, Placarding, non-use <sup>4</sup>	6.5	Electromagnetic	3.2	Based on geophysics, field tested for mustard
Burial Site, White Phosphorous Casings (2.8 acres)	None	None	Electromagnetic	0.66	Based on geophysics
Tracer Test Range-Flare Test Range (0.43 acres)	Fencing, Placarding, non-use	0.43	None	-	Clear UXO, if present
Surveillance Area (4.4 acres)	None	1.1	Electromagnetic	1.1	Based on geophysics
Ammunition Workshop, Leaching Beds (2.09 acres)	None	None	None	-	Test Pits, Field Screening for TNT <sup>5</sup>
Disassembly Plant (1.9 acres)	None	1.9	None	-	None
Suspected Pit Area	None	None	Electromagnetic	3.4	Based on geophysics
<b>Total Acreage 2,173.72</b>		<b>384.63</b>		<b>93.6</b>	

<sup>1</sup>Fencing should enclose all trenches, pits, burn areas, and ravines.

<sup>2</sup>Acreage includes ravines where UXO have been observed. Due to the numbers of UXO present, the percent visual survey has been increased from what is normally recommended.

<sup>3</sup>May require personnel with Chemical Surety.

<sup>4</sup>A portion of the area is currently fenced and placarded, recommended fencing should enclose both pits and the incinerator and leaching field area.

<sup>5</sup>Field screening according to CRREL method.

## **FIGURES**



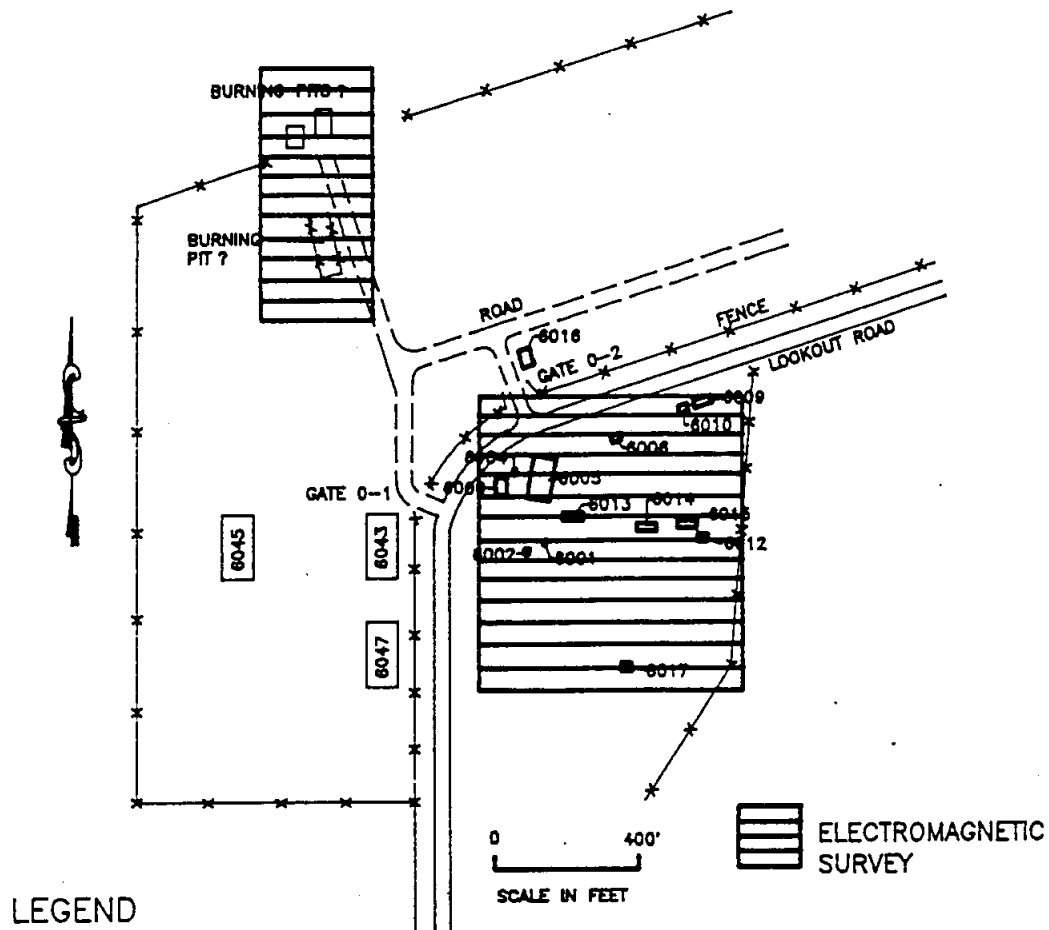


Figure 2-1

Huntingdon

**TCT**

St. Louis

**GEOPHYSICAL SURVEY LOCATION  
CHEMICAL AREA-BASED  
ON 1963 FACILITY MAP  
FORMER BHAD**

Project No. 9392

By: *CH*

Chk'd By: *NMD*

Date: 9-25-93

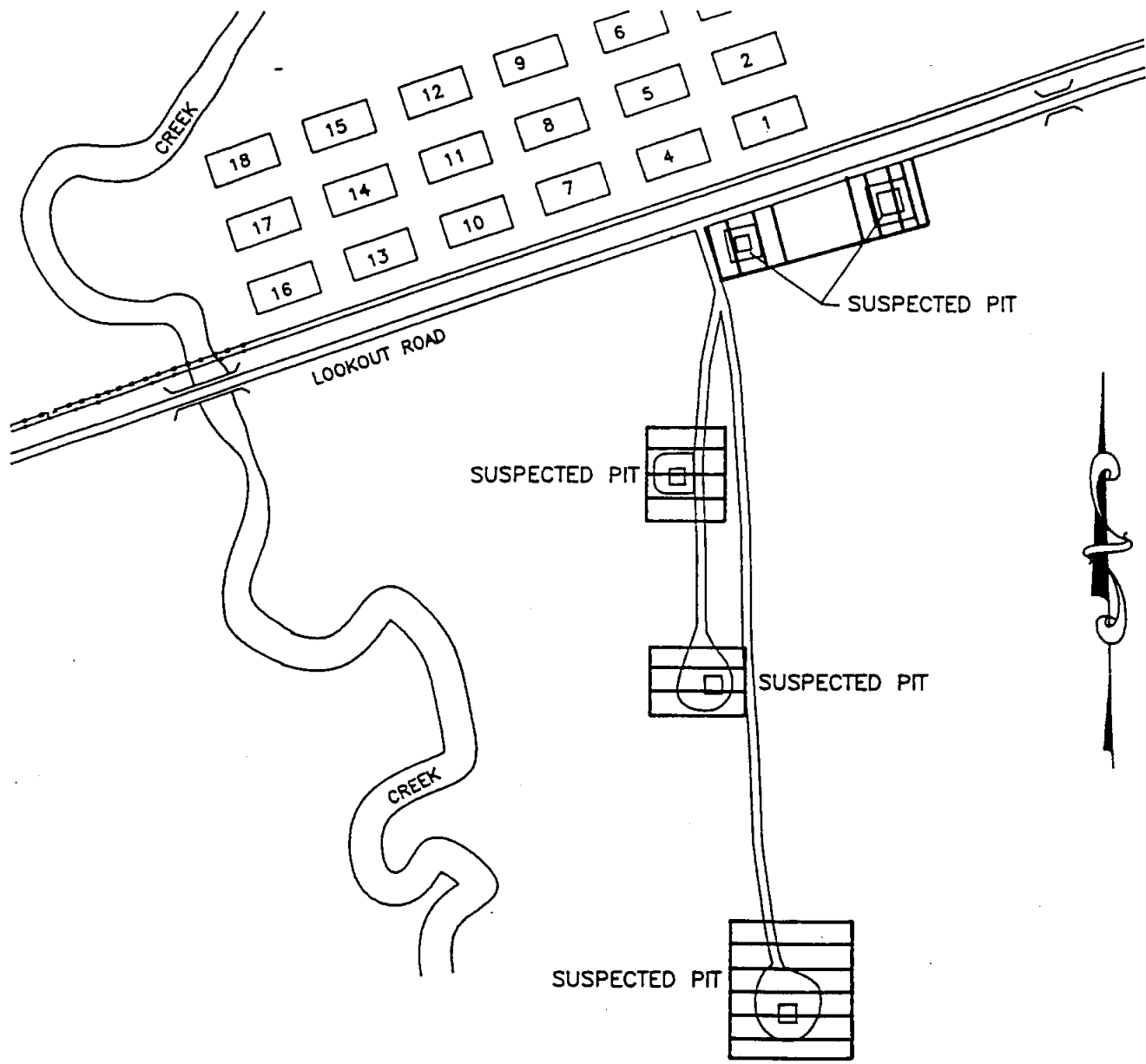


Figure 2-2

Huntingdon  
**TCT**  
 St. Louis

GEOPHYSICAL SURVEY LOCATION  
 SUSPECTED BURN PIT AREA  
 FORMER BHAD

Project No. 9392	By: <i>[Signature]</i>	Chk'd By: <i>NMD</i>	Date: 9-25-93
------------------	------------------------	----------------------	---------------



## REFERENCES

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-001	TCT-St. Louis, Final Report, Archives Search Report Preliminary Assessment of Ordnance Contamination at the Former BHAD, October 1992.
BHADb-002	Weapons Development and Engineering Laboratories, Edgewood Arsenal, Trip Report by Dean M. Dickey to BHAD Burning Site 2, July 21-27, 1971.
BHADb-003	Chemical Branch BHAD, Historical Report, April 1951.
BHADb-004	Chemical Branch BHAD, Historical Report, May 1951.
BHADb-005	Chemical Branch BHAD, Historical Report, October 1951.
BHADb-006	Chemical Branch BHAD, Historical Report, December 1951.
BHADb-007	U.S. Army Technical Escort Center, General and Chemical Shipment Information 1943-1959.
BHADb-008	BHAD, Pending Ammunition Receipts, January 8, 1954.
BHADb-009	Memos, BHAD, Disposal Demilitarization, Reworking of Ammunition at BHAD, October 1953.
BHADb-010	BHAD Demolition Area Layout, May 15, 1948.
BHADb-011	Ordnance Department Memo, Proposed Service Magazines for Demolition Ground, June 3, 1953.
BHADb-012	BHAD, Memo, Show Facilities, September 1, 1953.
BHADb-013	BHAD, Destruction of M600 Fuzes, February 2, 1953.
BHADb-014	BHAD, Decontamination, Chemical Area December 10, 1952.
BHADb-015	BHAD, Modification of Fuze, PD, M57, March 24, 1949.
BHADb-016	BHAD, Excerpts from Chemical Bomb Classification Report, May 28, 1953.
BHADb-017	BHAD, Disposal of Explosive Effluent, April 1, 1958.
BHADb-018	BHAD, Categories of Munitions at BHAD, January 16, 1953.
BHADb-019	BHAD, Suspended and Released Ammunition Lots, October 1952.
BHADb-020	BHAD, Normal Maintenance 1952; March 18, 1960.
BHADb-021	BHAD, Possible Mustard Burn Injuries, 1957.
BHADb-022	Raritan Arsenal, Priorities of Reworking at BHAD, March 2, 1953.
BHADb-023	Raritan Arsenal, Schedule and Progress Report Ammunition Repair, June 1, 1953.
BHADb-024	Sierra Ordnance Depot, Inspection of BHAD, July 15, 1953.
BHADb-025	Amy Environmental Health Laboratory, Industrial Hygiene Survey, BHAD, December 1952.
BHADb-026	BHAD, List of Surveillance Employees, 1953.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-027	Army Environmental Health Laboratory, Industrial Hygiene Survey, BHAD, June 1951.
BHADb-028	BHAD, Report of Annual Inspection of Lightening Protection Systems, September 1951.
BHADb-029	Ordnance Department Assignment of AIC Symbol and Item Stock Number List 33, BHAD, 1948, 1950.
BHADb-030	BHAD, Special Surveillance of 1,000 lb Gas CK Bomb, 1952.
BHADb-031	Raritan Arsenal, Disposition of Ammunition, September, 1953.
BHADb-032	BHAD, SOP, Demilitarization of 105 MM Shell.
BHADb-033	U.S. District Court, William Tanner vs. USA, circa 1979.
BHADb-034	BHAD, Ammunition Schedule and Progress Report (Ammunition Repair), circa 1952.
BHADb-035	Chief of Engineers, Owned, Sponsored and Leased Facilities, undated.
BHADb-036	Personal Communication with Lee Deans, 2 July 1993.
BHADb-037	U.S. Army Judge Advocate's Office, request for information concerning Tanner vs. U.S., July 28, 1981.
BHADb-038	Facility Map, BHAD, 1942.
BHADb-039	Facility Map, BHAD, 1961.
BHADb-040	BHAD Reports, 1950 and 1951 Supplied to Judge Advocates Office, 20 August 1981.
BHADb-041	Memo, "Special Surveillance of Bomb, Gas, CK, 1,000 lb, AN-M-79" from Depot Chemical Commander, from September 23, 1952, 1 page.
BHADb-042	Memo "List of Chemical Corps Ammunition Suspended from Issue", 1 page, memo only, no list. September 3, 1952.
BHADb-043	Directive "Surveillance of CK Bombs", Directs frequency of testing after evidence of deterioration is detected, August 25, 1952, 1 page.
BHADb-044	Operation Work Sheets "Remove Fuze from Mine Crate and Destroy", August 12, 1952, 5 pages.
BHADb-045	Inspection Reports "Item RIQIB-Shell, Semi-Fixed, Gas, Persistent, N, M60, with Fuse PD M97 for 105 mm HOW M2A1 and M4", 10 pages, September 4, 1951.
BHADb-046	Memo, "Shell Semi-Fixed, Gas, Persistent, H, M60" discusses storage of subject item, October 31, 1951, 3 pages.
BHADb-047	Demilitarization Analysis Report, September 10 & 12, 1951, 4 pages from Midwest Chemical Depot Subject Adapter Booster T3E1 used in Gas Bomb, Persistent HD 125 lb MC13.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-048	Surveillance Procedures for "Container One Ton", "Grenade, Hand. Smoke (WP) M15", "Persistent Agents H, HD, HN-1, HT, & L "Gas Marker", 17 pages undated.
BHADb-049	Operation Work Sheet "Wash Out Rejected Projectiles; Flake and Box TNT", March 15, 1951, 1 page.
BHADb-050	Memo, "Weekly Progress Report, Chemical Corps Activities". Reports progress on normal maintenance of 3965 M-78 or M-79, CD or CK Bombs, 1 page, May 1, 1951.
BHADb-051	SOP-Memo, "Destruction of M600 and M601 Chemical Fuzes by Mechanical Shock", January 23, 1953, 12 pages.
BHADb-052	Memo and Surveillance Reports, "Pressure Tests and Classification Reports, M-78 and M-79 CG-Filled Bombs", December 29, 1952, 3 pages.
BHADb-053	Memo, "Semi-Annual Pressure and Agent Quality Tests of CG and CK Filled Chemical Bombs", November 10, 1952, 1 page.
BHADb-054	Memo, "Quality Report of Inspection Activities", October 2, 1952, 2 pages.
BHADb-055	Memo, "Surveillance Reports, M-70 H-Filled Bombs", August 19, 1952. Report on persistent Gas Bombs stored at BHAD, 1 page.
BHADb-056	Memo and Surveillance and Classification Reports, M-70 H-Filled Bombs, August 12, 1952, 5 pages.
BHADb-057	Memos, "Pelletizing Processing and Destruction of M-70 H-Filled Bombs, 1951-1952, 7 pages.
BHADb-058	Memo, "Unserviceable M-79 CG or CK Bombs", July 9, 1951, 3 pages.
BHADb-059	Quarterly Report of Inspection Activities, January 20, 1954, 5 pages.
BHADb-060	"Report of Industrial Hygiene Survey No. 1765598-54", 7 pages. Identifies exposure to chemical warfare agents, memo.
BHADb-061	"Status of Certain Ammunition Items", July 13, 1954, 1 page, identifies quantities of CG M78 and M79 Gas Bombs.
BHADb-062	Memo, "Classification of chemical Corps Supplies (Bomb H, M70), June 22, 1954, 1 page.
BHADb-063	Schedule and Progress Report, Ammunition Repair, undated, 2 pages.
BHADb-064	Memo, "Request for Waiver", July 1955, requests permission to process ammunition containing blister agents with other items, 1 page.
BHADb-065	Memo, "Closure for the M11 Canister, June 13, 1955, 1 page.
BHADb-066	Black Hills Ordnance Depot "Ammunition Operating Facilities", June 8, 1955, 8 pages.
BHADb-067	Black Hills Ordnance Depot Workload, September, 1954.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-068	Memos, "Use of Gas Mask to Protect from Exposure to Mustard Gas", December, 1955, 5 pages.
BHADb-069	"Study-Retention of Mustard H in Bomb Casings, January 6, 1956, 5 pages.
BHADb-070	"Report of Ammunition Operations at Black Hills Ordnance Depot, November 18, 1955, 2 pages.
BHADb-071	Memo, "Report of Chemical Corps Station Liaison Visitation on Stock Control and Related Functions", November 15, 1955, 2 pages.
BHADb-072	Memo, "Sample Cartridge Cases, M12", December 16, 1955, 1 page.
BHADb-073	Memo, "Sample Cartridge Cases, M14", December 9, 1955, 1 page.
BHADb-074	Memo, "Storage of Bombs, Gas, Persistent, H, 115 lb., M70, Less Fuzing Components", October 12, 1955, 1 page.
BHADb-075	Memo, "Bomb, Gas, CK 1000#, Less Fuzing Components, AN-M79", September 13, 1955, 2 pages.
BHADb-076	Memos, "Stock Number R14-5-943 Bomb, Gas, Persistent, H, 115 lb., M70", August 4, 1955 and November 29, 1955, 2 pages.
BHADb-077	Memo, "Proposed Project and Personnel Projection Report for Black Hills Ordnance Depot, September 14, 1955, 2 pages.
BHADb-078	Memo, "Reclassification of Certain Ammunition Items", September 7, 1955, 1 page.
BHADb-079	Memo, "Inspection of Black Hills Ordnance Depot", June 28, 1955?, 9 pages.
BHADb-080	Report of Official Travel Black Hills Ordnance Depot, April 14, 1955, 2 pages.
BHADb-081	Table, Chemical Corps Stocks at Black Hills Ordnance Depot, Inspection 11-12 April 1955, 1 page.
BHADb-082	Memo, "OAC Safety Disposition", April 28, 1955, 2 pages.
BHADb-083	"Improvement Description" on Demilitarization of Rocket HE 1C2 (T160) Series 4.5, no date, 1 page.
BHADb-084	"Improvement Description" on Leveling Ditch, April 5, 1958, 1 page.
BHADb-085	Memo, "Programmed Objectives for Improvements in Storage Division - 1958, January 31, 1958, 1 page.
BHADb-086	Memo, "Quarterly Report of Inspection Activities", July 8, 1952, 2 pages.
BHADb-087	Memo, "Quarterly Report of Inspection Activities", no date, 3 pages.
BHADb-088	Memo, "Quarterly Report of Inspection Activities", October 3, 1951, 2 pages.
BHADb-089	Memo, "ASESB Safety Survey of Black Hills Ordnance Depot" October 29, 1952, 8 pages.
BHADb-090	Excerpt from "Inspection of Black Hills Ordnance Depot 8 April 1952, 2 pages.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-091	Untitled memo, November 10, 1952, 1 page.
BHADb-092	Appendix - Safety Inspection, Black Hills Ordnance Depot, Igloo, SD 24 thru 25 October 1951, October 30, 1951, 8 pages.
BHADb-093	Appendix - Safety Inspection, Black Hills Ordnance Depot, Igloo, SD 6 thru 8 June 1951, 1 page.
BHADb-094	Memo, "Historical Report, Chemical Branch, 1 Oct thru 31 Dec 1952", January 12, 1953, 2 pages.
BHADb-095	Memo, "Historical Report, Chemical Branch, 1 July thru 30 Sept 52", October 13, 1952, 3 pages.
BHADb-096	Memo, "Historical Report, Chemical Branch, 1 April thru 30 June 1952, July 10, 1952, 3 pages.
BHADb-097	Memo, "Historical Report, Chemical Branch, 1 March through 31 March '52", April 8, 1952, 2 pages.
BHADb-098	Memo, "Historical Report, Chemical, 1 February through 29 February" March 7, 1952, 1 page.
BHADb-099	Memo, "Historical Report, Chemical Branch, 1 November 1951 through 21 December 1951", January 10, 1952, 3 pages.
BHADb-100	Memo, "Historical Report, Chemical Branch, 1 Oct thru 1 Oct 1951", November 5, 1951, 1 page.
BHADb-101	Memo, "Historical Report, Chemical Branch, 1 September through 30 September 1951", October 4, 1951, 1 page.
BHADb-102	Memo, "Historical Report, Chemical Branch 1 August thru 31 August 1951", September 7, 1951, 1 page.
BHADb-103	Memo, "Historical Report, Chemical Branch, 1 June thru 30 June 1951", August 1, 1951, 2 pages.
BHADb-104	Memo, "Historical Report, chemical Branch, 1 June thru 30 Jun 1951", July 9, 1951, 2 pages.
BHADb-105	Memo, "Historical Report, Chemical Branch, 1 May thru 31 May 1951", undated, 2 pages.
BHADb-106	Memo, "Historical Report, Chemical Branch, 1 April thru 30 April 1951", May 9, 1951, 1 page.
BHADb-107	Memo, "Historical Report, Chemical Branch 1 March thru 31 March 1951", April 12, 1951, 1 page.
BHADb-108	Memo, "Historical Report, Chemical Branch, 1 Feb thru 28 Feb 1951", April 12, 1951, 2 pages.
BHADb-109	Memo, "Historical Report, Chemical Branch, 1 January thru 31 January 1951", April 10, 1951, 2 pages.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-110	Weekly Progress Reports, Chemical Corps Activities January 2 - April 20, 1951, April 23, 1951, 16 pages.
BHADb-111	Management Improvement Reports 1955-1956, 10 pages.
BHADb-112	Memo, "Grievance, Local 1549, American Federation of Government Employees", undated, 3 pages.
BHADb-113	Surveillance Report of M-70, H-Filled Bombs, August 1, 1951, 2 pages.
BHADb-114	Quarterly Report of Inspection Activities - Describes surveillance of 221,830 H-Filled Bombs and planned destruction of 2,294 H-Filled Bombs, July 6, 1951, 3 pages.
BHADb-115	Quarterly Report of Inspection Activities - Describes maintenance and/or destruction of H, CG, and CK Bombs, April 3, 1951, 2 pages.
BHADb-116	"Design Criteria 50-14 Ammunition Normal Maintenance Building", May 4, 1952, 1 page.
BHADb-117	Describes hygiene improvements for workers handling leaking M-70 H-Filled Bombs, undated, 2 pages.
BHADb-118	Memo, "Preparation of Chemical Corps Materiel for Shipment" - Describes shipping priorities, non-specific, October 10, 1952, 1 page.
BHADb-119	Memo, "Preparation of Chemical Corps Materiel for Shipment" - Quantifies CG and CK Bombs requiring maintenance, October 22, 1952, 1 page.
BHADb-120	List of "Permanent Buildings", undated, 2 pages.
BHADb-121	USACE, Findings of Fact, BHAD, undated.
BHADb-122	BHAD, Semi-Annual Historical Report, BHAD, January 1, 1957 - June 30, 1957.
BHADb-123	BHAD, Semi-Annual Historical Report BHAD, July 1, 1958 - December 31, 1958.
BHADb-124	BHAD, Semi-Annual Historical Report, BHAD, January 1, 1958 - June 30, 1958.
BHADb-125	BHAD, Excerpts from Semi-Annual Historical Report, BHAD, July 1, 1956 - December 31, 1956.
BHADb-126	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, July 1, 1961 - December 31, 1961.
BHADb-127	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1, 1962 - July 31, 1962.
BHADb-128	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1956 - June 30, 1956.
BHADb-129	BHAD, Excerpts from Semi-Annual Historical Report, BHAD, July 1, 1955 - December 31, 1955.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-130	BHAD Excerpts from Semi-Annual Historical Report, BHAD, January 1, 1955 - June 30, 1955.
BHADb-131	BHAD, Excerpts from Semi-Annual Historical Summary, BHAD, January 1, 1959 - June 30, 1959.
BHADb-132	BHAD Excerpts from Semi-Annual Historical Report, BHAD, July 31, 1957 - December 31, 1957.
BHADb-133	BHAD, Production vs. Schedule, 1955.
BHADb-134	Technical Escort Detachment, Trip Report, BHAD, July 19, 1949.
BHADb-135	Department of the Army, Technical Manual, TM9-1900, General Ammunition, 1945.
BHADb-136	Excerpts from Community Fact Sheet, Edgemont, SD, circa 1967.
BHADb-137	Sgt. LaBarge, Technical Escort Unit, December 14, 1979. Notes on BHAD.
BHADb-138	U.S. Forest Service, South Dakota Plains Grassland, 1968.
BHADb-139	Information on Former BHAD Employees, undated.
BHADb-140	Ordnance Department, 1944. Excerpts from Surveillance Report, BHAD.
BHADb-141	Ordnance Department, 1951. Excerpts from Historical Summary BHAD, 1945-1951.
BHADb-142	BHAD, Emissions from the Mustard Incinerator, 1960.
BHADb-143	Correspondence concerning activities at the BHAD between DOD, South Dakota, and the Rapid City Journal, 1980s.
BHADb-144	Memos, notes, and correspondence concerning activities at the BHAD 1979-1981.
BHADb-145	Notes concerning BHAD, 1976.
BHADb-146	Notes concerning BHAD operation, undated.
BHADb-147	Ordnance Department, June 1, 1971 memo: Site Survey at the Former BHAD.
BHADb-148	Facility Map BHAD, Burning Ground 2, undated.
BHADb-149	Office of Assistant Secretary of Defense, Ammunition Color Coding, February 16, 1959.
BHADb-150	U.S. Army Chemical Corps Engineering Command, Shipping Regulations for Chemical Agents, Chemical Ammunition, Poison's and other Dangerous Articles.
BHADb-151	U.S. Army Chemical Corps Engineering Command, Disposal of Cyanide Waste and Chronic Acid.
BHADb-152	Weekly Chemical Branch Progress Reports and Memos, BHAD, January 1947.
BHADb-153	Weekly Chemical Branch Progress Reports and Memo BHAD, February 1947.
BHADb-154	Weekly Chemical Branch Progress Reports, BHAD, March 1947.



<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-155	Weekly Chemical Branch Progress Reports, BHAD, April 1947.
BHADb-156	Weekly Chemical Branch Progress Reports, BHAD, May 1947.
BHADb-157	Weekly Chemical Branch Progress Reports, BHAD, June, 1947.
BHADb-158	Weekly chemical Branch Progress Reports, BHAD, July 1947.
BHADb-159	Weekly Chemical Branch Progress Reports, BHAD, August 1947.
BHADb-160	Weekly Chemical Branch Progress Reports, BHAD, September 1947.
BHADb-161	Weekly Chemical Branch Progress Reports, BHAD, October 1947.
BHADb-162	Weekly Chemical Branch Progress Reports, BHAD, November 1947.
BHADb-163	Weekly Chemical Branch Progress Reports, BHAD, December 1947.
BHADb-164	Weekly Chemical Branch Progress Reports, BHAD, January 1948.
BHADb-165	Memo to Chief of Ordnance regarding Proposed Layout at Demolition and Explosives Burning Ground, BHAD, June 1955.
BHADb-166	Memo from U.S. Army Environmental Hygiene Agency to BHAD, Mustard Demilitarization Plant, September 30, 1960.
BHADb-167	Memo from U.S. Army Environmental Hygiene Agency to BHAD, Disposal of CK Gas, February 5, 1945.
BHADb-168	Memo from ORD Chemical Officer to Chief, Supply and Procurement Division Office, Chief Chemical Corps, Washington, D.C, 12/2/49. Subject: M70 H-Filled Bombs. Quantifies H-filled bombs, leakers describes disposal method by burning 20 at a time; cost and time frame, 2 pages.
BHADb-169	Memo from Department of the Army, OC Cml C, Washington, D.C. to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota, dated 12/19/49. Subject: M70-H-Filled Bombs, permission to destroy all leaking M70 H-filled and request for greatest quantity that could be destroyed in one day, 1 page.
BHADb-170	Memo from H.S. Hewhall Lt. Col. Ord. Dept. to Chief, Chemical Corps, Washington, D.C., Inspection Division, undated. Subject: Rate of destruction M70-H-filled bombs, up to 150 per working day by constructing 3 new pits, 2 pages.
BHADb-171	Memo from J.M. Richardson, Major, Ord. Dept. Assistant to Chief, Chemical Corps dated 2/14/50, 1 page. Subject: Comments concerning decontamination of M70 H-filled bombs.
BHADb-172	Memo from Lt. Col. C.P. Holm, Chief Safety Officer to Chief of Ordnance, Washington, D.C. dated 4/17/50, 2 pages. Subject: M70 H-Filled Bombs, including PPEs for workers. Also SOP for rupturing bomb case.
BHADb-173	Memo from S.E. Purnell, Maj., Ord. Dept. Assistant to Office, Chief Chemical Corps, Washington, D.C. dated 5/4/90, comments on previous memo regarding disposal methods, 1 page. Subject: M70 H-Filled Bombs Disposal.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-174	Memo from C.J. Merrill, Lt. Col., Cml C, Asst. Chief, Supply and Procurement Div. to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota dated 5/9/50, answers to comments in BHADb-173 regarding disposal methods. 1 page. Subject: Disposal of H-Filled Bombs.
BHADb-175	Memo from Carl E. Grant, Lt. Col., Cml C Assistant, Supply & Procurement Div. to Commanding Officer, Black Hills Ordnance Depot dated 5/17/50, Subject: Maintenance of M70 H-Filled Bombs, involving the testing of 500 H-filled M70 bombs to determine general condition of lot numbers. Recommend that action be taken to provide sufficient burning pits for the disposal of 30,000 M-70 H-filled bombs per year. 7 pages.
BHADb-176	Memo from Carl E. Grant, Lt. Col., Cml C Chief, Supply Division to Commanding Officer, Black Hills Ordnance Depot, Igloo, South Dakota dated 2/7/51, 5 pages. Subject: Destruction of M-70, H-filled bombs, Burning Ground procedure. Approval given for bomb destruction and procedure for Burning Ground #2 of 619 M-70 H-filled 115 bombs.
BHADb-177	Memo from Carl E. Grant to Commanding Officer, Black Hills Ordnance Depot dated 11/15/49, 2 pages. Subject: M70 H-filled bombs, Plan to dispose certain lots stored for the Department of the Navy.
BHADb-178	Memo from Stephen M. Wondrasek, Captain, Cml C, Depot Chemical Officer to Commanding Officer, Black Hills Ordnance Depot dated 12/11/51, 4 pages. Subject: Report to Trip to GC Cml C Supply Division. Theoretical discussion of best methods for H-Filled bomb disposal, i.e., agent burned in furnace and cases melted down; removal and replacement of burster well tube, agent burned in fuel oil or lumber, pressure testing of CG & CK bombs. Recommendations were made for investigating a special furnace.
BHADb-179	Memo from Fred J. Delmore, Colonel, Cml C Commanding to Chief Chemical Officer, Washington, D.C. dated 11/21/51, 3 pages. Subject: Demilitarization alternatives for disposal of large quantities of M-70 H-Filled Bombs at Black Hills Ordnance Depot. Determination that a destruction rate of 25,000 per year by burning would be hazardous. Alternatives given of shipment to Rocky Mountain Arsenal or construction of facilities at Black Hills Ordnance Depot.
BHADb-180	Memo from Martin F. Massoglia, Major, Chemical Corps, Acting Chief, Inspection Division to Commanding Officer Deseret Chemical Depot, Tooele, Utah dated 11/2/51, 2 pages. Subject: Special Test of Bomb, Chemical, H. M70, rough handling test of 50 bombs from 4 lots.
BHADb-181	Memo from H. Walmsley, Colonel, Cml C, Deputy Commander, Materiel Command to Chief Chemical Officer dated 11/30/51, 1 page. Subject: Disposition - Bomb, Gas, Persistent, H115-lb. M-70, request that a decision regarding disposal or renovation of 60,000 bomb be made.
BHADb-182	Report on M-70, H-Filled Bombs, undated, 2 pages. Quantities of bombs, leakers, method of disposal. Recommendation that leakers be destroyed by pit method at Black Hills. All others be renovated at Rocky Mountain Arsenal.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-183	Memo from H.S. Newhall, Colonel, Ord Corps Commanding, to Chief, Chemical Corps, Washington, D.C., January 26, 1951, 2 pages. Subject: Destruction of M-70, H-filled bombs. Request to destroy 27,431 bombs considered leakers or potential leakers with cost estimate.
BHADb-184	Memo from Raymond C. Morris, Lt. Colonel, Cml C Chief, Supply Division, to Commanding Officer, Black Hills Ordnance Depot, January 31, 1952, 1 page. Subject: Disposition Instructions for Bomb, Gas, Persistent, H, 115-lbs, M70. Changes to memo dated 27 December 1951.
BHADb-185	Special Orders from Frank P. Duley, Captain, Cml C, January 4, 1952, 1 page. States that Board will make recommendations to Chief Cml Officer and change of date for Board recommendations.
BHADb-186	Photo - employees with gas masks, undated, 2 pages.
BHADb-187	Minutes of Meeting - Chemical Corps M-70 Bomb Disposal Board Recommendations on Disposal, 3 pages, December 18, 1951. Costs for renovation of bombs. Classification of bombs.
BHADb-188	Memo from Stephen M. Wondrasek, Depot Chemical Officer to Office of Chief Chemical Officer, Chief Historical Officer, February 11, 1952, 10 pages. Subject: Historical Reports, Chemical Branch, 1 January through 31, January 1952. Maintenance performed on M-70, H-filled bombs; lead washers installed. Maintenance and repair performed on M-78 CG and M-79 CK bombs. 4,000+ bombs shipped to Rocky Mountain Arsenal for renovation.
BHADb-189	Memo from Stephen M. Wondrasek, Drapeu, Southworth, Chemical Officers, April 13, 1953, 9 pages. Subject: Historical Reports, Chemical Branch, 1 January thru 31 March 1953. Describes CG, CK, H-filled bombs. Maintenance and repair performed on M-70, M-78 and M-79 bombs. 20,000+ M-70 bombs shipped to Rocky Mountain Arsenal. Shipments to Rock Mountain discontinued.
BHADb-190	Memo from W710 Technical Service Unit Cml, Technical Escort Detachment, Army Chemical Center, Maryland to Office of the Chief, Chemical Corps, Gravelly Point, Virginia, June 28, 1950, 2 pages. Subject: Trip Report - does not pertain to BHAD.
BHADb-191	Memo from John P. Drapeau, Depot Chemical Officer to Office of Chief Chemical Officer, Chief Historical Officer, Washington, D.C., April 19, 1954, 8 pages. Subject: Historical Reports, Chemical Branch, 1 January thru 31 March 1954. Ck, CG, H bombs. 481 M-70 bombs found leaking and labeled for disposal.
BHADb-192	Memo from John Drapeau, Depot Chemical Officer to Office of Chief Chemical Officer Chief, Historical Officer, Washington, D.C., April 6, 1955, 11 pages. Subject: Historical Report, Chemical Branch, 1 January thru 31 March 1955. 1,300+ M78 and M79 bombs found to need repair. 500+ M-70 leakers labeled for destruction. Radiac detection equipment issued.
BHADb-193	Memo from William J. Allen, Jr., Colonel, Cml C Commanding to Commanding Officer, Black Hills Ordnance Depot October 14, 1955, 2 pages. Subject: Valve, Needle, AN-M1. Defective needle valves incidence twice as high for CK bombs compared to CG bombs.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-194	Memo from Elwood T. Jones, Captain, Cml C, Chemical Supple Storage Officer to Chief, Chemical Officer, Washington, D.C., April 16, 1956, 18 pages. Subject: Historical Report of Chemical Corps Operations for Quarter Ending 31 March 1956. Commercial weed killer to be used in mustard gas storage areas. 600+ CK and CG bombs repaired. 700+ H gas bombs, 6 CK and 2 CG bombs transferred to burning area.
BHADb-195	1956 Photos of bomb bunker, storage and movement, 5 pages.
BHADb-196	Photos and Captions on H decontamination, removal and testing of H-gas. Decon procedures, May 10, 1957, 15 pages.
BHADb-197	Memo from Col. Ordnance Corps, Black Hills Army Depot, to Chief Chemical Officer, Washington, D.C., April 15, 1957, 19 pages. Subject: Quarterly Historical Reports of Chemical Corps Operations for Quarter Ending 31 March 1957. Four one-ton containers of H gas sent to Rocky Mountain Arsenal for tests. Repair of 2,000+ CG and CK bombs. 200+ leaking H gas bombs transferred to burning ground. Empty bomb casings from 160 M-70 bombs were burned in pits in chemical storage area. Proposal for destruction of M-70 bombs in kiln furnace.
BHADb-198	Memo from Elwood T. Jones, Captain, Cml C, Chemical Supply Storage Officer to Chief Chemical Officer, Washington, D.C., July 17, 1958, 10 pages. Subject: Quarterly Historical Report of Chemical Corps Operations for Quarter Ending 30 June 1958. Repair of 1200+ CK and CG bombs. Observed miniature kiln operation. 6000+ CK and CG bombs repaired. All M-70 H gas bombs converted to bulk mustard.
BHADb-199 Drawing	Black Hills Army Depot Igloo SD Longitudinal Sections Explosives Washout Plant, April 14, 1964.
BHADb-200 Drawing	Ammunition Workshops Plot Plan Proposed Filter Bed, March 14, 1957.
BHADb-201 Drawing	Black Hills Army Depot Igloo SD Enclosure of Furnace at Bldg. 6005, May 15, 1964.
BHADb-202 Drawing	Plane Table Sheet Chemical Warfare Area 29, August 1958.
BHADb-203 Drawing	Black Hills Army Depot Igloo SD Chemical Warfare Area Record Drawing 22, September 1964.
BHADb-204 Drawing	Storage for 115 lb. M-70 Chemical Bombs for Pallets in 80 ft. Igloo, December 6, 1944.
BHADb-205 Drawing	Black Hills Army Depot Igloo SD Flare Test Range, 24 February 1964.
BHADb-206 Drawing	Black Hills Army Depot Igloo SD Fencing Contaminated Area, July 11, 1966.
BHADb-207 Drawing	Black Hills Army Depot Igloo SD Elevations and Plan View Explosives Washout Plant, April 14, 1964.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-208 Drawing	Black Hills Army Depot Igloo SD Reservation Map, 15 December 1963.
BHADb-209	Letter from Lt. Col. Jack Carstarphen, BHAD, 11 January 1966, to Mr. Adelbert Hedglin, transmitting photos of CK demilitarization operation.
BHADb-210	Eleven 8 x 10 photocopies of photos with captions, CK demilitarization.
BHADb-211	Press Release, Nr. 117-65, 3 January 1966, BHAD, "BHAD Demil Job Pays for Itself with \$365,912.00 to Boot", 2 pages. Documents demilitarization of 5,000 500-lb and 200 1000-lb cyanogen chloride (CK) bombs in approximately 1965. Also states 206,508 H (mustard) gas bombs were demilitarized at BHAD in approximately 1962.
BHADb-212	"Analytical Report" BHAD, Igloo, S.D., Revised August 24, 1962, pages I-1 thru I-6, II-1 thru II-10, III-1 thru III-7.
BHADb-213	"Master Plan Analysis of Existing Facilities Black Hill Army Depot" pages I-1 thru I-2, II-1 thru II-16, III-1-1 thru III-1-2, III-4-1, III-4-3, III-4-4, III-4-8 thru III-4-11, III-8-1, III-8-21 thru III-8-26, III-8-31 thru III-8-67. Includes index. Describes areas including Ammunition Normal Maintenance, Open Ammunition Storage Pad, Magazines, Ammunition Workshops, Ammunition Disassembly, Bundle Ammunition Parking, Igloos, Burning Grounds 1, 2, & 3, Toxic Chemical Storage Area, Tracer Test Firing Range, etc. Provides outline description of each building by number including size, use, capacity, etc.
BHADb-214	Sheet 7 of 53 General Storm-Drainage & Tree-Cover Map.
BHADb-215	Sheet 8 of 53 General Site Map Storage Area 1.
BHADb-216	Sheet 9 of 53 General Site Map Storage Area 2.
BHADb-217	Sheet 24 of 53 General Site Map Warehouse and Airfield Area.
BHADb-218	Sheet 25 of 53 General Site Map Aboveground Magazine Area.
BHADb-219	Black Hills Army Depot Chemical Area 6000 Block Plans (3 Sheets).
BHADb-220	"Fire Fighting Plan for Chemical Area - VX - GB". 26 February 1963. Index card. 1 page. States "storage of VX and GB is confined to G block area".
BHADb-221	"Fire Fighting Plan Involving Nuclear Weapons", 3-1-63, index card, 1 page.
BHADb-222	Black Hills Army Depot Igloo, SD Chemical Area Block Plans (17 Sheets).
BHADb-223	Black Hills Army Depot Igloo, SD Provo Water Well #2, Well Log (3 Sheets).
BHADb-224	Black Hills Army Depot Igloo, SD Provo Water Well #1, Well Log (4 Sheets).
BHADb-228	Personal communication, Sgt. Marks, 74th ORdnance Detachment, Ft. Riley, Kansas, September 22, 1993.
BHADb-229	Personal communication, Bill Dorkin, CEMRD, September 21, 1993.
BHADb-230	Personal communication, Art Lawrence and James Rickard, Former BHAD Employees, August 19, 1993.

<p style="text-align: center;"><b>REFERENCES</b> <b>FORMER BLACK HILLS ARMY DEPOT</b></p>	
BHADb-231	Department of the Army, Technical Manual TM9-1904, Ammunition Inspectors Guide, 1945.
BHADb-232	Personal communication, Art Lawrence, September 17, 1993.
BHADb-233	Personal communication, Lee Deans, Former BHAD Employee, September 17, 1993.
BHADb-234	Personal communication, Louis Reckard, Former BHAD Employee, August 18, 1993.
BHADb-235	Personal communication with James Rickard, September 17, 1993.
BHADb-236	Ordnance Department, 1976. Memos regarding Residual Contamination at the BHAD.
BHADb-237	USATHAMA, February 1980. Black Hills Depot Historical Operations.
BHADb-238	USATHAMA, Draft Archives Search Report, 1980.

**REFERENCES  
FROM  
1992 REPORT**

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**

BHAD-001	USATHAMA, Archives Search 1980
BHAD-002	Information from Army Material Center, undated. Provided by CEHND 5/92.
BHAD-003	Findings and Determination, BHAD, DERP 1985.
BHAD-004	List of BHAD records transferred to Archives, May 1978.
BHAD-005	OEW Risk Assessment, CEHND-ED-SY, undated.
BHAD-006	Site Survey Summary, Findings and Determination and Preliminary Assessment, COE, 1985. Includes Statement of Clearance 1967 and OEW Risk Assessment CEMRD.
BHAD-007	Investigation into Chem-Nuclear Study, Technical Information Project, 1985. Included Documents BHAD-007-1 through BHAD-007-12.
BHAD-008	Contaminated Area Analysis Report, Igloo, South Dakota, Chem-Nuclear, 1981.
BHAD-009	Field Investigation of Uncontrolled Sites, USEPA, 1981.
BHAD-010	Photographs, BHAD, undated.
BHAD-011	Report on Excess Real Property at BHAD to GSA, CEMRDO.
BHAD-012	Property Ownership Information. CEMRDO Real Estate Records.
BHAD-012-1A	Quit Claim Deed, City of Edgemont, 1975.
BHAD-012-1B	Purchase Agreement between GSA and Edgemont, 1968.
BHAD-012-1C	Quit Claim Deed, City of Edgemont, 1983.
BHAD-012-2A/B	Deeds from Edgemont to Security Industries, 1976.
BHAD-012-3A	Ownership Documents, Burton Hutton and FHT, 1983.
BHAD-012-3B	City Deed from Edgemont to Burton Hutton, 1983.
BHAD-012-3C	Property Owned by Hutton's and Property Dispute, 1984.



**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-012-4A/B	Ownership Information, FHT, 1983.
BHAD-012-5A	Ownership Information, Igloo Subdivision, 1981-1984.
BHAD-012-5B	Igloo Subdivision Owners, Circa. 1975.
BHAD-012-6	Ownership Information, Tract Igloo, 1975.
BHAD-012-7A/B	Ownership Information, Robert Vallejas, 1984.
BHAD-012-8	Quit Claim Deed, Edgemont to Black Hills, Freeport, 1970.
BHAD-012-9	Warranty Deed from Black Hills Industrial Freeport to Texas Calf Palace, 1970.
BHAD-012-10	Deed from Security Industries to Circle P Farms, 1976.
BHAD-012-11	Deed from Security Industries to Southern Hills Bank, 1984.
BHAD-013	Ownership Information Including Tract Maps (some are copies of the above documents).
BHAD-014	Letter from South Dakota Department of Environment and Natural Resources to CEHND, 1991.
BHAD-015	Thompson, C.T. and L. Mays. Experts from The Ordnance Department; Procurement and Supply, Office of the Chief of Military History 1960.
BHAD-016	Green, C.L.; H.C. Thompson; P.C. Roots. Experts from The Ordnance Department: Planning Munitions for War, Office of the Chief of Military History, 1955.
BHAD-017	Meyer Michael, A Summary of South Dakota's Groundwater Information Resources, Data Management Efforts and Data Needs, USEPA and SEA, 1986.
BHAD-018	Owned, Sponsored, and Leased Facilities at BHAD, 1983.
BHAD-019	Temporary Storage of AMMO at BHAD from Chief of Ordnance, 1946.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-020      Personal Communication, Charlene Hillgran, May 20, 1992.
- BHAD-021      Groundwater quality data, BHAD, South Dakota Department of Water and Natural Resources, May 1991.
- BHAD-022      Mineral and Water Resources of South Dakota, USGS and South Dakota geological survey, July 1975.
- BHAD-023      Reconnaissance Investigation of Water Quality, Bottom Sediment and Biota Associated with irrigation in the Angostura Reclamation Unit, Southwestern S.D. 1988-1989, USGS, 1990.
- BHAD-024      Schoon Robert, Geology and Hydrology of the Dakota Formation in South Dakota, South Dakota Geological Survey 1971.
- BHAD-025      Rothrock, E.P. Structures South of the Black Hills, South Dakota Geological Survey, 1959.
- BHAD-026      Personal Communication, Marilyn Mitchell-Thompson, Pueblo Depot Activity, May 20, 1992.
- BHAD-027      Personal Communication, Marilyn Mitchell-Thompson, Pueblo Depot Activity, May 20, 1992
- BHAD-028      Personal Communication, Vernon Ichimura, Chem-Nuclear Systems Inc., May 28, 1992.
- BHAD-029      Edgemont, South Dakota, Southwestern Gateway to the Black Hills, Edgemont Chamber of Commerce, Circa 1990.
- BHAD-030      Environmental Hygiene Survey, Black Hills Ordnance Depot, U.S. Environmental Hygiene Agency, April 26, 1961.
- BHAD-031      Potential Mustard Exposure, BHAD, U.S. Environmental Hygiene Agency, February 13, 1981.
- BHAD-032      Comprehensive Use Plan from the City of Edgemont to GSA February 25, 1966.
- BHAD-033      Monthly Inactivation Progress Report, '64, '65, '66.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-034	Phamplet, Welcome to BHAD, Igloo South Dakota.
BHAD-035	Ordnance Installation and Activity Information Brochure, 6/15/60.
BHAD-036	Historical Background, up to 1955.
BHAD-037	Additional Personnel Requirements, August 20, 1964.
BHAD-038	Closing and Reduction of Certain Army Installations, April 23, 1964.
BHAD-039	Workload Data Presentation - FY'56 from Headquarters in Joliet, Illinois to Commanding Officer in BHAD, September 27, 1955.
BHAD-040	Renovation and Demilitarization Activities, January 1, 1956 - June 30, 1956.
BHAD-041	Operating Instructions for Radioactive Test Sample, July 13, 1956.
BHAD-042	Demilitarization of Bombs, January 1, 1957 to June 30, 1957.
BHAD-043	Statistical Report of Depot Operations, July 1, 1957 to December 31, 1957.
BHAD-044	Accu-Lab Test Report of Radioactivity Samples at Henderson & Igloo Wells, Collected April 4, 1992.
BHAD-045	Soil Survey of Fall River County South Dakota 1982. USDA Soil Conservation Service and Forest Service.
BHAD-046	Igloo: A History of the Black Hills Ordnance Depot, 1984. Igloo Area History Committee, Fall River County Historical Society.
BHAD-047	Request for use of Igloos at BHAD for Explosive Tests, July 1967. Omaha District, Corps of Engineers and U.S. Army Material Command.
BHAD-048	Property Summary, Circa 1967, General Services Administration.
BHAD-049	Quit claims deed, City of Edgemont, South Dakota from GSA, November 15, 1982.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-050	Inspection Report, 1965. GSA
BHAD-051	Commercial value of mineral deposits, BHAD, July 11, 1968. Jon Paul Gries, Consulting Geologist.
BHAD-052	Water Analysis, City of Edgemont, Well #2, February 22, 1951. South Dakota State Board of Health.
BHAD-053	Preliminary Decontamination Report, July 22, 1965. BHAD
BHAD-054	Study Plan of the BHAD, Provo South Dakota, 1980, USEPA.
BHAD-055	Transcript of taped conversation of Kenneth O. Flag of Chem-Nuclear concerning BHAD, 1984.
BHAD-056	Memos from Omaha District pertaining to BHAD, Circa November 1984 to January 1985.
BHAD-057	Newspaper clippings on Chem-Nuclear, 1985.
BHAD-058	CFR Judgements against CFR Chem Waste Management, Volume 50, No. 31, Thursday, February 14, 1985.
BHAD-059	GSA Interpretation of deed restrictions BHAD, GSA, 1985 and 1986.
BHAD-060	Information Packet, BHAD Site, 1984, Chem-Nuclear
BHAD-061	Special Inspection Report, BHAD, 1985. GSA
BHAD-062	Correspondence with City of Edgemont Pertaining to Posting of Signs. 1985 GSA
BHAD-063	BHAD, Land-lease History, Volume 9, Part 2. March, 1943 - December, 1944.
BHAD-064	BHAD Historical Reports, January, 1946 - June, 1946.
BHAD-065	Completion Report BHAD, 1942. U.S.A Army Corps of Engineers.
BHAD-066	Demilitarization of Chemical Agents Munitions and other Material, 1948. U.S. Army Chemical Corps.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-082	History of the Technical Escort Detachment, 1949. Army Chemical Center.
BHAD-083	Monthly Report of the Technical Escort Detachment, February 1952. Army Chemical Center.
BHAD-084	Instructions for using gas identification sets, 1943. Chemical Warfare School.
BHAD-085	Decontamination Procedures 1945. War Department Supply Bulletin SB5-52.
BHAD-086	Typical Procedures for renovation of fragmentation grenades, 1951. Ordnance Ammunition Center.
BHAD-087	Trip Report Evaluation Safety Issues of GB Filled Munitions, 1952. Army Chemical Center.
BHAD-088	Report of Explosives Safety Inspections of BHAD, 1950. Ordnance Department.
BHAD-089	Waivers and Exemptions, 1950-1953. Armed Services Explosive Safety Board and Structures.
BHAD-090	Correspondence related to land transferred to the Department of Agriculture, 1968. GSA
BHAD-091	Finding of fact and Inventory Report, 1985, Omaha COE.
BHAD-092	Press Release From Deb Rogers, 1985.
BHAD-093	Correspondence Pertaining to Deed Restriction Violations, 1985. CEMRD
BHAD-094	Correspondence Pertaining to Chem-Nuclear, 1985. CEMRD
BHAD-095	Correspondence from Bureau of Land Management to COE, 1990.
BHAD-096	William J. Bangsund, 1985. Hydrogeology of Upper Cretaceous Shales and Surficial Depots, Igloo Area. South Dakota School of Mines and Technology.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-067	Tracer Loading and Components, observed at Wolf Creek Ordnance Plant 1943. Ordnance Department.
BHAD-068	Ammunition Supply Branch 1943. Ordnance Department.
BHAD-069	Memos relating to white phosphorous fire at BHAD, 1946. Ordnance Department.
BHAD-070	Memos relating to Industrial Hygiene Surveys, BHAD, 1946.
BHAD-071	Demilitarization of Selected Types of Ammunition at BHAD, 1946 Ordnance Department.
BHAD-072	Summary of BHAD Facility, Undated. Ordnance Department.
BHAD-073	BHAD Quarterly Restorical Reports, January to December 1943. Ordnance Department.
BHAD-074	BHAD Quarterly Historical Reports January to December, 1944. Ordnance Department.
BHAD-075	BHAD Quarterly Historical Reports, October 1941 to Oct 1942, Ordnance Department.
BHAD-076	BHAD Quarterly Historical Reports, January to September 1945. Ordnance Department.
BHAD-077	Decomposing Waster High Explosives 1945. Ordnance Department.
BHAD-078	Trip reports and transportation manifests shipments of mustard gas ordnance Rocky Mountain Arsenal, 1950. Army Chemical Center.
BHAD-079	Trip Reports of Shipments of Mustard Gas Ordnance to Rocky Mountain Arsenal, 1948. Army Chemical Command.
BHAD-080	Trip reports and transportation manifests of shipment of chemical munitions to Alberta, Canada, 1948. Army Chemical Center.
BHAD-081	History of the Technical Escort Detachment, January to June 1947. Army Chemical Center.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-097	Supplement Report of Excess Real Property, Undated, GSA.
BHAD-098	Property Purchased by USDA Undated, Department of Agriculture.
BHAD-099	Correspondence Relating to USDA and Other Property Owners at BHAD, 1968. USDA
BHAD-100	Correspondence relating to USDA Property Dispute, 1970. USDA
BHAD-101	Black Hills Industrial Freeport Marketing Brochure, 1968.
BHAD-102	Historical Reports, BHAD. 1955-1958. Ordnance Department.
BHAD-103	Improvements Reported for Demilitarization of 8" shells, 20lb Fragmentation Bombs and M28 Rifle Grenades, 1958. Black Hills Ordnance Depot.
BHAD-104	General Provisions for Operation of Burning Ground #2, 1958. Black Hills Ordnance Depot.
BHAD-105	Demilitarization, January to June 1959. Black Hills Ordnance Depot.
BHAD-106	List of Restricted Areas, BHAD, July 17, 1959.
BHAD-107	Demilitarization, July to December 1959. Black Hills Ordnance Depot.
BHAD-108	Supply Operations with Photos, July to December 1960, Black Hills Ordnance Plant.
BHAD-109	Demilitarization and Maintenance, January to June 1961. Black Hills Ordnance Plant.
BHAD-110	Management Improvements with photos, January to June 1958. Black Hills Ordnance Plant.
BHAD-111	Photos of Ammunition and Renovation, 1943. Black Hills Ordnance Plant.
BHAD-112	Photos of Demolition and Renovation, 1960, Black Hills Ordnance Plant.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-113 Michael Meyer, 1984. Evaluation of Groundwater Resources in Western South Dakota. South Dakota Department of Water and Natural Resources.
- BHAD-114 Excerpts from Daily Duty Logs, BHAD Fire Department, 1950 to 1968, Black Hills Ordnance Plant.
- BHAD-115 Site Characterization for the Fall River Project, 1991. Johnson Environmental Concepts and EIC Corporation.
- BHAD-116 Occurrence and Characteristics of Groundwater in the Denver-Julesburg Basin Wyoming Volume 7 A and B, 1981. Water Resources Research Institute, Wyoming.
- BHAD-117 Jack Keen. Groundwater resources of the western half of Fall River County, South Dakota, South Dakota Geological Survey, Report of Investigation No. 109, 1973.
- BHAD-118 John Foster Sawyer. Depositional Environment of the Turner Sandy Member of the Carlile Shale near provo, South Dakota. South Dakota School of Mines and Technology, 1990.
- BHAD-119 Personal Communication with Matt Brown, Former Mayor of Edgemont, South Dakota, June 29, 1992.
- BHAD-120 Personal Communication with Merle Hollaway, Salvage Operator, BHAD, June 29, 1992.
- BHAD-121 1990 Census Report, U.S. Bureau of Census.
- BHAD-122 Edgemont Centennial, 1989.
- BHAD-123 Chemical Division Depot Report, BHAD, 1949-1950.
- BHAD-124 Decontamination Procedures, War Department Supply Bulletin, SB5-52, July, 1945.
- BHAD-125 Personal Communication with Francis Finkel, Former Demolition Foreman. BHAD, June 2, 1992.



**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- BHAD-126      Personal Communication with Louis Rickard, Former Fire Chief, BHAD, June 2, 1992.
- BHAD-127      Personal Communication with Dave Henderson, Edgemont Fire Chief, June 29 - July 3, 1992.
- BHAD-128      Personal Communication with Russell Anderson, Salvage Operator and Igloo Resident, June 30 - July 2, 1992.
- BHAD-129      Personal Communication with Merle Holloway, June 30, 1992.
- BHAD-130      Personal Communication with Matt Brown, June 30, 1992.
- BHAD-131      Personal Communication with Leonara Pederson, Provo Resident, July 2, 1992.
- BHAD-132      Personal Communication with Woodie Markey, former BHAD Ordnance Transporter, July 2, 1992.
- BHAD-133      Personal Communication with Frank Manke, Mayor of Edgemont and Rancher, July 2, 1992.
- BHAD-134      Personal Communication with Bill Chaney, Local Rancher, June 29, 1992.
- BHAD-135      Personal Communication with James Rickard, Former Ammunition Division Chief, BHAD, July 4, 1992.
- BHAD-136      White Phosphorous Fire, Edgemont Tribune, July 3, 1946.
- BHAD-137      Disposal of cyanogenchloride at BHAD, Edgemont Tribune, June 6, 1966.
- BHAD-138      "BHOD is Born", the Bhodian, April, 1945.
- BHAD-139      Fuze dropped on foot, BHAD, Edgemont Tribune, April 25, 1956.
- BHAD-140      Personal Communication with Edgemont Police Department, April 1992.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

- |          |  |
|----------|--|
| BHAD-141 | Personal Communication with Bob Hodorf, U.S. Forestry Service, June 29, 1992.  |
| BHAD-142 | 94th Ordnance Detachment Incident Report, June 30, 1992.   |
| BHAD-143 | Chemical Division Depot Report, BHAD 1951.   |
| BHAD-144 | Chemical Division Depot Report, BHAD 1952.   |
| BHAD-145 | Chemical Division Depot Report, BHAD 1953.   |
| BHAD-146 | Chemical Division Depot Report, BHAD 1954.   |
| BHAD-147 | Chemical Division Depot Report, BHAD 1955.   |
| BHAD-148 | Chemical Division Depot Report, BHAD 1956.   |
| BHAD-149 | Chemical Division Depot Report, BHAD 1957.   |
| BHAD-150 | Chemical Division Depot Report, BHAD 1958.   |
| BHAD-151 | Ellsworth AFB South Dakota Incident Report, BHAD 1980 to present.  |
| BHAD-152 | Personal Communication with William Bruce, Former Millright BHAD, July 30, 1992.   |
| BHAD-153 | Personal Communication with Dwight Lackey, son of Perry Lackey (Salvage Operator at former BHAD), August 3, 1992.                    |
| BHAD-155 | Personal Communication with Eugene Erickson, Landowner, August 3, 1992.  |
| BHAD-156 | Arnold H. Witcomb. Groundwater Resources and Geology of Neobrara County, Wyoming, Wyoming Geological Survey Water Supply Paper 1788. |
| BHAD-157 | Personal Communication and Correspondence with Tom Yancy, UXO International, July 21 and July 23, 1992.                              |

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHAD-158	Personal Communication with Joe Trotter, Rancher during operation of BHAD, August 3, 1992.
BHAD-159	Fate of Chemical Weapons in the Environment, USATHAMA, 1989.
BHAD-160	Disposal of Explosive Effluent at BHAD, 1953. Ordnance Ammunition Center, Joliet, Illinois.
BHADM-001	Facility Drawings, 1959.
BHADM-002	Facility Map, undated.
BHADM-003	Tract Map, CEMRD, 1942.
BHADM-004	General Geologic Map of South Dakota Series 1, South Dakota Geological Survey.
BHADM-005	Physiographic Divisions of South Dakota, South Dakota Geological Survey.
BHADM-006	Topographic Map (7.5 Minute) Provo Quadrangle Fall River County, South Dakota 1982.
BHADM-007	Topographic Map (7.5 Minute), Phister Ranch Quadrangle, Fall River County, South Dakota, USGS, 1982.
BHADM-008	Hazardous and contaminated areas map, May 24, 1965. Office of the post Engineer.
BHADM-009	Late 40's early 50's Additions. 1940s Additions, Layout Plan, 1942.
BHADM-010	Soil Conservation Map, Ownership Map, 1992.
BHADM-011	U.S. Forestry Map, Forestry Ownership and Leases, 1992.
BHADM-012	Fall River County Tax Assessor's Office, Current Ownership Map, 1992.
BHADM-013	Restricted Areas Map, January 27, 1967, PE-1004-1.
BHADM-014	1954 aerial photographs, Department of Agriculture.

**REFERENCES**  
**BLACK HILLS ARMY DEPOT**  
**(Continued)**

BHADM-015	1957 aerial photographs, Department of Agriculture.
BHADM-016	1965 aerial photographs, Department of Agriculture.
BHADM-017	1971 aerial photographs, Department of Agriculture.
BHADM-018	Soil Horizon Map, Soil Conservation District, 1982.
BHADM-019	Hazardous & contaminated Area Map, BHAD, March 27, 1963.

**APPENDIX A**  
**RISK ASSESSMENT CODE**  
**(RAC)**

# **RISK ASSESSMENT PROCEDURES FOR ORDNANCE AND EXPLOSIVE WASTE (OEW) SITES**

Site Name Black Hills Army Depot  
Site Location Provo, SD  
DERP Project # B08SD000800  
Date Completed November 1993

Rater's Name M. Weber/N. Dickens  
Phone No. (314) 426-0880  
Organization TCT-St. Louis for CELMS  
RAC Score RAC 1

## **OEW RISK ASSESSMENT:**

This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10. The RAC score will be used by CEHND to prioritize the remedial action at this site. The OEW risk assessment should be based upon best available information resulting from records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. This information is used to assess the risk involved based upon the potential OEW hazards identified at the site. The risk assessment is composed of two factors, **hazard severity and hazard probability**. Personnel involved in visits to potential OEW sites should view the CEHND videotape entitled "A Life Threatening Encounter: OEW".

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

### **TYPE OF ORDNANCE** (Circle all values that apply)

#### **A. Conventional Ordnance and Ammunition**

	<u>VALUE</u>
Medium/Large Caliber (20 mm and larger)	10 ✓
Bombs, Explosive	10 ✓
Grenades, Hand and Rifle, Explosive	10 ✓
Landmines, Explosive	10 ✓
Rockets, Guided Missiles, Explosive	10 ✓
Detonators, Blasting Caps, Fuzes, Boosters, Bursters	6 ✓
Bombs, Practice (w/spotting charges)	6
Grenades, Practice (w/spotting charges)	4
Landmines, Practice (w/spotting charges)	4
Small Arms (.22 cal - .50 cal)	1 ✓
Conventional Ordnance and Ammunition (Select the largest single value)	<u>10</u>

What evidence do you have regarding conventional OEW? Live Butterfly bomblets, 105mm, 155mm, and 37mm rounds, a M47A4 bomb, small caliber arms, fuzes, and boosters were found at the site during the 1992 and 1993 site visit. Large quantities of all types of ammunition were destroyed at the facility (see Tables 3-2, 3-3, and 3-4 for references).

B.	Pyrotechnics (For munitions not described above.)	<u>VALUE</u>
	Munition (Container) Containing White Phosphorus or other Pyrophoric Material (i.e., Spontaneously Flammable)	10 ✓
	Munition Containing A Flame or Incendiary Material (i.e., Napalm, Triethylaluminum Metal Incendiaries)	6 ✓
	Flares, Signals, Simulators	4 ✓
	Pyrotechnics (Select the largest single value)	<u>10</u>

What evidence do you have regarding pyrotechnics? Live incendiary, smoke, and white phosphorous bombs and shells were found at the surface during the 1992 and 1993 site visits. A flare test range was present at the site and burned parachute flares were found at the surface of Burning Ground 2.

C.	Bulk High Explosives (Not an integral part of conventional ordnance; uncontainerized).	<u>VALUE</u>
	Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, Tetracene, etc.)	10 ✓
	Demolition Charges	10 ✓
	Secondary Explosives (PETN, Compositions A, B, C Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	8 ✓
	Military Dynamite	6
	Less Sensitive Explosives (Ammonium Nitrate, Explosive D, etc.)	3 ✓
	High Explosives (Select the largest single value)	<u>10</u>

What evidence do you have regarding bulk explosives? Bulk explosives including lead azide (BHAD-077), TNT, PETN various explosive mixtures, black powder, and ammonium nitrate were stored and destroyed at the BHAD (see Table 3-2 for references). Suspected TNT was found on the surface of the explosive leaching beds during the 1993 site visit.

D.	Bulk Propellants (Not an integral part of rockets, guided missiles, or other conventional ordnance; uncontainerized)	<u>VALUE</u>
	Solid or Liquid Propellants	6
	Propellants	<u>6</u>

What evidence do you have regarding bulk propellants? Unsymmetrical dimethylhydrazine was disposed of at Burning Ground 3 (BHAD-114) and unidentified propellant was destroyed at a suspected pit area west of Block J during the mid-forties [BHADb-232].

E. Radiological/Chemical Agent/Weapons

VALUE

Toxic Chemical Agents  
(Choking, Nerve, Blood, Blister)

25 ✓

War Gas Identification Sets

20

Radiological

15

Riot Control and Miscellaneous  
(Vomiting, Tear, Incendiary and Smoke)

5 ✓

Radiological/Chemical Agent (Select the largest single value)

25

What evidence do you have of chemical/radiological OEW? Mustard gas was destroyed at the depot. Phosgene and cyanogen chloride were poured on the ground in trenches at Burning Ground 2. A 250-foot line possibly filled with mustard is believed to be present in the subsurface at the chemical plant (see Table 3-4) [BHAD-125, 126, 53]. Empty bursting chemical bomb casings and shells were found at the surface of Burning Grounds 1 and 2 in 1992 and 1993.

=====

Total Hazard Severity Value

61

(Sum of Largest Values for A through E--Maximum of 61).

Apply this value to Table 1 to determine Hazard Severity Category.

TABLE 1

HAZARD SEVERITY\*

Description	Category	Value
CATASTROPHIC	I	$\geq 21$
CRITICAL	II	$\geq 10 < 21$
MARGINAL	III	$\geq 5 < 10$
NEGLIGIBLE	IV	$\geq 1 < 5$
**NONE		0

\*Apply Hazard Severity Category to Table 3.

Hazard Severity Category for the BHAD is Category I, Catastrophic (total points 61).

\*\*If Hazard Severity Value is 0, you do not need to complete Part II. Proceed to Part III and use a RAC Score of 5 to determine your appropriate action.



Part II. Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF OEW HAZARD  
(Circle all values that apply)

A. Locations of OEW Hazards

	<u>Value</u>
On the surface	5 ✓
Within Tanks, Pipes, Vessels or other confined locations.	4 ✓
Inside walls, ceilings, or other parts of buildings or structures.	3
Subsurface	2 ✓
Location (Select the single largest value)	<u>5</u>

What evidence do you have regarding location of OEW? Pipes/vessels, walls, ceilings, etc., were not examined, documents indicate chemical toxics and explosives may be present in pipes, etc. [BHAD-53]. OEW was found on the surface in 1992 and 1993 and is believed to be in the subsurface at Burning Grounds 1 and 2, the Chemical Area, and Ammunition Workshop.

B. Distance to nearest inhabited locations or structures likely to be at risk from OEW hazard (roads, parks, playgrounds, and buildings).

	<u>VALUE</u>
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.5 miles to 1.0 mile	3 ✓
1.0 mile to 2.0 miles	2
Over 2 miles	1
Distance (Select the single largest value)	<u>3</u>

What are the nearest inhabited structure? Based on topographic maps and the site visit, a small residential area exists within a mile of Burning Ground 3. Ranchers grazing the areas, souvenir hunters, and salvage operators may work and dig directly in the burning areas.

- C. Numbers of buildings within a 2 mile radius measured from the OEW hazard area, not the installation boundary.

	<u>VALUE</u>
26 and over	5
16 to 25	4
11 to 15	3 ✓
6 to 10	2
1 to 5	1
0	0
Number of Buildings (Select the single largest value)	<u>3</u>

Narrative Buildings include those within the residential area and the salvage business.

---

- D. Types of Buildings (within a 2 mile radius)

	<u>VALUE</u>
Educational, Child Care, Residential, Hospitals, Hotels, Commercial, Shopping Centers	5 ✓
Industrial, Warehouse, etc.	4
Agricultural, Forestry, etc.	3
Detention, Correctional	2
No Buildings	0
Types of Buildings (Select the largest single value)	<u>5</u>

Describe types of buildings in the area. The types of buildings are primarily residences with a salvage operation.

---

- E. Accessibility to site refers to access by humans to ordnance and explosive wastes. Use the following guidance:

<u>BARRIER</u>	<u>VALUE</u>
No barrier or security system	5
Barrier is incomplete (e.g.e, in disrepair or does not completely surround the site). Barrier is intended to deny egress from the site, as for a barbed wire fence for grazing.	4 ✓
A barrier, (any kind of fence in good repair) but no separate means to control entry. Barrier is intended to deny access to the site.	3 ✓
Security guard, but no barrier	2
Isolated site	1 ✓
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility; or An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0
Accessibility (Select the single largest value)	<u>4</u>

Describe the site accessibility. The Depot itself is an isolated area, but Burning Grounds 1 and 2 and the burning pit in the Chemical Area are public lands. An 8-10 foot chain link fence is present at all of these locations along the depot perimeters. Barbed wire fencing partially surrounds each area to keep cattle from mixing; however locks exist only at the depot fence.

- F. Site Dynamics - This deals with site conditions that are subject to change in the future, but may be stable at the present. Examples would be excessive soil erosion by beaches or streams, increasing land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

	<u>VALUE</u>
Expected	5 ✓
None Anticipated	0
Site Dynamics (Select largest value)	<u>5</u>

Describe the site dynamics. Planned extension of water lines in the area by the State and potential development of an area of the former BHAD for disposal of ash (not within a hazardous area) will increase the number of people at the BHAD. In addition, the entire area is extremely susceptible to wind erosion (blow outs) and stream erosion due to climate, topography and geology at the site. Most of the ordnance components and fragments were encountered along the steeply sloping sides and bottoms of ravines.

Total Hazard Probability Value  
(Sum of Largest Values for A through F -- Maximum of 30)

25

Apply this value to Hazard Probability Table to determine Hazard Probability Level.

TABLE 2

HAZARD PROBABILITY\*

Description	Level	Value
FREQUENT	A	$\geq 27$
PROBABLE	B	$\geq 21$ < 27
OCCASIONAL	C	$\geq 15$ < 21
REMOTE	D	$\geq 8$ < 15
IMPROBABLE	3	< 8

\*Apply Hazard Probability Level to Table 3.

Hazard Probability Level for the BHAD is Level B, Probable (total points 25).

Part III. Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

TABLE 3

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

RAC 1 Imminent Hazard - Expedite INPR - Immediately call CEHND-ED-SY--commercial 205-955-4968 or DSN 645-4968.

RAC 2 High priority on completion of INPR - Recommend further action by CEHND.

RAC 3 Complete INPR - Recommend further action by CEHND.

RAC 4 Complete INPR - Recommend further action by CEHND.

RAC 5 Recommend no further action. Submit NOFA and RAC to CEHND.

=====  
Part IV. Narrative. Summarize the documented evidence that supports this risk assessment. If no documented evidence was available, explain all the assumptions that you made.

The BHAD scored a RAC 1 (Severity Category I, Catastrophic; Probability Level B, probable). The Inventory Project Report (INPR) should be completed immediately. Emergency fencing and a Feasibility Study are recommended for the following reasons. The supplemental archives search produced documentation of CWM and UXO currently on the surface at Burning Grounds 1 and 2. CWM may be present in the subsurface at the Chemical Area. UXO and CWM are most likely present in the subsurface at Burning Grounds 1 and 2 [BHAD-53, BHADb-1, 153, 170, 233, Tables 3-2, 3-3, and 3-4]. Local residents continue to search the ground surface for memorabilia and probably have done so since the depot's closing in 1967. Visual evidence and reports of bombs or fragments found indicate a possibility that ordnance or UXO made its way to the ground surface from the subsurface either through wind erosion (blow outs) or stream erosion.

There is a high probability that UXO and CWM are present in the subsurface at several locations. Reportedly, a visual clearance of the ground surface and covering of demolition pits were the only method used during previous decontamination activities. Records also indicate that chemical bombs were not always removed from pits after burning, but were, at times, covered with soil. [BHADb-154] A former BHAD employee stated that the area had originally been restricted to non-use due to the hazardous nature of the site. [BHADb-230]

In conclusion, it is TCT-St. Louis' judgment that CWM and UXO are present at the former BHAD and their presence could pose a critical hazard. It is also TCT-St. Louis' judgment that the potential for exposure to CWM and UXO and its associated hazard currently exists at the facility.

**APPENDIX B**

**SECTION 2.0  
RECOMMENDATIONS  
FINAL ARCHIVES SEARCH REPORT,  
PRELIMINARY ASSESSMENT OF ORDNANCE  
CONTAMINATION AT THE FORMER  
BLACK HILLS ARMY DEPOT  
SOUTH DAKOTA  
OCTOBER 1992**

## SECTION 2

### **2.0 RECOMMENDATIONS**

Based on the results of the former BHAD Archives Search TCT-St. Louis concluded that OEW or UXO may be present at a number of locations at the former depot. Based on a risk assessment that took into consideration the hazard severity and hazard probability, TCT recommends installation of fencing, placarding of hazardous areas, and performance of a remedial investigation to determine the extent, location, quantities, and types of OEW or UXO contamination. Fencing should enclose all trenches, pits, burn and demolition areas, and ravines containing UXO. Hundreds of UXOs were observed in the ravines at Burning Grounds 1 and 2. The ravines should be visually surveyed and cleared of all UXO. The acreage recommended for the visual surveys include the ravine areas at both burning grounds. A summary of the recommended action is presented in Table 2-1. TCT-St. Louis recommends contacting the 94th Ordnance Detachment, Fort Carson, Colorado, (719-579-4242) prior to initiating survey and excavation activities. Additional emergency response contacts are included in Appendix C.

TCT recommends visual surveys and geophysical surveys. The geophysical surveys would include electromagnetometry, magnetometry and metal detection. These methods are capable of detecting the existence and approximate depth of ordnance items and other disturbed areas. Magnetometry and metal detection are appropriate for locating ferrous and nonferrous metallic objects such as individual projectiles, rockets, bombs, etc. Electromagnetometry is appropriate for detecting non-metallic objects and metallic objects such as non-metallic drain lines and landfills. In addition, excavation, hand or otherwise, would be necessary to positively identify a "contact" located during the visual or geophysical surveys.

In the following paragraphs, TCT's recommendations are described in more detail. However, these recommendations and suggestions are to be considered general. Site conditions may limit field activities. A site-specific safety and work plan should be developed before any field activities take place.

All maps presented are based on the presence of pits, trenches, burn areas, or disturbed soil as shown on 1954, 1957, and 1965 aerial photos rather than on the observed conditions of the potentially contaminated areas. Estimated acreage for each area was based on the areal extent shown in the aerial photographs.

### **2.1 Personnel**

It is not clear whether personnel performing field work are required to have attended a USEPA-approved 40-hour Safety Course for working at hazardous materials sites or have been examined by a physician in the past year to ensure they are fit to work at hazardous waste sites. However, due to the potential presence of chemical-filled ordnance, this training and examination would probably be beneficial. Field personnel directly responsible for

TABLE 2-1					
SUMMARY OF RECOMMENDATIONS BLACK HILLS ARMY DEPOT					
			Geophysical		
Location	Emergency Action	Visual Survey (Acres)	Type	Acres	Excavation
Burning Ground 1 (495 acres)	Fencing <sup>1</sup> , placarding, non-use	74 <sup>2</sup>	Magnetometer, metal detector	17	Based on geophysics
Burning Ground 2 (965 acres)	Fencing <sup>1</sup> , placarding, non-use	270 <sup>2</sup>	Magnetometer, metal detector	65	Based on geophysics
Burning Ground 3 (675 acres)	Fencing <sup>1</sup> , placarding, surface use only	32.6	Magnetometer, metal detector	7.3	Based on geophysics
Chemical Area, Chemical Plant (1.1 acres)	Fencing <sup>1</sup> , placarding, non-use	None	Electromagnetic	0.5	Excavate <sup>3</sup> drain line
Chemical Area, Chemical Burning Pit (26 acres)	Fencing, Placarding, non-use <sup>4</sup>	6.5	Magnetometer, metal detector	1.6	Based on geophysics
Burial Site, White Phosphorous Casings (2.8 acres)	None	None	Magnetometer, metal detector	0.66	Based on geophysics
Tracer Test Range (0.43 acres)	Fencing <sup>4</sup> , Placarding, non-use	0.43	None	-	Clear UXO, if present
Surveillance Area (4.4 acres)	None	1.1	Magnetometer, metal detector	1.1	Based on geophysics
Ammunition Workshop, Leaching Beds (2.09 acres)	None	None	None	-	Test Pits, Field Screening for TNT <sup>5</sup>
Disassembly Plant (1.9 acres)	None	1.9	None	-	None
Total Acreage 2,173.72		384.63		93.6	

<sup>1</sup>Fencing should enclose all trenches, pits, burn areas, and ravines.

<sup>2</sup>Acreage includes ravines where UXO have been observed. Due to the numbers of UXO present, the percent visual survey has been increased from what is normally recommended.

<sup>3</sup>May require personnel with Chemical Surety.

<sup>4</sup>A portion of the area is currently fenced and placarded, recommended fencing should enclose both pits and the incinerator and leaching field area.

<sup>5</sup>Field screening according to CRREL method.



accessing and retrieving UXO must have been trained at the Naval School of Explosive Ordnance Disposal, Indian Head, Maryland. In areas containing potential chemical weapons or chemical toxics such as the Chemical Plant Area, U.S. Army Chemical Surety personnel are required to be present.

## **2.2 Visual Survey**

A visual survey entails visually scanning an area to locate ordnance on the surface or surface indications of the presence of subsurface ordnance (e.g., projectile entry holes, craters, or burial trenches). It also entails using a geophysical survey instrument such as the Schoenstedt device to aid in surveying the ground surface.

For the purposes of this report, as an example, a 100% visual survey refers to surveying 100% of an entire area, and a 50% visual survey refers to surveying 50% of an entire area. For example, the search lanes for a 100% visual survey would overlap slightly, while the search lanes for a 50% visual survey would not, thus resulting in half of the area not being surveyed. A 50% visual survey is not intended to mean that a predetermined portion of an area is not to be surveyed at all. For example, a 50% survey is not intended to mean that the western half of an area is 100% surveyed and the eastern half if not surveyed at all.

## **2.3 Geophysical Surveys**

### **2.3.1 Magnetometer**

The Foerster Ferex Electromagnetic Detector is recommended. It is the most recent military approved locator and is in use by the U.S. Military EOD forces, designated the MK 26 Ordnance Locator, for detecting subsurface ordnance items. The locator is a hand-held unit and uses two fluxgate magnetometers, aligned and mounted a fixed distance apart to detect changes in the earth's ambient magnetic field caused by ferrous metal or disturbances caused by soil conditions. Both an audio and metered signal are provided to the operator. The detection capability of the Foerster Ferex is dependent on the size of the item versus its depth. The Foerster Ferex is capable of ordnance location to the following depths:

<u>ITEM</u>	<u>DEPTH</u>
Small Arms Round	1 ft
Hand Grenade	2 ft
Anti-Personnel Mine	3 ft
Anti-Tank Mine	4.5 ft
Medium Projectile	10 ft
Small Bomb	15 ft
Large Bomb	19 ft

Although the Foerster Ferex Ordnance Locator will detect disturbances caused by changes in soil conditions, its ability to detect metallic items is not affected by local soil conditions. Items of debris, such as crates and boxes, can interfere with the Ferex' ability to locate ordnance due to the metallic fasteners and hinges used in the construction of these items.

### **2.3.2 Metal Detector**

The White's Eagle II Metal Detector is recommended. It is a man-carried, microprocessor-controlled metal detector with a Liquid Crystal Display and a keypad user interface. This metal detector operates on the induction principle whereby a transmitter coil induces eddy currents within buried metal and these induced eddy currents are received by a receiver unit. The advantage of this detector is that it can detect both ferrous and non-ferrous metals.

### **2.3.3 Electromagnetic Survey**

The Electromagnetic method measures the electrical conductivity of subsurface soil and rock. It can be used to identify metallic and non-metallic anomalies at depth. Lateral variations in electromagnetic conductivity are mapped by profiling measurements made with a specialized instrument such as a Geonics EM31. This instrument measures the conductivity from the surface to depths of approximately 20 feet.

## **2.4 Excavation/Trenching**

The only way to positively identify a "contact" located during visual or geophysical surveys is to excavate. Shallow hand excavation would be used where items are considered close to the surface. Trenching or excavation by backhoe may be necessary to identify deeper items.

## **2.5 Burning Ground 1**

Burning Ground 1 consists of 438 acres and two burning pits [BHAD-053]. Based on aerial photographs, the potentially contaminated area extends beyond the documented size of Burning Ground 1 and consists of several smaller areas totaling about 495 acres. Ordnance components and empty incendiary bomb casings (potentially containing incendiary residue) were found within the ravines. As soon as practical, access should be limited by fencing and posting of signs. The fenced area should include all trenches, pits, burn and demolition areas, and ravines containing UXO. No digging or intrusive activities should be allowed in this area until the hazards have been fully identified and assessed. Recommended field activities should be conducted during the time of year when vegetational growth is limited.

Due to the actual presence of UXO at the surface of Burning Ground 1, an intensive reconnaissance needs to be performed in the vicinity of the former burning pits and the ravines. As shown in Figure 2-1, a 15% visual survey should be conducted over the entire

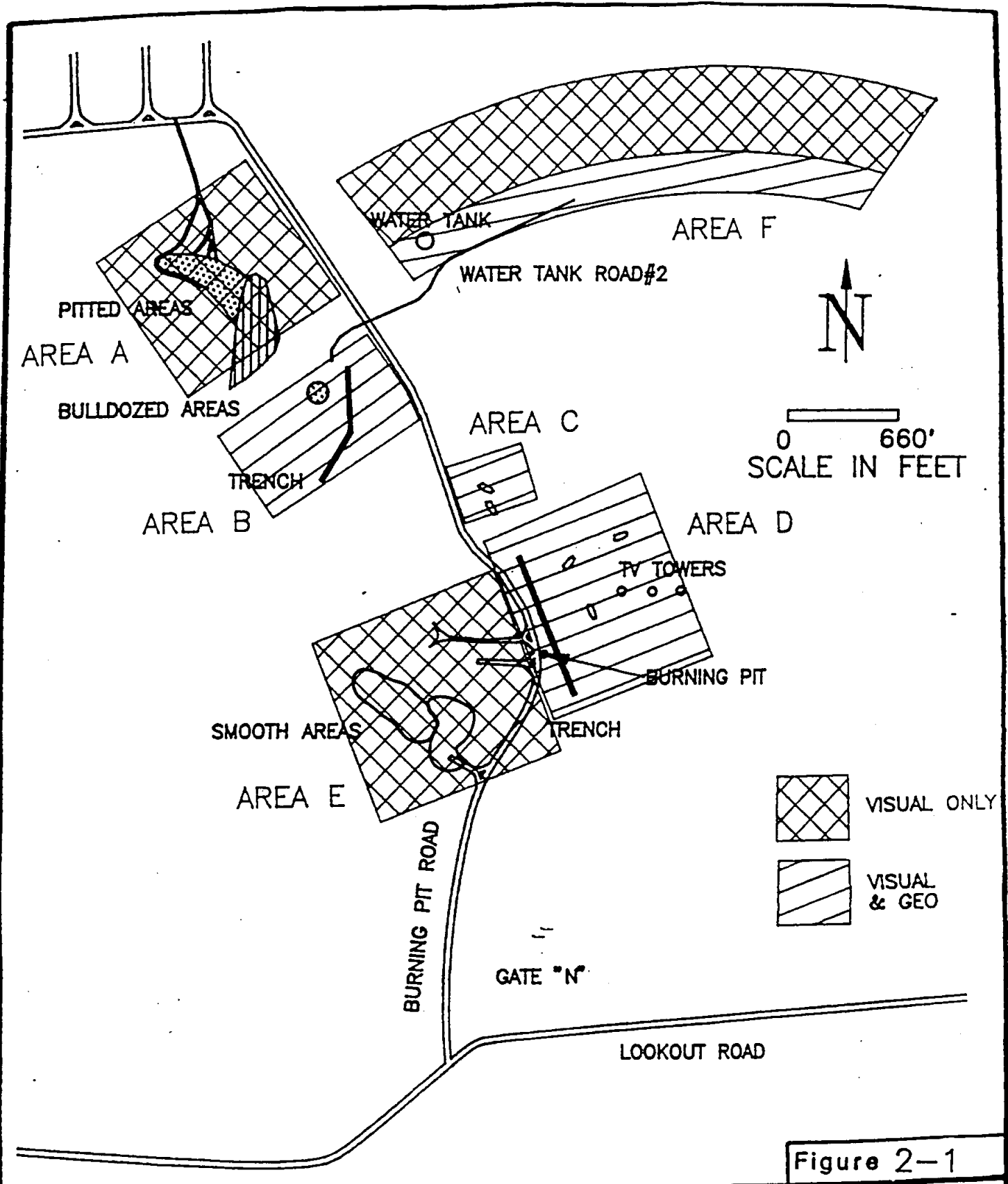


Figure 2-1

**TCT**

**St. Louis**

BURNING GROUND #1  
FORMER BHAD

VISUAL AND GEOPHYSICAL SURVEY LOCATIONS

Project No. 9772

By: DT

Chk'd By: TML

Date: 8-12-92

area (73.86 acres). UXO found on the surface and within the ravines should be destroyed. Field conditions may alter the suggested percentage of the area to be visually surveyed.

A geophysical (magnetometer and metal detector) survey is suggested to be conducted in the level portions of the burning ground in order to determine the location, quantities, and types of UXO present. Survey lanes should be closer to each other near the locations of former trenches, and the pattern of the lanes should be perpendicular to the orientation of the trenches. Suggested geophysical survey lanes are presented in Figure 2-1. If the survey lanes are 6 feet in width, the suggested lanes total approximately 17.2 acres. Prior to conducting the survey, the area should be cleared of surface debris.

The suggested geophysical lanes may be altered based upon results of the visual survey. If the results of the visual and/or geophysical surveys indicate UXO is present, the additional survey areas may be considered.

Due to the potential presence of mustard in the soil, any excavation activities should be conducted in Modified C or B allowing no dermal exposure or inhalation of contaminated air.

## **2.6 Burning Ground 2**

Burning Ground 2 consists of 965 acres which includes numerous trenches and demolition craters [BHAD-053]. Fuzes, boosters, bursters, and bomb casings were found during TCT's site visit down the sides of ravines and burned out shells were found in a pond on the southern edge of the site. As soon as practical, access should be strictly limited by fencing and posting of signs. The fenced area should include all trenches, pits, burn and demolition areas, popping furnace, and ravines containing UXO. No digging or intrusive activities should be allowed in this area until the hazards have been fully identified and assessed. Recommended field activities should be conducted during the time of year when vegetational growth is limited.

Due to the actual presence of UXO at the surface of Burning Ground 2, an intensive reconnaissance needs to be performed in the vicinity of trenches, burning pits, and the northern ravines. As shown in Figure 2-2, a 25% visual survey should be conducted over the entire area (270 acres including a 100% visual survey of the ravines). UXO found during the visual survey should be destroyed and removed. Field conditions may alter the suggested percentage of the areas being visually surveyed.

A geophysical survey (magnetometry and metal detection) is recommended for the site in order to determine the location quantities and types of UXO present. Survey lanes should be closer to each other near the locations of former trenches and burn areas. The pattern of survey lines should be perpendicular to the orientation of the trenches. Suggested geophysical survey lanes are presented in Figure 2-2. If the survey lanes are 6 feet in width, the suggested lanes total approximately 65 acres. Prior to conducting the survey, the survey area should be cleared of surface debris.

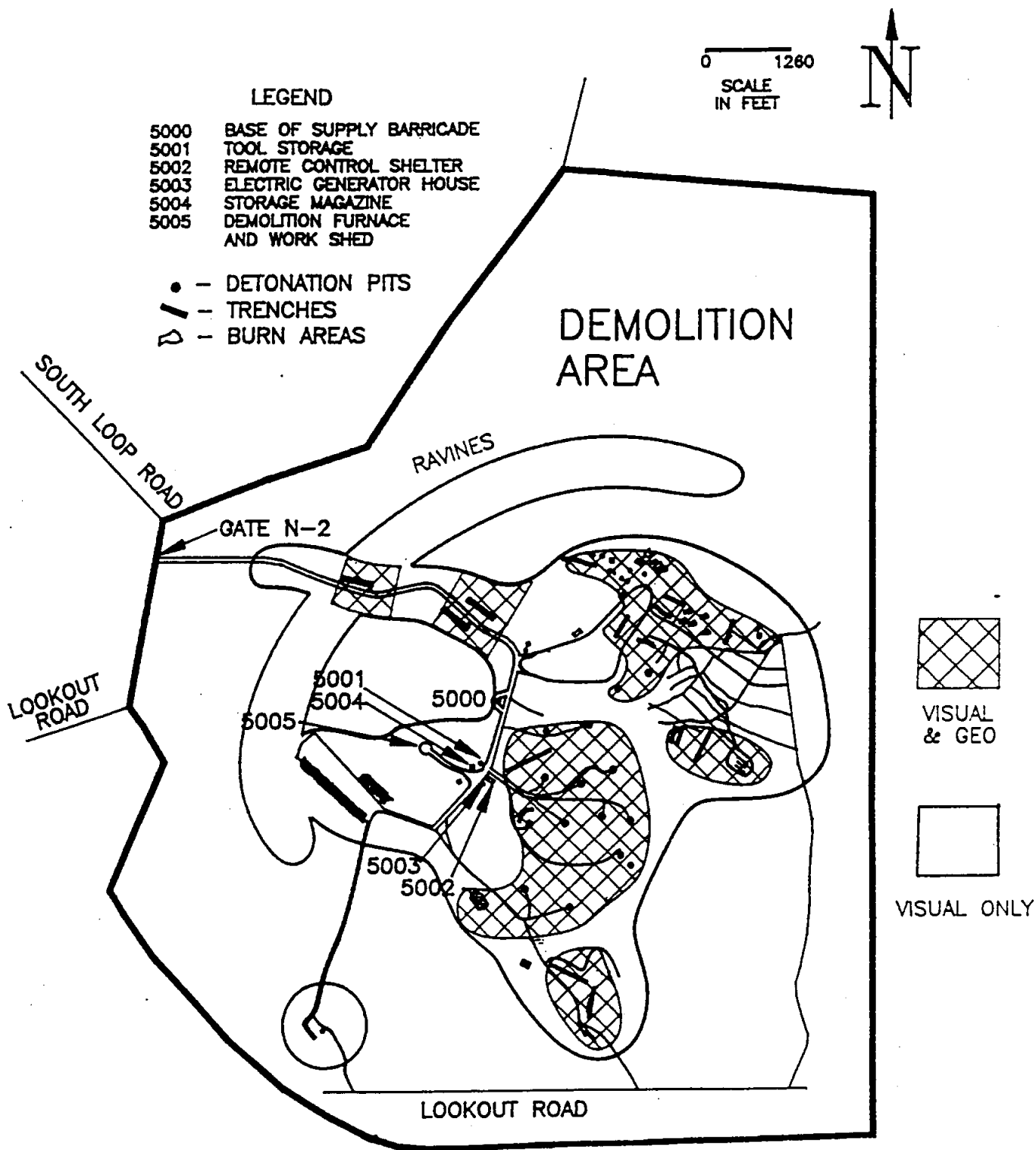


Figure 2-2

**TCT**  
St. Louis

BURNING GROUND #2  
FORMER BHAD  
VISUAL AND GEOPHYSICAL SURVEY LOCATIONS

Project No. 9777

By: D.S.

Chk'd By: TML

Date: 8-12-92

The suggested geophysical lanes may be altered based upon results of the visual survey. If the results of the visual and/or geophysical surveys indicate UXO is present, additional survey areas may be considered.

Due to the potential presence of mustard in the soil, any excavation activities should be conducted in modified Level C or B allowing no exposure of skin or inhalation of contaminated air.

### **2.7 Burning Ground 3**

Fuzes, bursters, and bomb fragments were sporadically encountered by TCT throughout the 675 acre burning area. No surface expression of former trenches or pits were observed at Burning Ground 3. As soon as practical, the entire area should be fenced and "surface use only signs" posted. The entire fenced area should include all trenches, leaching beds, pits, burn areas, and ravines containing UXO. No investigations requiring digging should be allowed without the presence of personnel trained in explosive ordnance disposal.

TCT-St. Louis suggests a 5% visual survey (32.6 acres) over the entire area should be conducted; however, more intensive reconnaissance should be performed in the vicinity of former trenches and burning site. Field conditions may alter the suggested percentage of the area to be visually surveyed.

A geophysical survey (magnetometry and metal detection) is suggested to be conducted perpendicular to the former trenches. Suggested geophysical survey lanes are presented in Figure 2-3. If survey lanes are 6 feet in width, the suggested lanes total approximately 7.3 acres.

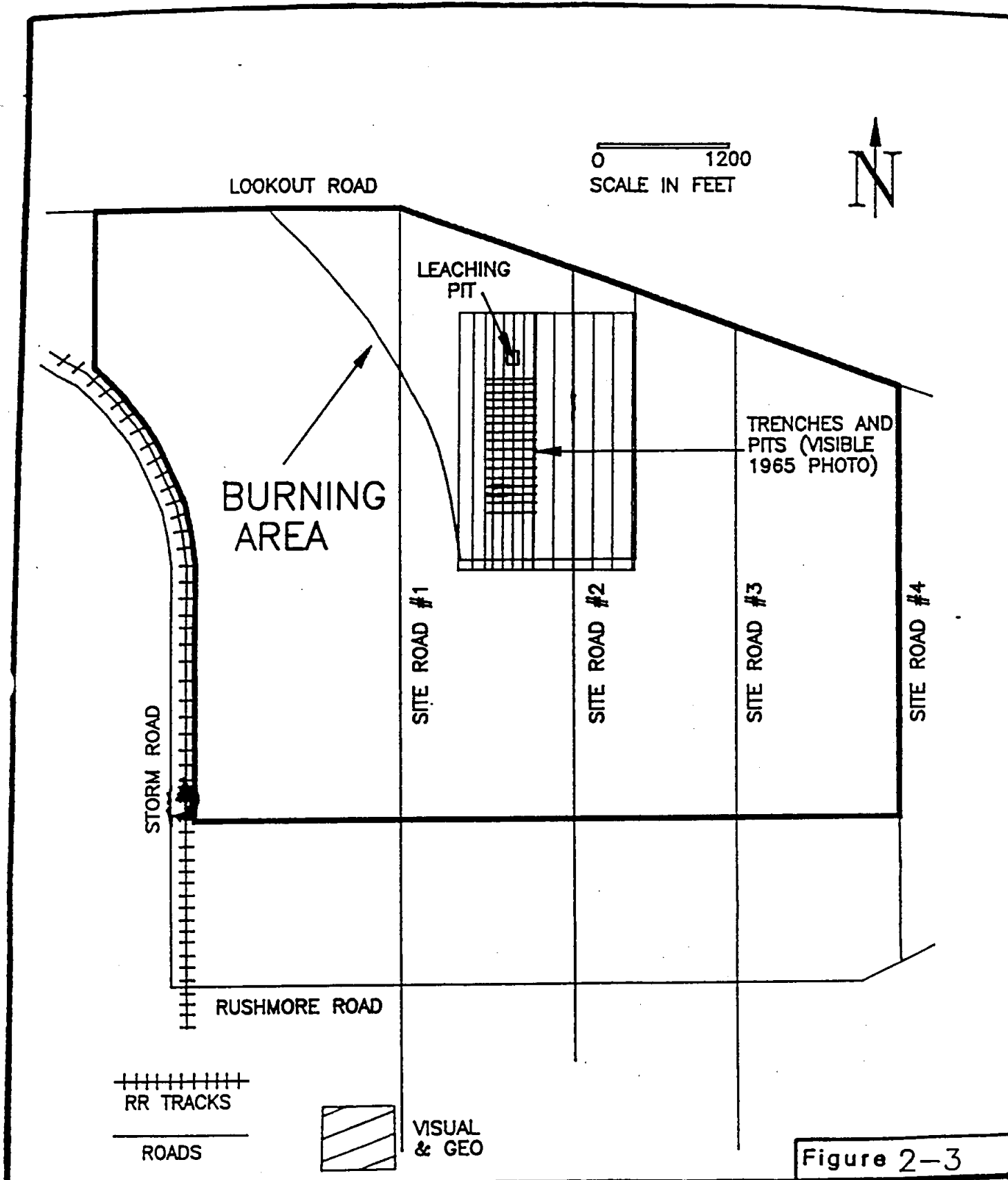
The suggested geophysical survey lanes may be altered later based upon results of the visual survey. If the results of the visual and/or geophysical surveys indicate UXO is present, additional survey areas may be considered.

### **2.8 Chemical Area**

According to documents, a 250-foot mustard filled drain line may be present in the subsurface near the former mustard gas incinerator in an area consisting of approximately 1.1 acres [BHAD-053]. Drain lines may have been composed of rubber or non-metallic components.

As soon as practical, access to the chemical plant area should be strictly limited by fencing and posting of signs. Fencing should surround both trenches at the burning pit, the former incinerator area, and the leaching bed area. No digging or intrusive activities should be allowed in this area until the hazards have been identified and assessed.

An 11% electromagnetic survey should be conducted in the area east of the former incinerator. Survey lines should be more closely spaced directly east of the former incinerator. Most likely, the original drain lines ran east-west; however, the precise location



**TCT**

**St. Louis**

BURNING GROUND #3  
FORMER BHAD  
VISUAL AND GEOPHYSICAL SURVEY LOCATION

Project No. 0 - -

By: DT

Chk'd By: TMI

Date: 8-12-92

and orientation of the buried line is unknown. A geophysical survey is suggested to be conducted perpendicular to the direction of the lines. Recommended geophysical survey lanes are presented in Figure 2-4. Based on survey results, the survey area may be expanded to include the large denuded area east of the former incinerator area.

Following the survey, the suspected drain lines should be excavated. All excavation activities should be conducted in modified Level A or B with Chemical Surety personnel present. Dermal and inhalation exposure should be completely avoided. TCT-St. Louis suggests that excavation be conducted in the winter. At low temperatures, mustard solidifies and safety hazards are substantially reduced. Due to the action of burrowing animals, contaminated items may be brought to the surface at the Chemical Burning Pit. Based on aerial photographs, the area comprising the Chemical Burning Pit is estimated to be 26 acres. A 25% visual survey (6.5 acres) and a 6% magnetometer and metal detector survey (1.6 acres) should be conducted within the burning pit area. A geophysical survey is suggested to be conducted roughly perpendicular to the two trenches which were present at the burning pit during operation of the former BHAD.

Suggested geophysical lanes are presented in Figure 2-5. The suggested geophysical survey lanes may be altered based upon results of the visual survey. If the results of the visual and/or geophysical surveys indicate UXO is present, additional survey lanes may be considered.

## **2.9 Burial Site - White Phosphorous Casing**

Subsequent to a fire in 1946, burned white phosphorous casings were buried at a location north of Igloo Block J [BHAD-053]. The size of the burial location area is estimated to be 2.8 acres. No surface evidence of the burial site was found during the site visit. A visual survey of the area is therefore not required.

A 25 percent geophysical survey (magnetometer and metal detector) should be conducted over the entire area. Suggested geophysical survey lanes are presented in Figure 2-6. If the results of the geophysical survey indicate UXO is present, additional survey lanes may be considered.

## **2.10 Tracer Test Range**

Small arms ammunition with tracer was tested at the Tracer Test Range shown in Figure 2-6. During the site visit, 30 and 50 caliber tracer projectiles were found at the surface on the target berm at the Test Range. An incendiary filler may be present in the projectile [BHAD-157]. Access to the berm should be limited by fencing (of the bermed area only) and posting of signs. No activities should be allowed in this area until the hazards have been fully identified and assessed.

TCT-St. Louis recommends a 100 visual survey of the berm area (0.43 acres). The type of filler in the projectiles should be identified. If the filler is determined to be incendiary or otherwise hazardous, the berm should be excavated and the projectiles recovered and destroyed.



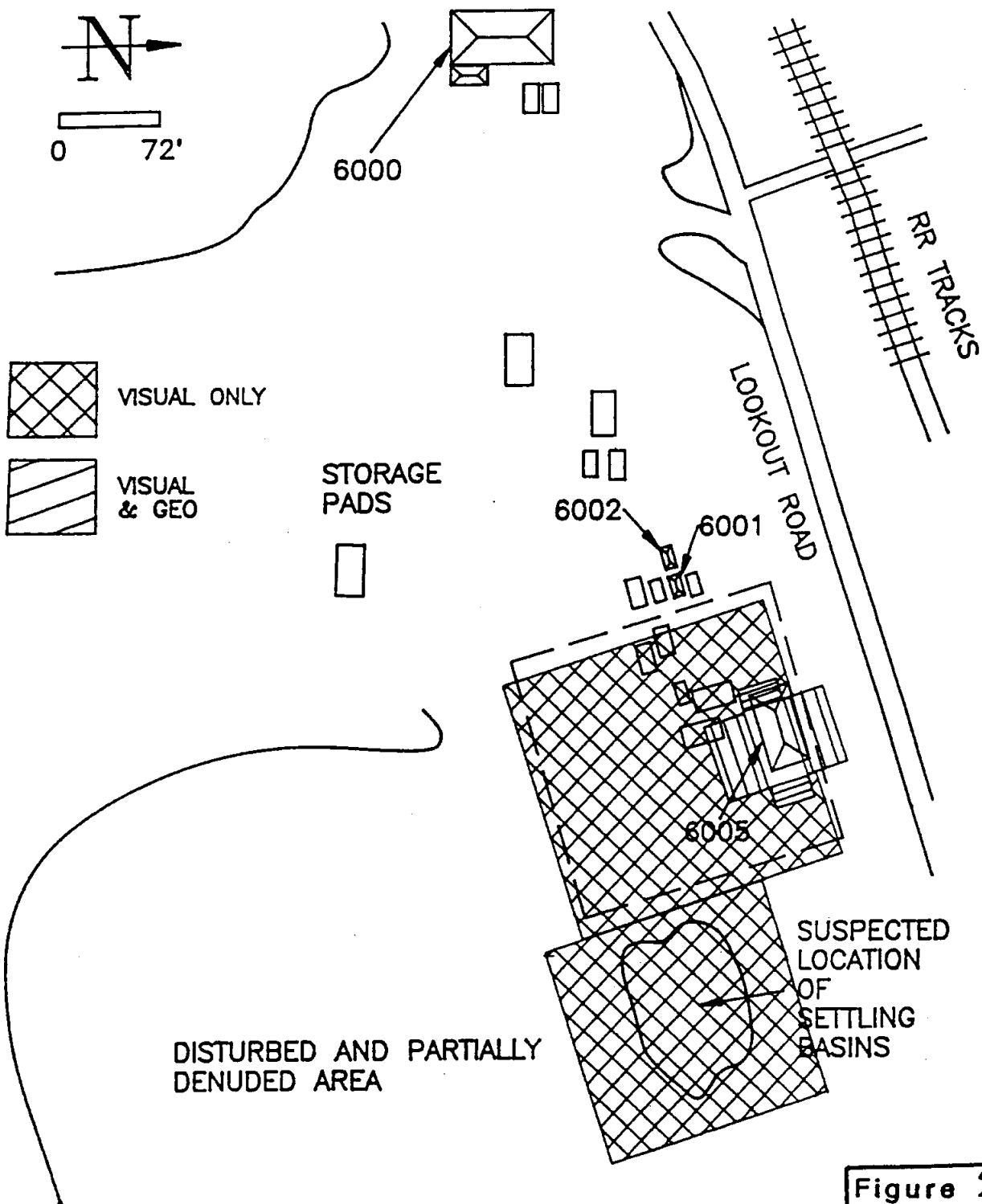


Figure 2-4

**TCT**

St. Louis

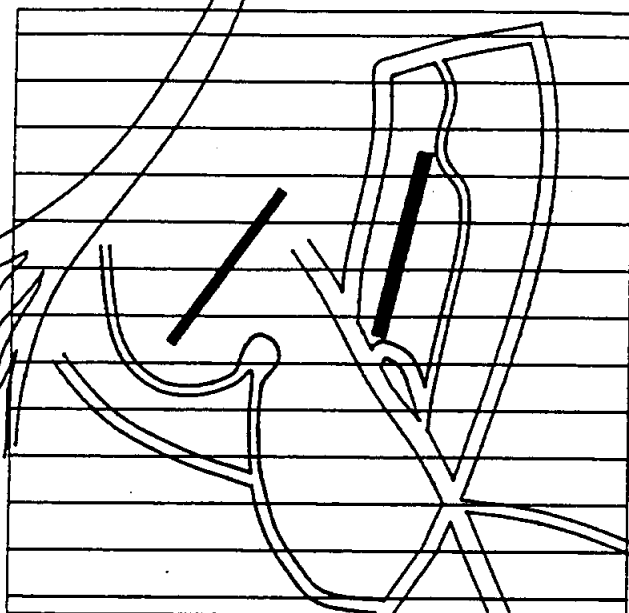
CHEMICAL (INCINERATOR) PLANT AREA  
FORMER BHAD  
GEOPHYSICAL SURVEY LOCATION

UNNAMED SEASONAL  
CREEK BED

0 144'



VISUAL  
& GEO



OUTSIDE  
STORAGE  
PADS

LOOKOUT  
ROAD

STORAGE  
SHEDS

6045

6043

Figure 2-5

**TCT**

St. Louis

CHEMICAL BURNING PITS AREA  
FORMER BHAD  
VISUAL AND GEOPHYSICAL SURVEY LOCATION

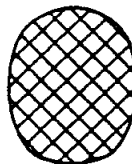
Checked By:

Date: 8-10-97

0 310  
SCALE IN FEET



30 AND 50 CALIBER  
AMMUNITION BERM FOR  
TRACER TEST RANGE



FENCED AREAS

RR TRACKS

ROADS



VISUAL ONLY



GEOPHYSICAL  
ONLY

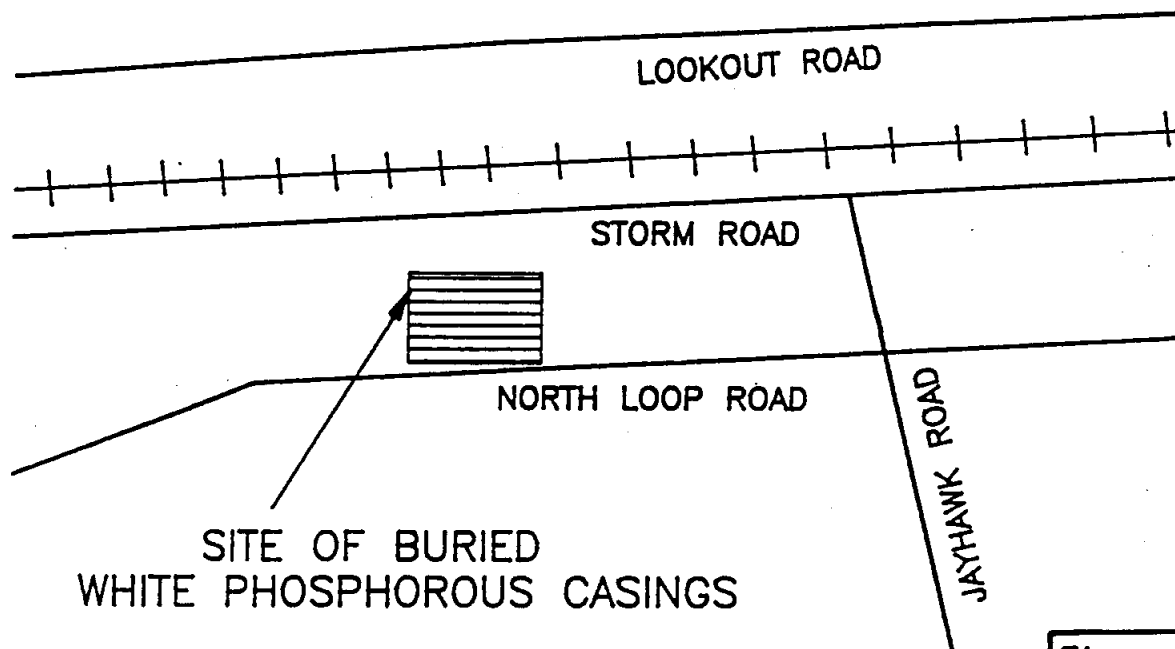


Figure 2-6

**TCT**

**St. Louis**

WHITE PHOSPHOROUS BOMB CASINGS  
BURIAL PIT/SURVEY LOCATION-  
TRACER TEST RANGE BERM AREA/  
EXCAVATION AREA

Project No. 9222

By: DJ

Chk'd By: TML

Date: 8-12-92

### **2.11 Surveillance Area**

The surveillance area consists of approximately 4.4 acres. Ordnance and ordnance components may have been tested and destroyed at this locations [BHAD-125,126]. Spent igniter tubes and primers were found at this location. It is suggested that a 25 percent visual survey be conducted. Field conditions may alter the suggested percentage of the area to be visually surveyed. Field activities are recommended to be conducted during the time of year when the growth of vegetation is limited.

A 25% geophysical survey (magnetometry and metal detection of the are) is suggested. Suggested geophysical survey lanes are presented in Figure 2-7. If the survey lanes are 6 feet in width, the suggested lanes total approximately 1.1 acres. If the results of the visual and/or geophysical surveys indicate UXO is present, additional survey lanes may be considered.

### **2.12 Ammunition Workshop Area**

OEW may be present in the subsurface at the location of the former explosive leaching beds. Three leaching beds (2.09 acres total) were present in the southeastern corner of the workshop area. Documents do not clearly identify how many of the leaching beds contained OEW [BHADM-001].

TCT-St. Louis recommends conducting test pit excavations and analytical field screening for TNT at these three locations to determine the presence or absence of potentially explosive levels of TNT in the subsurface. Excavation samples should be analyzed in the field for TNT using the U.S. Army Corps of Engineers CRREL method.

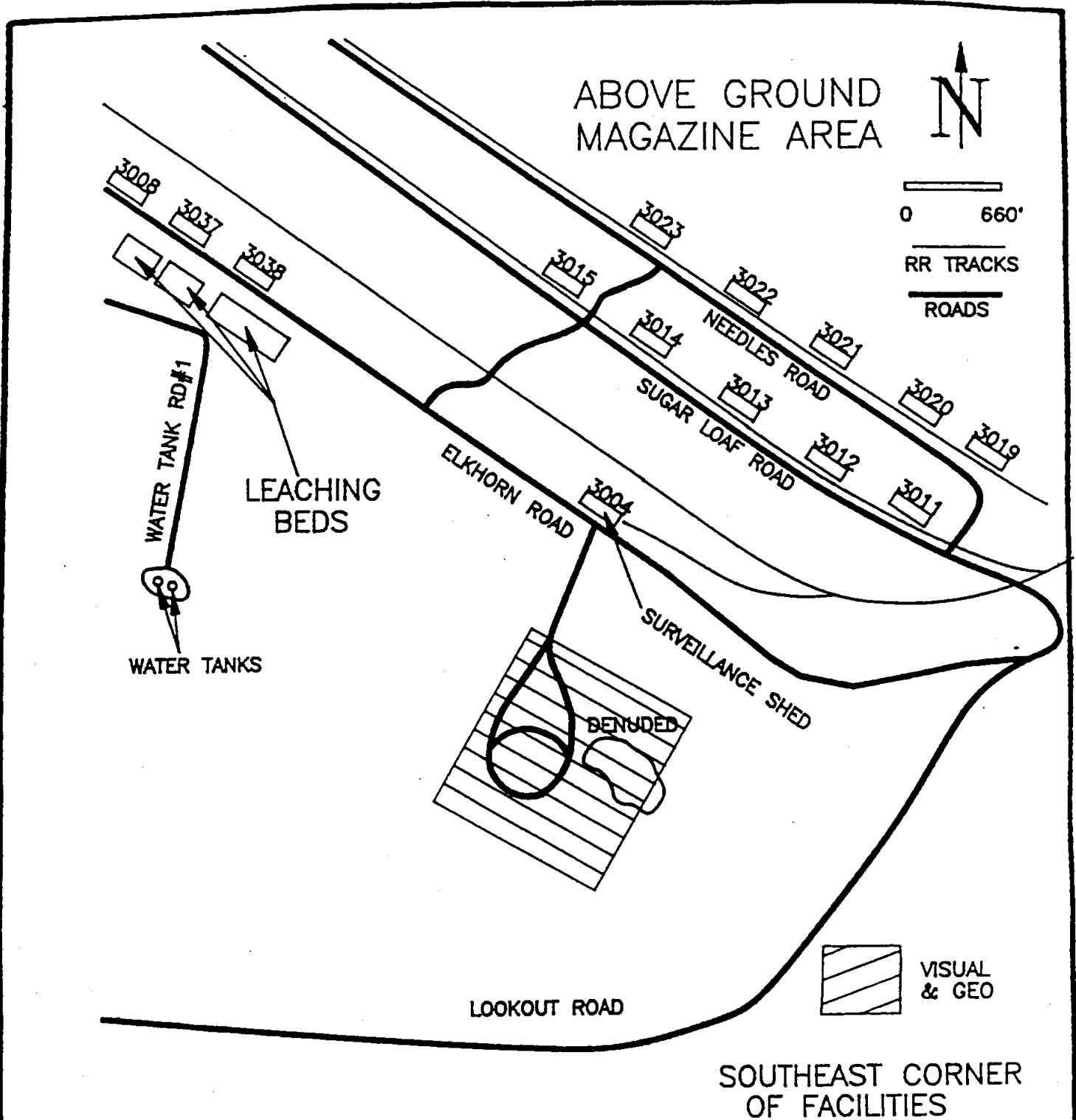
Test pits should be excavated within the confines of the leaching beds as shown in Figure 2-8.

### **2.13 Disassembly Plant**

A crescent-shaped berm is present south of the disassembly plant. A 100% visual survey of the area shown in Figure 2-9 should be conducted (1.9 acres). Soil samples should be collected from the areas which may contain incendiary compounds. If the results of the visual survey indicate UXO or OEW is present a geophysical survey or test pit excavation may be considered.

### **2.14 Chemically Contaminated Areas**

The results of visual and geophysical surveys should be used to assess whether soil, surface water or groundwater may be contaminated with high explosive, incendiary, or chemical toxics related to activities at the BHAD. In addition, chlorinated solvents may be present as a result of the use of decontaminating agents such as DANC which were documented to have been used in the Chemical Area [BHAD-149]. Numerous underground storage tanks and landfills are present at the former depot[BHAD-001,119].



AERIAL MAP 1954

Figure 2-7

**TCT**

St. Louis

SURVEILLANCE BURNING GROUND  
FORMER BHAD  
GEOPHYSICAL SURVEY LOCATION

CHART BY

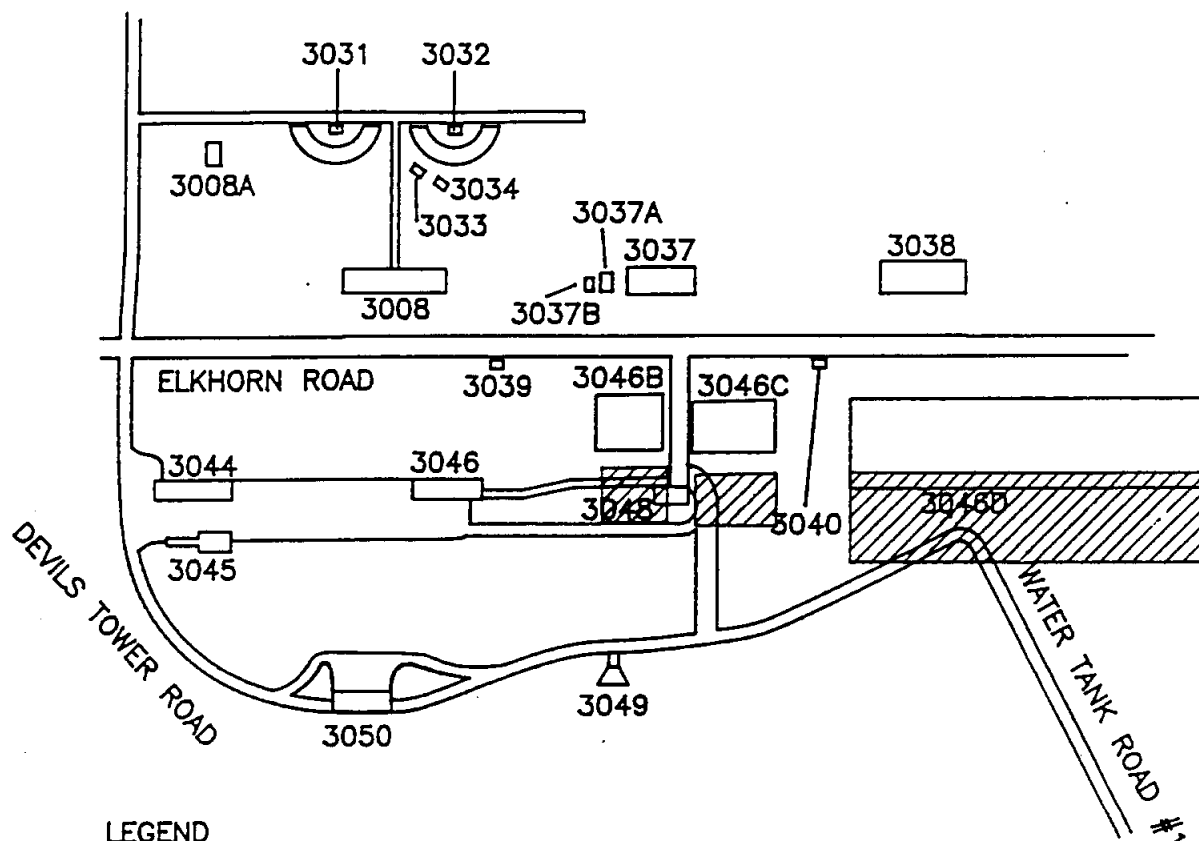
Date: 8-15-97



TRENCHING  
ONLY



0 400  
SCALE IN FEET



LEGEND

3008 AMMUNITION RENOVATION  
3008A POWDER PROPELLANT STORAGE  
3031 SMOKELESS POWDER MAGAZINE  
3032 SMOKELESS POWDER MAGAZINE  
3033 VACUUM UNIT PUMP HOUSE  
3034 VACUUM UNIT BARRICADE  
3037 DEBOND & DEPRIME BUILDING  
3037A EARTH BARRICADE  
3037B SERVICE MAGAZINE  
3038 CLEAN & PAINT BUILDING  
3039 SERVICE MAGAZINE  
3040 SERVICE MAGAZINE

3044 BOILER RM CHANGE HOUSE & OFFICE  
3045 MACHINE SHOP & TOOL HOUSE  
3046 TNT WASHOUT & FLAKER BUILDING  
3046B LEACH BED  
3046C LEACH BED  
3046D LEACH BED  
3048 TNT STORAGE  
3050 WORK SHED  
3049 DEBOOSTING BARRICADE

SOURCE: BHADM-001  
DATED 1959

Figure 2-8

**TCT**  
St. Louis

AMMUNITION WORKSHOP AREA  
FORMER BHAD  
LEACHING BEDS EXCAVATION LOCATIONS

Chk'd By: \_\_\_\_\_

Date: 6-10-97

BUNDLE AMMUNITION  
PACKING AREA



0 400  
SCALE IN FEET

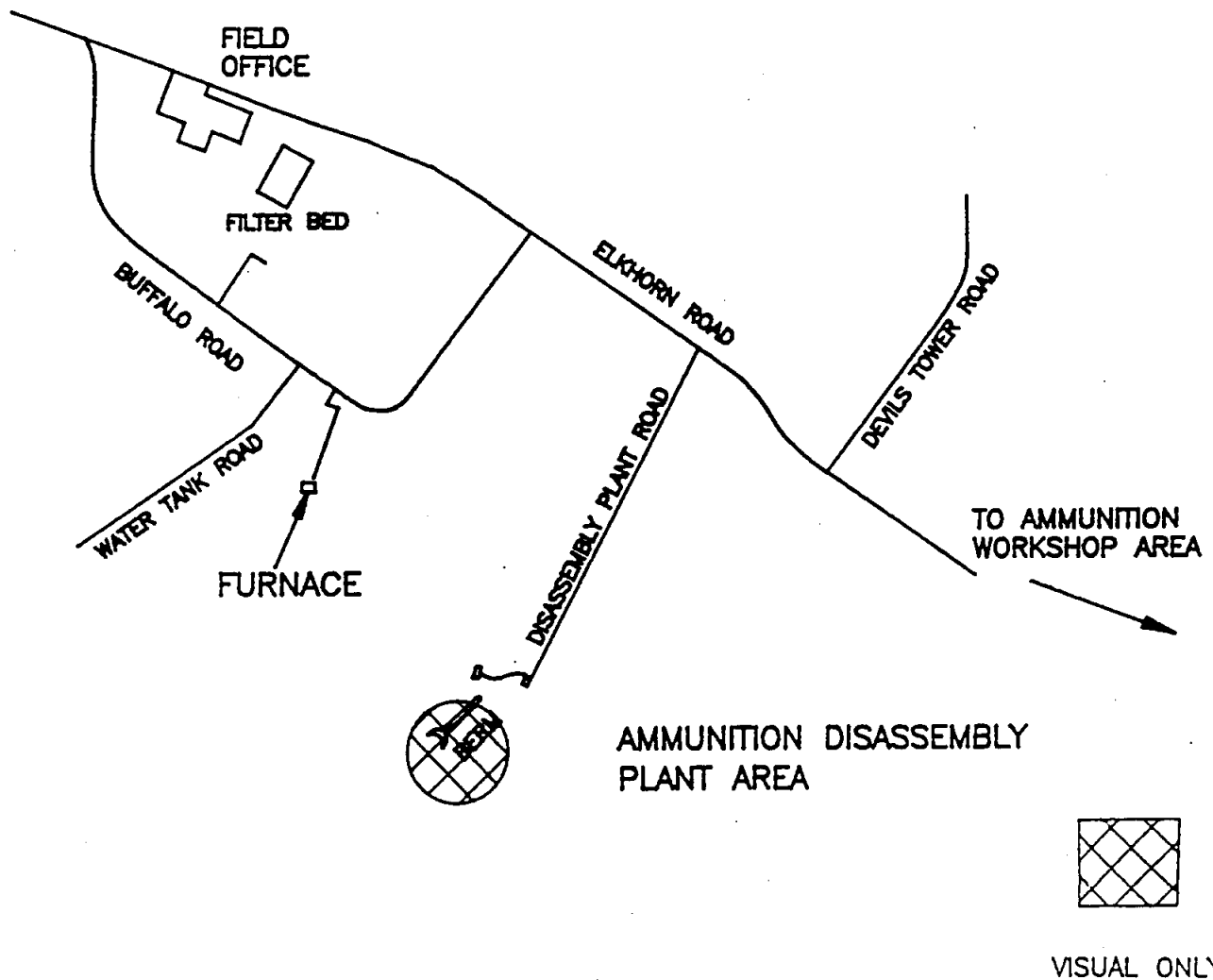


Figure 2-9

**TCT**

St. Louis

AMMUNITION DISASSEMBLY PLANT  
BERM AREA — VISUAL SURVEY LOCATION  
FORMER BHAD

CHART BY

Date:

The potential for extensive contaminant transport is limited due to the presence of bentonite and shale; however, the presence of seeps, vertical fractures, and perched aquifers may increase potential migration from contaminated areas [BHAD-025,096,114]. Mustard and nitroaromatic compounds are extremely persistent in the environment [BHAD-159] Groundwater is used throughout the area; however, drinking water is generally obtained from deep aquifers. Shallow waterbearing zones do provide water to livestock and in some cases domestic uses [BHAD-025,096,114].



0

**FINAL**  
**SUPPLEMENTAL ARCHIVES SEARCH REPORT**

**VOLUME III OF III**  
**PHOTO DOCUMENTATION AND MASTER PLANNING DOCUMENTS**

**PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS**  
**AT THE FORMER BLACK HILLS**  
**ARMY DEPOT, SOUTH DAKOTA**  
**SITE NUMBER B085SD000800**

Contract No. DACW-43-93-D0508

Prepared For:

U.S. Army Corps of Engineers  
St. Louis District  
St. Louis, Missouri 63103-2833

November 1993

9392

**TCT-ST. LOUIS**

1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700  
(314) 426-0880

FINAL

SUPPLEMENTAL ARCHIVES SEARCH REPORT

VOLUME III OF III  
PHOTO DOCUMENTATION AND MASTER PLANNING DOCUMENTS

PRELIMINARY ASSESSMENT OF CHEMICAL WARFARE MATERIALS  
AT THE FORMER BLACK HILLS  
ARMY DEPOT, SOUTH DAKOTA  
SITE NUMBER B085SD000800

Contract No. DACW-43-93-D0508

Prepared For:

U.S. Army Corps of Engineers  
St. Louis, Missouri  
St. Louis, Missouri 63103-2833

Prepared By:

TCT-St. Louis  
1908 Innerbelt Business Center Drive  
St. Louis, Missouri 63114-5700

November 1993

9392

## **CONTENTS**

### **Aerial Photos**

Plate 1, Suspected Burn Pit, 1945

### **Site Photographs, Site Visit**

Former Black Hills Army Depot, August 16 - August 20, 1993

Excerpts, Master Plan Basic Information, Analysis of Existing Facilities,  
Black Hills Army Depot, Igloo, South Dakota

Master Plan Basic Information Maps, 15 December 1963, Drawing 29-02-02

BHADb-214 Sheet 7 of 53

BHADb-215 Sheet 8 of 53

BHADb-216 Sheet 9 of 53

BHADb-217 Sheet 24 of 53

BHADb-218 Sheet 25 of 53

General Storm-Drainage & Tree-Cover Map

General Site Map Storage Area 1

General Site Map Storage Area 2

General Site Map Warehouse and Airfield Area

General Site Map Aboveground Magazine Area

Chemical Area 6000 Block Plans (3 Sheets)

## **AERIAL PHOTOS**

## **SITE PHOTOGRAPHS**

SITE: Black Hills Army Depot  
Igloo SD #9392

Date: 8/19/93

Time: AM

Direction: N/A

Object: Photo showing liquid  
cyanogen chloride being  
drained into 500 gallon  
tank.

Frame No. 1



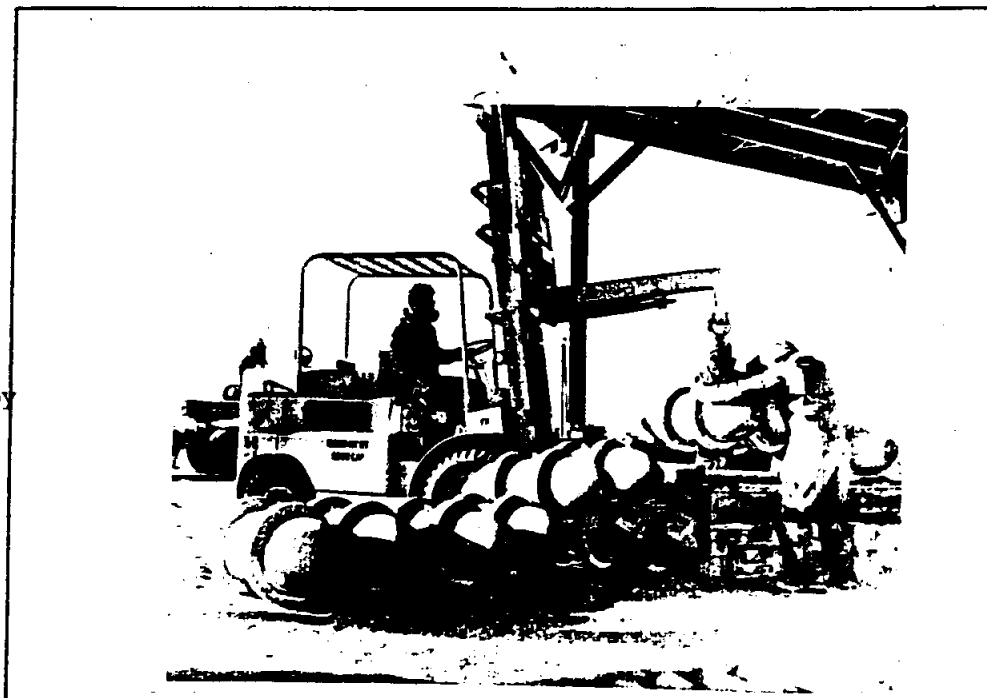
Date: 8/19/93

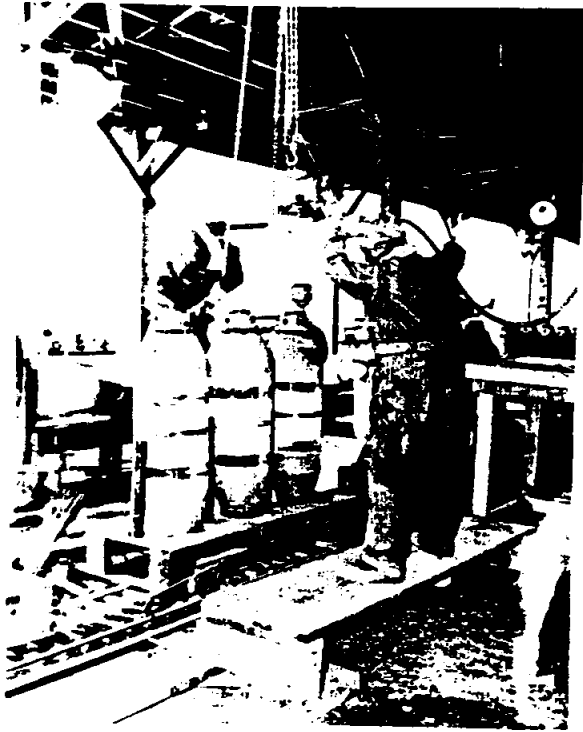
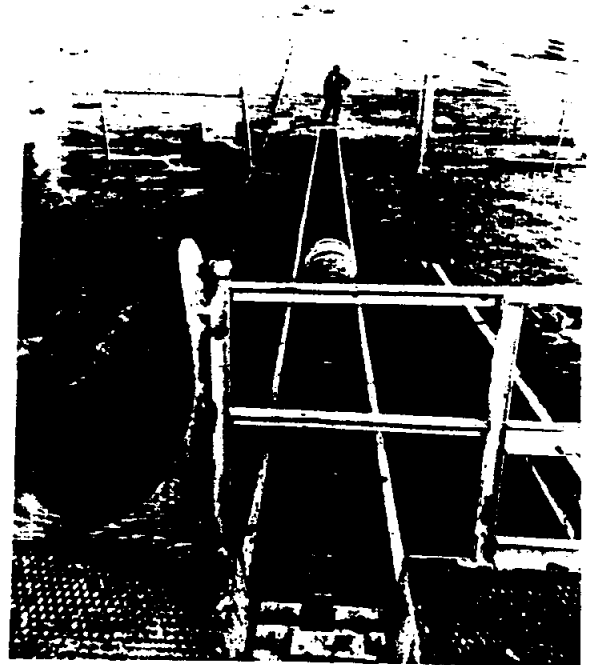
Time: AM

Direction: N/A

Object: Photo showing 500 lb  
cyanogen chloride bombs being  
brought to the conveyor line by  
fork truck to begin  
demilitarization

Frame No. 2



PHOTOGRAPHIC DOCUMENTATION  
FORMSheet 2 of 11  
Film No. 1  
(Roll No.)  
Initials: MLSSITE: Black Hills Army Depot  
Igloo, SD #9392FRAME NO. 3Date: 8/19/93  
Time: A.M.  
Direction: N/AObject: Photo showing removal of filler  
plugs from 500 lb CK bombs with  
impact wrench.FRAME NO. 4Date: 8/19/93  
Time: A.M.  
Direction: N/AObject: Photo showing CK bomb casing roll-  
ing its way to Rocky Mountain Arsenal  
and re-use. After being drained.

SITE: Black Hills Army Depot  
Igloo SD #9392

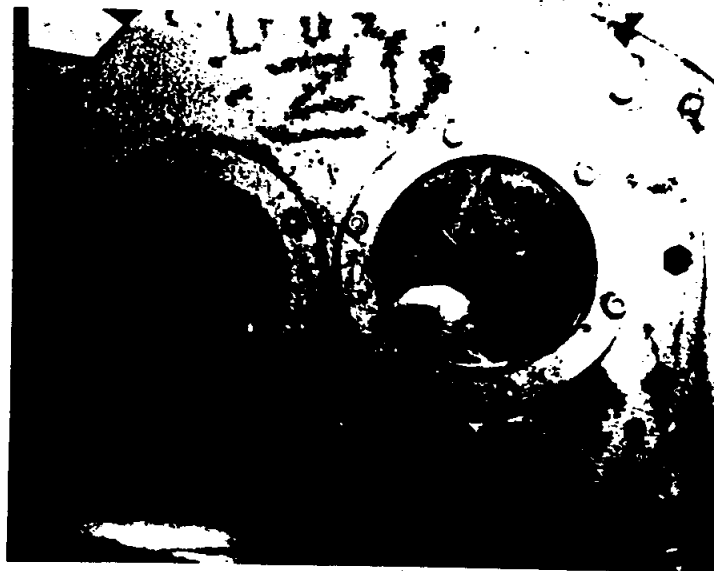
Date: 8-19-93

Time: AM

Direction: N/A

Object: Photo showing end of  
20 x 4 foot kiln used to  
destroy the cyanogen  
chloride liquid by burning  
at 2000 degree F.

Frame No. 5



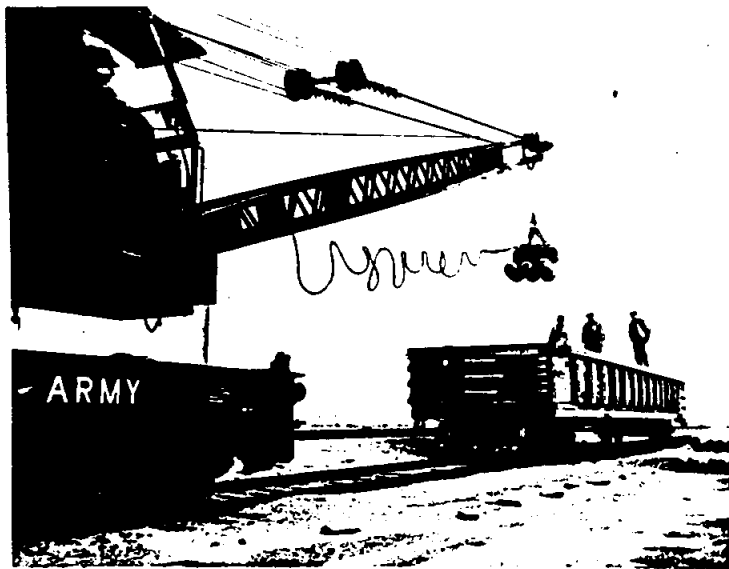
Date: 8/19/93

Time: AM

Direction: N/A

Object: Photo showing the  
loading of three steel  
bomb casings into a  
gondola with magnetic  
railroad crane.

Frame No. 6





SITE: Black Hills Army Depot  
Igloo SD #9392

Date: 8/19/93

Time: AM

Direction: N/A

Object: Photo showing  
cleaning the inside of  
a CK bomb casing with  
compressed air

Frame No. 7



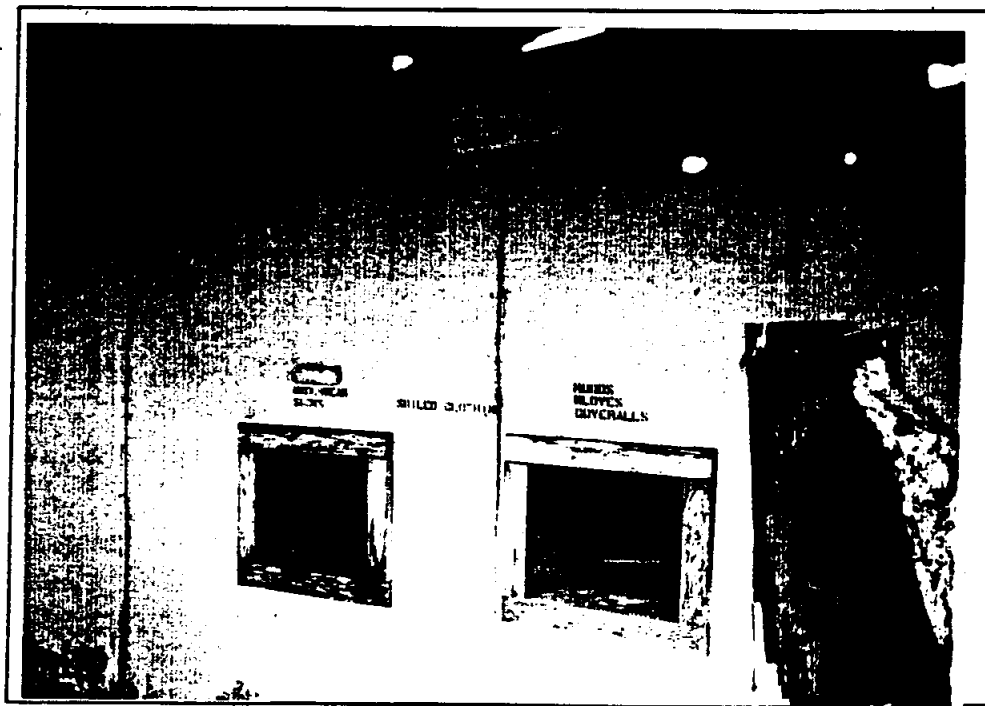
Date: 8/18/93

Time: PM

Direction: N/A

Object: Building 6000  
Chemical Area Change  
Area; contaminated  
clothing placed in  
designated areas.

Frame No. 8



PHOTOGRAPHIC DOCUMENTATION  
FORM

Sheet 5 of 11

Film No. 1

(Roll No.)

Initials: MLS

SITE: Black Hills Army Depot  
Igloo, SD #9392

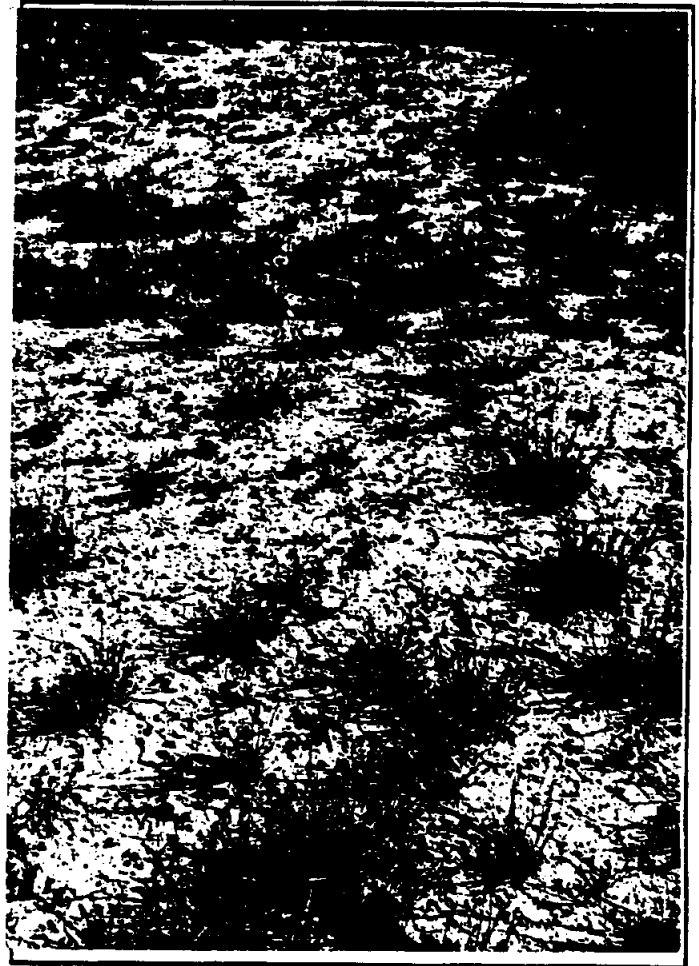
Date: 8/18/93

Time: PM

Direction: South

Object: Denuded area in Area  
6000 near location of chemical  
leaching bed and recycling  
pond.

Frame No. 9



Date: 8/18/93

Time: PM

Direction: North

Object: Denuded area in  
chemical area.

Frame No. 10



PHOTOGRAPHIC DOCUMENTATION  
FORM

Sheet 6 of 11  
Film No. 1

(Roll No.)  
Initials: MLS

SITE: Black Hills Army Depot  
Igloo, SD #9392



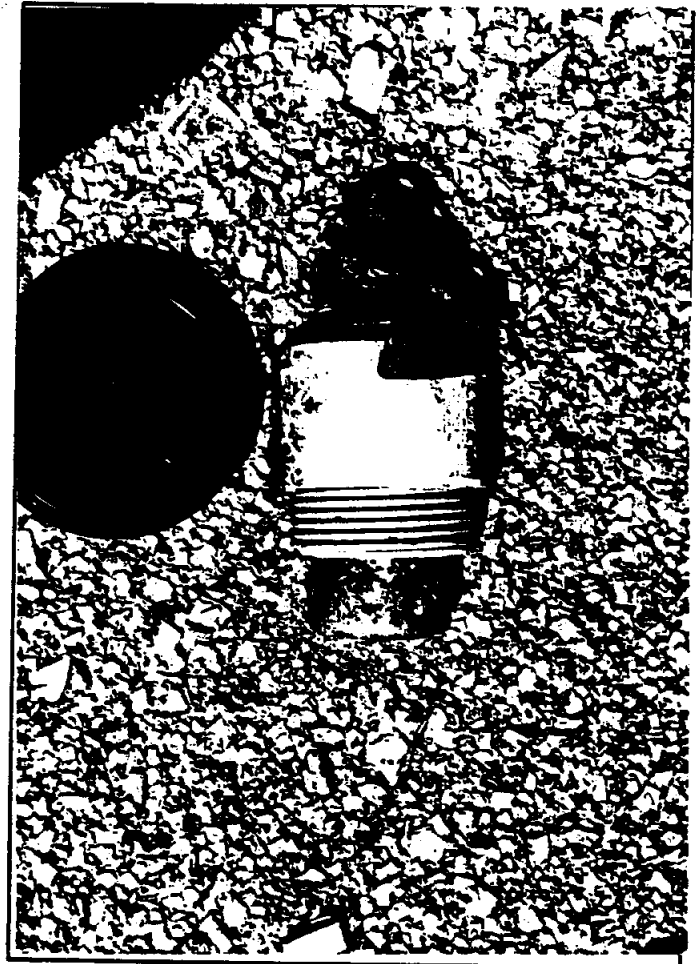
FRAME NO. 11

Date: 8/17/93

Time: AM

Direction: South

Object: 155 mm bursting chemical  
or WP round in Buring Ground #1.



FRAME NO. 12

Date: 8/17/93

Time: AM

Direction: North

Object: Bomb fuze intact. Burning  
Ground #2.

SITE: Black Hills Army Depot  
Igloo, SD #9392

Date: 8/18/93

Time: PM

Direction: East

Object: Empty 5 inch, rocket  
bursting chemical located  
at Dave Hendersons house  
in Edgemont, SD. Shell  
found at Burning Ground  
#1.

Frame No. 13



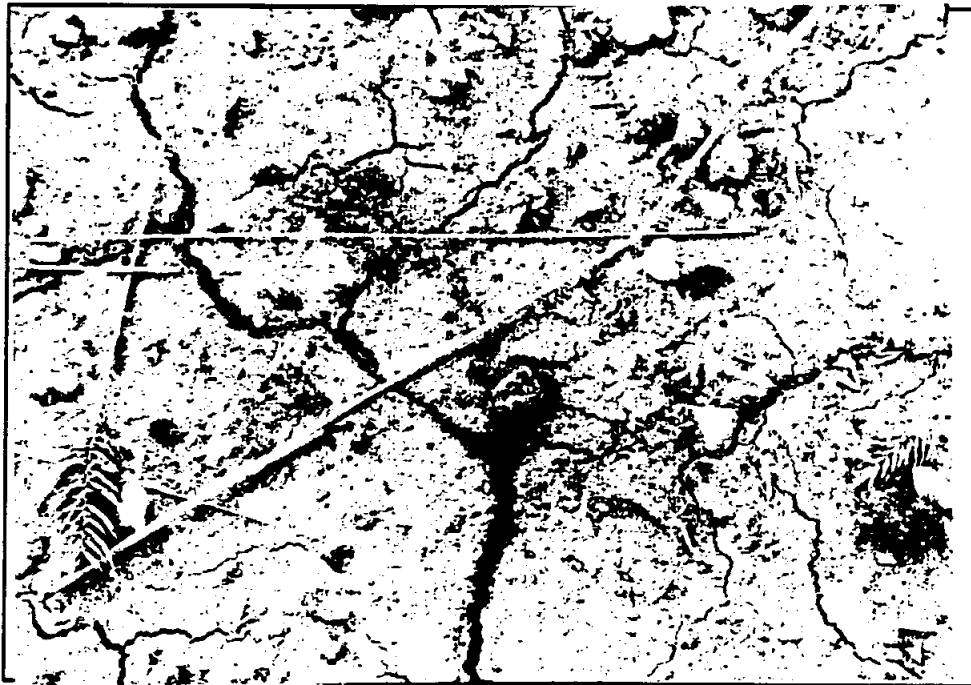
Date: 8/19/93

Time: PM

Direction:                     

Object: Suspect TNT found  
in small denuded areas with  
TNT leaching bed 4046b  
directly NE of Bomb  
Washout Building 4046.

Frame No. 14



**SITE:** Black Hills Army Depot  
Igloo, SD #9392

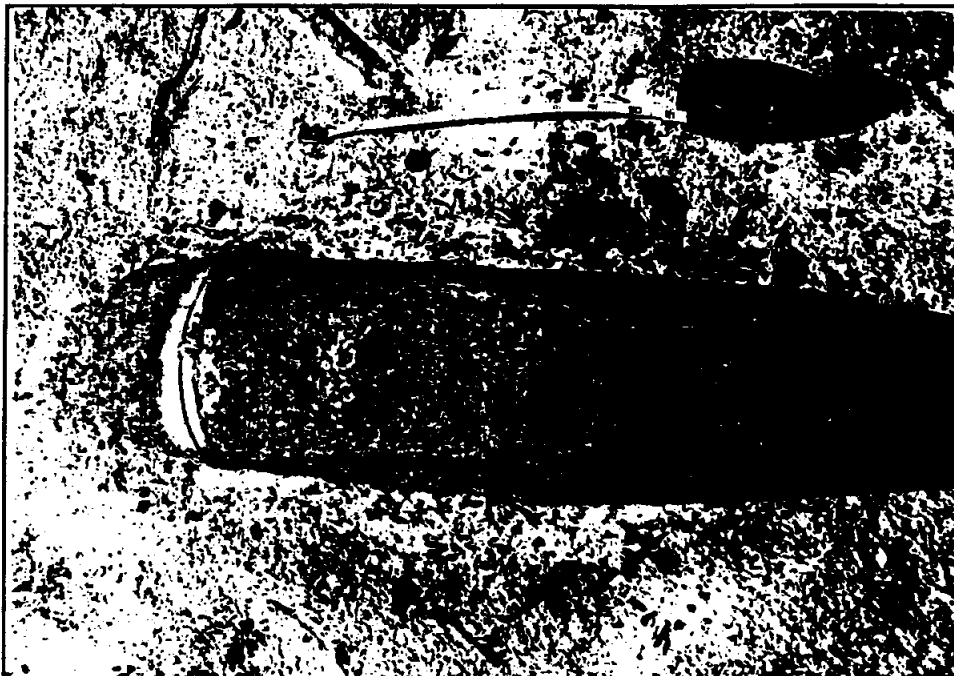
**Date:** 8/17/93

**Time:** PM

**Direction:** North

**Object:** 155 mm chemical or  
WP round in pond. Southern  
end of Burning Ground #2.  
Hole was due to shape  
changing the round to re-  
lease chemical for complete  
burn.

**Frame No.** 15



**Date:** 8/17/93

**Time:** PM

**Direction:** Southeast

**Object:** 155 mm chemical or  
WP rounds in pond, southern  
end of Burning Ground #2.

**Frame No.** 16



SITE: Black Hills Army Depot  
Iqloo, SD #9392

Date: 8/19/93

Time: 13:00

Direction: North

Object: Demil-point  
detonating fuzes Burning  
Ground #2.

Frame No. 17



Date: 8/19/93

Time: 15:00

Direction: East

Object: M-83 "Butterfly"  
fragmentation bomblet  
Burning Ground #2.

Frame No. 18



SITE: Black Hills Army Depot  
Igloo, SD #9392

Date: 8/18/93

Time: 11:00

Direction: South

Object: Burned out M-47  
series bombs filler  
unknown Burning Ground #1.

Frame No. 19



Date: 8/18/93

Time: 10:00

Direction: South

Object: M-70 HD bomb empty  
Burning Ground #1.

Frame No. 20



SITE: Black Hills Army Depot  
Igloo SD #9392Date: 8/17/93Time: PMDirection: WestObject: 155 mm chemical or  
WP round in pond,  
southern end of  
Burning Ground #2.Frame No. 21Date: 8/17/93Time: AMDirection: EastObject: 155 mm bursting  
chemical burning Ground #1.Frame No. 22



# EXCERPTS

## MASTER PLAN BASIC INFORMATION

### ANALYSIS OF EXISTING FACILITIES BLACK HILLS ARMY DEPOT IGLOO, SOUTH DAKOTA

#### Contains:

##### Index

Pages	I-1 thru I-2
	II-1 thru II-16
	III-1-1 thru III-1-2
	III-4-1
	III-4-3 thru III-4-4
	III-4-8 thru III-4-11
	III-8-1
	III-8-21 thru III-8-26
	III-8-31 thru III-8-67

# ANALYSIS OF EXISTING FACILITIES

## BLACK HILLS ARMY DEPOT

Igloo, South Dakota

	<u>INDEX</u>	<u>PAGES</u>
PART I	INTRODUCTION	I-1 thru I-2
PART II	LAND AND WATER AREAS	II-1 thru II-16
	Section 1. Description of Land and Water Areas	II-1
	Section 2. Administration Areas	II-1 thru II-2
	Section 3. Officers Housing Area	II-2
	Section 4. Hospital Area	II-2 thru II-3
	Section 5. Sewage and Waste Disposal Area	II-3
	Section 6. Mobilization Area	II-3 thru II-4
	Section 7. Provo School Area	II-4
	Section 8. Housing Area	II-4 thru II-5
	Section 9. Utilities Area	II-5
	Section 10. Railway Car Set-Out Yard (Area WYE)	II-5 thru II-6
	Section 11. Warehouse Storage Area	II-6
	Section 12. Ammunition Normal Maintenance Area	II-6 thru II-7
	Section 13. Open Ammunition Storage Pad Area	II-7 thru II-8

<u>INDEX</u>	<u>PAGES</u>
Section 14. Above Ground Magazine Area	II-8
Section 15. Ammunition Work Shops Area	II-8
	thru
	II-9
Section 16. Ammunition Disassembly Plant Area	II-9
Section 17. Bundle Ammunition Packing Area	II-9
	thru
	II-10
Section 18. Underground Igloo Magazine Storage Area	II-10
Section 19. Demolition Area (Burning Ground Nr. 2)	II-11
Section 20. Burning Grounds Nrs. 1 and 3	II-11
Section 21. Toxic Chemical Storage Area	II-12
Section 22. Tracer Test Firing Range	II-12
	thru
	II-13
Section 23. Airfield Area	II-13
Section 24. Recreation Areas	II-13
	thru
	II-14
Section 25. Golf Course	II-14
Section 26. Safety Clearance and Buffer Zone Areas	II-14
	thru
	II-15
Section 27. Other Area	II-15
	thru
	II-16
 PART III BUILDINGS AND STRUCTURES	
	III-1-1
	thru
	III-8-69
Section 1. General	III-1-1
	thru
	III-1-2
Section 2. Quarters (Military and Civilian)	III-2-1
	thru
	III-2-12
Section 3. Mess Halls	III-3-1
	thru
	III-3-2
Section 4. Warehouses	III-4-1
	thru
	III-4-11

<u>INDEX:</u>		<u>PAGES</u>
Section 5.	Administrative Buildings	III-5-1 thru III-5-2
Section 6.	Technical Maintenance Shops	III-6-1
Section 7.	Hospital Technical Buildings	III-7-1
Section 8.	Miscellaneous Buildings and Structures	III-8-1 thru III-8-69
Part IV	ROADS, PARKING AREAS, WALKS AND RAILROADS	IV-1-1 thru IV-4-4
Section 1.	Roads	IV-1-1 thru IV-1-7
Section 2.	Parking, Open Ramps and Open Storage Areas	IV-2-1 thru IV-2-4
Section 3.	Sidewalks	IV-3-1 thru IV-3-2
Section 4.	Footbridges	IV-4-1 thru IV-4-2
Section 5.	Railroads	IV-5-1 thru IV-5-4
Part V	UTILITIES	V-1-1 thru V-7-4
Section 1.	Water Supply & Distribution System	V-1-1 thru V-1-9
Section 2.	Waste Disposal	V-2-1 thru V-2-8
Section 3.	Electricity	V-3-1 thru V-3-5
Section 4.	Heating - Central Heating Plants and Steam Distri- bution System	V-4-1 thru V-4-13
Section 5.	Cold Storage and Refrigeration	V-5-1 thru V-5-3
Section 6.	Air Conditioning and Ven- tilation	V-6-1 thru V-6-3
Section 7.	Automatic or Manual Fire Alarm Systems	V-7-1 thru V-7-4

	<u>INDEX</u>	<u>PAGES</u>
PART VI	COMMUNICATIONS	VI-1-1
		thru
	Section 1. Teletype	VI-3-2
	Section 2. Radio	VI-1-1
		VI-2-1
		thru
	Section 3. Telephone	VI-2-2
		VI-3-1
		thru
		VI-3-2
PART VII	RECREATIONAL FACILITIES	VII-1-1
		thru
	Section 1. Indoor Recreational Facilities	VII-2-5
		VII-1-1
		thru
	Section 2. Outdoor Athletic Facilities	VII-1-4
		VII-2-1
		thru
		VII-2-5

## ANALYSIS OF EXISTING FACILITIES

### BLACK HILLS ARMY DEPOT

- IGLOO, (FALL RIVER COUNTY) SOUTH DAKOTA

#### Part I. INTRODUCTION.

LOCATION AND SURROUNDINGS. (Reference Drawing Nr. 18-02-02, Sheet Nr. 1, Basic Information Map). The Black Hills Army Depot is located in the southwestern part of Fall River County, South Dakota, about seven and one-half miles southwesterly from the town of Edgemont, which has a present population of approximately 2,050, Ardmore, located 22 miles southeasterly with a population of approximately 75 and Hot Springs, 38 miles distant with a population of approximately 5,000. The settlement of Provo, adjacent to the railroad station of that name, and about one and one-half miles east of the Depot, has a normal population of approximately 130. The Wyoming state line is approximately four miles west of the west line of the reservation and the Nebraska state line is approximately nine miles south of the south line of the reservation. All of the surrounding area bordering the reservation is range land covered with native grasses similar to that within the Depot boundaries. Within a radius of four miles outside of the boundaries of the reservation there are only 20 ranch houses and, due to the sparse population and low land value, conditions are ideal for future expansion of the Depot for ammunition storage, renovation, and demilitarization activities. The most desirable expansion, considering topography, is to the west and south. The semi-arid climate in this locality also provides ideal conditions for the storage and preservation of combat equipment. The main line of the Chicago Burlington and Quincy Railroad from eastern points to Billings, Montana, serves the Area. An asphalt surfaced State Highway Nr. 52 runs from the Depot boundary to Edgemont, where it joins U. S. Highway Nr. 18 running east and west.

TOPOGRAPHY AND CLIMATE. The topography of the area is somewhat rolling, with numerous ravines. A water shed, running north and south through the approximate center of the Area, divides the drainage to the west into Alum Creek, and to the east into Softwater and Coal Creeks. These streams are dry during the greater part of the year. The elevation of the area ranges between 3600 feet and 4150 feet above sea level. The climate is semi-arid with an average annual precipitation of 13.91 inches, including an average annual snow fall of 41.5 level inches. The highest recorded temperature was 111

degrees and the lowest, -54 degrees. The vegetation is, for the most part, low growing sage brush and western grass. Trees, shrubs, flowers and lawns will grow if adequately watered during dry weather.

The geologic formations within the Area are Pierre Shale, Niobrara and Carlile formations.

The Depot was designed primarily for long time storage of Warfare Ammunition and Combat Equipment Storage. It includes 21,095.85 acres of Government-owned land, divided into the following areas: Administration, Officers' Housing, Hospital, Mobilization, Sewage and Waste Disposal, Provo School, Civilian Housing, Railway Car Set-Out Yard (Area Wye), Utilities, Warehouses, Ammunition Normal Maintenance, Open Storage Pad, Above Ground Magazine, Ammunition Works Shop, Ammunition Disassembly Plant, Bundle Ammunition Packing, Underground Igloo Magazine Storage, Burning Ground and Demolition, Chemical Storage, Tracer Test Firing Range, Airfield and Park and Recreation Areas.

Part II. LAND AND WATER AREAS. (Reference Drawing Nr. 18-02-02,  
Sheet Nr. 2, Basic Information Map)

Section 1. DESCRIPTION OF LAND AND WATER AREAS.

- a. Total Acreage: 21,095.85
  1. Land: 20,956.45
  2. Water: 139.40 Acres (at high water elevation)
- b. Number of acres in use by Areas: Administrative Area, 17 acres; Officers' Housing Area, 15 acres; Hospital Area, 12 acres; Mobilization Area, 27 acres; Sewage and Waste Disposal Area, 16 acres; Provo School Area, 23.77 acres; Housing Area, 60 acres; Utilities Area, 54 acres; Warehouse Storage Area, 135 acres; New Ammunition Normal Maintenance Area, 10 acres; Igloo Area, 7,190 acres; Open Ammunition Storage Area, 1,620 acres; Burning Grounds, 163 acres; Above Ground Magazine Area, 95 acres; Bundle Ammunition Packing Area, 95 acres; Railway Car Set-Out Yard adjacent to Chicago, Burlington and Quincy Railroad (Area Wye), 22 acres; Ammunition Disassembly Plant Area, 3 acres; Ammunition Work Shop: Areas, 77 acres; Toxic Chemical Storage Area, 110 acres; Demolition Area, 66 acres; Tracer Test Firing Range Area, 220 acres; Airfield Area, 140 acres; Recreation Areas, 85 acres; Golf Course, 43 acres; Safety Clearance Areas and buffer zone areas, 10,797 acres between and surrounding hazardous and restricted areas.
- c. Number of acres by areas which are owned by the U. S. Government: 21,095.85 acres.
- d. Number of acres by areas leased (Not Government-owned): None.

Section 2. ADMINISTRATION AREA.

- a. Description of area: About 16 acres of graded and remainder is rolling prairie land containing 12 buildings.
  1. Seeded Areas:
    - (a) Number of acres: 6
    - (b) Type growth: Grass
    - (c) Predominant species: Crested Wheat and Lawn Grass
  2. Native Growth Areas:
    - (a) Number of acres: 4
    - (b) Types of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  3. Wooded Areas: None.
  4. Dust Controlled Areas: None.
  5. Erosion Controlled Areas: None.
  6. Water Areas: None.
- b. The Administration Area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is at a minimum.



- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use.

Section 3. OFFICERS' HOUSING AREA.

- a. Description of area: The area consists of approximately 15 acres of land that is graded and landscaped. It contains 27 buildings (18 Family Quarters and 9 Automotive Garages)
  - 1. Seeded Areas:
    - (a) Number of acres: 5
    - (b) Type of Growth: Lawn Grass
    - (c) Predominant Species: Blue Grass and Clover
  - 2. Native Growth Areas:
    - (a) Number of acres: 3
    - (b) Type Growth: Native Grass
    - (c) Predominant Species: Buffalo Grass
  - 3. Wooded Areas: None
  - 4. Dust Controlled Areas: None
  - 5. Erosion Controlled Areas: None
  - 6. Water Areas: None
- b. The Officers' Housing Area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is at a minimum. Each occupant maintains his own lawn.
- c. At present no alternate use of which area can be better adapted is ascertained.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use and expanded as required by the provisions of the Depot Master Plan.

Section 4. HOSPITAL AREA.

- a. Description of area: Approximately 8 acres are graded and landscaped; remainder is rolling prairie land. Area contains 12 buildings.
  - 1. Seeded Areas:
    - (a) Number of acres: 4
    - (b) Type Growth: Grass
    - (c) Predominant Species: Crested Wheat and Lawn Grass
  - 2. Native Growth Areas:
    - (a) Number of acres: 4
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  - 3. Wooded Areas: None
  - 4. Dust Controlled Areas: None
  - 5. Erosion Controlled Areas: None
  - 6. Water Areas: None

- b. The Hospital Area is well grassed; no difficulties are being experienced with soil erosion; and ordinary maintenance is at a minimum.
- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use, or until a better location is selected when feasible to replace with permanent type buildings.

#### Section 5. SEWAGE AND WASTE DISPOSAL AREA.

- a. Description of Area: The area is rolling prairie land and is bordered on three sides by drainage draws. This area contains the sewage disposal plant and sanitary fill consisting of 17 buildings and structures.
  - 1. Seeded Area:
    - (a) Number of Acres: 2
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat and Lawn Grass
  - 2. Native Growth Area:
    - (a) Number of Acres: 9
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  - 3. Wooded Areas: None
  - 4. Dust Controlled Area: None
  - 5. Erosion Controlled Area: None
  - 6. Water Area: 2.64 Acres
- b. Due to topography, this is the logical location for the sewage disposal plant and should be retained for continuing permanent use.
- c. Alternate use: None
- d. Recommend this area be retained in its present status and improved by re-grading and proper landscaping.

#### Section 6. MOBILIZATION AREA.

- a. Description of Area: This area is on the side of a hill sloping toward the east. It contains 34 buildings, consisting of barracks, civilian dormitories, civilian apartments, shopping center, library, Post Office, post restaurant, Provost Marshal Office and dry cleaning building.
  - 1. Seeded Area:
    - (a) Number of Acres: 9
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat and Lawn Grass
  - 2. Native Growth Area:
    - (a) Number of Acres: 3
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass

3. Wooded Area: None
4. Dust Controlled Area: None
5. Erosion Controlled Area: None
6. Water Area: None
- b. The Mobilization Area is partially grassed and there is some soil erosion; however, ordinary maintenance is not too great.
- c. At present no alternate use for which area can be better adapted is evident.
- d. Recommend this area be retained for mobilization purposes as outlined in the Depot Master Plan.

Section 7. PROVO SCHOOL AREA.

- a. Description of Area: The area consists of 23.77 acres of land that is graded and landscaped. It contains 5 buildings and structures (grade school, high school, shower and change house, and two sets of bleachers).
  1. Seeded Area:
    - (a) Number of Acres: 7
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Lawn Grass
  2. Native Growth Area:
    - (a) Number of Acres: 6
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  3. Wooded Area: None
  4. Dust Controlled Area: None
  5. Erosion Controlled Area: None
  6. Water Area: None.
- b. The Provo School Area is fairly well grassed with the exception of a part of the play ground; however, no difficulty is being experienced with soil erosion and ordinary maintenance is at a minimum.
- c. This area is well adapted for future expansion of permanent school facilities.
- d. Recommend this area be retained and enlarged as the school buildings and athletic facilities are enlarged and converted to permanent type construction.

Section 8. HOUSING AREA.

- a. Description of Area: Area is 90% graded and contains 179 buildings.
  1. Seeded Area:
    - (a) Number of Acres: 17
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Lawn Grass

2. Native Growth Area:
  - (a) Number of Acres: 5
  - (b) Type of Growth: Grass
  - (c) Predominant Species: Buffalo Grass
3. Wooded Area: None
4. Dust Controlled Area: None
5. Erosion Controlled Area: None
6. Water Area: None
- b. Due to the fact that during original grading for the construction of housing units in this area, top soil was buried in fills, leaving sub-soil exposed, which made it very difficult to obtain a cover of vegetation. However, tenants have hauled in top soil and planted lawns, trees and shrubs.
- c. At present no alternate use for which area can be better adapted is evident.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use, or until a better location is selected in the overall Master Planning.

#### Section 9. UTILITIES AREA.

- a. Description of Area: 82 percent of this area is graded and the balance is hilly. Area contains 32 buildings.
  1. Seeded Area:
    - (a) Number of Acres: 2
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Area:
    - (a) Number of Acres: 7
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  3. Wooded Area: None
  4. Dust Controlled Area: None
  5. Erosion Controlled Area: None
  6. Water Area: None
- b. This area is economical to maintain and should be retained for permanent use.
- c. The majority of the buildings are brick and tile type construction arranged conveniently for maintenance of vehicles and equipment used on the depot; therefore, is not adapted for any other use.
- d. Recommend this area be retained for continuing permanent use in its present capacity.

#### Section 10. RAILWAY CAR SET-OUT YARD (AREA WYE).

- a. Description of Area: This area contains the car siding and Area Wye adjacent to the Chicago, Burlington and Quincy Railroad. There are no buildings located in the area.

1. Seeded Area: None
2. Native Growth Area:
  - (a) Number of Acres: 8
  - (b) Type of Growth: Grass
  - (c) Predominant Species: Redtop
3. Wooded Area: None
4. Dust Controlled Area: None
5. Erosion Controlled Area: None
6. Water Area: None
- b. This area consists primarily of railroad grades and is easily maintained.
- c. Alternate use: None
- d. Recommend this area be retained in its entirety and present status as it is an integral part of the transportation facilities for this Depot.

Section 11. WAREHOUSE STORAGE AREA.

- a. Description of Area: The area is rolling prairie land with that portion occupied by buildings, roads, and railroads being graded. The area contains 30 buildings and structures.
  1. Seeded Areas:
    - (a) Number of Acres: 10
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Areas:
    - (a) Number of Acres: 10
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Wheat Grass
  3. Wooded Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas: None
  6. Water Areas: None
- b. Warehouse Storage Area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is at a minimum.
- c. At present no alternate use for which area can be better adapted is ascertained. The area is adapted for future expansion of permanent warehouse facilities.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use.

Section 12. AMMUNITION NORMAL MAINTENANCE AREA.

- a. Description of Area: The area is gently rolling prairie with adequate drainage which gradually slopes to the southeast; contains 8 buildings and a sewage disposal system consisting of an Imhoff Tank with dosing siphon, filter bed, sludge drying beds, diversion box and collection manholes, together with piping and outfall line.

1. Seeded Areas:
  - (a) Number of Acres: 1
  - (b) Type of Growth: Grass
  - (c) Predominant Species: Crested wheat grass, western wheat grass, creeping red Fescus and annual Rye.
2. Native Growth Areas:
  - (a) Number of Acres: 1
  - (b) Type of Growth: Grass
  - (c) Predominant Species: Wheat Grass
3. Wooded Areas: None
4. Dust Controlled Areas: None
5. Erosion Controlled Areas: None
6. Water Areas: None
- b. The Ammunition Normal Maintenance Area is well grassed; no difficulties are being experienced with soil erosion; and ordinary maintenance is a minimum.
- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use, as it is vitally essential to perform the Ammunition Normal Maintenance Mission of the Depot.

Section 13. OPEN AMMUNITION STORAGE PAD AREA.

- a. Description of Area: Land is rolling prairie-land containing one 100'-0" x 200'-0" covered storage pan and twenty-five 100'-0" x 200'-0" gravel surfaced open storage pads.
  1. Seeded Areas:
    - (a) Number of Acres: 375
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Areas:
    - (a) Number of Acres: 1,130
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Wheat Grass
  3. Wooded Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas: None
  6. Water Areas:
    - (a) Number of Acres: 15
    - (b) Use made of Water Areas: Drainage and live stock dams.
- b. The area is well grassed except for the Areas around the X-sites and open storage sites where ammunition is stored. The site and the area for a distance of 50 feet around these sites must be denuded of all vegetation to conform with safety regulations. Extra maintenance is required to keep them denuded of vegetation and to control soil erosion. These X-sites and open storage sites are temporary arrangements and as ammunition is renovated

and placed in permanent storage or shipped from the Depot, the sites will be made to conform to the contour of the surrounding terrain and reseeded.

- c. This area is well adapted for future expansion of permanent renovation areas, additional igloos or above ground magazines.
- d. This area along with the above ground magazine area and igloc. area is within a man-proof fence, commonly known as the "Limited Area" and it is recommended it be retained for continuing permanent use.

#### Section 14. ABOVE GROUND MAGAZINE AREA.

- a. Description of Area: The area is gently rolling prairie land and contains 12 buildings.
  - 1. Seeded Areas:
    - (a) Number of Acres: 85
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  - 2. Native Growth Area:
    - (a) Number of Acres: 5
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  - 3. Wooded Areas: None
  - 4. Dust Controlled Areas: None
  - 5. Erosion Controlled Areas: None
  - 6. Water Areas: None
- b. The above ground magazine area is well grassed; no difficulties are being experienced with soil erosion; and ordinary maintenance is a minimum.
- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Recommend this area be retained in its entirety and present status for continuing permanent use.

#### Section 15. AMMUNITION WORK SHOP AREAS.

- a. Description of Area: The areas are gently rolling prairie land containing 57 buildings and structures.
  - 1. Seeded Areas:
    - (a) Number of Acres: 5
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  - 2. Native Growth Area:
    - (a) Number of Acres: 20
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  - 3. Wooded Areas: None
  - 4. Dust Controlled Areas: None
  - 5. Erosion Controlled Areas: None

6. Water Areas: None
- b. The Ammunition Work Shops Area is fairly well grassed; no difficulties are being experienced with soil erosion; and ordinary maintenance is not excessive.
- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Recommend this area, which is fenced with a stock fence, be retained in its entirety and present status for continuing permanent use as it is essential for the Ammunition Renovation Phase of the Depot mission.

Section 16. AMMUNITION DISASSEMBLY PLANT AREA.

- a. Description of Area: The land is gently rolling, slopes to the north, drains adequately and contains 7 buildings and structures.
  1. Seeded Area:
    - (a) Number of Acres: 1
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Area:
    - (a) Number of Acres: 1
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  3. Wooded Area: None
  4. Dust Controlled Area: None
  5. Erosion Controlled Area: None
  6. Water Area: None
- b. This area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is a minimum.
- c. At present no alternate use for which area can be better adapted is ascertained.
- d. Redommend this Area be retained in its entirety in present status for continuing permanent use as it is essential for accomplishment of the Depot's assigned mission.

Section 17. BUNDLE AMMUNITION PACKING AREA.

- a. Description of Area: The land slopes toward the north; is gently rolling and contains 17 buildings and structures including sewage system.
  1. Seeded Area:
    - (a) Number of Acres: 5
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Area:
    - (a) Number of Acres: 75
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass



3. Wooded Area: None
4. Dust Controlled Area: None
5. Erosion Controlled Area: None
6. Water Area: None
- b. This area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is a minimum.
- c. At present no alternate use, for which area is better adapted, is evident.
- d. Recommend this area be retained in its entirety in present status for continuing permanent use as it is essential for accomplishment of the Depot's assigned mission.

Section 18. UNDERGROUND IGLOO MAGAZINE STORAGE AREA.

- a. Description of Area: Varies from gently sloping to hilly ground and is crossed by Cottonwood Creek and its tributaries, which are mostly dry runs except during rainy periods. Banks of creeks are nearly vertical and deep. This area contains 801 igloos, one black powder magazine, 8 Dunnage and Equipment buildings, 82 Fox Hole Safety shelters and three covered concrete loading platforms. One Igloo was destroyed in 1950 by an explosion.
  1. Seeded Areas:
    - (a) Number of Acres: 400
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat
  2. Native Growth Areas:
    - (a) Number of Acres: 6,900
    - (b) Type of Growth: Sagebrush and Grass
  3. Wooded Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas:
    - (a) Number of Acres: 8
    - (b) Method of Control: Checks
  6. Water Areas:
    - (a) Number of Acres: 21.9
    - (b) Use made of Water Areas: Live stock dams.
- b. Difficulties encountered in this area are soil erosion on earth cover of igloos and creek banks. The two foot earth cover on igloos dries out during hot summer months, causing vegetation to die and hard rains erode the earth. Creek banks erode rapidly during rainy season and more checks or dams should be constructed to retard erosion.
- c. No alternate use of this area is feasible.
- d. Recommend this area be retained. Area is necessary in order to fulfill the assigned storage mission of the Depot.

Section 19. DEMOLITION AREA (BURNING GROUND NR. 2).

- a. Description of Area: This area lies southeast of the Igloo Magazine Area on a heavy rolling terrain which rises to an elevation of 4,150, the highest on this station. It contains 7 structures (5 of which are covered with earth on three sides), a burning ground and a demolition ground.
  1. Seeded Area: None
  2. Native Growth Area:
    - (a) Number of Acres: 30
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Buffalo Grass
  3. Wood Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas: 20 Acres
  6. Water Areas: None
- b. The Burning and Demolition Area is well grassed except on the exposed shale slopes and where the bombs are detonated; erosion is under control.
- c. At present no alternate use for which this area can be better adapted is evident.
- d. Recommend this area be retained in its entirety for continuing permanent use until a separate Demolition Area and Burning Ground has been established.

Section 20. BURNING GROUNDS NRS. 1 and 3.

- a. Description of Area: Burning Ground Nr. 1 lies southeast of the Igloo Magazine Area on a heavy rolling terrain. Burning Ground Nr. 3 is north of the Open Storage Pad area on gently rolling prairie land. There are no buildings at Burning Ground Nr. 1. There are 5 buildings adjacent to Burning Ground Nr. 3.
  1. Seeded Area: None
  2. Native Growth Area:
    - (a) Number of Acres: 20 at Burning Ground Nr. 1; 100 at Burning Ground Nr. 3.
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Buffalo Grass at Burning Ground Nr. 1 and Western Wheat Grass at Burning Ground Nr. 3.
  3. Wooded Area: None
  4. Dust Controlled Area: None
  5. Erosion Controlled Area: 40 Acres
  6. Water Area: None
- b. The Burning Ground Areas are well grassed except for sections denuded for fire control; erosion is under control.
- c. At present there is no alternate use for which these areas can be better adapted.
- d. Recommend these areas be retained for continuing permanent use.

Section 21. TOXIC CHEMICAL STORAGE AREA.

- a. Description of Area: The land is rolling prairie land containing 3 covered storage pads and 38 open Chemical Ammunition Storage Pads.
  1. Seeded Areas:
    - (a) Number of Acres: 10
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Crested Wheat Grass
  2. Native Growth Areas:
    - (a) Number of Acres: 90
    - (b) Type of Growth: Grass
    - (c) Predominant Species: Western Wheat Grass
  3. Wooded Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas: None
  6. Water Areas: None
- b. This area is well grassed except for the sites where toxic chemicals are stored. The sites must be denuded of all vegetation to comply with safety regulations. Extra maintenance is required to keep them denuded of vegetation by application of chemical weed killer. These open storage sites are temporary arrangements and as toxic chemicals are destroyed or shipped from the Depot, the sites will be made to conform to the contour of the surrounding terrain and re-seeded.
- c. This area is well adapted for the storage of toxic chemical as it is remotely located from the housing area and occupied buildings. The area is located in the northwest corner of the Depot. The prevailing winds are from the northwest and in the event of a large escape of gas it would travel through the igloo area which could be rapidly evacuated.
- d. It is recommended this area be retained in its entirety and present status for continuing permanent use or until the Depot no longer has an assigned chemical mission.

Section 22. TRACER TEST FIRING RANGE.

- a. Description of Area: This area lies southwest of the Chemical Warfare Area and north of Igloo Block J. The land is gently rolling and contains 8 permanent buildings and structures which were constructed in 1956.
  1. Seeded Area: None
  2. Native Growth Area:
    - (a) Number of Acres: 220
    - (b) Type of Growth: Native Grass
    - (c) Predominant Species: Buffalo Grass
  3. Wooded Area: None
  4. Dust Controlled Area: None
  5. Erosion Controlled Area: None
  6. Water Area: None (Water runs in natural drainage channel during wet seasons).

- b. This area is well grassed; no difficulty is being experienced with soil erosion; and ordinary maintenance is a minimum.
- c. At present no alternate use, for which area is better adapted, is evident.
- d. Recommend this area be retained in its entirety in present status for continuing permanent use as it is essential for tracer testing of lots of small arms ammunition.

Section 23. AIRFIELD AREA.

- a. Description of Area: This area lies southeast of the Warehouse Storage Area on gently sloping terrain from 3680 to 3743 feet elevations. It contains two bituminous surfaced runways, 50 feet by 2600 feet and 50 feet by 2800 feet; one earth runway 100 feet by 4200 feet; one graded earth strip 75 feet by 2300 feet; three bituminous surfaced taxiways 25 feet wide by a total of 1207 feet in length; one hanger and one fuel dispensing facility.
  - 1. Seeded Area:
    - (a) Number of Acres: 20
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Crested Wheat
  - 2. Native Growth Area:
    - (a) Number of Acres: 90
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Western Wheat
  - 3. Wooded Area: None
  - 4. Dust Controlled Area: None
  - 5. Erosion Controlled Area: None
  - 6. Water Area: None
- b. This area is well grassed; there is no soil erosion.
- c. At present no alternate use, for which this area is better adapted, is evident.
- d. Recommend this area be retained in its entirety in present status for continuing permanent use.

Section 24. RECREATION AREAS.

- a. Description of Areas: One recreation and park area lies south of the Provo School area and consists of a small park and Garden Lake behind Dam Nr. 55. The other recreation area lies east of the mobilization area and contains the baseball, softball field, tennis courts, bowling alley, theater and swimming pool. Approximately 16 acres are graded and landscaped. The Golf Course is not included in these areas (See Section 25).
  - 1. Seeded Area:
    - (a) Number of Acres: 19
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Crested Wheat

2. Native Growth Area:
  - (a) Number of Acres: 40
  - (b) Type of Growth: Grass
  - (c) Predominate Species: Western Wheat
3. Wooded Area: None
4. Dust Controlled Area: None
5. Erosion Controlled Area: None
6. Water Area:
  - (a) Number of Acres: 10
  - (b) Use of Water Area: Recreation facility; fishing.
- b. The areas require little maintenance. Trees have been planted and parts of these areas are well adapted for use as picnic grounds and park. The predominate portion of these areas is not adapted to other use because of the natural drainage channel running through the area.
- c. Recommend that these areas be retained entirely at the present status for continuing permanent use.

Section 25. GOLF COURSE.

- a. Description of Area: This area lies northwest of the Officers Housing Area. The terrain is prairie rolling land. A nine-hole gulf course is laid out in this area. The fairways are native prairie grass and the "greens" are sand.
  1. Seeded Area:
    - (a) Number of Acres: 10
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Crested Wheat
  2. Native Growth Area:
    - (a) Number of Acres: 30
    - (b) Type of Growth: Grass
    - (c) Predominate Species: Western Wheat and Buffalo Grass
  3. Wooded Areas: None
  4. Dust Controlled Areas: None
  5. Erosion Controlled Areas: None
  6. Water Areas:
    - (a) Number of Acres: 1
    - (b) Use made of Water Areas: Obstacles.
- b. The area is well grassed; there is no erosion and maintenance is minor.
- c. This area is well adapted for use as a golf course.
- d. Recommend the area be retained for continuing use as a golf course.

Section 26. SAFETY CLEARANCE AND BUFFER ZONE AREAS.

- a. Description of areas: These areas consist of unallocated areas on the south and west of the Underground Igloo Magazine Storage Area; Buffer Zone areas between the Depot boundary and the hazardous areas; Quantity-Distance clearance areas between designated

use areas within the restricted ammunition explosives and toxics storage and maintenance area.

1. Seeded Area:
  - (a) Number of Acres: 930
  - (b) Type of Growth: Grass
  - (c) Predominate Species: Crested Wheat
2. Native Growth Area:
  - (a) Number of Acres: 9700
  - (b) Type of Growth: Grass and Sage
  - (c) Predominate Species: Western Wheat and Buffalo Grass.
3. Wooded Area: None
4. Dust Controlled Area: None (Adequate grass cover maintained by controlled grazing)
5. Erosion Controlled Area: None
6. Water Area:
  - (a) Number of Acres: 91
  - (b) Use of Water Area: Live Stock Dams.
- b. These areas have a good cover of grass or low shrubs and normally no difficulty is experienced with soil erosion.
- c. These areas are required for safety clearance. Outleasng for grazing purposes, where feasible, provides for full efficient use of the land.
- d. Recommend that these areas be retained entirely for continued use as safety clearance and buffer zone areas.

Section 27. OTHER AREA.

There are no areas of which no use has ever been made, nor are there any areas for which no use is likely and which the Planning Board might recommend for disposal to the advantage of the Government and/or of the local community.

The areas between the Restricted Area and the boundary fence are outleased for grazing purposes. The terrain is so rugged that it cannot be economically utilized for other than grazing purposes. Because of the rough terrain these areas have little appeal to the populace in the surrounding communities. The areas also serve as safety buffer zones. The outleasng for grazing of land retained for protection or safety zones is considered to accomplish substantially the same purpose as sale under restrictive covenants, but with more positive protection.

The fenced area north and west of the Sewage Disposal Area is rugged terrain (included in the acreage of Section 26, Buffer Zone) presently used for grazing by the Igloo Saddle Club. This area is adaptable to future development. The area north of the Warehouse and Airfield Area (acreage also included in Section 26, Buffer Zone) is divided by several natural drainage channels and is best

suited for grazing or haying purposes. Part of this area could be used for future expansion of Warehouse Storage facilities. In the Buffer Zone at the northern boundary of the Depot north of the Toxic Chemical Storage area there are 137 acres outleased for grazing and agricultural purposes. A total of 14,488 acres on the Depot are outleased for grazing.

Neither are there areas in the vicinity of present or former ranges; nor are there any areas on the Depot known or suspected to have been previously used as ranges. There are no areas where existing conditions may introduce hazards.

It is recommended the installation be retained in its entirety for efficient and economical accomplishment of the assigned mission.

### Part III. BUILDINGS AND STRUCTURES

#### Section 1.

##### a. GENERAL:

In general costs of maintenance and repair of buildings and structures have not been excessive even though most of the facilities were constructed during 1942 and 1943. In fact maintenance and repair costs are considered to be average. These low costs can be contributed primarily to the fact the semi-arid climate with few rainfalls is very favorable to the long life of buildings in this locality. Only a few of the buildings have had major rehabilitation or major repairs performed on them since initial erection.

Some dry rot has been found in very small amounts. However, damage from dry rot is negligible. Treated lumber is used in cases where dry rot is likely to occur. Wet rot is found in some of the native timber which is purchased from local lumber yards. No damage has been done to timber in the buildings by insects such as powder post, the pole borer and termites. None of these three types of insects have been observed here on the Depot. There are not nearly as many insects in this semi-arid climate as there are in southern localities with heavy rainfall.

##### b. EXEMPTIONS AND WAIVERS:

###### 1. EXEMPTIONS:

There are presently five exemptions in effect at Black Hills Army Depot. These exemptions are as follows:

REF.-BARR.	AMCR 786-224	NUMBER	CONDITION	DATE APPROVED
801(a)	E-1-54	Bldgs 1810, 1813, 1816, 1818, 1822, 1823 and 1824 exempted from provisions of para. 801a as it is considered uneconomical to install lightning systems (storage of Small Arms Ammo).	13 May 54	
1712(a)	E-2-54	Storage of Class 4 ammunition in standard above ground magazine 3027 located 1175 ft from solid propellant service magazines 3031 and 3032.	17 May 54	



REF. PARA.	NUMBER	CONDITION	DATE APPROVED
AMCR 385-224			
810	E-1-56	Existing non-standard air terminals adjacent to ventilators on igloos.	10 Apr 56
504a	E-1-58	Violation of construction requirements in washout Building Nr. 3046.	12 Mar 58
505	E-1-62	Firewalls in Buildings Nr. 1822, 1823 and 1824 do not meet minimum requirements of Para 505.	20 July 62

2. WAIVERS: Waivers presently in effect at Black Hills Army Depot are as follows:

REF. PARA.	NUMBER	CONDITION	DATE APPROVED	EXPIRATION DATE
AMCR 385-224				
817	W-1-63	Rails at loading docks not bonded and grounded	11 Feb 63	15 Feb 64

One local waiver is presently in effect and expires on 8 July 1964. The waiver covers the following:

Unoccupied buildings in which windows and doors in the proximity of fire escapes are not glazed with wire glass. These unoccupied buildings are EM Barracks. Building Nrs. 104, 105, 111, 112, 114, 116, 117, 118, 122, 123, 124, 125, 126, and 128.

Part III. BUILDINGS AND STRUCTURES.

Section 4. Warehouses.

- a. BUILDING NR.: H-60
  - b. USE: Medical Supply Storehouse.
  - d. TYPE: STOR-C-H (Mod). Temporary, Wood Frame.
  - e. SIZE: 25'-6" x 81'-2 3/4", one story.
  - f. The building is in good condition and should be retained in use until such time that replacement with permanent type construction is feasible. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. The building is necessary for the storage of medical supplies used at the Station Hospital. Recommend it be retained until replaced with permanent type construction or other arrangements have been made for a hospital.
- 
- a. BUILDING NR.: 148
  - b. USE: General storehouse, miscellaneous community facilities equipment.
  - c. TYPE: Originally constructed as a recreational building. Temporary, wood frame.
  - d. CAPACITY: 1,459 sq. ft. gross floor area.
  - e. SIZE: 19'-4" x 72'-3", one story. Two enclosed porches 4'-3" x 6'-11".
  - f. The building is in fair condition. Maintenance is minor.
  - g. ALTERNATE USE: The building could be used as a temporary recreation facility.
  - h. Recommend the building be retained for storage of miscellaneous community facilities equipment until permanent type construction is feasible.
- 
- a. BUILDING NR.: 1302
  - b. USE: Warehouse. Miscellaneous Storage by Concessionaires.
  - c. TYPE: Temporary, CCC Panel.
  - d. CAPACITY: 1,615.3 sq. ft.
  - e. SIZE: 20'-1" x 80'-5 1/2", one story.
  - f. The construction is temporary panel type and is not suitable for continuing use. Maintenance is not high.
  - g. ALTERNATE USE: None
  - h. The building is needed for storage of merchandise in connection with the operation of the Trading Post and Clothing Store. It should be retained until a more permanent type warehouse is provided for these facilities.
- 
- a. BUILDING NR.: 1804
  - b. USE: Warehouse. Used for storage of flammable materials.
  - c. TYPE: Std 60' Warehouse (Mod). Mobilization, Wood Frame.
  - d. CAPACITY: 12,047.2 sq. ft. of floor area.
  - e. SIZE: 60'-2" x 200'-2 3/4", one story.
  - f. The construction is generally good in this building, and maintenance and repair to keep it in a usable condition is minor. Satisfactory for continuing use until converted to permanent type building or until replaced.
  - g. ALTERNATE USE: Storage of lumber.
  - h. The available storage space in the building is occupied, and the building should be retained until such time that it can be replaced or converted to permanent type building.

- a. BUILDING NR.: 1809.
  - b. USE: Warehouse is presently in a standby status.
  - c. TYPE: WH-6 (Mod). Mobilization, Wood Frame.
  - d. CAPACITY: 50,632.8 sq. ft. of floor area.
  - e. SIZE: Main Building 180'-5½" x 280'-2½", one story, offset 8'-11" x 7'-6" addition, one story.
  - f. The construction is generally good on this building. Maintenance and repair to keep it in a usable condition is not excessive. Satisfactory for continuing use until replaced or converted to permanent type building.
  - g. ALTERNATE USE: General warehousing.
  - h. Recommend the building be retained until such time that it can be replaced or converted to a permanent type building or it has been definitely determined it is no longer required.
- 
- a. BUILDING NRS.: 1810 and 1814.
  - b. USE: Warehouses are presently on standby status.
  - c. TYPE: WH-6 (Mod), Mobilization, Wood Frame.
  - d. CAPACITY: 90,301.3 sq. ft. of floor area in 1810 and 90,309.7 sq. ft. of floor area in 1814.
  - e. SIZE: 180'-3" x 500'-2½", one story for 1810 and 180'-3½" x 500'-2", one story for 1814. Each building has two 8'-11" x 7'-6" offsets.
  - f. The construction is generally good on these buildings. Maintenance and repair to keep them in a usable condition is not excessive. Satisfactory for continuing use until replaced or converted to permanent type buildings.
  - g. ALTERNATE USE: General Warehousing.
  - h. Recommend the buildings be retained until such time that they can be replaced or converted to permanent type buildings, or it has been definitely determined they are no longer required.
- 
- a. BUILDING NRS.: 1816 and 1818.
  - b. USE: Warehouse. Storage of Small Arms Ammunition.
  - c. TYPE: WH-6 (Mod). Permanent, Wood Frame.
  - d. CAPACITY: 90,351.2 sq. ft. of floor area in 1816 and 90,288.7 sq. ft. of floor area in 1818.
  - e. SIZE: 500'-2" x 180'-4½", one story, for 1816 and 500'-2" x 180'-3" for 1818. Each building has two 8'-11" x 7'-6" offsets.
  - f. The construction is good on these buildings. Maintenance and repair is minor. The buildings are suitable for continuing permanent use as warehouses. They were rehabilitated during Calendar Year 1959.
  - g. ALTERNATE USE: Dehumidified Storage.
  - h. Recommend the buildings be retained for permanent use as storage warehouses. They can be converted to dehumidified storage with the installation of the necessary equipment and machinery.

- a. BUILDING NRS.: 1822, 1823, 1824.
  - b. USE: Warehouses. Presently in a standby status.
  - c. TYPE: Shed Type OS-1 (Mod). Mobilization, Wood Frame.
  - d. CAPACITY: 1822 has 91,117.4 sq. ft. of floor area, 1823 has 91,079.4 sq. ft. of floor area, 1824 has 91,037.3 sq. ft. of floor area.
  - e. SIZE: 501'-9" x 181'-4" for 1822, 502'-0" x 181'-2" for 1823 and 502'-0" x 181'-1" for 1824. All warehouses are one story and each have two 8'-11" x 7'-6" offsets.
  - f. The construction is generally good on these buildings, maintenance and repair to keep them in a usable condition is a minimum. Satisfactory for continuing use until replaced or converted to permanent type buildings.
  - g. ALTERNATE USE: General warehousing.
  - h. Recommend the buildings be retained until such time that they can be replaced or converted to permanent buildings or it has been determined they are no longer required.
- 
- a. BUILDING NRS.: 1825 and 1827.
  - b. USE: Storage of Ammunition Components and Packing Materials.
  - c. TYPE: Shed type OS-1 (Mod). Permanent, Wood Frame.
  - d. CAPACITY: 91,282.6 sq. ft. of floor area in 1825 and 91,199.3 sq. ft. of floor area in 1827.
  - e. SIZE: 502'-1½" x 181'-6¼" for 1825 and 502'-5" x 181'-3" for 1827. Both warehouses are one story and both have two 9'-0" x 7'-7" offsets.
  - f. The buildings are constructed of durable material throughout and are suitable for continuing permanent use. Maintenance is a minimum. They were rehabilitated during Calendar Year 1957.
  - g. ALTERNATE USE: Dehumidified Storage.
  - h. Recommend these buildings be retained for continuing permanent use as storage warehouses. They can be converted to dehumidified storage with the installation of the necessary equipment and machinery.
- 
- a. BUILDING NR.: 1829.
  - b. USE: Warehouse. Presently in a standby status.
  - c. TYPE: Shed Type OS-1 (Mod). Mobilization, Frame Construction.
  - d. CAPACITY: 51,095.4 sq. ft. floor area.
  - e. SIZE: 181'-2" x 281'-8", one story, with one 8'-11" x 7'-6" offset.
  - f. The construction is generally good on this building, and maintenance and repair to keep it in a usable condition is not excessive. Satisfactory for continuing use until replaced or converted to permanent type building.
  - g. ALTERNATE USE: General Warehousing.
  - h. Recommend the building be retained until such time that it can be replaced or converted to permanent building or it has been determined it is no longer required.

- a. BUILDING NRS.: 3011, 3012, 3013, 3014, 3015, 3019, 3020, 3021, 3022, and 3023.
  - b. USE: Standard Above Ground Magazines. Storage of Ammunition.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 11,301.6 sq. ft. floor area each.
  - e. SIZE: 51'-7½" x 218'-11", one story.
  - f. These buildings are well constructed of durable materials throughout and are suitable for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: General warehousing.
  - h. The Standard Above Ground Magazines are used for the storage of ammunition, and are essential in order to fulfill the mission of this Depot. Recommend they be retained for permanent use.
- 
- a. BUILDING NRS.: 3018 and 3027.
  - b. USE: Standard Above Ground Magazines. Storage of Ammunition.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 11,301.6 sq. ft. floor area each.
  - e. SIZE: 51'-7½" x 218'-11", one story.
  - f. These buildings are well constructed of durable materials throughout and are suitable for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: General warehousing.
  - h. The Standard Above Ground Magazines are used for the storage of ammunition, and are essential in order to fulfill the mission of this Depot. Recommend they be retained for permanent use.
- 
- a. BUILDING NR.: 4002.
  - b. USE: Storehouse. Storage of tools used by Storage Division and impregnated clothing.
  - c. TYPE: T. O. (Mod), Wood Frame.
  - d. CAPACITY: 1,388.0 sq. ft. floor area.
  - e. SIZE: 20'-4" x 36'-4", one story, with a 30'-9½" x 20'-4" addition and a 5'-4" x 4'-4" offset.
  - f. The building is of temporary construction, originally designed for a lunchroom in the Bundle Ammunition Packing Area, later converted to storehouse for tools and impregnated clothing. The building should be retained for continuing use until replacement with permanent type construction is considered feasible. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. This building is essential for storage and it is recommended that it be retained until permanent type construction is provided.

- a. BUILDING NR.: 4012.
  - b. USE: Storehouse. Storage of railroad section crew tools.
  - c. TYPE: Shed, Temporary, Wood Frame.
  - d. CAPACITY: 386.7 sq. ft. floor area.
  - e. SIZE: 24'-0 $\frac{1}{2}$ " x 16'-1", one story.
  - f. The building is in good condition and should be retained for continuing use until replacement with permanent type construction is considered feasible. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. The building is essential for storage of tools and motor cars used by Post Engineer railroad maintenance crews. Recommend it be retained until permanent type construction is provided.
- 
- a. BUILDING NRS.: 6043, 6045, and 6047.
  - b. USE: Storage Shed. Storage of Chemical Bombs.
  - c. TYPE: Open Shed, Temporary, Wooden Columns.
  - d. CAPACITY: 17,225.9 sq. ft. each.
  - e. SIZE: 90'-7" x 190'-2", one story.
  - f. These buildings are well constructed and resist heavy winds. However, they are not suitable for continuing permanent use. Maintenance is not too high.
  - g. ALTERNATE USE: Storage of other types of explosives, inert ammunition components, or other inert materials.
  - h. The buildings are used to keep the sun off of chemical bombs. Recommend they be retained as long as there is a requirement for them, and when this requirement no longer exists it is recommended they be dismantled and sold as salvage.
- 
- a. BUILDING NRS.: A101 thru A104, A201 thru A204, A301 thru A305, A401 thru A404, A501 thru A504, A601 thru A604, A701 thru A703, A801 thru A805, A901 thru A906, A1001 thru A1005, A1101 thru A1106, A1201 thru A1209, A1301 thru A1311, A1401 thru A1408, A1501 thru A1508, A1601 thru A1606, A1701 thru A1705, A1801 thru A1803, D101 thru D109, D201 thru D211, D301 thru D313, D401 thru D413, D501 thru D514, D601 thru D616, D701 thru D715, D801 thru D809, Total-200 igloos.
  - b. USE: Igloo Magazines. Storage of Ammunition.
  - c. TYPE: Underground Igloo Magazines. Permanent, arch type of reinforced concrete, underground.
  - d. CAPACITY: 1,607.7 sq. ft. net floor area each.
  - e. SIZE: 29'-2" x 62'-8", underground, one story.
  - f. The buildings generally are in good condition. A few have cracks in floor and arch, but not to the extent that will cause failure of the structure or that cannot be satisfactorily repaired. They are suitable for continuing use. Maintenance is not high.

- g. ALTERNATE USE: Storage of various small items.
  - h. The igloo magazines are used for storage of ammunition which is the prime mission of this Depot; therefore, they should be retained for permanent use.
- 
- a. BUILDING NRS.: B101 thru B110, B201 thru B207, B301 thru B308, B401 thru B406, B501 thru B504, B601 thru B607, B701 thru B709, C101 thru C102, C201 thru C204, C301 thru C309, C401 thru C410, C501 thru C512, C601 thru C612, E101 thru E118, E201 thru E219, E301 thru E316, E401 thru E417, E501 thru E514, E601 thru E616, F101 thru F105, F201 thru F207, F301 thru F307, F401 thru F408, F501 thru F507, F601 thru F608, F701 thru F707, F801 thru F808, F901 thru F909, F1001 thru F1009, F1101 thru F1109, F1201 thru F1208, F1301 thru F1303, F1305 thru F1308, G101 thru G107, G201 thru G207, G301 thru G308, G401 thru G409, G501 thru G510, G601 thru G609, G701 thru G709, G801 thru G809, G901 thru G909, G1001 thru G1011, G1101 thru G1105, G1201 thru G1204, G1301 thru G1303, H101 thru H110, H201 thru H210, H301 thru H311, H401 thru H411, H501 thru H511, H601 thru H610, H701 thru H711, H801 thru H810, H901 thru H908, H1001 thru H1008, J101 thru J106, J201 thru J221, J301 thru J319, J401 thru J417, J501 thru J514, J601 thru J611, J701 thru J709, J801 thru J803. Total of 599 igloos.
  - b. USE: Igloo Magazines, Storage of Ammunition.
  - c. TYPE: Permanent, arch type reinforced concrete, underground
  - d. CAPACITY: 2,146.5 sq. ft. net floor area each.'
  - e. SIZE: 83'-0" x 29'-2", underground, one story.
  - f. The buildings are generally in good condition. A few have cracks in the floor and arch but not to the extent that will cause failure of the structure or that cannot be satisfactorily repaired. They are suitable for continuing use. Maintenance is not high.
  - g. ALTERNATE USE: Storage of various small items.
  - h. The Igloo Magazines are used for storage of ammunition which is the prime mission of this Depot; therefore, they should be retained for permanent use.
- 
- a. BUILDING NRS.: C-613 and C-614.
  - b. USE: Igloo Magazines. Storage of Ammunition.
  - c. TYPE: Permanent, Arch type, reinforced concrete, underground.
  - d. CAPACITY: 1,068.8 sq. ft. floor area, each.
  - e. SIZE: 29'-2" x 42'-4", underground, one story.
  - f. The buildings are in good condition and are suitable for retention for continuing permanent use. Maintenance is minor.
  - g. ALTERNATE USE: Storage of various small items.
  - h. The igloo magazines are used for storage of ammunition which is the prime mission of this Depot; therefore, they should be retained for permanent use.

- a. BUILDING NR.: C-615.
  - b. USE: Black Powder Magazine. Storage of Black Powder.
  - c. TYPE: Permanent, Standard post type, reinforced concrete, above ground.
  - d. CAPACITY: 49.0 sq ft. floor area.
  - e. SIZE: 8'-4" x 8'-4", one story.
  - f. The building is in good condition and is suitable for retention for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: Storage of various small items.
  - h. The black powder magazine is used for storage of bulk powder and is essential in the overall mission of this Depot; therefore, it should be retained for permanent use.
- 
- a. BUILDING NR.: X-115.
  - b. USE: Storage Shed. Storage of bulk silicon carbide for General Services Administration.
  - c. TYPE: Closed Shed.
  - d. CAPACITY: 20,844.5 sq. ft. storage area.
  - e. SIZE: 103'-10" x 200'-9", one story.
  - f. The building was strengthened by installing ground anchors to resist heavy winds. However, it is not suitable for continuing permanent use. Maintenance is not too high.
  - g. ALTERNATE USE: Storage of vehicles or other Ordnance supplies.
  - h. The building was inclosed to prevent the bulk silicon carbide, stored for General Services Administration, from becoming contaminated with dust and foreign matter. This building is recommended for retention until replaced with a permanent type structure, or until there is no longer a requirement for it.



ANALYSIS

PART III-8-1

III-8-69

(offset Master's)

Part III. BUILDINGS AND STRUCTURES.

Section 8. Miscellaneous Buildings and Structures.

- a. BUILDING NR.: 1A
  - b. USE: Generator House. To house standby generator for Building Nr. 1.
  - c. TYPE: Permanent, Concrete Block.
  - d. CAPACITY: 252.0 sq. ft. floor area.
  - e. SIZE: 15'-4" x 19'-4", one story
  - f. The building was completed in October 1961 and a 45 KW generator was installed for permanent standby use to serve as an emergency source of electrical energy to Building Nr. 1.
  - g. ALTERNATE USE: None.
  - h. This building houses a 45 KW generator for emergency source of electricity for Building Nr. 1. It is recommended that the building be retained for permanent use.
- 
- a. BUILDING NR.: 2
  - b. USE: Fire Station. Also houses Telephone Offices, Switchboard, and Automatic Dial Equipment.
  - c. TYPE: ALB (Mod) and C. D. Permanent, wood frame.
  - d. CAPACITY: 10,840.0 sq. ft. of floor area in Main Building first and second floors, attic and basement. 3,856.3 sq. ft. of floor area in wing, addition and offsets.
  - e. SIZE: Main Building; first and second story: 124'-9 $\frac{1}{4}$ " x 33'-0  $\frac{3}{4}$ ", two story, Basement; 60'-2" x 30'-7 $\frac{1}{2}$ ", Attic; 123'-9" x 6'-10 $\frac{1}{2}$ ". T. O. Addition; one story; 42'-4  $\frac{3}{4}$ ", Wing; 38'-9 $\frac{1}{4}$ " x 40'-3 $\frac{1}{4}$ ", Offsets; two - 4'-5" x 4'-3", one - 45'-10" x 5'-6".
  - f. The basement and two-story section is well constructed. The basement wall has been waterproofed and drain tile installed around entire building. The main part of the building is suitable for continuing permanent use. The wing is of temporary construction and suitable for use until replaced with permanent type construction. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. This building houses the Fire Department, Safety Office, and Telephone Personnel and is vitally essential to the operation of the Depot. Recommend that the building be retained for permanent use and that the temporary wing be replaced with permanent type construction when considered feasible. The first floor was converted in 1962 from a Provost Marshals Office and Security to Communications Section for the dial telephone exchange and office.
- 
- a. BUILDING NR.: 2A
  - b. USE: Generator House. Houses standby generator for Building Nr. 2.
  - c. TYPE: Permanent, Concrete Block.
  - d. CAPACITY: 149.0 sq. ft. floor area.

- g. ALTERNATE USE: Light storage for various items.
- h. This building serves as a storage shed for saddles belonging to members of the Igloo Saddle Club. Recommend it be retained until replaced with permanent type construction or until there is no longer a requirement for it.

- a. BUILDING NR.: 1634.
- b. USE: Dog Kennels.
- c. TYPE: Temporary, Wood Frame.
- d. CAPACITY: 64.0 sq. ft. floor area.
- e. SIZE: 16'-0" x 4'-0", one story.
- f. The building is in good condition and should be retained for continuing use until replaced with permanent type construction. Maintenance is minor.
- g. ALTERNATE USE: None.
- h. Recommend retention for continuing use until replaced with permanent type construction.

- a. BUILDING NR.: 1700
- b. USE: Aircraft Hangar
- c. TYPE: Permanent, Combination steel span and wood frame covered with galvanized iron.
- d. CAPACITY: 3,755.0 sq. ft. floor area.
- e. SIZE: Main building 36'-2" x 88'-4"; pilots' lounge addition 15'-6" x 36'-2", one story.
- f. The original main building and addition was erected in 1959. The main hangar was destroyed by a windstorm on 28 April 1962 and was replaced by new construction in August 1962. The building is in good condition and suitable for continuing permanent use.
- g. ALTERNATE USE: None.
- h. The hangar is used to house aircraft owned by the Flying Club. Recommend it be retained for continuing permanent use.

- a. BUILDING NR.: 1800.
- b. USE: Gate Guard House. Entrance to Warehouse Area.
- c. TYPE: EGH-2 (Mod). Mobilization, Wood Frame.
- d. CAPACITY: 986.5 sq. ft. floor area.
- e. SIZE: 14'-0 $\frac{1}{2}$ " x 26'-1" with 20'-4" x 30'-6" wing, one story.
- f. This building is in good condition and should be retained for continuing use and replaced with permanent type construction when considered feasible. Maintenance is a minimum.
- g. ALTERNATE USE: Light storage.
- h. The building is essential as a Guard Gate. Recommend it be retained until permanent type construction is provided.

- a. STRUCTURE NR.: 1800A.
- b. USE: Septic Tank. Part of Sewage System for Guard Gate at entrance to the Warehouse Area.
- c. TYPE: Permanent, Reinforced Concrete Culvert Pipe.

- d. CAPACITY: 6 man per day.
- e. SIZE: Three sections of 60 inch diameter reinforced concrete culvert pipe placed on end.
- f. The structure is in good condition; requires a minimum of maintenance; and should be retained for continuing permanent use.
- g. ALTERNATE USE: None.
- h. This independent sewage collection and disposal system is essential for treatment and disposal of sewerage from the Guard Gate located at the entrance to the Warehouse Area. Recommend the septic tank be retained for permanent use.

- a. BUILDING NR.: 1801.
- b. USE: Sewage Pumping Station.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 284.3 sq. ft. floor area.
- e. SIZE: 10'-0" x 14'-8", one story, with an 8'-0" x 7'-10 $\frac{1}{2}$ " sub-surface pump room and an 8'-0" x 4'-0" collection basin.
- f. This building is in good condition and should be retained for continuing permanent use. Maintenance is minor.
- g. ALTERNATE USE: None.
- h. The sewage pumping station is an essential part of the Sewage Disposal System. Recommend it be retained and improved for permanent use.

- a. BUILDING NR.: 1808.
- b. USE: Storehouse. Storage of Miscellaneous Supplies. Originally constructed as a first aid station.
- c. TYPE: Mobilization, Wood Frame.
- d. CAPACITY: 734.5 sq. ft. floor area.
- e. SIZE: 20'-3" x 36'-3 $\frac{1}{4}$ ", one story, with one 5'-3" x 4'-4 $\frac{1}{2}$ " offset.
- f. The building is in good condition; should be retained for continuing use; and replaced with permanent type construction when considered feasible. Maintenance is minor.
- g. ALTERNATE USE: Could be easily converted back to a first aid station.
- h. This building is used for miscellaneous storage by the Storage Division. Recommend it be retained until replaced with permanent type construction.

- a. STRUCTURE NR.: 1811.
- b. USE: 60 Ton Hoist.
- c. TYPE: Stationary Hoist, Reinforced Concrete.
- d. CAPACITY: 60 ton lift.
- e. SIZE: Permanent, hoist, reinforced concrete, 60 tons; Temporary building (Operator's House), 12'-2" x 15'-0 $\frac{1}{2}$ ".
- f. The hoist is constructed of reinforced concrete and is suitable for permanent continuing use. Since the building is temporary, it should be retained for continuing use until replaced with permanent type construction.

g. ALTERNATE USE: None.

h. This hoist is essential for lifting heavy equipment from railroad cars or trucks and is recommended to be retained.

a. BUILDING NR.: 1812.

b. USE: Engineer Field Maintenance Shop.

c. TYPE: Ord. Prefab. Steel. Permanent, Steel Frame.

d. CAPACITY: 18,619.0 sq. ft. of floor area.

e. SIZE: 60'-1" x 302'-3", one story mill type, with one 20'-2" x 17'-7" offset.

f. The building is constructed of durable material throughout and is suitable for continuing permanent use as a Heavy Equipment Maintenance Shop. Maintenance is a minimum.

g. ALTERNATE USE: Storage of various items.

h. Recommend the building be retained for continuing permanent use as a Engineer Field Maintenance Shop.

a. STRUCTURE NR.: 1812A.

b. USE: Wash Platform.

c. TYPE: Permanent, Reinforced Concrete Ground Level Slab.

d. CAPACITY: 887 sq. ft.

e. SIZE: 19'-6" x 45'-6" x 6" concrete slab.

f. This structure was constructed in 1962 and is used to wash down heavy equipment for repair in Building Nr. 1812.

g. ALTERNATE USE: None.

h. Recommend this wash platform be retained for continuing permanent use.

a. BUILDING NR.: 1813.

b. USE: Operating line for inert items and small arms ammunition.

c. TYPE: Ord. Prefab. Steel, Permanent, Steel Frame.

d. CAPACITY: 18,535.1 sq. ft. of floor area.

e. SIZE: 60'-1" x 302'-2", one story, mill type with 22'-3" x 16'-2" offset.

f. The building is constructed of durable material throughout and is suitable for continuing permanent use as a processing building for ammo components. Maintenance and repair is minor.

g. ALTERNATE USE: Operation equipment shops or storage of various items.

h. Recommend the building be retained for continuing permanent use as a processing and maintenance building.

a. BUILDING NRS.: 1815, 1817, 1826, 1828.

b. USE: Toilets.

c. TYPE: Mobilization, Wood Frame.

d. CAPACITY: 435.1 sq. ft. each.

e. SIZE: 18'-1" x 24'-0 3/4", one story.

- f. These buildings are suitable for continuing use until replacement with a permanent structure is feasible. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. Recommend these lavatories be retained until permanent type construction is provided.
- 
- a. STRUCTURE NR.: 1819.
  - b. USE: Railroad Loading Dock.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 20,717.3 sq. ft. of deck area.
  - e. SIZE: Main deck slab; 499'-11" x 25'-3". End Wing slab; 22'-2" x 25'-1". Five side ramps; 38'-3" x 25'-0". Two end ramps; 47'-5" x 34'-11½" and 38'-3" x 25'-0".
  - f. The deck slab was replaced during the summer of 1956. The structure is suitable for continuing permanent use. Maintenance is now an absolute minimum.
  - g. ALTERNATE USE: None.
  - h. The loading dock is located in the Warehouse Area and is needed for loading and unloading of railroad cars of general supplies, equipment, etc. Recommend it be retained for permanent continuing use.
- 
- a. STRUCTURE NR.: 1820.
  - b. USE: Railroad Loading Dock.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 20,735.0 sq. ft. of deck area.
  - e. SIZE: Main deck slab; 499'-3" x 25'-3". End wing slab; 24'-2½" x 22'-5". Five side ramps; 38'-2½" x 25'-0". Two end ramps; 47'-8" x 38'-11" and 38'-2½" x 25'-0".
  - f. The deck slab was replaced during the summer of 1958. The structure is suitable for continuing permanent use. Maintenance is now an absolute minimum.
  - g. ALTERNATE USE: None.
  - h. The loading dock is located in the Warehouse Area and is needed for loading and unloading of railroad cars of general supplies, equipment, etc. Recommend it be retained for permanent use.
- 
- a. BUILDING NR.: 1821.
  - b. USE: Fire Station.
  - c. TYPE: F-2, Mobilization, Wood Frame.
  - d. CAPACITY: 4,194.7 sq. ft. floor area.
  - e. SIZE: Main 100'-0 3/4" x 25'-1", wing 44'-1¼" x 37'-0½", one offset 16'-0¼" x 9'-6", one offset 10'-0¼" x 9'-6", one story.
  - f. This building is in good condition and should be retained for continuing use until replaced with permanent type construction when considered feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.

- h. The Fire Station is essential to the Fire Department in carrying out their Fire Prevention and Protection program especially in the Warehouse Area. Recommend it be retained until permanent type construction is provided.
- a. BUILDING NR.: 1834.  
 b. USE: Salvage Operations Building.  
 c. TYPE: Temporary, Wood Frame.  
 d. CAPACITY: 1,215.1 sq. ft. floor area.  
 e. SIZE: 20'-2" x 60'-3", one story.  
 f. The building is of temporary construction but should be used in its present capacity until replaced with permanent type construction. Maintenance costs are not excessive.  
 g. ALTERNATE USE: None.  
 h. The building is essential to perform salvage operations. Recommend it be retained for continuing use until permanent type construction is provided, or until there is no longer a requirement for the building.
- a. BUILDING NR.: 1835.  
 b. USE: Bailer Shed.  
 c. TYPE: Temporary, Wood Frame.  
 d. CAPACITY: 410.8 sq. ft. floor area.  
 e. SIZE: 28'-6" x 14'-5", one story.  
 f. The building is in poor condition and should be replaced as soon as practicable. Maintenance costs are high.  
 g. ALTERNATE USE: None.  
 h. The building is used as a shelter for scrap metal bailing machine. Recommend the building be retained until replaced with permanent type construction or until a requirement no longer exists.
- a. BUILDING NR.: 1839.  
 b. USE: Guard Shelter. Located at Gate M-1.  
 c. TYPE: Mobilization, Wood Frame.  
 d. CAPACITY: 54.0 sq. ft. floor area.  
 e. SIZE: 6'-4" x 8'-5½", one story.  
 f. The building is in good condition and is suitable for continuing use. Maintenance costs are minor.  
 g. ALTERNATE USE: None.  
 h. This building is recommended for retention until it is deemed feasible to replace with permanent type construction. It is used by the security forces as a shelter for the guard stationed at Gate M-1.
- a. BUILDING NR.: 1842.  
 b. USE: Personnel Shelter. Located at Bus Stop at Provo Gate.  
 c. TYPE: Mobilization, Wood Frame.  
 d. CAPACITY: 123.7 sq. ft. of floor area.  
 e. SIZE: 12'-1 3/4" x 10'-2½", one story.

- f. The building is in good condition and should be retained for continuing use until replaced with permanent type construction. Maintenance costs are small.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for continuing use as it is essential for the health and moral of Depot personnel.
- 
- a. BUILDING NR.: 2000.
  - b. USE: Truck Scales and Scale House.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 448.2 sq. ft. floor area.
  - e. SIZE: 14'-0 $\frac{1}{2}$ " x 7'-8 $\frac{1}{2}$ " (house), 10'-0" x 34'-0" (Scale), one story.
  - f. The building is in good condition and requires a minimum of maintenance and repair. It should be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. The truck scale house is an essential part of Depot operations and recommended to be retained for permanent use. Fixed electric strip heaters should be installed to provide safe heat during winter season.
- 
- a. BUILDING NR.: 2003.
  - b. USE: Automotive Garage.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 16,714.1 sq. ft. floor area.
  - e. SIZE: 58'-10 $\frac{1}{2}$ " x 283'-5", one story, with one 5'-5 $\frac{1}{2}$ " x 5'-1 $\frac{1}{2}$ " offset.
  - f. The building is well constructed and is suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: Storage of automotive vehicles.
  - h. This building is essential for servicing and repairing of the vehicles used throughout the post and is recommended to be retained for permanent use.
- 
- a. BUILDING NR.: 2004.
  - b. USE: Transportation Division and Motor Pool Dispatch Office.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 4,194.3 sq. ft. floor area.
  - e. SIZE: 61'-10" x 67'-10", one story.
  - f. The building is well constructed and it is suitable for continuing permanent use. In 1962 the roof of this building was damaged by a windstorm. It was replaced by contract. Maintenance costs are a minimum.
  - g. ALTERNATE USE: Carpenter Shop or Tire Repair Shop.
  - h. This building is used as a Motor Pool Dispatch Office and Transportation Division Office and is an essential part of the functions of the Transportation Division. Recommend it be retained for permanent use.



on the Depot. The building should be replaced with permanent type construction in the near future as maintenance costs are excessive.

- a. BUILDING NR.: 2033
  - b. USE: Paint Shop. Post Engineer Paint Work Shop.
  - c. TYPE: Permanent, Structural Tile, (Concrete Block Addition).
  - d. CAPACITY: 1244.7 sq. ft. floor area.
  - e. SIZE: 30'-0 $\frac{1}{4}$ " x 32'-0 $\frac{1}{2}$ ", one story, 10'-8" x 26'-10" addition.
  - f. The building is in good condition and is suitable for continuing permanent use. The concrete block addition was constructed in 1963 to provide a safe work area in which to mix paints and clean paint brushes. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. This building is being used as a Post Engineer paint work shop and recommend it be retained for permanent use.
- 
- a. BUILDING NR.: 2037,
  - b. USE: Vehicle Wash Rack.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 1,805.0 sq. ft. floor area.
  - e. SIZE: 30'-1" x 60'-0", one story.
  - f. This building is in good condition and should be retained for continuing permanent use. However, it should be enlarged to accommodate buses and large trucks. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. This building is essential as a wash rack for transportation division motor vehicles and recommend it be enlarged and retained for permanent use.
- 
- a. BUILDING NR.: 2038.
  - b. USE: Storehouse. Storage of Portable Air Compressors and Light Plants and Weasels.
  - c. TYPE: Permanent, Armco Steel.
  - d. CAPACITY: 2,904.8 sq. ft. area.
  - e. SIZE: 50'-8" x 57'-4", one story.
  - f. The building was erected in 1954, is in good condition, and should be retained for continuing permanent use. Maintenance costs are an absolute minimum.
  - g. ALTERNATE USE: Storage of other items.
  - h. This building is used by the Transportation Division as storage for portable air compressors, light plants, Weasels, and other equipment. Recommend it be retained for permanent use.
- 
- a. STRUCTURE NRS.: 3000 and 3001.
  - b. USE: Cold Water Storage Tanks.
  - c. TYPE: Permanent, Reinforced Concrete, Ground Level.
  - d. CAPACITY: 500,000 gallons each.
  - e. SIZE: 62'-0" diameter X 23'-6" deep.

- f. The structures are in good condition; require little maintenance; and are suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend the structures be retained for permanent use as they are an essential part of the Depot water distribution system.
- 
- a. STRUCTURE NR.: 3002.
  - b. USE: Valve Vault. Control Vault for Valves on 20" cast iron water main.
  - c. TYPE: Permanent, reinforced concrete, underground.
  - d. CAPACITY: 208.0 sq. ft.
  - e. SIZE: 11'-3" x 18'-6" in height.
  - f. The structure is in good condition and is suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. The structure is an essential part of the water distribution system which serves the Ammunition Renovation Area and is necessary for accomplishment of the Renovation and Demilitarization Mission. Recommend the structure be retained for permanent use.
- 
- a. STRUCTURE NR.: 3003.
  - b. USE: Sewage System Manhole.
  - c. TYPE: Permanent, Reinforced Concrete, Underground.
  - d. CAPACITY: 19.6 sq. ft.
  - e. SIZE: 5'-0" diameter, 7'-0" deep.
  - f. The structure is in good condition and suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. The structure is essential to the sewage disposal system at the Inspector's Workshop. Recommend it be retained for continuing permanent use.
- 
- a. BUILDING NR.: 3004.
  - b. USE: Surveillance Inspector's Workshop.
  - c. TYPE: Standard Ordnance, Permanent, Brick and Structural Tile.
  - d. CAPACITY: 4,771.6 sq. ft. floor area.
  - e. SIZE: Main building 41'-4" x 114'-1", one story. One covered 10' wide x 114'-0" reinforced concrete railroad loading dock extends the full length of the Building. One 8' wide x 114'-0" reinforced concrete truck height loading dock extends the full length of the building. One 8'-59'-4" reinforced concrete truck height loading dock extends across one end of the building. One 8' x 22'-9" reinforced concrete access ramp. One 10' x 22'-9" reinforced concrete access ramp. One 9'-1" x 6'-2½" offset.
  - f. The building is well constructed; in good condition; and suitable for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.

- h. The building is essential as an Inspector's Work Shop for the Surveillance Division. Recommend it be retained for permanent use.
- a. BUILDING NR.: 3005.
- b. USE: Heating Plant.
- c. TYPE: Permanent, Brick.
- d. CAPACITY: 486.7 sq. ft. floor area.
- e. SIZE: 16'-0" x 22'-0", one story, with 8'-5" x 16'-0" Coal Bin.
- f. This building serves as a Heating Plant for the Inspector's Work Shop; is well constructed; in good condition and suitable for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. The building is essential for the heating of the Inspector's Work Shop. Recommend it be retained for permanent use.
- a. BUILDING NR.: 3006A.
- b. USE: Storehouse. Storage of paints for the Surveillance Division.
- c. TYPE: Temporary, Wood Frame.
- d. CAPACITY: 50.2 sq. ft. floor area.
- e. SIZE: 5'-1" x 9'-10 $\frac{1}{2}$ ", one story.
- f. The building is in fair condition and should be retained as long as there is use for it or until replaced with permanent type construction. Maintenance costs are not excessive.
- g. ALTERNATE USE: None.
- h. The building is essential to assist the Surveillance Division in accomplishing their assigned mission. Recommend it be retained as long as there is a need for it or until replaced with permanent type structure.
- a. BUILDING NR.: 3006B.
- b. USE: Storehouse. Storage of miscellaneous items by the Surveillance Division.
- c. TYPE: Temporary, Wood Frame.
- d. CAPACITY: 50.4 sq. ft. floor area.
- e. SIZE: 6'-2" x 8'-2", one story.
- f. The building is in good condition and should be retained until replaced with permanent type construction or until there is no further need for it. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. The building is essential to assist the Surveillance Division in accomplishing their assigned mission. Recommend the building be retained for its present use, or until replacement with permanent type construction is feasible.
- a. STRUCTURE NR.: 3007.
- b. USE: Septic Tank. Serves Inspector's Work Shop, Building Nr. 3004.

- c. TYPE: Permanent, concrete culvert pipe.
  - d. CAPACITY: 206.2 cu. ft.
  - e. SIZE: Two separate sections each consisting of 4'-60 inch diameter concrete culvert pipe 10'-0" in length connected by a 6 inch cast iron pipe.
  - f. The septic tank is in good condition and is suitable for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. This septic tank is essential for the treatment and disposal of sewerage from the Inspector's Work Shop, Building Nr. 3004. Recommend it be retained for permanent use.
- 
- a. BUILDING NR.: 3008.
  - b. USE: Ammunition Packing, Shipping, and Receiving Building.
  - c. TYPE: Permanent, Brick.
  - d. CAPACITY: 14,331.2 sq. ft. floor area.
  - e. SIZE: 61'-6" x 232'-1", one story, Addition: 8'-1 3/4" x 8'-1 3/4".
  - f. The building is well constructed; in good condition and suitable for continuing permanent use. Maintenance costs are not high.
  - g. ALTERNATE USE: None.
  - h. The building is essential for the Ammunition Work Shop Section of the Operations Division. Recommend it be retained for permanent use.
- 
- a. BUILDING NR.: 3009.
  - b. USE: Storehouse. Originally constructed as a Heating Plant for Building Nr. 3008.
  - c. TYPE: Permanent, Brick.
  - d. CAPACITY: 480.0 sq. ft. floor area.
  - e. SIZE: 16'-0" x 22'-0", one story.
  - f. The building is in good condition; requires little maintenance and is suitable for continuing permanent use.
  - g. ALTERNATE USE: Heating Plant building for Building Nr. 3008. Requires boiler which has been removed.
  - h. The building is used by the heating section for storage. Recommend it be retained for permanent use.
- 
- a. STRUCTURE NR.: 3010.
  - b. USE: Imhoff Tank.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 483 cu. ft.
  - e. SIZE: 6'-8" x 17'-6" x 12'-4", one story.
  - f. The septic tank is in good condition and is suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this septic tank be retained in its present standby

status as it could easily be placed in use should toilet facilities be reinstalled in Building Nr. 3008 as is presently planned.

- a. BUILDING NR.: 3028.
  - b. USE: Track Scale House and Yard Office.
  - c. TYPE: Track Scale House: Permanent, Brick. Yard Office: Temporary, Wood Frame.
  - d. CAPACITY: Track Scale House and Yard Office, 1,595.8 sq. ft. floor area. Scale capacity 75 ton.
  - e. SIZE: 10'-0" x 16'-4½" one story, Scale platform 63'-0" x 10'-0".
  - f. The building is well constructed and in good condition. It is suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. The building is essential for the weighing of railroad cars in and out of the Depot. Recommend it be retained for permanent use.
- ADDITION TO SCALE HOUSE.
- i. TYPE: Temporary, Wood Frame.
  - j. SIZE: 18'-2½" x 36'-1½", one story.
  - k. This building is in fair condition, and not suitable for continuing permanent use. Maintenance costs are not too great.
  - l. ALTERNATE USE: None.
  - m. The building houses the Yard Office in connection with track scales and is essential to operations pertaining to shipping and receiving carload lots of ammunition. Recommend this building be retained until replacement with permanent type construction is feasible.
- 
- a. STRUCTURE NR.: 3028A.
  - b. USE: Septic Tank. Sewage System for Railroad Track Scale.
  - c. TYPE: Permanent, concrete drain tile, underground.
  - d. CAPACITY: 19.7 sq. ft.
  - e. SIZE: Two 60 inch diameter reinforced concrete drain tile set on end, 7'-0" in height.
  - f. The structure is in good condition and suitable for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. The structure is essential for the collection, treatment and disposal of sewerage from the Railroad Classification Yard office and the Railroad Track scale. Recommend it be retained for permanent use.
- 
- a. STRUCTURE NR.: 3029.
  - b. USE: Valve Vault. Control Vault for valves on 20" cast iron water main.

- c. TYPE: Permanent, reinforced concrete, underground.
- d. CAPACITY: 208.0 sq. ft.
- e. SIZE: 11'-3" x 18'-6" x 8'-0" deep.
- f. The structure is in good condition and is suitable for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. The structure is an essential part of the water distribution system which serves the Ammunition Renovation Area and necessary for accomplishing the Renovation and Demilitarization Mission. Recommend the structure be retained for permanent use.

- a. STRUCTURE NR.: 3030.
- b. USE: Inspection Pit, for inspection of railroad cars.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 1 railroad car.
- e. SIZE: 12'-0" x 25'-0" x 7'-4", one story.
- f. This reinforced concrete railroad car inspection pit is in good condition and is suitable for continuing permanent use. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. The Inspection Pit is necessary for inspection of the running gear of railroad cars and is recommended to be retained for permanent use.

- a. BUILDING NRS.: 3031 and 3032.
- b. USE: Smokeless Powder Magazines.
- c. TYPE: Temporary, Wood Frame and Corrugated Metal.
- d. CAPACITY: 64.0 sq. ft. each.
- e. SIZE: 8'-0" x 8'-0", one story. Wood Frame.
- f. The buildings are poorly constructed and should be replaced with permanent type construction in the near future. Maintenance costs are not too excessive.
- g. ALTERNATE USE: None.
- h. The buildings are used in connection with demilitarization and inspection of ammunition. Recommend they be retained until replaced with permanent type construction.

- a. STRUCTURE NR.: 3033.
- b. USE: Vacuum Unit Pump House.
- c. TYPE: Temporary, Wood Frame and Corrugated Aluminum Sheets.
- d. CAPACITY: 101.0 sq. ft.
- e. SIZE: 10'-1 $\frac{1}{4}$ " x 10'-0", one story.
- f. The building was constructed in 1948 and is not suitable for continuing permanent use. Maintenance costs are not too great.
- g. ALTERNATE USE: None.
- h. The building is necessary for operation of demilitarization and inspection of ammunition. Recommend it be retained for use until replaced with permanent type construction.

- a. STRUCTURE NR.: 3034.
- b. USE: Vacuum Unit - Barricade.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 157.5 sq. ft.
- e. SIZE: 10'-6" x 15'-0" structure, one story.
- f. The building was constructed in 1948; is in good condition; and is suitable for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. The Vacuum Unit - Barricade is an essential part of the Ammunition Work Shop and is used in demilitarization and inspection of ammunition. Recommend it be retained for permanent use.

- a. BUILDING NR.: 3035.
- b. USE: Receiving Building, Ammunition Work Shop.
- c. TYPE: Mobilization, Wood Frame and Corrugated Metal.
- d. CAPACITY: 2,812.7 sq. ft. of floor area.
- e. SIZE: 25'-3" x 111'-5", one story, with 10'-0" wide truck height reinforced concrete loading dock running the full length of the building.
- f. The building was constructed in 1948 as a part of the Ammunition Work Shop; is in good condition; and should be retained until replaced with permanent type construction. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. The building is a necessary part of demilitarization and inspection of ammunition. Recommend the building be retained until replaced with permanent type construction.

- a. BUILDING NR.: 3035A.
- b. USE: Compressor House.
- c. TYPE: Temporary. Wood Frame and Corrugated Aluminum Sheets.
- d. CAPACITY: 99.4 sq. ft. floor area.
- e. SIZE: 8'-2" x 12'-2", one story.
- f. The building is in good condition and should be retained for continuing use as long as there is a requirement for it or until replaced with permanent type construction. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained for continuing use until replaced with permanent type construction or until there is no further need for it.

- a. BUILDING NR.: 3036.
- b. USE: Condensate Pump House.
- c. TYPE: Mobilization, Wood Frame and Corrugated Aluminum Sheets.
- d. CAPACITY: 126.5 sq. ft.
- e. SIZE: Building: 9'-2 3/4" x 9'-2", addition 5'-2" x 8'-1 1/4", both one story.

f. The building is in good condition and should be retained for continuing use until replacement with permanent type construction is feasible.

g. ALTERNATE USE: None.

h. Recommend this building be retained for continuing use until replaced with permanent type construction as it is an essential part of the Ammunition Work Shop heating system.

a. BUILDING NR.: 3037.

b. USE: Deprime and Deband Building.

c. TYPE: Temporary, Wood Frame and Corrugated Aluminum Sheets.

d. CAPACITY: 4,347.6 sq. ft.

e. SIZE: 40'-2 $\frac{1}{2}$ " x 108'-1 $\frac{1}{2}$ ", one story.

f. The building is in good condition and adequate for present intended use, but not suitable for continuing permanent use. Maintenance costs are not excessive.

g. ALTERNATE USE: None.

h. Recommend the building be retained for present use until replaced with permanent type construction.

a. BUILDING NR.: 3037A.

b. USE: Barricade for Building Nr. 3037.

c. TYPE: Temporary, Wood Frame filled with common earth.

d. CAPACITY: 317.7 sq. ft.

e. SIZE: Bottom dimensions 7'-7 $\frac{1}{2}$ " x 41'-8"; top dimensions 4'-4" x 41'-8", one story.

f. The structure is in fair condition and suitable to be retained for continuing use, until replaced with permanent type construction. Maintenance costs are minor.

g. ALTERNATE USE: None.

h. Recommend this structure be retained for continuing use as long as there is a need for it or until replaced with permanent type construction.

a. BUILDING NR.: 3037B.

b. USE: Service Magazine.

c. TYPE: Temporary, Wood Frame covered with Corrugated Metal.

d. CAPACITY: 69.5 sq. ft.

e. SIZE: 6'-3" x 11'-1 $\frac{1}{2}$ ", one story.

f. The building is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance is not high.

g. ALTERNATE USE: None.

h. Recommend this building be retained for continuing use until replaced with permanent type construction.



- a. BUILDING NR.: 3037C.
- b. USE: Valve House. For Air Tank and Steam Distribution System.
- c. TYPE: Temporary, Wood Frame covered with Corrugated Metal Sheets.
- d. CAPACITY: 84.0 sq. ft.
- e. SIZE: 5'-1 $\frac{1}{2}$ " x 9'-1 $\frac{1}{2}$ " with 5'-9 $\frac{1}{4}$ " x 6'-5 $\frac{1}{2}$ " offset, one story.
- f. The building is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained for continuing use until replaced with permanent type construction as it is an essential part of the Ammunition Work Shop heating system.

- a. BUILDING NR.: 3038.
- b. USE: Clean and Paint Building.
- c. TYPE: Temporary, Wood Frame and Corrugated Aluminum Sheets.
- d. CAPACITY: 8,583.3 sq. ft. of floor area.
- e. SIZE: Buildings: 124'-3" x 50'-4 $\frac{1}{4}$ ". Wings: One 80'-7" x 15'-2 $\frac{1}{2}$ " and one 50'-4 $\frac{1}{4}$ " x 20'-7". Offset: 8'-1 $\frac{1}{2}$ " x 8'-0", all one story.
- f. The building is in good condition and presently adequate for its intended use, but should be replaced with permanent type construction when feasible. Maintenance costs are minor.
- g. ALTERNATE USE: None
- h. Recommend the building be retained for continuing use until replaced with permanent type construction as it is an essential part of the Ammunition Work Shops.

- a. BUILDING NR.: 3038A.
- b. USE: Valve House, for Steam Distribution System.
- c. TYPE: Temporary, Wood Frame covered with Corrugated Aluminum Sheets.
- d. CAPACITY: 68.0 sq. ft. floor area.
- e. SIZE: 5'-1 $\frac{1}{2}$ " x 9'-2", one story.
- f. The building is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are minor.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained for continuing use until replaced with permanent type construction as it is an essential part of the Ammunition Work Shop steam heating system.

- a. BUILDING NR.: 3038B.
- b. USE: Hot Water Tank Shed.
- c. TYPE: Temporary, Wood Frame covered with Corrugated Aluminum Sheets.
- d. CAPACITY: 186.6 sq. ft. floor area.
- e. SIZE: 18'-2 $\frac{1}{2}$ " x 10'-3", one story.

- f. The building is well constructed and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are not too great.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use until replaced with permanent type construction as it is essential for the Ammunition Work Shop activities.
- 
- a. BUILDING NRS.: ~~3039~~, 3040, and 3041.
  - b. USE: Building Nrs. 3039, 3040, ~~and~~ Service Magazines and Building Nr. 3041 is Paint Storage Magazine.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 100.0 sq. ft. each floor area.
  - e. SIZE: 10'-0" x 10'-0", one story.
  - f. The buildings are in poor condition, and are not suitable for continuing permanent use. Maintenance is not too great.
  - g. ALTERNATE USE: None
  - h. Recommend the buildings be retained for continuing use but replaced with permanent type construction in the near future.
- 
- a. STRUCTURE NR.: 3042.
  - b. USE: Septic Tank.
  - c. TYPE: Permanent, Reinforced Concrete and Brick, Underground.
  - d. CAPACITY: 2,670 gallons.
  - e. SIZE: 9'-4 1/2" inside diameter x 6'-8" deep.
  - f. The structure was erected in 1948 to serve Building Nr. 3044. It is suitable for continuing use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the septic tank be retained for continuing permanent use, as it is essential for the disposal of sewage from Building Nr. 3044.
- 
- a. STRUCTURE NR.: 3043.
  - b. USE: Suspect Railroad Car Barricade.
  - c. TYPE: Temporary, Compacted Earth, Seeded Side Slopes.
  - d. CAPACITY: 8,347.5 sq. ft.
  - e. SIZE: 185'-6" x 45'-0", earth barricade.
  - f. The structure is in poor condition, and is unsuitable for continuing use. The construction and siting does not meet the requirements of AMCR 385-224.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be replaced with a permanent type combination ~~on~~ siding and truck barricade located in an area to meet safety requirements.
- 
- a. BUILDING NR.: 3044.
  - b. USE: Boiler House, Change House and Office.
  - c. TYPE: Temporary, Wood Frame covered with Aluminum Sheathing.
  - d. CAPACITY: 5,147.1 sq. ft. floor area.
  - e. SIZE: Main Building : 44'-3" x 44'-2", Wing: 86'-0" x 37'-1 1/2", one story.

- f. The building is in good condition and well constructed. Should be replaced with permanent type construction when feasible.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use until replaced with permanent type construction in a different location.
- 
- a. BUILDING NR.: 3044A.
  - b. USE: Compressor Air Tank House.
  - c. TYPE: Temporary, Wood Frame and Corrugated Metal.
  - d. CAPACITY: 98.2 sq. ft. of floor area.
  - e. SIZE: 12'-1" x 8'-1 $\frac{1}{2}$ ", one story.
  - f. The building is in good condition and is suitable for continuing use until replacement with permanent type construction is feasible. Maintenance costs are not excessive.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use until replaced with permanent type construction.
- 
- a. STRUCTURE NR.: 3044B.
  - b. USE: Blow-Off Pit, for Boiler in Building Nr. 3044.
  - c. TYPE: Permanent, Non-reinforced Concrete, Underground.
  - d. CAPACITY: 194.4 cu. ft.
  - e. SIZE: 5'-4" x 8'-0 $\frac{1}{2}$ ", underground.
  - f. The structure is in good condition and suitable for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained for continuing permanent use as it is an essential part of the Ammunition Work Shop steam heating system.
- 
- a. BUILDING NR.: 3045.
  - b. USE: Machine Shop and Tool Storage.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 3,686.0 sq. ft. floor area.
  - e. SIZE: 20'-4 $\frac{1}{2}$ " x 101'-1 $\frac{1}{2}$ ", one story, with one 50'-7" x 10'-0 $\frac{1}{2}$ " offset and one 56'-0" x 19'-11 $\frac{1}{2}$ " addition.
  - f. The building was originally constructed of old materials for storage of tools and later partially converted to a machine shop. It is not suitable for continuing permanent use. Maintenance is not excessive.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for use until replaced with permanent type construction or until there is no longer a requirement for it.
- 
- a. BUILDING NR.: 3046.
  - b. USE: TNT Flaker and Washout Unit.
  - c. TYPE: Temporary, Wood Frame and Aluminum Sheets.

- d. CAPACITY: 5,326.9 sq. ft. floor area.
  - e. SIZE: 37'-3" x 121'-8", one story plus 37'-3" x 20'-6", two story. One dust collector 5'-7" x 5'-7", one story, connected to building.
  - f. This building was constructed for its present use; is now in good condition; but should be replaced with permanent type construction. Maintenance costs are not too great.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for use until replaced with permanent type construction as it is an essential part of the Ammunition Work Shops.
- 
- a. BUILDING NR.: 3046A.
  - b. USE: Condensate Return Pump House.
  - c. TYPE: Temporary, Wood Frame covered with Corrugated Aluminum Sheets.
  - d. CAPACITY: 54.0 sq. ft. floor area.
  - e. SIZE: 6'-2" x 8'-9", one story.
  - f. The building is in good condition and suitable for continuing use until replacement with permanent type construction is feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. This building is an essential part of the Ammunition Work Shop heating plant system. Recommend it be retained for continuing use until replaced with permanent type construction.
- 
- a. STRUCTURE NR.: 3046B.
  - b. USE: Leaching Bed. To contain waste waters from bomb, mine, rocket and explosive washout operations.
  - c. TYPE: Temporary, Compacted Earth.
  - d. CAPACITY: 17,080 sq. ft.
  - e. SIZE: Overall dimensions of leaching bed 142'-0" x 160'-0". Inside bottom dimensions of leaching bed 122'-0" x 140'-0". Bed is enclosed by a rolled earth embankment with 1 on 1 side slopes and 12' wide crown.
  - f. This leaching bed is in good condition and suitable to be retained for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. The leaching bed is essential for washout operations on bombs, mines, rockets and other explosives. Recommend it be retained as it is required to assist the Storage Division in accomplishing their Demilitarization and Renovation Mission.
- 
- a. STRUCTURE NR.: 3046C.
  - b. USE: Leaching Bed. To contain waste waters from bomb, mine, rocket, and explosive washout operations.

- c. TYPE: Temporary, Compacted Earth.
  - d. CAPACITY: 18,150 sq. ft.
  - e. SIZE: Overall dimensions of leaching bed 130'-0" x 185'-0".  
Inside bottom dimensions of leaching bed 110'-0" x 165'-0".  
Bed is enclosed by a rolled earth embankment with 1 on 1 side slopes and 12' wide crown.
  - f. This leaching bed is in good condition and suitable to be retained for continuing permanent use. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. The leaching bed is essential for washout operations on bombs, mines, rockets and other explosives. Recommend it be retained as it is required to assist the Storage Division in accomplishing their Demilitarization and Renovation Mission.
- 
- a. STRUCTURE NR.: 3046D.
  - b. USE: Leaching Bed. To contain waste waters from bomb, mine, rocket, and explosive washout operations.
  - c. TYPE: Temporary, Compacted Earth.
  - d. CAPACITY: 100,800 sq. ft.
  - e. SIZE: Inside bottom dimensions of leaching bed 160'-0" x 630'-0". Enclosed by earth embankment. EARTH EMBANKMENT: 1 on 1 side slopes, and 12' wide crown. Embankment was compacted with a sheeps foot roller.
  - f. This leaching bed which was constructed during June 1957; is in excellent condition and suitable to be retained for continuing use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. The leaching bed is essential for washout operations on bombs, mines, rockets and other explosives. Recommend it be retained as it is required to assist the Storage Division in accomplishing their Demilitarization and Renovation Mission.
- 
- a. BUILDING NR.: 3046E.
  - b. USE: Pump House.
  - c. TYPE: Temporary, Wood Frame covered with Corrugated Aluminum Sheets.
  - d. CAPACITY: 52.0 sq. ft. floor area.
  - e. SIZE: 6'-0" x 8'-8", one story.
  - f. The building is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. The building is an essential part of demilitarization of ammunition. Recommend the building be retained until replaced with permanent type construction.

- a. BUILDING NR.: 3048.
  - b. USE: Storehouse. Temporary Storage of TNT.
  - c. TYPE: Temporary, Wood Frame covered with Aluminum Sheets.
  - d. CAPACITY: 366.4 sq. ft. floor area.
  - e. SIZE: 18'-2" x 20'-2", one story.
  - f. The building was constructed for its present use; is in good condition, but should be replaced with permanent type construction when feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained until permanent type construction is feasible.
- 
- a. STRUCTURE NR.: 3049.
  - b. USE: Barricade for Deboosting Bombs.
  - c. TYPE: Permanent, Reinforced Concrete. Control Room: Temporary, Wood Frame covered with Corrugated Aluminum Sheets.
  - d. CAPACITY: 1,068.7 sq. ft. floor area.
  - e. SIZE: 20'-2" x 16'-1 $\frac{1}{2}$ ", one story. Frame building 13'-11" x 10'-0", one story. Overall size including concrete aprons, 43'-4" x 42'-9".
  - f. The structure was constructed for its present use; is in good condition and should be retained for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained for continuing permanent use and the frame control building be replaced with permanent type construction when feasible.
- 
- a. BUILDING NR.: 3050.
  - b. USE: Work Shop.
  - c. TYPE: Temporary, Wood Frame covered with Corrugated Metal.
  - d. CAPACITY: 3,308.3 sq. ft.
  - e. SIZE: 33'-0" x 100'-3", one story.
  - f. The structure is very temporary and not recommended for continuing permanent use. Maintenance is not excessive.
  - g. ALTERNATE USE: None.
  - h. The building is used for ammunition breakdown and needed for continuing use until a more permanent structure is feasible. Recommend it be retained.

- a. STRUCTURE NR.: 3052.
  - b. USE: Fuel Oil Storage.
  - c. TYPE: Permanent, Metal Tanks.
  - d. CAPACITY: 52,000 gallons,
  - e. SIZE: Three -14,000 gallon tanks, 8'-6" diameter x 34'-9" long. One - 10,000 gallon tank, 8'-6" diameter x 20'-9" long.
  - f. The tanks are in good condition; and suitable to be retained for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend the tanks be retained for permanent use as they are essential for storage of fuel oil utilized for heating of the Ammunition Work Shop Buildings.
- 
- a. BUILDING NR.: 3052A.
  - b. USE: Pump House. To transfer fuel oil from tank trucks into storage tanks.
  - c. TYPE: Temporary, Wood Frame covered with Aluminum Sheets.
  - d. CAPACITY: 39.1 sq. ft. floor area.
  - e. SIZE: 6'-3" x 6'-3", one story.
  - f. The structure is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for continuing use or until replaced with permanent type construction. It is essential for pumping fuel oil from tank trucks into the fuel storage tanks.
- 
- a. BUILDING NR.: 3054.
  - b. USE: Vacuum Building for Building Nr. 3046, the Washout and Flaker Unit.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 704.7 sq. ft. floor area.
  - e. SIZE: 19'-2" x 35'-6", one story.
  - f. The building is in good condition; requires little maintenance and is suitable to be retained for continuing use until replaced with permanent type construction.
  - g. ALTERNATE USE: None.
  - h. The building is essential for Renovation and Demolition operations. Recommend it be retained until replaced with permanent type construction.
- 
- a. BUILDING NR.: 3055.
  - b. USE: Welding and Blacksmith Shop.
  - c. TYPE: Temporary, Wood Frame covered with Aluminum Sheets.
  - d. CAPACITY: 322.7 sq. ft. floor area.
  - e. SIZE: 16'-0" x 20'-2", one story.

- f. This building is in good condition and is suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. This building is essential for use as a welding and blacksmith shop for the Ammunition Work Shop Operations. Recommend it be retained for continuing use until replaced with permanent type construction.
- 
- a. BUILDING NRS.: 3055A and 3055B.
  - b. USE: Storehouse. Storage of Cylinders of Acetylene and Oxygen.
  - c. TYPE: Temporary, Wood Frame and Sheathing covered with Aluminum Sheets.
  - d. CAPACITY: 43.9 sq. ft.
  - e. SIZE: 4'-9" x 9'-3", one story.
  - f. The building is in good condition and is suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use as long as there is a requirement for it or until replacement with permanent type construction is feasible.
- 
- a. BUILDING NR.: 3500.
  - b. USE: TV Booster Station.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 60.0 sq. ft.
  - e. SIZE: 6'-0" x 10'-0".
  - f. This building, built in 1961, is in good condition and is suitable to be retained for continuing use.
  - g. ALTERNATE USE: None.
  - h. This building is used to house the TV Booster and is necessary for the welfare of the community. Recommend it be retained for continuing use.
- 
- a. BUILDING NR.: 4000.
  - b. USE: Fork Lift Storage and Repair, Field Office and Lunch Room.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 10,990.2 sq. ft. of floor area.
  - e. SIZE: Main Building: 160'-9" x 48'-8 $\frac{1}{2}$ ", Wing: 37'-3 $\frac{1}{2}$ " x 84'-0", Offset: 6'-2" x 4'-6 $\frac{1}{2}$ ".
  - f. This building is in fair condition and is suitable to be retained for continuing use until replacement with permanent type construction is feasible. The chimney of this building had to be repaired in 1962 because of lightning damage. A lightning protection system was installed when the repair was made. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. This building is essential as a storage and repair shop for fork lift trucks used in Magazine Area. Recommend it be retained for continuing use until replaced with permanent construction or until other arrangements are made.



- a. BUILDING NR.: 4001.
- b. USE: Box and Crate Shop.
- c. TYPE: Temporary, Wood Frame covered with 3/16" Transite.
- d. CAPACITY: 4,673.8 sq. ft. floor area.
- e. SIZE: 36'-3" x 123'-4", one story.
- f. The building is of temporary construction and not suitable for continuing permanent use. Maintenance costs are not excessive.
- g. ALTERNATE USE: None.
- h. Recommended for continuing use until replacement with permanent type construction, or until other arrangements are made.

- a. BUILDING NR.: 4003.
- b. USE: Fire Extinguisher Shed.
- c. TYPE: Temporary, Wood Frame.
- d. CAPACITY: 23.0 sq. ft. of floor area.
- e. SIZE: 4'-9½" x 4'-9½", one story.
- f. The building is in good condition and suitable for continuing use. Should be replaced with permanent type construction when considered feasible. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. Recommend the building be retained for continuing use until replacement with permanent type construction is feasible.

- a. STRUCTURE NR.: 4006.
- b. USE: Sewage collection and treatment system for the Bundle Ammunition Packing Area buildings.
- c. TYPE: Permanent, Reinforced Concrete with Sand and Gravel Filter.
- d. CAPACITY: 3,937 cu. ft.
- e. SIZE: Permanent, Reinforced Concrete, Main Section: 26'-0" x 18'-0"; Addition: 8'-8" x 12'-8", underground. Two 8" vitrified clay pipes collect the sewage from the various buildings and the sewer main divides into two 6" vitrified clay pipes at a 4' manhole located about 20 feet from the Imhoff Tank. The sewage flows from the manhole through each of the 6" pipes into the two separate compartments of the Imhoff Tank.
- FILTER BED.
- f. SIZE: Permanent, sand and gravel filter bed, 126'-0" x 276'-0". (Two 6" vitrified clay tile lead from the Imhoff Tank and empty into the Filter Bed.) The filter bed is underlaid by 5,145 feet of 6" farm drain tile converging into 270 ft. of 8 inch vitrified clay tile pipe and discharges the effluent into a roadside drainage ditch.
- g. The Imhoff Tank and drain field are in good condition: require little maintenance; and are suitable to be retained for continuing permanent use.
- h. ALTERNATE USE: None.

- i. The Imhoff Tank and drain field is essential for the collection, treatment, and disposal of sewerage from the ammunition bundle packing buildings. Recommend they be retained for permanent use.
  
- a. BUILDING NR.: 4007.
- b. USE: Heating Plant.
- c. TYPE: Permanent, Brick.
- d. CAPACITY: 938.7 sq. ft.
- e. SIZE: 26'-0 $\frac{1}{2}$ " x 36'-0 $\frac{1}{2}$ ", one story.
- f. This building is of permanent type construction and is suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. The boiler plant provides steam for heating Building Nrs. 4008, 4009, and 4010. Recommend it be retained for permanent use as these buildings are all essential for the Storage Division to accomplish their assigned mission.
  
- a. STRUCTURE NR.: 4007A.
- b. USE: Steam Valve Vault.
- c. TYPE: Permanent, Reinforced Concrete, Underground.
- d. CAPACITY: 32.4 sq. ft. of floor area.
- e. SIZE: 4'-7 $\frac{1}{2}$ " x 7'-0" x 7'-10" deep.
- f. The structure is in good condition and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. Recommend the structure be retained for continuing permanent use as it is an essential part of the Bundle Ammunition Packing Area heating system.
  
- a. BUILDING NR.: 4008.
- b. USE: Bundle Ammunition Packing Building.
- c. TYPE: Permanent, Brick and Structural Tile.
- d. CAPACITY: 11,186.2 sq. ft. of floor area.
- e. SIZE: Main Building: 220'-2" x 32'-6". Offset: 12'-1" x 5'-0", both one story.
- f. The building is in good condition and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. The building is essential for the handling, maintenance and shipping of ammunition. Recommend it be retained for permanent use or until the Planning Board deems it inadequate or not necessary.
  
- a. BUILDING NR.: 4009.
- b. USE: Lavatory.
- c. TYPE: Temporary, Wood Frame.

- d. CAPACITY: 439.0 sq. ft. floor area.
  - e. SIZE: 18'-2" x 24'-2", one story.
  - f. This building is of temporary construction and not suitable for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. The building is essential as a lavatory to serve workers in the Bundle Packing Buildings. Recommend it be retained until replacement with permanent type construction is feasible.
- 
- a. BUILDING NR.: 4010.
  - b. USE: Bundle Ammunition Packing Building.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 9,405.2 sq. ft. of floor area.
  - e. SIZE: Main Building: 220'-3" x 32'-3 $\frac{1}{2}$ ". Offset: 12'-1" x 5'-0". Wing: 16'-1 $\frac{1}{2}$ " x 16'-1 $\frac{1}{2}$ ", all one story.
  - f. The building is in good condition and suitable to be retained for continuing permanent use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. The building is essential to the handling and shipping of ammunition. Recommend it be retained for permanent use or until the Planning Board deems it inadequate or not necessary.
- 
- a. STRUCTURE NR.: 4011.
  - b. USE: Cold Water Storage Tank.
  - c. TYPE: Permanent, Reinforced Concrete, Ground Level.
  - d. CAPACITY: 200,000 gallons.
  - e. SIZE: 42'-6" diameter x 20'-0" deep.
  - f. The structure is in good condition; requires little maintenance; and is suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained for permanent use as it is an essential part of the Depot water distribution system.
- 
- a. BUILDING NRS.: 4012A, 4012B and 4012C.
  - b. USE: Storehouse. Storage of fire fighting equipment.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 4.0 sq. ft. floor area each.
  - e. SIZE: 2'-0" x 2'-0", one story.
  - f. These buildings are in good condition and suitable for continuing use until replacement with permanent type construction is considered feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. These buildings are used for storage of fire fighting equipment at the Ammunition Work Shop track classification yard. Recommend they be retained for continuing use until replacement with permanent type construction is considered feasible.

- a. BUILDING NR.: 4014.
  - b. USE: Compressor House.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 136.5 sq. ft. floor area.
  - e. SIZE: Original Building 8'-3" x 9'-11½", addition 10'-3" x 10'-2", both one story.
  - f. The building is in good condition and is suitable to be retained for continuing use as long as there is a requirement for the building or until replaced with permanent type construction. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. The building is necessary to house compressors used by the Storage Division in operations performed in Building Nrs. 4008 and 4010. Recommend it be retained for continuing use until replaced with permanent type construction or until there is no further need for it.
- 
- a. BUILDING NR.: 4015.
  - b. USE: Storage Division Lumber Yard Office.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 151.7 sq. ft. floor area.
  - e. SIZE: 11'-2" x 13'-7", one story.
  - f. The building is well constructed and suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use until replaced with permanent type construction as it is essential to lumber reclamation operations.
- 
- a. BUILDING NR.: 4016.
  - b. USE: Storehouse. Storage of Tools used in Lumber Reclamation.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 70.3 sq. ft. of floor area.
  - e. SIZE: 6'-3" x 11'-3", one story.
  - f. The building is in fair condition and is suitable to be retained until replacement with permanent construction is considered feasible. Maintenance costs are not excessive.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use until replacement with permanent type construction is considered feasible.
- 
- a. BUILDING NR.: 4030.
  - b. USE: Deactivation Furnace Building.
  - c. TYPE: Permanent, galvanized metal on steel frame with concrete block blast walls.
  - d. CAPACITY: 2,247.1 sq. ft.
  - e. SIZE: Main building 24'-0" x 36'-0", two offsets at 4'-7" x 6'-8"; one wing 26'-4" x 50'-3" (Blast walls without roof.)
  - f. The building was constructed in 1961, is in good condition and suitable for continued permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continued permanent use as it is essential to deactivation furnace activities.

- a. BUILDING NR.: 4031.
  - b. USE: Generator House. Houses standby generator for the deactivation furnace.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 83.7 sq. ft.
  - e. SIZE: 8'-3" x 10'-2", one story.
  - f. This building was built in 1961 of temporary construction. Maintenance is minor.
  - g. ALTERNATE USE: None.
  - h. This building houses a 10 KW standby generator for the deactivation furnace. It is recommended that the building be retained for its present use.
- 
- a. BUILDING NRS.: 4032 and 4033.
  - b. USE: Storage sheds. Storage of Miscellaneous Items.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: Building Nr. 4032, 51.0 sq. ft.; Building Nr. 4033, 51.6 sq. ft.
  - e. SIZE: 6'-2" x 8'-2 $\frac{1}{2}$ " and 6'-3" x 8'-3", both one story.
  - f. These buildings are of temporary construction, but suitable for continuing use in their present capacity.
  - g. ALTERNATE USE: None.
  - h. Recommend the buildings be retained for their present use as long as there is a requirement for them, or until feasible to replace with permanent type construction.
- 
- a. BUILDING NR.: 4040.
  - b. USE: Ammunition Holding Pad and Barricade.
  - c. TYPE: Permanent, reinforced concrete and earth barricade.
  - d. CAPACITY: 990.0 sq. ft.
  - e. SIZE: 20'-0" x 25'-6", one story.
  - f. The structure is in good condition and is suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be retained for permanent use as it is an essential part of the Ammunition Disassembly Plant.
- 
- a. BUILDING NR.: 4041
  - b. USE: Operating barricade, electrical.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 286.0 sq. ft.
  - e. SIZE: 23'-2 $\frac{1}{4}$ " x 12'-4 $\frac{1}{4}$ ", one story.
  - f. This structure is in excellent condition; requires a minimum of maintenance, and is suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained for permanent use as it is an essential part of the Ammunition Disassembly Plant.

- a. STRUCTURE NR.: 4042.
  - b. USE: Protective Barricade for the Operating Barricade.
  - c. TYPE: Permanent, Earth Barricade.
  - d. CAPACITY: 2,400 sq. ft. base area.
  - e. SIZE: Base dimensions 40'-0" x 60'-0", top dimensions 3'-0", height 13'-6".
  - f. The structure is in good condition; requires a minimum of maintenance; and is suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be retained for permanent use as it is an essential part of the Ammunition Disassembly Plant.
- 
- a. STRUCTURE NR.: 4043.
  - b. USE: Splinter Proof Shelter.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 114.0 sq. ft. of floor area.
  - e. SIZE: 8'-0" x 8'-0" operating area, one story.
  - f. The structure is in good condition; requires a minimum of maintenance and is suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be retained for permanent use as it is an essential part of the Ammunition Disassembly Plant.
- 
- a. BUILDING NR.: 4044.
  - b. USE: Storehouse. Storage of Tools and Operating Supplies.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 538.9 sq. ft. floor area.
  - e. SIZE: 16'-8" x 32'-4", one story.
  - f. The building is in good condition; requires little maintenance; and is suitable to be retained for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for permanent use as it is essential for performance of operations at the Ammunition Disassembly Plant.
- 
- a. BUILDING NR.: 4045.
  - b. USE: Latrine.
  - c. TYPE: Permanent, Structural Tile.
  - d. CAPACITY: 72.0 sq. ft. floor area.
  - e. SIZE: 8'-0" x 9'-0", one story.
  - f. The building is in good condition and is suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for permanent use as it is essential for operations at the Ammunition Disassembly Plant.
- 
- a. STRUCTURE NR.: 4046.
  - b. USE: Personnel Protective Barricade.
  - c. TYPE: Temporary, Wood Frame filled with Common Earth.
  - d. CAPACITY: 117.1 sq. ft. floor area.
  - e. SIZE: 3'-10 $\frac{1}{2}$ " x 30'-2 $\frac{1}{2}$ ", one story.

- f. The structure is in good condition and is suitable to be retained for continuing use as long as there is a requirement for it or until replaced with permanent type construction. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained for continuing use until replacement with permanent type construction is feasible as it is essential for operations at the Ammunition Disassembly Plant.
- 
- a. BUILDING NR.: 4050.
  - b. USE: TV Booster Shed.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 54.4 sq. ft.
  - e. SIZE: 10'-3 $\frac{1}{2}$ " x 5'-3 $\frac{1}{2}$ ", one story.
  - f. The building is in good condition and is suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. The building is used to house TV booster equipment. Recommend the building be retained for continuing use until replacement with permanent type construction is feasible. It is important to the morale of the Military and Civilian personnel stationed at this isolated installation.
- 
- a. STRUCTURE NR.: 4051.
  - b. USE: Unloading platform.
  - c. TYPE: Temporary, Wood.
  - d. CAPACITY: 496.0 sq. ft. of deck area.
  - e. SIZE: 31'-0" x 16'-0", platform.
  - f. The structure is in good condition and is suitable for continuing use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be retained for continuing use until replacement with permanent type construction is feasible.
- 
- a. BUILDING NR.: 5000.
  - b. USE: Base Supply Barricade.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 360.0 sq. ft.
  - e. SIZE: 20'-0" x 18'-0", one story.
  - f. The building was constructed in 1949; is in good condition; and is suitable for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this structure be retained for permanent use as it is an essential part of the Burning and Demolition Ground Facilities.

- a. BUILDING NR.: 5002.
- b. USE: Remote Control Shelter.
- c. CAPACITY: 824.7 sq. ft. floor area.
- d. TYPE: Permanent, Reinforced Concrete.
- e. SIZE: 28'-11½" x 23'-0", one story, Addition: frame, 6'-6" x 24'-0".
- f. The structure was erected in 1949; is in good condition; requires little maintenance; and is suitable for continuing permanent use.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained in continuing permanent use as it is an essential part of the Burning and Demolition Ground Facilities.

- a. BUILDING NR.: 5003.
- b. USE: Shelter for Portable Electric Generator.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 30.2 sq. ft.
- e. SIZE: 6'-0½" x 5'-0", one story.
- f. The structure was erected in 1949; is in good condition; requires little maintenance; and is suitable for continuing permanent use.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained for permanent use as it is essential to the operation of the Burning and Demolition Ground.

- a. BUILDING NR.: 5004.
- b. USE: Cap, Fuse and Squib Storage.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 30.2 sq. ft.
- e. SIZE: 5'-3" x 5'-9", one story.
- f. This building was erected in 1949; is in good condition; requires little maintenance; and is suitable for continuing permanent use.
- g. ALTERNATE USE: None.
- h. Recommend the building be retained for permanent use as it is essential to the operation of the Burning and Demolition Ground.

- a. STRUCTURE NR.: 5005.
- b. USE: Demolition Furnace.
- c. TYPE: Work Shelter; Temporary, Wood Frame; Demolition Furnace: Reinforced Concrete, Furnace lined with Fire Brick.
- d. CAPACITY: 135.1 sq. ft. floor area.  
WORK SHELTER.
- e. SIZE: 11'-8" x 11'-7", one story with raised platform 6'-0" above ground floor.  
DEMOLITION FURNACE.
- f. SIZE: Reinforced concrete with 1'-4" inside diameter steel stack ¼" steel plate, 5'-9" x 5'-9", one story.
- g. The structure is in very poor condition and should be dismantled.



- h. ALTERNATE USE: None.
  - i. It is recommended this structure be dismantled.
- 
- a. BUILDING NR.: 5006.
  - b. USE: Storage of Heavy Equipment.
  - c. TYPE: Permanent, Steel Frame covered with Steel, underground.
  - d. CAPACITY: 2,484.9 sq. ft.
  - e. SIZE: 18'-4" x 135'-6½", one story, underground.
  - f. The building was constructed in 1955; is in good condition; and is suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for permanent use as it is essential to house and protect heavy equipment used at the Burning and Demolition Ground from flying fragments of bombs and shells.
- 
- a. BUILDING NR.: 5010.
  - b. USE: Guard Gate House. Located at Entrance to the Burning and Demolition Ground.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 90.0 sq. ft. of floor area.
  - e. SIZE: 8'-9" x 10'-0½", one story.
  - f. This structure is in good condition; requires little maintenance; but is not suitable for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained in continuing use as long as there is a requirement for it or until replacement with permanent type construction is feasible.
- 
- a. BUILDING NRS.: 5011 and 5012.
  - b. USE: Storehouse. Storage of Explosives.
  - c. TYPE: Permanent, Welded Steel Plate.
  - d. CAPACITY: 43.3 sq. ft.
  - e. SIZE: 6'-7" x 6'-7", one story.
  - f. The buildings are in good condition and suitable to be retained for continuing use. Maintenance is an absolute minimum.
  - g. ALTERNATE USE: Miscellaneous storage.
  - h. Recommend these buildings be retained for continuing permanent use as they are essential for operation of the Burning and Demolition Ground.
- 
- a. BUILDING NR.: 5013.
  - b. USE: Storehouse. Miscellaneous Storage.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 70.3 sq. ft.
  - e. SIZE: 6'-3" x 11'-3", one story

- f. The building is in good condition and is suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for continuing use until replacement with permanent type construction is feasible. It is necessary for storage of miscellaneous items used in the operation of the Burning and Demolition Ground.
- 
- a. STRUCTURE NR.: 5015.
  - b. USE: Storage bunker.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 179.4 sq. ft. floor area.
  - e. SIZE: 10'-3" x 17'-6", one story, partially underground.
  - f. The structure is in good condition and suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the structure be retained until replaced with permanent type construction as it is an essential part of the facilities for the Burning and Demolition Ground.
- 
- a. BUILDING NR.: 6000.
  - b. USE: Change House and Office. Used by Toxic Chemical Workshop personnel.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 2,234.9 sq. ft.
  - e. SIZE: 20'-5" x 60'-10", one story with one 60'-8" x 13'-10 $\frac{1}{2}$ " offset and one 15'-1 $\frac{1}{2}$ " x 10'-0" offset.
  - f. This building is in good condition and is suitable to be retained in continuing use, as long as the Toxic Chemical mission of the Depot requires it or until replaced with a permanent type building. Maintenance is not great.
  - g. ALTERNATE USE: None.
  - h. The building is essential for the Depot to perform the assigned Chemical Mission. Recommend it be retained in continuing use as long as the Toxic Chemical Mission of the Depot requires it or until replaced with a permanent type building.
- 
- a. BUILDING NR.: 6001.
  - b. USE: Storehouse. Miscellaneous storage.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 242.5 sq. ft. floor area.
  - e. SIZE: 12'-1 $\frac{1}{2}$ " x 20'-0", one story.
  - f. The building is in fair condition and suitable to be retained as long as there is a requirement for it or until feasible to replace with a permanent type building. Maintenance costs are not excessive.

- g. ALTERNATE USE: Building could be moved to another area and used as storage for other light weight items such as supplies.
- h. The building is presently required to assist the Toxic Chemical section in accomplishing the assigned chemical mission. recommend the building be retained for use as long as there is a requirement for it or until replacement with permanent type construction is feasible.

a. BUILDING NR.: 6002.

b. USE: Storehouse. Miscellaneous Storage.

c. TYPE: Temporary, Wood Frame.

d. CAPACITY: 118.0 sq. ft. floor area.

e. SIZE: 8'-3" x 14'- $\frac{1}{2}$ ", one story.

f. The building is in fair condition and is suitable for continuing use until replaced with permanent type construction. Maintenance costs are not great.

g. ALTERNATE USE: Storage of other light weight supplies.

h. This building is essential for storage of miscellaneous tools and supplies utilized in Toxic Chemical operations. Recommend it be retained as long as there is a requirement for it or until replacement with permanent type construction is feasible.

a. BUILDING NR.: 6004.

b. USE: Pump House at Well Nr. 3.

c. TYPE: Permanent, Wood Frame, Wood Sheathing covered with Corrugated Aluminum.

d. CAPACITY: 164.4 sq. ft. of floor area.

e. SIZE: 16'-2" x 10'-2", one story.

f. The building is in very good condition and should be retained for continuing permanent use. Maintenance costs are a minimum.

g. ALTERNATE USE: None.

h. The building is essential to the operation of the demilitarization plant. Recommend it be retained for continuing permanent use.

a. BUILDING NR.: 6005.

b. USE: Demilitarization Building.

c. TYPE: Permanent, Steel Frame covered with Ribbed Steel.

d. CAPACITY: 1,975.2 sq. ft. of floor area.

e. SIZE: Main building; 35'-7" x 47'-9", one story. Offset; 7'-5" x 7'-10". Addition; 17'-2" x 12'-8".

f. The building is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance is at a minimum.

g. ALTERNATE USE: None.

h. Recommend this building be retained for permanent use as it is essential for demilitarization of chemical and conventional type ammunition.

- a. STRUCTURE NR.: 6005A.
- b. USE: Fuel Storage Tank. Storage of fuel oil for heating Chemical Demilitarization Building Nr. 6005.
- c. TYPE: Permanent, Metal Frame.
- d. CAPACITY: 1,600 gallons.
- e. SIZE: 5'-0" diameter, 11'-0" long.
- f. The tank is in good condition and suitable to be retained for continuing permanent use.
- g. ALTERNATE USE: None.
- h. The tank is essential to store fuel oil that is used to heat Demilitarization Building Nr. 6005. Recommend it be retained for permanent use.

- a. STRUCTURE NR.: 6006.
- b. USE: Sump Tank.
- c. TYPE: Permanent, Concrete Block.
- d. CAPACITY: 352.0 sq. ft.
- e. SIZE: 21'-2" in diameter and 11'-6" deep.
- f. The structure is in good condition; requires little maintenance; and is suitable for continuing permanent use.
- g. ALTERNATE USE: None.
- h. This structure is essential for operation of the Chemical Demilitarization Plant. Recommend it be retained for continuing permanent use.

- a. BUILDING NR.: 6007.
- b. USE: Storehouse. Storage of Equipment and Tools.
- c. TYPE: Temporary, Wood Frame.
- d. CAPACITY: 69.0 sq. ft. floor area.
- e. SIZE: 6'-2" x 11'-2", one story.
- f. The building is in good condition; requires little maintenance; and is suitable for continuing use until replaced with permanent type construction.
- g. ALTERNATE USE: Storage of other light weight items.
- h. This building is essential for storage of equipment and tools used by the Toxic Chemical Branch. Recommend it be retained until permanent type construction is provided or until there is no requirement for the building.

- a. STRUCTURE NR.: 6009.
- b. USE: Filter Bed.
- c. TYPE: Permanent, Compacted Earth.
- d. CAPACITY: 5,625.0 sq. ft.
- e. SIZE: 75'-0" x 75'-0" leaching bed, Earth embankment.
- f. The structure is in good condition; requires little maintenance and should be retained for continuing permanent use.
- g. ALTERNATE USE: None.
- h. The structure is essential to the operation of the Chemical Demilitarization Plant. Recommend it be retained for continuing permanent use.

- a. BUILDING NR.: 6010.
  - b. USE: Pump House. Houses Recirculating Pump for Chemical Demilitarization Plant.
  - c. TYPE: Temporary, Wood Frame covered with Corrugated Aluminum.
  - d. CAPACITY: 102.3 sq. ft. of floor area.
  - e. SIZE: 8'-2" x 12'-5", one story.
  - f. The building is in good condition; requires little maintenance and should be retained until replaced with permanent type construction.
  - g. ALTERNATE USE: None.
  - h. The building is essential to the operation of the Demilitarization Plant. Recommend it be retained until replaced with permanent type construction.
- 
- a. BUILDING NR.: 6011.
  - b. USE: Welding Shop
  - c. TYPE: Temporary, Steel Frame covered with Corrugated Metal.
  - d. CAPACITY: 144.0 sq. ft.
  - e. SIZE: 12'-0" x 12'-0", one story.
  - f. The building is in good condition; requires little maintenance and should be retained until replaced with permanent type construction.
  - g. ALTERNATE USE: None.
  - h. The building is essential to the operation of the Chemical Demilitarization Plant. Recommend it be retained until replaced with permanent type construction.
- 
- a. BUILDING NR.: 6012.
  - b. USE: Recycle Pump House.
  - c. TYPE: Temporary, Wood Frame covered with corrugated metal.
  - d. CAPACITY: 120.0 sq. ft.
  - e. SIZE: 8'-2" x 10'-2" with 3'-7" x 10'-4" offset.
  - f. The building is in good condition; requires little maintenance and should be retained until replaced with permanent type construction.
  - g. ALTERNATE USE: None.
  - h. The building is essential to the operation of the Chemical Demilitarization Plant. Recommend it be retained until replaced with permanent type construction.
- 
- a. STRUCTURE NR.: 6013.
  - b. USE: Fume Scrubber.
  - c. TYPE: Temporary, enclosed wood structure made of Redwood.
  - d. CAPACITY: 430.0 sq. ft.
  - e. SIZE: 8'-10" x 48'-8" x 9'-0" high.
  - f. This structure is in good condition and should be retained for continued use as part of the Chemical Demilitarization Plant.
  - g. ALTERNATE USE: None.

- h. The structure is essential to the operation of the Chemical Demilitarization Plant. Recommend it be retained for continued use as long as the need exists.
- 
- a. STRUCTURE NRS: 6014, 6015, 6016 and 6017.
  - b. USE: Structure Nr. 6014 is a spray pond; structure Nr. 6015 is a Recycle pond; structure Nr. 6016 is a leaching bed and structure Nr. 6017 is a condensate pit.
  - c. TYPE: These structures are temporary earth embankments.
  - d. CAPACITY: Structure Nr. 6014 has 9,350 sq. ft; Structure Nr. 6015 has 24,750 sq. ft; Structure Nr. 6016 has 160,000 sq. ft. and Structure Nr. 6017 has 2,400 sq. ft. area.
  - e. SIZE: Structure Nr. 6014 is 85' x 110' x 5' deep; Structure Nr. 6016 is 320' x 500' x 3' deep; Structure Nr. 6015 is 150' x 165' x 5' deep and Structure Nr. 6017 is 40' x 60' x 5' deep.
  - f. These structures are for use in connection with Chemical Demilitarization operations and should be retained as long as the requirement exists.
  - g. ALTERNATE USE: None.
  - h. Recommend these structures be retained as part of the Chemical Plant Area for Chemical Demilitarization operations.
- 
- a. BUILDING NR.: 8000.
  - b. USE: Ammunition Normal Maintenance
  - c. TYPE: Permanent, Reinforced Concrete Frame and Concrete Block.
  - d. CAPACITY: 18,423.0 sq. ft. floor area.
  - e. SIZE: 60'-0" x 300'-0" with a 19'-8" x 21'-6" Defusing Room attached. A 16'-9 1/2" x 60'-0" covered 9" reinforced concrete platform is attached to each end of the building. One story.
  - f. This building was completed in November 1955. Alterations were made in 1962 including a paint booth. Conveyor system and operating shields. It is in excellent condition; and suitable to be retained for permanent use in its present capacity. Maintenance costs are a minimum.
  - g. ALTERNATE USE: Demilitarization and modification of Ammunition.
  - h. Recommend the building be retained for permanent use as it is essential for ammunition normal maintenance operations and the accomplishment of the Depot's assigned mission.
- 
- a. STRUCTURE NR.: 8001.
  - b. USE: Sewage System. Sewage collection, treatment and disposal plant for the new ammunition Normal Maintenance Building, Building Nr. 8000.
  - c. TYPE: Permanent, reinforced concrete, sand and gravel.
  - d. CAPACITY: 173 sq. ft. Imhoff tank (only).  
IMHOFF TANK:
  - e. SIZE: Reinforced concrete. Main Section: 8'-8 1/2" x 19'-5" x 14'-0" in depth, one story. Addition: Reinforced concrete 2'-6" x 2'-0" x 3'-5" in height.  
SLUDGE DRYING BED:

- f. SIZE: Sand and gravel, 10'-0" x 20'-0", one story.  
FILTER BED:
  - g. SIZE: Sub-surface sand filter bed, 90'-0" x 96'-0" with a 12" layer of sand.
  - h. The structure was completed in November 1955, is in excellent condition and is suitable to be retained for permanent use. Maintenance costs are an absolute minimum.
  - i. ALTERNATE USE: None.
  - j. Recommend the structure be retained for permanent use as it is essential for sewage disposal in the Ammunition Normal Maintenance Area.
- 
- a. BUILDING NR.: 8002.
  - b. USE: Flammable Materials Storehouse.
  - c. TYPE: Permanent, Concrete Block.
  - d. CAPACITY: 400.0 sq. ft. floor area.
  - e. SIZE: 20'-0" x 20'-0", one story.
  - f. This building was erected in 1955 as a storehouse for flammable materials used in ammunition normal maintenance; is in excellent condition and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: Light storage of other items.
  - h. Recommend the building be retained as it is an essential part of the Ammunition Normal Maintenance Facilities.
- 
- a. BUILDING NR.: 8003.
  - b. USE: Vacuum Collector Barricade Building.
  - c. TYPE: Permanent, Reinforced Concrete and Concrete Block.
  - d. CAPACITY: 513.0 sq. ft. of floor area.
  - e. SIZE: 13'-6" x 38'-0", one story.
  - f. The structure was erected in 1955; is in excellent condition; and should be retained for permanent continuing use. Maintenance is a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for permanent use as it is essential for operation of the Ammunition Normal Maintenance Plant.
- 
- a. BUILDING NR.: 8004.
  - b. USE: Service Magazine. Storage of Ammunition.
  - c. TYPE: Permanent, Reinforced Concrete and Concrete Block.
  - d. CAPACITY: 126.0 sq. ft. of floor area.
  - e. SIZE: 10'-10" x 11'-8", one story.
  - f. This building was erected in 1956; is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: Storage of Ordnance supplies.
  - h. Recommend the building be retained as it is essential for ammunition normal maintenance operations and for the accomplishment of the Depot's assigned mission.

- a. BUILDING NR.: 8005.
  - b. USE: Central Heating Plant.
  - c. TYPE: Permanent, Concrete and Concrete Block.
  - d. CAPACITY: 792.0 sq. ft. floor area.
  - e. SIZE: 14'-0" x 35'-0" with attached Compressor Room 10'-8" x 24'-4", one story.
  - f. This building was completed in November 1955; is in excellent condition; and suitable to be retained for permanent continuing use. Maintenance is a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for permanent use as it is essential for operation of the Ammunition Normal Maintenance Plant during the winter months.
- 
- a. BUILDING NRS.: 8006 and 8008.
  - b. USE: Ammunition Storehouse.
  - c. TYPE: Permanent, Concrete Block.
  - d. CAPACITY: 126.3 sq. ft. of floor area.
  - e. SIZE: 10'-10" x 11'-8", one story.
  - f. The buildings were constructed in 1958; are in excellent condition and suitable to be retained for continuing use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend these buildings be retained for permanent use as they are essential to Ammunition Normal Maintenance operations.
- 
- a. BUILDING NR.: 8007.
  - b. USE: Ammunition Storage.
  - c. TYPE: Permanent, Reinforced Concrete.
  - d. CAPACITY: 142.8 sq. ft. floor area.
  - e. SIZE: 11'-6" x 12'-5", one story.
  - f. The building was constructed in 1958; is in good condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for permanent use as it is essential to Ammunition Normal Maintenance operations.
- 
- a. BUILDING NRS.: 8009 and 8010.
  - b. USE: Service Magazines.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: Building Nr. 8009 has 56.0 sq. ft and Building Nr. 8010 has 70.3 sq. ft. floor area.
  - e. SIZE: Building Nr. 8009 is 5'-5" x 10'-5"; Building Nr. 8010 is 6'-3" x 11'-3".
  - f. These buildings are in fair condition and suitable for continuing use until replaced with permanent type construction.
  - g. ALTERNATE USE: Storage of light weight supplies.



- h. Recommend these buildings be retained for use as a service magazines as long as there is a requirement for them or until replacement with permanent type construction.
- 
- a. STRUCTURE NRS.: 8101 and 8102.
  - b. USE: Valve Vaults on 16" Cast Iron Water Main.
  - c. TYPE: Permanent, Reinforced Concrete, Underground.
  - d. CAPACITY: 12.6 sq. ft.
  - e. SIZE: 4'-0" diameter, 9'-6" deep.
  - f. The structures are well constructed; need little maintenance and are suitable for continuing permanent use.
  - g. ALTERNATE USE: None.
  - h. The structures are essential for the Depot water distribution system. Recommend they be retained for continuing permanent use.
- 
- a. BUILDING NR.: 9000.
  - b. USE: Chief Observer's Tower.
  - c. TYPE: Permanent, Wood Frame and Structural Steel.
  - d. CAPACITY: 99.0 sq. ft. floor area.
  - e. SIZE: 9'-0" x 11'-0", one story.
  - f. The building was erected in 1958; is in excellent condition and suitable to be retained for continuing permanent use. Maintenance is a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend this building be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range.
- 
- a. BUILDING NRS.: 9001 and 9002.
  - b. USE: Observer's Towers.
  - c. TYPE: Permanent, Wood Frame and Structural Steel.
  - d. CAPACITY: 35.0 sq. ft. floor area.
  - e. SIZE: 7'-0" x 5'-0", one story.
  - f. The buildings were constructed in 1958; are in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
  - g. ALTERNATE USE: None.
  - h. Recommend these buildings be retained for permanent use as they are essential for the operation of the Small Arms Tracer Test Firing Range.
- 
- a. BUILDING NR.: 9003.
  - b. USE: Cleaning building
  - c. TYPE: Permanent, Concrete Block.
  - d. CAPACITY: 80.0 sq. ft. floor area.
  - e. SIZE: 8'-0" x 10'-0", one story.
  - f. The building was constructed in 1958; is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.

- g. ALTERNATE USE: None.
- h. Recommend the building be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range.
- a. BUILDING NR.: 9004.
- b. USE: Ammunition Storage.
- c. TYPE: Permanent, Concrete Block.
- d. CAPACITY: 126.4 sq. ft. floor area.
- e. SIZE: 10'-10" x 11'-8", one story.
- f. The building was constructed in 1959; is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. Recommend the building be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range.
- a. BUILDING NR.: 9005.
- b. USE: Small Arms Storage.
- c. TYPE: Permanent, Concrete Block.
- d. CAPACITY: 36.0 sq. ft. floor area.
- e. SIZE: 6'-0" x 6'-0", one story.
- f. The building was constructed in 1958; is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: Storage of small items.
- h. Recommend the building be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range.
- a. BUILDING NR.: 9006.
- b. USE: Gun Platform.
- c. TYPE: Permanent, Reinforced Concrete and Steel Plate.
- d. CAPACITY: 49.3 sq. ft.
- e. SIZE: 7'- $\frac{1}{4}$ " x 7'- $\frac{1}{4}$ ", one story.
- f. The structure was constructed in 1958; is in excellent condition; and suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE:
- h. Recommend the structure be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range
- a. BUILDING NR.: 9007.
- b. USE: Barricade.
- c. TYPE: Permanent, Rolled Earth Barricade.
- d. CAPACITY: 28,980.0 sq. ft.
- e. SIZE: 345'-0" x 84'-0", 21'-4" high.
- f. The structure was constructed in 1958; is in excellent condition; and should be suitable to be retained for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.

- e. Recommend the structure be retained for permanent use as it is an essential part of the Small Arms Tracer Test Firing Range.
- 
- a. BUILDING NR.: 10000.
  - b. USE: Lunch Room.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 53.7 sq. ft. floor area.
  - e. SIZE: 8'-2" x 8'-2", one story.
  - f. This building is in good condition and suitable to be retained for continuing use until replacement with permanent type construction is feasible. Maintenance costs are not great.
  - g. ALTERNATE USE: None.
  - h. The building is essential as a lunch room and smoking area for Post Engineer personnel working at the Gravel Stock Pile. Recommend it be retained for continuing use until replacement with permanent type construction is considered feasible.
- 
- a. BUILDING NR.: 10001.
  - b. USE: Acid Storage Shed.
  - c. TYPE: Temporary, Steel Frame covered with Corrugated Metal.
  - d. CAPACITY: 560.0 sq. ft. floor area.
  - e. SIZE: 22'-5" x 25'-0", one story.
  - f. The building is in good condition and suitable to be retained for continuing use. Maintenance costs are minor.
  - g. ALTERNATE USE: None.
  - h. Recommend the building be retained for continuing use.
- 
- a. BUILDING NR.: 10002.
  - b. USE: Storehouse. Storage of Miscellaneous Items.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 71.0 sq. ft. floor area.
  - e. SIZE: 6'-4" x 11'-2", one story.
  - f. The building is in good condition and suitable to be retained for continuing use until replaced with permanent type construction. Maintenance costs are not great.
  - g. ALTERNATE USE: Storage of other light weight items.
  - h. The building is essential for efficient ammunition normal maintenance operations. Recommend it be retained until replaced with permanent type construction.
- 
- a. BUILDING NR.: 10003.
  - b. USE: Lunch Room.
  - c. TYPE: Temporary, Wood Frame.
  - d. CAPACITY: 426.6 sq. ft. floor area.
  - e. SIZE: 16'-3" x 26'-3", one story.
  - f. The building is in good condition and suitable to be retained for continuing use until replaced with a permanent type construction. Maintenance costs are minor.
  - g. ALTERNATE USE: Storage of light weight ordnance supplies.
  - h. Recommend that the building be retained for continuing use until replaced with permanent type construction or until there is no further need for it.

- a. BUILDING NR.: 10006.
- b. USE: Acid Storage Shed.
- c. TYPE: Temporary, Steel Frame covered with Corrugated Metal.
- d. CAPACITY: 100.8 sq. ft.
- e. SIZE: 10'-1" x 10'-0", one story.
- f. The building is in good condition and should be retained as long as there is a need for it or until replaced with permanent type construction. Maintenance costs are not great.
- g. ALTERNATE USE: None.
- h. Recommend this building be retained for use as long as there is a need for it or until replacement with permanent type construction is considered feasible.

- a. STRUCTURE NR.: 10007.
- b. USE: Acid Disposal pit.
- c. TYPE: Temporary, Gravel Filled Pit.
- d. CAPACITY: 120.0 sq. ft. 480.0 cu. ft.
- e. SIZE: Gravel filled pit, 30'-0" x 4'-0", underground with necessary soil pipe for receiving acid.
- f. This structure is in good condition and is suitable to be retained for continuing use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. This structure is essential for disposal of acid. Recommend it be retained for continuing use.

- a. BUILDING NRS.: DE-1 thru DE-8.
- b. USE: Dunnage and Equipment Buildings.
- c. TYPE: Permanent, Brick.
- d. CAPACITY: 806.5 sq. ft. floor area each.
- e. SIZE: 24'-1" x 36'-0 $\frac{1}{2}$ ", one story.
- f. The buildings are well constructed; in good condition and suitable for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. Recommend the eight Dunnage and Equipment Buildings be retained for permanent use as they serve the definite purpose of storing dunnage and equipment used in handling and storing ammunition in the igloos.

- a. BUILDING NRS.: FH-1 thru FH-82.
- b. USE: Fox Hole Shelters.
- c. TYPE: Permanent, Reinforced Concrete.
- d. CAPACITY: 1 to 10 persons.
- e. SIZE: 8'-0 $\frac{1}{4}$ " x 21'-0  $\frac{3}{4}$ ", one story.
- f. The fox hole shelters are in good condition and suitable for continuing permanent use. Maintenance costs are a minimum.
- g. ALTERNATE USE: None.
- h. Recommend the Fox Hole Shelters be retained in their present status for permanent use as they would afford protection to personnel during a bomb attack.

- a. STRUCTURE NRS.: X-108, X-109, X-112, X-113, X-114, X-116, X-117, X-118, X-119, X-120, X-121, X-122, X-125, X-126, X-127 and X-128.
- b. USE: Storage Pads. Storage of inert ammunition components.
- c. TYPE: Temporary, Compacted Gravel Pads.
- d. CAPACITY:

X-108:	3,100.0	X-117:	2,972.2	X-122:	3,287.9
X-109:	3,203.2	X-118:	2,674.3	X-125:	2,922.1
X-112:	2,789.9	X-119:	2,856.0	X-126:	3,449.6
X-113:	3,380.0	X-120:	3,139.0	X-127:	3,597.3
X-114:	3,958.3	X-121:	2,886.0	X-128:	3,133.3
X-116:	2,991.4				
- e. SIZE: Open 6" compacted gravel pads.

X-108:	225' x 124'	X-117:	214' x 125'	X-122:	233' x 127'
X-109:	227' x 127'	X-118:	213' x 113'	X-125:	221' x 119'
X-112:	211' x 119'	X-119:	216' x 119'	X-126:	237' x 131'
X-113:	234' x 130'	X-120:	219' x 129'	X-127:	228' x 161'
X-114:	249' x 125'	X-121:	222' x 117'	X-128:	235' x 120'
X-116:	218' x 123.5'				
- f. The pads are in good condition; are adequate for their present use; and are suitable for continuing use. Maintenance costs are not high.
- g. ALTERNATE USE: Storage of other types of inert materials and supplies.
- h. Recommend these pads be retained as long as there is a requirement for them as they are essential for accomplishing the Depot's present storage mission.

- a. STRUCTURE NRS.: X-106, X-107, X-110, X-111, X-123, X-124, X-129, X-130, and X-131.
- b. USE: Storage Pads. Storage of inert ammunition components.
- c. TYPE: Temporary, Compacted Earth.
- d. CAPACITY: Sq. Yds. of storage space.

X-106:	3,344.0	X-124:	3,271.1
X-107:	3,458.0	X-129:	3,251.6
X-110:	3,100.0	X-130:	3,376.9
X-111:	3,192.2	X-131:	3,009.3
X-123:	3,364.9		
- e. SIZE: Open, compacted earth pads.

X-106:	228' x 132'	X-124:	230' x 128'
X-107:	234' x 133'	X-129:	236' x 124'
X-110:	225' x 124'	X-130:	232' x 131'
X-111:	221' x 130'	X-131:	222' x 122'
X-123:	226' x 124'		
- f. The pads are in fair condition and are adequate for their present use. Maintenance is not excessive.
- g. ALTERNATE USE: Storage of other types of inert materials and supplies.
- h. Recommend these pads be retained as long as there is a requirement for them as they are essential for accomplishing the Depot's present storage mission.

# **EXCERPTS**

## **ANALYTICAL REPORT BLACK HILLS ARMY DEPOT IGLOO, SOUTH DAKOTA**

**Revised August 24, 1962**

### **Contains:**

#### **Table of Contents**

<b>Pages</b>	<b>I-1 thru I-6</b>
	<b>II-1 thru II-10</b>
	<b>III-1 thru III-7</b>

Analytical Report  
Black Hills Army Depot  
Igloo, South Dakota

117 x 152

BHAD 212

CONTENTS

<u>Section</u>	<u>Page</u>
<u>I. General</u>	
a. Location	I-1
b. Mission	I-1 & I-2
c. Strength	I-2 & I-3
d. Area	I-3
e. Real Estate Requirements	I-3
f. Off-Post Housing	I-3
g. Health Conditions	I-3
h. Recreational Facilities	I-4
i. Other Pertinent Considerations	I-4, I-5 & I-6
j. Main Elements of the Plan	I-6
<u>II. Operational</u>	
a. General	II-1
b. Open and Closed Storage Facilities	II-1 & II-2
c. Closed Storage	II-2, II-3 & II-4
d. Magazine Storage Facilities	II-4 & II-5
e. Ammunition Work Shops	II-6 & II-7
f. Ammunition Disassembly Plant	II-7
g. Demolition Facilities	II-7
h. Bundle Ammunition Packing Area	II-8
i. Ammunition Normal Maintenance	II-8
j. Tracer Test Firing Range	II-8 & II-9
k. Field Maintenance Shop	II-9
l. Machine Shop	II-9
m. Explosive Truck Inspection Station	II-9
n. Miscellaneous Proposed Facilities Required to Accomplish Assigned Mission	II-9 & II-10
o. Chemical Warfare	II-10
<u>III. Housing and Other Basic Facilities</u>	
a. Housing, General	III-1
b. Enlisted Housing	III-1
c. Quarters Area	III-1, III-2, III-3, III-4, III-5 & III-6
d. Civilian Housing	III-3
e. Messes	III-6

Analytical Report  
Black Hills Army Depot  
Igloo, South Dakota

CONTENTS

<u>Section</u>	<u>Page</u>
f. Administration	III-6, III-7, III-8 & III-9
g. Athletic and Recreation Facilities	III-9, III-10, III-11 & III-12
h. Community Facilities	III-12, III-13, III-14 & III-15
i. Schools	III-15
j. Hospital	III-16
k. Service Facilities	III-17, III-18, III-19, III-20, III-21 & III-22
 <u>IV. Transportation Facilities</u>	
a. Roads	IV-1 & IV-2
b. Parking Areas	IV-2
c. Railroads	IV-2 & IV-3
d. Air Access	IV-3
 <u>V. Utilities</u>	
a. Storm Sewers	V-1
b. Sewage Plant and Sanitary Sewer System	V-1 & V-2
c. Water Treatment and Water Distribution	V-2, V-3 & V-4
d. Fire Protection	V-4
e. Gas Distribution	V-4
f. Electric Distribution	V-4, V-5, V-6 & V-7
g. Communications	V-7 & V-8
h. Fire Alarms	V-8 & V-9
i. Steam Plants and Distribution System	V-10
j. Domestic Hot Water	V-10 & V-11
k. Street Lighting System	V-11
l. Garbage and Waste Collection and Disposal	V-11
 <u>VI. Protective Construction</u>	
a. General	VI-1
b. Existing Facilities	VI-1
c. Proposed Facilities	VI-1, VI-2, VI-3 & VI-4



Analytical Report  
U. S. Army Ordnance Depot, Black Hills  
Igloo, South Dakota

I. General

a. Location. U. S. Army Ordnance Depot, Black Hills, is located in the southwestern part of Fall River County, South Dakota, about seven and one-half miles southwesterly from the town of Edgemont, which has a present population of 2,011, Ardmore, located 20 miles southeasterly with a population of 72 and, Hot Springs, 35 miles distant with a population of 4,875. The settlement of Provo, adjacent to the railroad station of that name, and about one and one-half miles east of the Depot has a population of 133. The Wyoming state line is about four miles west of the west line of the reservation; the Nebraska state line is about nine miles south of the south line of the reservation.

b. Mission. The mission to be accomplished as established by Section X, paragraphs 48 through 52 of Army Regulation 780-970 dated 14 October 1960 is as follows:

SUPPLY

RESERVE

A. Ammunition. Receives and stores ammunition including propellants and explosive components of guided missiles under the accountability of the Ordnance Ammunition Command, Joliet, Illinois, and the stock control responsibility for guided missile ammunition under Redstone Arsenal, Huntsville, Alabama; ships as instructed by the Ordnance Ammunition Command for conventional ammunition; by Redstone Arsenal for guided missile ammunition.

B. Chemical Corps Toxics and Chemical Corps Ammunition. Stores, inspects, maintains and issues various types of Chemical Corps Toxics, and Chemical Corps Ammunition, in accordance with instructions received from Chief, Chemical Corps.

C. General Services Administration. Receives and stores supplies of GSA in accordance with instructions from the Chief of Ordnance.

DEPOT MAINTENANCE

Ammunition - Chemical Ammunition. Restores ammunition to serviceable condition by operations more extensive or hazardous than reconditioning,

normally by the replacement of components; and maintenance of propellants and explosive components of guided missiles.

#### OTHER ACTIVITIES

A. Surveillance - Tests lot samples of Ammunition, Chemical Corps Toxics, and Chemical Corps Ammunition items, normally in accordance with procedures established in ORDM 3-4, for the purpose of establishing their degree of serviceability and enabling the assignment of grades as pertinent to the lots involved.

B. Functional Packing of Small Arms Ammunition - Unpacks small arms ammunition (.30 - .50 Cal.) from original container, then assemble into a functional pack by either linking, belting, or clipping, and repacking.

C. Demilitarization - Demilitarizes unsafe, obsolete, and surplus ammunition, chemical ammunition, ammunition components, Chemical Corps toxics, and general supplies.

c. Strength. The authorized permanent peacetime strength is as given in the tabulation below, followed by a breakdown by Ranks and Grades.

#### Permanent Peacetime Strength Used for Planning Purposes\*

Officers, Male. . . . .	.12
Officers, Female. . . . .	9
Enlisted, Male. . . . .	5
Enlisted, Female. . . . .	9
Total Military. . . . .	.15
Total Civilians . . . . .	815
Total Military and Civilian . . . . .	830

#### Breakdown of Permanent Peacetime strength by Rank and Grade\*

	Lt.Cols. Cols. & Majors	Company Grade	E 6,5,4, &3	GS13 &12	GS 11,10 &9	GS8, 7&6	GS 5,4, 3&2	Ungraded
Officers,								
Male,	1	7	4					
Enlisted,								
Male,			3					
Civilians				9	28	45	100	633

\*As outlined in the Troop Program (U) of the Army for Long Range Permanent Construction Planning, 30 June 1956, as amended.

The actual strength of Black Hills Ordnance Depot on 1 August 1962 was 7 commissioned officers, 8 enlisted men, and 590 civilians; a total of 605. This total includes 20 temporary civilian employees.

d. Area. The Depot contains 21,095.85 acres which is under the control of the U. S. Army. The Department of the Army acquired, in fee simple title, 12,370.05 acres for \$96,469.00, through purchase and condemnation proceedings. This acreage was obtained from Fall River County, State of South Dakota and individual land owners by the War Department during 1942. The United States has exclusive jurisdiction over 11,919.05 acres of this land. Jurisdiction is not vested in the United States over the remaining 451 acres fee. 7,630.14 acres were obtained from the Department of Agriculture under use permit dated 31 January 1942 and Executive Order 9197 dated 9 July 1942, at no cost to the Department of the Army. The United States has exclusive jurisdiction over the land. This land was originally acquired by the Department of Agriculture for the United States in fee for use in connection with the Soil Conservation Service. The land is to revert back to the Department of Agriculture at termination of Army need for it. The Public Domain Land consisting of 1,095.32 acres was acquired from the Department of Interior, at no charge under Public Land Order Nr. 10 dated 8 July 1942, Executive Order 9526, dated 28 February 1945 and Public Land Order 676, dated 3 September 1950. The land was withdrawn from all forms of appropriation under public land laws, including mining laws, and reserved for the use of the War Department as an Ordnance Storage Depot. Jurisdiction is not vested in the United States for this area. An area of 0.34 of an acre was obtained from the Chicago, Burlington and Quincy Railroad by means of a license for fence (lesser interest). The cession statute is not applicable to this licensed area. The General Site Plan indicates that the land is nearly all used or may be used in the future. However, the explosive limit criteria governs the use of some areas.

e. Real Estate Requirements. At present there is no requirement for additional Real Estate.

f. Off-Post Housing. Presently the majority of the Depot employees live on post. There are thirty Federal Housing Agency units available in Edgemont, South Dakota, a distance of approximately  $7\frac{1}{2}$  miles, at rates somewhat higher than those on the Depot. Some of these units are occupied by Depot employees. Approximately 190 employees live off-post in Ardmore, Edgemont, Hot Springs, and Provo, South Dakota. A future housing shortage may occur in the surrounding area if uranium mining and milling activities and other industries are greatly increased.

g. Health Conditions. The health conditions are exceptionally good in the Black Hills area. This is verified by the fact that in 1950 the national average of the population 65 years and over was 8.2 percent. South Dakota's average was 8.4 percent. The climate is semi-arid with an average annual precipitation of about 15 inches including an average annual snow fall of about 41.5 inches. The highest recorded temperature at the Depot is 111 degrees F and the minimum, -34 degrees F.

h. Recreational Facilities. The recreational facilities of the neighboring cities and communities in South Dakota, Wyoming, and Nebraska are available to Depot personnel and may be easily reached by automobile within three to four hours. The facilities consist of public golf courses, public parks, swimming pools, theaters, bowling alleys, and athletic fields. An inclosed warm water pool in Hot Springs, South Dakota offers year around swimming. Angostura and Cold Brook Dams near Hot Springs, South Dakota and Pactola Dam near Hill City, South Dakota offers good fishing, boating, swimming, and water skiing. To the north in South Dakota and Wyoming are National and State Parks and National Forests as well as a few private resorts, affording opportunities for scenic train rides, skiing, boating, swimming, picnicing, camping, fishing, and hunting. In addition to the scenery there are many points of historic interest in the Black Hills area. To the south in Nebraska are State Parks and National Forests which also offer similar types of recreation and points of historic interest. These facilities are all within a day's travel by automobile.

i. Other Pertinent Considerations.

(1) Construction History. On 4 September 1941, the Secretary of War issued a directive for a board of Army Officers to make a report on a site near Provo, South Dakota for the construction of an ammunition storage Depot. The board convened 28 September 1941; and on 2 December 1941 it recommended the Provo site. The project was assigned to the Missouri River Division and to the Fort Peck District on 26 December 1941. On 5 January 1942 Directive Nr. 21 was issued authorizing construction of Black Hills Ordnance Depot. Preliminary surveys were initiated by the U. S. Army Engineers on 9 January 1942. All surveys, field layouts, and preparation of preliminary estimates, plans and specifications were accomplished by the Fort Peck District Office or were contracted for by them. Supervision of construction and preparation of final estimates were performed by the Fort Peck District Office. Actual construction was initiated 3 April 1942 when grading operations for the construction of the railroad began. From this date the tempo of construction was greatly accelerated; by 31 December 1942 a group of 1055 buildings and structures was completed, with minor exceptions, in the Administration, Mobilization, Combat Equipment Storage, Above Ground Magazine, Bundle Ammunition Packing and Shipping, Igloo Storage, and Utilities Areas. In addition the railroad, sidewalks and road net, manproof fence and barbed wire boundary fence, water distribution system, sanitary sewer system, storm sewer system, electrical distribution system and fence lighting system were completed.

The Ordnance Corps began operating the Depot on 6 May 1942 when an Army Officer with the rank of Major was assigned as Depot Commander.

By 15 May 1943, a second group of 139 buildings and structures was completed. This group consisted of eighty-five existing single family houses, contractor built, later purchased and renovated by the Government;

fifty 2-family houses, one Fire Station, a chemical ammunition worker's Change House and two Lunch Rooms. In addition thirty-two existing 74-man type mobilization barracks were converted as follows: twenty-four to family apartments and eight to dormitories. Also in 1943, forty-four type A six-family dwellings, fifteen type B six-family dwellings, nineteen type C four-family dwellings, a Child Service Center, and a Community Building were constructed by the Federal Public Housing Authority and transferred to the Ordnance Corps. In 1945 a chapel, theater, and mess hall were dismantled at Camp Hale, Pando, Colorado and modified before reassembly at Black Hills Ordnance Depot. Several smaller miscellaneous buildings and facilities were also constructed during this period. In 1948 the Ammunition Workshop group consisting of 15 buildings was constructed. The original school building erected in 1942 by the Provo School District was enlarged in 1947. Construction of a new brick school building for the elementary grades was completed in 1954. The 74-man barracks, Nrs. 141 through 146 was converted into two and three bedroom apartments in 1951. Construction of the new Ammunition Normal Maintenance Facilities consisting of 6 buildings and structures was completed in November 1955. A Senior Field Grade Officers Quarters, A Field Grade Officers Quarters and a Company Grade Duplex Officers Quarters were constructed during calendar year 1956. During the first half of Fiscal Year 1959 the following buildings and facilities were constructed on the Depot: (a) A Tracer Test Firing Range consisting of a group of 6 buildings, a concrete gun platform, and an earth barricade in an area northeast of the Chemical Warfare Storage Area. (b) Two concrete block Magazines and a mounded concrete box Magazine (500 cu. ft.) were constructed in the new Ammunition Normal Maintenance Area. (c) A water well was drilled to 1,420 feet and a new all retail building was erected in the Chemical Warfare Storage Area. (d) An air field consisting of two low type bituminous runways, an earth runway and a small combination hangar and office building were constructed in the Combat Equipment Storage Area. The Chemical Plant was enlarged and expanded during Fiscal Year 1960. In calendar year 1961 a Small Arms and Small Items Deactivation Furnace was constructed in the Limited Area. In addition a Standby Generator House, Building Nr. 1-A; two 2-car garages, Building Nrs. 29 and 30, a TV Booster Equipment Shed, Building Nr. 3500 and a second Standby Generator House, Building Nr. 4031 were constructed in calendar year 1961. Although the Depot has been in operation over twenty years, many of the buildings do not meet the present criteria for permanent construction and have been treated as temporary for Master Planning purposes. The only buildings which are of permanent construction are the Senior Field Grade Officers Quarters, the Field Grade Officers Quarters, the Company Grade Duplex Quarters, the five two-story Officers Quarters, Building Nr. 1 (Headquarters Building), Building Nr. 2 (Fire, Guard and Security Building), 801 concrete igloos, one concrete Black Powder Magazine, 82 concrete Fox Hole Shelters, 12 tile Above Ground Magazines, 20 tile and concrete buildings in the Utilities Area, the group of 6 buildings and facilities at the Tracer Test Firing Range, the group of 9 buildings and facilities in the new Ammunition Normal Maintenance Area, the new steel building in the Chemical Warfare Storage Area, the Small Arms and Small Items Deactivation Furnace, and a few other concrete or tile buildings and structures, including some of the sewage and water facilities, scattered throughout the Depot.

(2) Special Character of Grounds. The topography of the area is somewhat rolling, with numerous ravines. A water shed, running north and south through the approximate center of the area, divides the drainage to the west into Alum Creek, and to the east into Softwater and Coal Creeks. The Depot is located in the Cheyenne water shed. These streams are dry during the greater part of the year. The elevation of the area ranges between 3,600 feet and 4,150 feet above sea level. The geologic formations within the area are Pierre Shale, Niobrara and Carlile formations. The soil has the peculiar characteristic that when metallic pipe is embedded in it the resulting reaction is basically electro-chemical in nature. This reaction is greater when the soil is wet. The resistivity of the soil in this area is fairly low and provides excellent corrosive environments. The vegetation consists primarily of low growing sage brush and western grass. Crested wheat grass and other types of grass which are adaptable to this region have been planted in some barren areas. A few scattered trees grow throughout the area. Since inception of the Depot, trees, shrubbery, and lawns have been planted in the Administration, Hospital, and the Civilian Family Housing Areas. 25.9 acres of shelter belts were planted during May 1962 in the Administration and Housing areas and the golf course. In general, the area encompassed by the Depot is typical of semi-arid western prairie country.

(3) Size of Facilities. In the planning, an attempt has been made to follow AR 415-31, Basic Housing and Space Allowances, as closely as possible. This installation is located in an isolated area where adequate housing accommodations in the neighboring communities are not available for all civilian employees. The U. S. Army Ordnance Depot, Black Hills is unique in that it contains the town of Igloo where approximately 75 percent of the Civilian Employees live. This condition requires some adjustments which would not be necessary at the normal troop type military installation.

j. Main Elements of the Plan. A comparison of the existing arrangement of the main elements, such as Administration, Civilian Housing, and the Igloo Areas with those proposed by the General Site Plan will reveal that few major shifts in locations are proposed even though radical changes are indicated within some of these areas. One notable change is in the street layout in the Officer Housing Area. Some existing streets will be retained; others will be eliminated; and new and wider streets will be constructed to serve the proposed Military and Key Civilian housing. One main objective of the plan has been to concentrate into one convenient, efficient area each activity properly belonging together. Examples are: Post Engineer, and School, and Athletic Facilities. An examination of the plan will show that there is opportunity for expansion of all major elements beyond requirements of the present mission.

Analytical Report  
U. S. Army Ordnance Depot, Black Hills  
Igloo, South Dakota

II. OPERATIONAL:

a. General. Operational facilities consist of underground arch type igloo magazines, standard above ground magazines, standard shed type warehouses, and barricaded, covered, and open storage pads for storage of all types of ammunition; a group of buildings used for inspection, renovation and demilitarization of ammunition; a second group of buildings used for Normal Maintenance of Ammunition; a third group of buildings used for disassembly of ammunition; a fourth group of buildings, a burning ground and demolition ground used for the destruction of obsolete and unsafe ammunition; a fifth group of buildings used for bundle ammunition packing, and miscellaneous supporting facilities; a sixth group of buildings, including a new all metal building and deep water well which were constructed during the first half of Fiscal Year 1959, used in demolition and decontamination of Chemical Ammunition; a seventh group of buildings constructed during the first half of Fiscal Year 1959 used for tracer testing lots of small arms ammunition; and a Small Arms and Small Items Deactivation Furnace constructed during Fiscal Year 1961. A study of the General Site Plan reveals that the location of the major part of these buildings is governed by the explosive limit criteria.

b. Open and Closed Storage Facilities.

(1) Open Hardstand.

(a) Existing Facilities. Open hardstand storage includes 51,212 square yards in the vehicle classification yard in the Combat Equipment Storage Area. This area is in good condition and is to be retained.

(b) Proposed Facilities. At present the need for additional open hardstand storage does not exist.

(2) Storage Pads - "Y" Sites.

(a) Existing Pads. There are 684 "Y" Site storage pads (1800 square feet each) in the Igloo Magazine Area. In addition the site of an igloo which was destroyed by an explosion was converted to a "Y" Site. (The pad on the site of the igloo which was destroyed has the concrete igloo floor for a base). These sites have 6' high earth revetted barricades around the 30' x 60' pad and have stabilized gravel

surfaces. During calendar year 1954 and prior years, four hundred and sixty-eight (468) of these pads were reconditioned and an Armour coat was placed upon them. However, they are not considered as permanent requirements. As the "Y" Sites are emptied they are permitted to deteriorate and maintenance is not performed on them. However, any pads that are required for outside storage of ammunition and bombs should continue in use as long as there is a need for them.

(b) Proposed Facilities. Future plans do not require the construction of additional "Y" Site storage pads.

(3) Open Storage Pads.

(a) Existing Facilities. There are 9 open graded and unsurfaced storage pads (20,000 square feet each) and 16 gravel surfaced storage pads (approximately 20,000 square feet each) in the area across Storm Road east of existing igloo Blocks H and J. These pads are not required for future development, but should be retained as long as there is need for them.

(b) Proposed Facilities. Additional open storage pads are not required for accomplishment of the present Depot mission.

(4) Covered Storage Pads.

(a) Existing Facilities. There are three covered storage pads (17,226 square feet each) with dirt floors in the Chemical Warfare Area for storage of chemical ammunition. In addition, there is one covered storage pad X-115 (20,844 square feet) in the area across Storm Road east of existing igloo Block H. During 1955 this storage pad was inclosed on all four sides and is presently used as storage for silicon carbide owned by General Services Administration. These pads are in good condition. However, none of them are to be retained as it is planned to eventually store all ammunition, etc. in igloos and/or inclosed structures. Nevertheless, the pads should continue to be utilized as long as there is need for them. Seven covered storage pads were severely damaged by a wind storm on 12 July 1958 and were dismantled. These pads are now used for open storage of inert materials.

(b) Proposed Facilities. It is not planned to construct additional covered storage pads.

c. Closed Storage.

(1) Existing Facilities: The major part of the closed storage facilities are in the Combat Equipment Storage Area and consist of Buildings Nr. 1804 (12,042 square feet), a standard 60' wide 200' long one-story modified warehouse, which is presently empty (it is planned for



Depot Property to use this building for lumber storage); Nr. 1805 (14,592 square feet), a standard 60' wide 200' long two-story modified warehouse, of which the first floor (12,100 square feet) is used for packing of Ordnance Materials and normal maintenance of small arms ammunition; and the second floor (2,492 square feet) contains the installed MARS radio equipment and serves as a radio repair shop; Nr. 1806 (30,075 square feet), a standard 60' wide 500' long one-story, modified warehouse, used for storage of Post Engineer and other supplies. Nr. 1807 (12,031 square feet), a standard 60' wide 200' long one-story modified warehouse is presently empty; Nr. 1809 (50,633 square feet) type WH-6 modified 280' long warehouse, which is presently empty; Nr. 1810 (90,301 square feet), type WH-6 modified 500' long warehouse, which is presently empty; Nr. 1814 (90,130 square feet), type WH-6 modified 500' long warehouse, which is presently empty; Nr. 1816 (90,351 square feet), type WH-6 modified 500' long warehouse used for storage of small arms ammunition and inert ammunition component; Nr. 1818 (90,289 square feet) type WH-6 modified 500' long warehouse used for storage of small arms ammunition and inert ammunition components; Nr. 1822 (91,117 square feet) shed type OS-1 modified 500' long warehouse, which is presently empty; Nr. 1823 (91,079 square feet), shed type OS-1 modified 500' long warehouse, which is presently empty; Nr. 1824 (91,037 square feet) shed type OS-1 modified 500' long warehouse, which is presently empty; Nr. 1825 (91,283 square feet) shed type OS-1 modified 500' long warehouse, used for storage of inert ammunition components; Nr. 1827 (90,199 square feet) shed type OS-1 modified 500' long warehouse which is used for storage of inert ammunition components; and Nr. 1829 (51,095 square feet), a shed type OS-1 modified 280' long warehouse which is presently empty. These warehouses all have reinforced concrete floors, overhead dry pipe sprinkler systems, and 110-220 volt, single phase electric service. Warehouse Nrs. 1805 and 1807 have individual heating plants, sewer and water facilities. All warehouses except Nrs. 1804, 1805, 1806, 1807 and 1829 have fire walls running through the middle of the building. Warehouses Nrs. 1804, 1805, 1806, 1807, 1809, 1810, 1814, 1816 and 1818 have ten foot wide loading platforms extending the full length and on both sides of the buildings, one on the rail side and one on the track side. Warehouse Nrs. 1822, 1823, 1825, 1827 and 1829 have ground level platforms on one side. All warehouses, except Nr. 1824, are served by the Depot railroad system. Warehouse Nrs. 1825 and 1827 were converted to permanent type buildings during the first half of Fiscal Year 1959; Warehouse Nrs. 1816 and 1818 were converted to permanent type buildings during the first half of Fiscal Year 1960. The conversions were made in such a manner that the warehouses can be used as Controlled Humidity Storage Space by the installation of the necessary equipment. These buildings are in good condition and should be retained. There are also two concrete railroad loading platforms (20,717 and 20,735 square feet) in the Combat Equipment Storage Area. Platform Nr. 1819 was repaired during calendar year 1956; platform Nr. 1820 was repaired during calendar year 1958. Both platforms are in excellent condition and will be retained.

(2) Proposed Facilities. At present the need for additional warehouses does not exist. If required, this area is large enough for the erection of additional warehouses.

d. Magazine Storage Facilities.

(1) Standard Above Ground Magazines.

(a) Existing Facilities. The Above Ground Magazine Area contains 12 Standard Above Ground Magazines (11,302 square feet each) presently used for storage of Class IV ammunition and inert ammunition components. These permanent structural clay tile warehouses are served by both paved roads and railroads and are in good condition. They are required for accomplishment of the depot mission and are to be retained.

(b) Proposed Facilities. Additional Above Ground Magazines are not required; if the mission should change there is sufficient space for erection of additional magazines in this area.

(2) Igloo Type Magazines.

(a) Existing Facilities. There are 801 (2-40'; 200-60'; and 599-80') existing reinforced concrete mounded arch type igloo magazines for storage of all classes of ammunition and explosives including toxics; 226 of which have reinforced concrete aprons. A total of 116 of the 226 badly deteriorated 7" non-reinforced concrete aprons were replaced with 6" reinforced concrete aprons during the summer of 1957. A total of 110 badly deteriorated 7" non-reinforced concrete aprons were replaced with 6" reinforced concrete aprons during the summer of 1958. The remaining 575 igloos have compacted gravel aprons which greatly retard igloo storage operations during periods of wet weather. The gravel aprons should be replaced with concrete. The concrete floors in 70 igloos have been replaced; others need floors replaced. Open storage of ammunition, explosives, and toxics greatly increases maintenance costs and has a definite detrimental effect on them thereby reducing their effectiveness. Present plans are to enlarge the doors on 5 of the 80' igloos so large items can be stored in them. A project (Project Request NR. 5-61; Rev.1) To Enlarge Doors on 5 Igloos at an estimated cost of \$25,000 is included in our Fiscal Year 1963 O&M of Facilities Individual Project Program. In general, the existing igloos are in good condition, with the exception of those in need of arch and floor repair, and will be retained.

(b) Proposed Facilities.

(1) At the present time additional igloos are not required to accomplish the assigned mission. However, if the mission should change and the need for additional igloos should arise there is adequate space for their erection. 60 foot concrete igloos (1,608 square feet floor space each)

could be constructed over existing "Y" Sites in A and D Blocks; 262 eighty foot concrete igloos (2,147 square feet floor space each) could be constructed over existing "Y" Sites in E, F, G, H, and J Blocks and 154 standard concrete igloos with concrete aprons could be constructed in the area just north of and adjacent to Rushmore Road and across Storm Road east of existing igloos Blocks H and J.

(2) There is a requirement for construction of 6" reinforced concrete aprons in front of 575 igloos to replace the existing concrete aprons.

Justification for 575 Six Inch Reinforced Concrete Aprons.

The concrete platforms which were constructed in front of these 575 igloos in 1942 are too small to accommodate ammunition trucks. The area adjacent to these platforms has been surfaced with six to eight inches of gravel. During periods of wet weather the loaded ammunition trucks sink through the gravel and become mired in the mud. This condition increases both operation and maintenance costs. Many of these small reinforced concrete platforms have deteriorated beyond economical repair. The concrete used in these platforms appears to be of very poor quality and short of cement and large size aggregate. The concrete has crumbled; broken up for its entire depth; and unless replaced it will have to be removed in order to facilitate the operation of materials handling equipment. These platforms were constructed of concrete 7" in thickness placed directly on earth cut or fill. The soil in this locality contains bentonite which swells when it becomes wet, thereby, causing movement in the reinforced concrete platforms. If the platforms are removed and not replaced with concrete aprons the cost of storage operations in the igloos will be excessive and the Depot mission will be greatly retarded. The condition of these platforms is a definite safety hazard. It is very essential they be replaced with reinforced concrete aprons that are large enough to accommodate ammunition trucks.

(3) Support Facilities in Igloo Area for Igloo Storage.

(a) Fox Hole Shelter.

(1) Existing Facilities. The existing 82 concrete Fox Hole Shelters (169 square feet each and 1 to 10 person capacity) are conveniently located in the igloo area; are in good condition; and are to be retained.

(2) Proposed Facilities. Additional Fox Hole Shelters are not required, unless at some future date new igloos are constructed.

(b) Dunnage and Equipment Buildings.

(1) Existing Facilities. The 8 permanent type Dunnage and Equipment Buildings (868 square feet each) are conveniently located along side the 12 mile loop railroad serving the igloo area. These buildings are in good condition and meet requirements.

(2) Proposed Facilities. At present there are no requirements for additional Dunnage and Equipment buildings.

(c) Unloading Aprons and Platforms.

(1) Existing Facilities. The 27 existing unloading aprons are conveniently located alongside the 12 mile loop railroad which serves the Igloo Magazine Area. Concrete ammunition transfer platforms have been erected at nine of these aprons. Concrete platforms with tool rooms and canopies were erected in 1953 at Aprons 3, 10, and 18. The number of aprons and platforms meet requirements.

(2) Proposed Facilities. Future Development Plans do not require that additional unloading aprons and platforms be constructed.

e. Ammunition Work Shops.

(1) Existing Facilities. This group of structures is primarily comprised of a Packaging, Shipping and Receiving Building Nr. 3008 (14,331 square feet); two Smokeless Powder Magazines, Nrs. 3031 and 3032 (64 square feet each); Vacuum Unit Pump House, Nr. 3033 (101 square feet); Vacuum Unit Barricade, Nr. 3034 (158 square feet); Receiving Building, Nr. 3035 (3,813 square feet); Deprime and Deband Building; Nr. 3037 (4,348 square feet); Clean and Paint Building Nr. 3038 (8,583 square feet); three Service Magazines, Nrs. 3039, 3040 and 3041 (100 square feet each); Boiler and Change House, Nr. 3044 (5,147 square feet); TNT Washout Building; Nr. 3046 (5,397 square feet); and Storehouse and Deboosting Barricade (1,069 square feet). The roof trusses were replaced in Building Nrs. 3037 (Deprime and Deband Building); 3038 (Clean and Paint Building) and 3046 (TNT Washout Building), during the summer of 1957. In addition the walls and roof on Building Nr. 3046 were raised five feet to facilitate washout operations on 500 to 2000 pound bombs. There are also several supporting buildings of lesser importance. These facilities are used in the testing, maintenance and restoration of ammunition to serviceable condition; are in good condition with the exception of the two Black Powder Magazines and the three Service Magazines and are to be retained. These five temporary magazines should be replaced with permanent type construction.

(2) Proposed Facilities. At present it is not planned to erect any new facilities in this area. If the requirement arises, the necessary facilities will be acquired through the rehabilitation program and included in the Operation and Maintenance of Facilities Individual Project Program.

f. Ammunition Disassembly Plant.

(1) Existing Facilities. This group of structures consists of a combination Concrete Holding Pad and Concrete and Earth Barricade Nr. 4040 (990 square feet), Operating Barricade Nr. 4041 (286 square feet), Earth Barricade Nr. 4042, (2,400 square feet), A Splinter-Proof Shelter, Nr. 4043 (114 square feet), a structural clay tile Storehouse Nr. 4044 (539 square feet), a structural clay tile Latrine, Nr. 4045, (72 square feet) and frame personnel protective barricade, Building Nr. 4046 (117 square feet), all of which are used for disassembly of ammunition.

(2) Proposed Facilities. No new facilities are required to accomplish the assigned mission of this group of structures. If the need should arise, the area is adequate for erection of additional structures.

g. Demolition Facilities.

(1) Existing Facilities. The Demolition Area lies southeast of the Igloo Magazine Area on a heavy rolling terrain which rises to an elevation of 4,150, the highest on this station. It contains 10 structures of which 4 are covered with earth on three sides, a Burning Ground and Demolition Ground. The buildings consist of a concrete Base Supply Barricade Nr. 5000 (360 square feet); a concrete Remote Control Shelter Nr. 5002 (825 square feet); a concrete Electric Generator House Nr. 5003 (30 square feet); a concrete Fuse Cap and Equipment Storage Building Nr. 5004 (30 square feet); an obsolete Demolition Furnace which is not used Nr. 5005 (151 square feet); an Underground Equipment Storage Building Nr. 5006 (2,485 square feet); a TNT and Nitro Starch Storage Building Nr. 5011 (43 square feet); Explosive Storage Nr. 5012 (43 square feet); Miscellaneous Storage Building Nr. 5013 (70 square feet); Miscellaneous Storage Building Nr. 5014 (70 square feet) and a Test Firing Range Bunker Nr. 5015 (179 square feet). These buildings are used in the burning and destruction of obsolete and unsafe ammunition and component parts. A small arms and small items demolition furnace was constructed during the first half of Fiscal Year 1961 in an area south of the Bundle Ammunition Packing Area. The present burning ground and demolition area are too small to perform burning and demolition operations simultaneously. During June 1961 the electric generator at the Demolition Area was replaced with an aerial and buried electric line.

(2) Proposed Facilities. No new facilities are planned for demolition activities at the present time.

#### h. Bundle Ammunition Packing Area.

(1) Existing Facilities. The Bundle Packing group of buildings that are located in this area consists primarily of a combination Field Office and Fork Lift Storage, Building Nr. 4000 (10,990 square feet), Carpenter Shop; Building Nr. 4001 (4,674 square feet); Tool Room and Warehouse Nr. 4002 (1,388 square feet); Heating Plant Building Nr. 4007 (939 square feet); Bundle Ammunition Packing Building Nr. 4008 (11,186 square feet) and Bundle Ammunition Packing Building Nr. 4010 (9,405 square feet). Building Nrs. 4008 and 4010 are used for ammunition maintenance when required. There are also a few small supporting buildings of lesser importance in this group. These buildings are in good condition and are to be retained. There is sufficient open storage space for dunnage in this area. Building Nr. 4003 (3,400 square feet) which was used as storage space for fork lifts and miscellaneous supplies was destroyed by a wind storm on 12 July 1958.

(2) Proposed Facilities. No new buildings are planned for this area. However, space is adequate for erection of new structures should the need arise.

#### i. Ammunition Normal Maintenance.

(1) Existing Facilities. The new Ammunition Normal Maintenance group of buildings which were completed in September 1955 consist of an Ammunition Normal Maintenance Building Nr. 8000 (18,423 square feet); Sewage Treatment Plant Nr. 8001 (9,078 square feet); Flammable Materials Storehouse Nr. 8002 (400 square feet); Vacuum Collector Barricade Building Nr. 8003 (513 square feet); Ammunition Storehouse Nr. 8004 (126 square feet); Heating Plant Nr. 8005 (792 square feet). Construction of Ammunition Storehouse Nr. 8006 (126 square feet); Ammunition Storehouse Nr. 8009 (126 square feet) and Mounded Concrete Box Magazine Nr. 8007 (143 square feet) was completed in November 1958. Some normal maintenance of ammunition is being performed in Building Nrs. 4008 (11,186 square feet) and 4010 (9,405 square feet). These buildings were originally designed as Bundle Ammunition Packing Buildings and are not particularly suited for this type of operation. Maintenance of ammunition (inert) is also performed in Building Nr. 1813 (13,535 square feet) in the Combat Equipment Storage Area. The facilities meet the requirements for normal ammunition maintenance.

(2) Proposed Facilities. No additional Ammunition Normal Maintenance Facilities are planned.

#### j. Tracer Test Firing Range.

(1) Existing Facilities. The new Tracer Test Firing Range and Facilities are sited northeast of the Chemical Warfare Storage Area.

This group of facilities consist of a Chief Observer's Tower Nr. 9000 (99 square feet); two Observer's Towers Nrs. 9001 and 9002 (35 square feet each); Cleaning Building Nr. 9003 (80 square feet); Ammunition Storehouse Nr. 9004 (126 square feet); Small Arms Storage Building Nr. 9005 (36 square feet); Concrete Gun Platform Nr. 9006 (49 square feet) and an Earth Protective Barricade Nr. 9007 (28,980 square feet - base area).

(2) Proposed Facilities. Additional facilities are not required at this time.

k. Field Maintenance Shop.

(1) Existing Facilities. Building Nr. 1812 (18,609 square feet), a prefabricated steel structure, located in the Combat Equipment Storage Area, is utilized as an Engineer Field Maintenance Shop by the Depot's Transportation Division. This building is in good condition and is well suited for its present use, but is difficult to heat during cold weather.

(2) Proposed Facilities. No improvements or additional Field Maintenance Shops are planned.

l. Machine Shop.

(1) Existing Facilities. Building Nr. 2012 (12,058 square feet), a permanent building, serves as a machine shop. It is in very good condition and will be retained for its present use.

(2) Proposed Facilities. It is not planned to construct additional machine shop facilities.

m. Explosive Truck Inspection Station.

(1) Existing Facilities. The station is conveniently located, meets requirement and will be retained.

(2) Proposed Facilities. No new truck inspection stations are required.

n. Miscellaneous Proposed Facility Required to Accomplish Assigned Mission.

(1) General. The following proposed facility is required for the accomplishment of the assigned mission. The General Site Plan shows the proposed location of these structures and indicates the explosive limit criteria where applicable.

(2) Combination Suspect Car and Truck Barricade.

(a) A new combination Suspect Car and Truck Barricade with an inspection pit is proposed to be constructed in an area about 2,100 feet southwest of the existing group of the Storage Warehouses in the Combat Equipment Storage Area. The barricade will be served both by roads and railroad. About 2,000 lineal feet of railroad spur track will be required. When this structure is completed the existing obsolete suspect car spur and barricade will be abandoned.

(b) Justification. The proposed suspect car siding and truck barricade is required to satisfy requirements of Ordnance Safety Manual, ORDEM 7-224, Paragraphs 1716, 2120b and 2210 which states all explosive laden vehicles and rail cars entering the depot should be inspected. During periods of National emergency this inspection is mandatory. Those vehicles or rail cars failing to pass inspection must be taken to an inspection point where they can be opened without endangering personnel, supplies and facilities in the event an explosion occurs. The proposed facilities will accomplish this at a minimum cost. The barricade will be constructed of earth removed from a railroad cut which fills with snow during snowstorms. By using this earth for the barricade it will also eliminate trouble with snow blocking the mainline railroad.

o. Chemical Warfare.

(1) Existing Facilities. This group of buildings used by Chemical warfare Service in accomplishing their mission is located in the northeast corner of the Reservation. The temporary buildings consist of a Change House and Lunch Room Nr. 6000 (2,235 square feet); Storehouse Nr. 6001 (243 square feet); Storehouse Nr. 6002 (118 square feet); Well House Nr. 6004 (164 square feet); Tool Storage Shed Nr. 6007 (67 square feet); Pump House Nr. 6010 (102 square feet); Tool Room and Shop Nr. 6011 (96 square feet), and 3 covered Storage Pads Nrs. 6043, 6045 and 6047 (17,226 square feet). In the spring of 1957 a power line was constructed to serve the Chemical Warfare Area. During the first half of Fiscal Year 1959 a 36' x 48' (1,728 square feet) all metal building, Building Nr. 6005, was erected and a deep water well was drilled for use in the demilitarization of chemical bombs. Building Nr. 6010, a Pump House, an Earth Leaching Bed, a Recycle Pond and a Spray Pond were added in 1960. A Recycle Pump House, Building Nr. 6012 and a Fume Scrubber, Building Nr. 6013 were added during 1961. A second Leaching Bed was added in 1962. These facilities, with a few exceptions are considered adequate to accomplish the present chemical mission and are to be retained until replacement with permanent facilities are feasible or the chemical mission is completed or changed.

(2) Proposed Facilities. At present there is no requirement for additional facilities in the Chemical Warfare Area.



Analytical Report  
U. S. Army Ordnance Depot, Black Hills  
Igloo, South Dakota

III. HOUSING AND OTHER BASIC FACILITIES.

a. Housing, General. Housing requirements as presented here and on the General Site Plan are based on permanent peacetime strength and breakdown by Rank and Grade (see paragraph 1c) and actual experience at Black Hills Ordnance Depot. At present there is a requirement for 27 military and key civilian family housing at this isolated installation. For planning purposes the Senior Field Grade Officers' Quarters Nr. 34 (1,931 square feet), the Field Grade Officers' Quarters, Nr. 33 (2,105 square feet), the Company Grade Duplex Officers' Quarters, Nr. 35 (2,762 square feet) and the five two-story Officers' Quarters, Nrs. 18, 22, 24, 28 and 30 (2,378 square feet each) are considered permanent and will be retained.

b. Enlisted Housing. There is no anticipated need for enlisted men's or enlisted women's housing during peacetime. Neither is there any anticipated need for enlisted men's or enlisted women's barracks; nor is there any need for a male N.C.O. Dormitory. However, should the requirement occur enlisted personnel can be quartered in the existing Apartment and Dormitory buildings (formerly barracks and B.O.Q.) which are to be retained for mobilization purposes.

c. Quarters Area. Requirements for bachelors quarters and family housing are as follows:

(1) Bachelor Officers' Quarters, Male. Transient Bachelor Officers, Official Civilian visitors, and some Bachelor Civilians will continue to be quartered in the existing combination B.O.Q. and Officers' Open Mess, Building Nr. 7. (10,831 square feet), located in the Administration Area. Although this two-story building is not permanent type construction it is in good condition and should continue in its present use.

(2) Guest House. The present Guest House, Building Nr. 6 (2,090 square feet), is a T.O. (Modified) type one-story building located in the Administration Area across the street from the combination B.O.Q. and Officers' Open Mess. It contains four 2-room apartments. Three key civilians occupy three of the units; the fourth is reserved for guests. Although the building is not a permanent structure, it is in good condition and should be retained until feasible to replace with a permanent building.

(3) Nurses' Quarters. At present the need for Nurses' Quarters does not exist as the current Troop Program does not provide for assignment

of Army nurses to the Depot. Housing facilities are available for Civilian Nurses.

(4) Family Quarters. Family Housing was constructed on the Depot during 1942 and 1943 to accomodate Military Personnel and the civilian workers. At the time adequate housing was not available in the surrounding communities; neither is it available today. However, as stated in paragraph f, section 1 there are a few F. H. A. housing units available in Edgemont, South Dakota at somewhat higher rentals than military housing. If uranium activities should increase and other industries are attracted to the surrounding areas there will be a definite critical housing shortage in the nearby communities. The possibility of construction of Wherry Housing units was eliminated in favor of Military Housing primarily because of the higher rental rates of Wherry Housing. A conducted survey indicated that Depot Employees were opposed to paying the higher rentals asked for Wherry Housing. The Post Planning Board, in a meeting on 8 March 1961, determined that repair of existing substandard housing (including Lanham Act) and encouraging the development of new housing in Edgemont, South Dakota was more in line with Army policy and U. S. Government interests than constructing new housing for the Depot work force. The General Site Plan shows the location of the proposed key civilian and military housing. At one time consideration was given to moving the Civilian Housing from the present site to a new site on the golf course. However, the explosive criteria of 5,410 feet eliminated this area as a site. Other sites were considered but were eliminated.

(a) N.C.O. Family Quarters. At this time the need for construction of new N.C.O. Family Quarters does not exist. The N.C.O's and their families are presently being quartered in the Hospital Apartments. Should the necessity arise for additional N.C.O's family quarters they can be housed in the existing barracks buildings (converted to apartments) which are to be retained for mobilization purposes.

(b) Officers' Family Quarters. This area contemplated for the 27 Officer and Key Civilian Family Quarters is the site in the Administration Area which contains 54 acres that is already used for this purpose. The area will accomodate the requirement for Officer and Key Civilian Housing. The Senior Field Grade Officers' Quarters, the Field Grade Officers' Quarters, the Company Grade Duplex Officers' Quarters and the five two-story Officers' Quarters are in good condition and will adequately accomodate the nine military families. According to the latest plan it is proposed to erect fifteen single family dwellings on a site immediately northeast and adjacent to the two rows of existing Officer Family Housing, and to erect 12 houses on the site of the 10 existing substandard units. These twenty-seven dwellings are to accomodate officers and key civilians. If authority is received to construct the proposed 27 units of permanent housing a thorough study should be made of the grading, leveling and landscaping of the final location site. The possibility of installing all

electrical, street lighting, and communication trunk and service lines underground, and placing transformers in underground vaults should be thoroughly investigated and should not be eliminated unless proven economically unfeasible. For planning purposes the Senior Field Grade Officers' Quarters Nr. 34 (1,951 square feet), the Field Grade Officers' Quarters, Nr. 33 (1,105 square feet), the Company Grade Duplex Officers' Quarters, Nr. 35 (2,762 square feet) and the five two-story Officers' Quarters, Nrs. 18, 22, 24, 28, and 30 (2,377 square feet each) are considered permanent and will be retained. There is plenty of land available in this area to site the houses far enough apart to provide large lawns for each tenant.

d. Civilian Housing. Family quarters for key civilians are included under Officer Family Quarters (see paragraph c (4) (b)). The Post Planning Board in a meeting on 8 March 1961 determined that repair of existing substandard housing (including Lanham Act) and encouraging the development of new housing in Edgemont, South Dakota was more in line with Army policy and U. S. Government interests than constructing new housing for the depot work force. Projects for the construction of an addition to 79 single family houses and conversion of 35 Duplex Houses (70 units) to Single Family units were included in our MCA Program in a Master Planning Board Meeting held on 21 February 1962. The rehabilitation of 177 units of 4 and 6 plex housing were included in Report of Family Housing Assets and Requirements and projected Fiscal Year 1964 Program (Reports Control CSGLD (OT) - 1059). The need for the additions, conversions and rehabilitation of the civilian family housing has been magnified by the requirement that all Lanham Act Housing must be improved, demolished, or otherwise disposed of by 1 July 1965.

The 10 single family units on Staff Drive, Quarters Nrs. 12, 14, 15, 16, 17, 19, 21, 23, 25 and 27 are substandard. Nine of the houses are occupied by key civilians; the tenth is occupied by an Officer. If the 27 proposed houses are erected in this area, consideration should be given to moving these ten houses onto the playground west of the existing civilian Duplex Housing Area for use as civilian housing.

The 85 units of contractor built single family units and the 80 duplex units in the civilian housing area are in good condition. They will be retained as it is necessary that the civilian workers have some place to live. In addition, there are 14 apartment buildings containing 13 apartments each and 6 apartment buildings containing 6 apartments that accommodate civilian workers or may accommodate them. At present there is not adequate housing in the surrounding communities to house many of the depot workers.

The apartments in the 14 buildings are small one bedroom efficiency apartments. There are 5 two bedroom and one 3 bedroom apartments in each of the six apartment buildings, Building Nrs. 141 through 146. Building Nrs. 103, 104, 105, 110 and 130 are classed as male dormitories. The first floor of Building Nr. 110 is used as a Post Office; the first floor of Building Nr. 130 is used as a Barber Shop and Post Library. They will accommodate 180 bachelor men. The women's dormi-

tory, Building Nr. 106, was diverted temporarily to the Provost Marshal's Office. The buildings are in good condition and will be retained for Mobilization purposes.

## 2. Proposed Facilities

Projects for the construction of 27 units of family housing, construction of an addition to 79 single family units and conversion of 35 duplex houses (70 units) to single family units are included in our MCA Program. One hundred and seventy seven units of 4 and 6 plex houses were included in Report of Family Housing Assets and Requirements and projected Fiscal Year 1964 Program. (Reports Control CSGLD (OT - 1059).

### a. Justification for 27 Units of Family Housing.

The housing on the Depot was constructed in 1942 with a life expectancy of five years. The housing units constructed in 1942, with the exception of five, are of temporary type construction. The existing temporary housing units are too small; are substandard, have inadequate closet and storage space; have only one bath; are poorly arranged; and are generally unsatisfactory.

The number of existing housing units in the surrounding communities is insufficient to accommodate military and key civilian personnel.

Construction of 27 field grade quarters at this isolated installation will provide adequate quarters for military personnel and some of the key civilians. The proposed housing units will provide good functional interior arrangements, attractive appearance and proper relation of houses to outdoor spaces, with privacy between units and will eliminate unsightly and unsanitary aspects of service areas. Army policy for permanent installations states that elements and activities of the regular army shall be housed in permanent type construction by 30 June 1974.

Replacement of the existing temporary substandard housing units with adequate housing will result in a decrease in fuel consumption, a decrease in maintenance costs, with a possible reduction in maintenance personnel, and improved morale among the military and key civilian personnel.

### b. Justification for Conversion of 35 Duplex Houses to Single Family Units.

Black Hills Ordnance Depot is an isolated installation and practically no off-post quarters are available. Thirty five Depot employees could not possibly find off-post housing within commuting distance. Accomplishment of the proposed conversion would provide larger, modernized quarters for 35 depot employees. At present, these quarters are small and have but one entrance. This is a definite safety hazard

which would be alleviated by the conversion. The buildings are structurally sound, however, from the stand point of space, the existing quarters are substandard.

The greatest need that will be met by the conversion is the provision of larger quarters. The existing units have approximately 560 square feet of useable floor space as a two bedroom unit. Conversion would double the net floor area and increase the number of bedrooms to accommodate larger families. Another item which is badly needed is a second entrance. With only one entrance it would be very easy for a person to be trapped in the building if a fire should start in the front part of the unit.

Accomplishment of this project is essential to maintain high morale among the employees and provide necessary quarters for part of the depot work force. Since adequate housing in the surrounding communities is practically non-existent, larger quarters are needed to house the necessary workers. Essential space and safety requirements would be met by conversion of the duplex units to single family houses.

c. Justification for Construction of an Addition to 79 Single Family Units.

Ten of these houses are 24' x 26' and the remaining 69 houses are 22' x 24'. They contain a very limited amount of closet space and storage room. There is no room available for installation of washing machines and clothes dryers. Construction of an addition to these family units will alleviate the critical lack of storage space and will provide for better arrangement of furniture. It will also increase the morale and efficiency of the tenants who live in these houses. The proposed additions will eliminate an existing safety hazard as the tenants store items in the open where they become tripping hazards. Since adequate housing in the surrounding community is practically non-existent, larger quarters are essential to attract and retain the necessary workers. It is essential the additions be constructed to increase storage space and provide utility rooms for the tenants; eliminate safety hazards; and improve morale.

d. Justification to Rehabilitate 177 Units of 4 and 6 Plex Family Houses.

Rehabilitation of 177 units of 4 and 6 plex family houses is urgently required to provide better living quarters for part of the Depot work force.

Black Hills Ordnance Depot is an isolated installation and practically no off-post quarters are available. The families living in these 177 quarters could not find off-post housing. Since adequate housing in the surrounding communities is practically non-existent, improvements to these dwellings is necessary to attract and retain employees.

These buildings are resting on small concrete piers which have settled to the point the floors are very uneven. This condition creates a definite safety hazard. The old style kitchen sinks are in need of replacement with modern sinks. The deteriorated kitchen cabinets are unsanitary and in need of replacement. The installation of one additional exterior door and one window will assist in providing more desirable living quarters. The existing roofs consist of 90 lb. mineral surfaced roofing paper mopped on one half inch gypsum board sheathing which has deteriorated. These roofs leak badly and need to be replaced. The partitions are poorly arranged and some of them need to be relocated to provide good functional interior arrangements.

Black Hills Ordnance Depot is an isolated installation. There is a very limited amount of off-post housing available. Since adequate housing in the surrounding communities is practically non-existent, improvements to these dwellings is necessary to provide more desirable living quarters for part of the Depot work force.

Improvements to these 177 units is essential to maintain high morale among the employees living in them; to reduce maintenance costs; to eliminate safety hazards by leveling the floors; and to attract and retain employees.

Elimination of the proposed improvements will result in continued use of these poorly arranged quarters; continued high maintenance costs; less attraction for new hires; and may cause a more rapid turn-over among critical and key personnel.

e. Messes. Provisions for messing facilities were not considered in the Plan.

f. Administration. The attempt has been made to concentrate as many administrative activities as feasible in the present Administrative Area. In general, requirements for administrative space are based on the 125 square feet per person allowed by AR 415-31. At present a very large part of the administrative space is located in Building Nrs. 1, 2, 3, and 5. Building Nrs. 1 and 2 are considered permanent; Building Nrs. 3 and 5 are in good condition and will be retained until replaced with a permanent type building.

1. Existing Facilities.

(a) Headquarters Building. Building Nr. 1 (13,076 square feet) presently serves as offices for the Commanding Officer, Deputy Post Commander, Adjutant, Director of Administration, Comptroller, Mail and Records, Teletype Office, Finance and Accounting Branch, Photography and Reproduction, Personnel, Wage and Salary, and Management Engineering. Fireproof vault space is also available. This building is adequate, in good condition, and is to be retained.

(b) Communications and Fire Department Building. Building Nr. 2 (16,308 square feet) accommodates the Fire Department, Telephone Operators and Repairmen and Safety personnel. In addition to offices, the building contains a telephone switchboard, battery room, telephone repair room, conference room, and detention cell. Fire Station Nr. 1 is located in this building; accommodations for firemen consist of sleeping, messing and lounge facilities. This structure is in good condition; is considered permanent in the Master Plan and is to be retained for its present use.

(c) Building Nr. 106 formerly a women's dormitory was converted to a Guard and Security Building. This temporary building is in fair condition and will be retained until replaced with a permanent type facility.

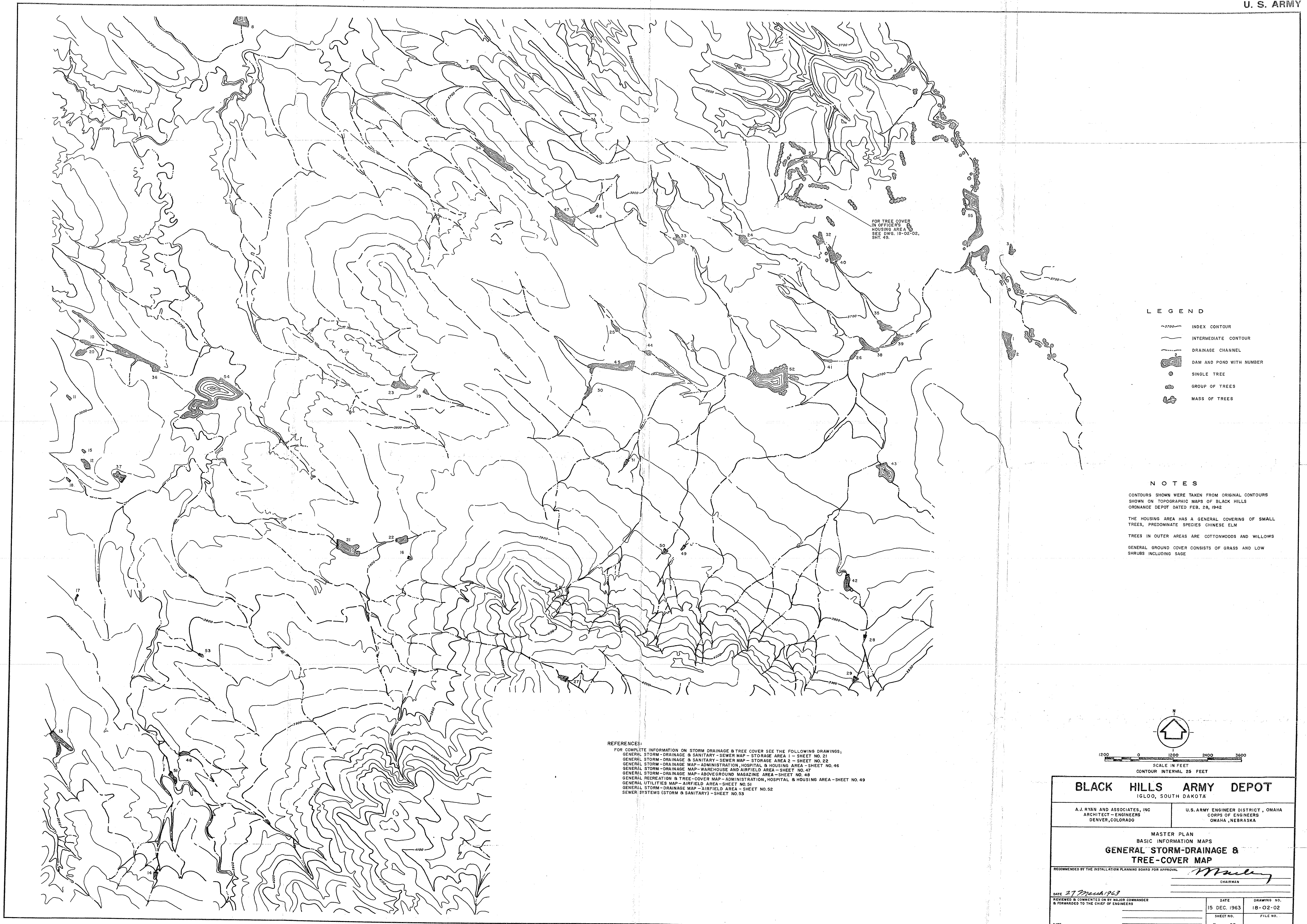
2. Proposed Facility: There is a requirement for a permanent type building to house the Guard and Security Division. This facility will be sited in an area near the main entrance to the Depot.

3. Justification for Provost Marshal Office. The Provost Marshal's office is located presently in Building Nr. 106, a temporary wood frame, one story building, which was originally designed as a housing office and later converted to a women's dormitory. The building was constructed in 1942 with a life expectancy of 5 years. It is sited in an area adjacent to two high street fills. This condition makes the building extremely hot during the summer months. The building is located about one fourth of a mile from the main entrance gate to the Depot.

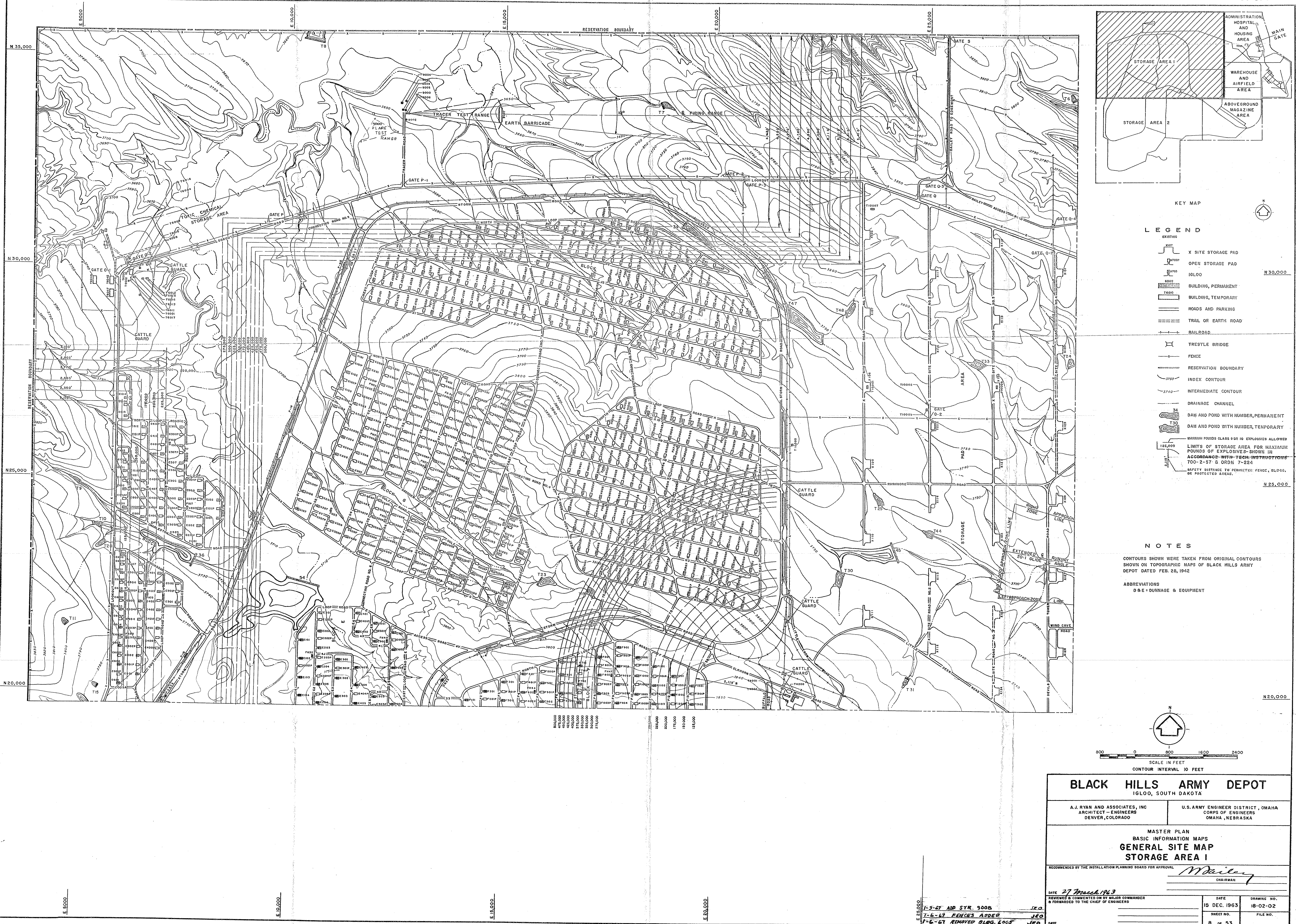
The detention cell is located in Building Nr. 2 about one half mile west of the Provost Marshal and Police headquarters. Under this arrangement fire prevention and protection personnel are required to make frequent checks on anyone confined to the detention cell.

**BLACK HILLS ARMY DEPOT  
MASTER PLAN BASIC INFORMATION MAPS  
15 DECEMBER 1963  
DRAWING 18-02-02**

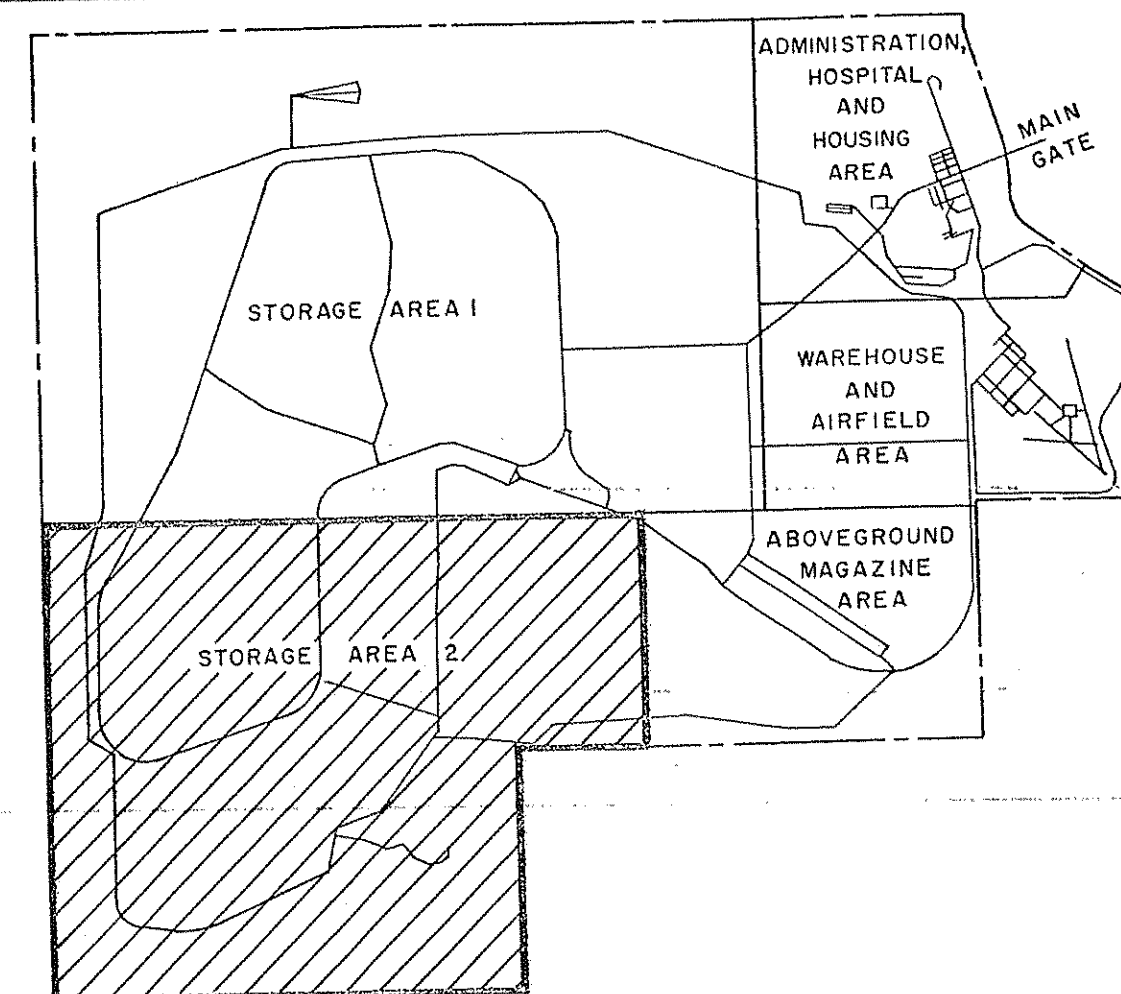
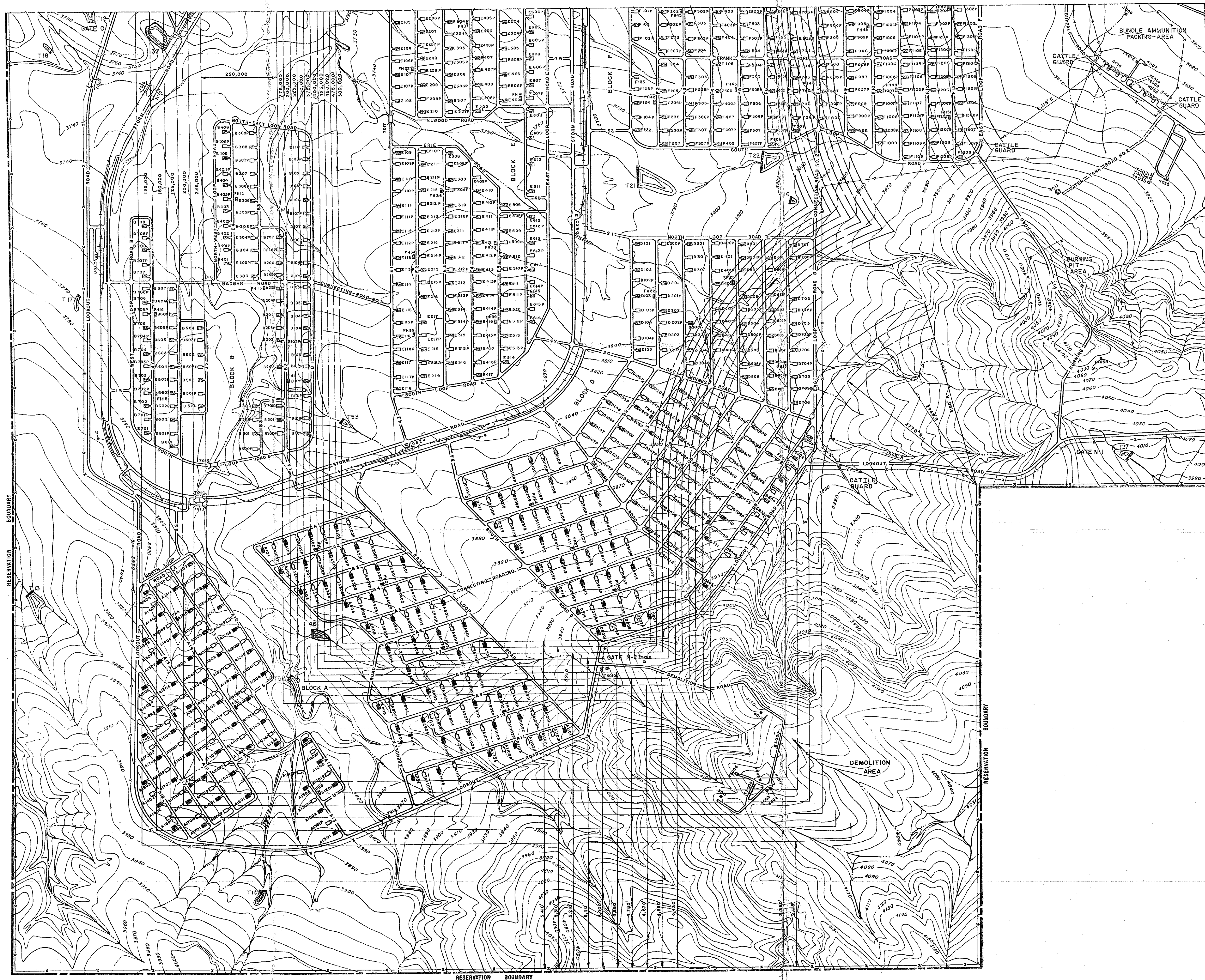












KEY MAP

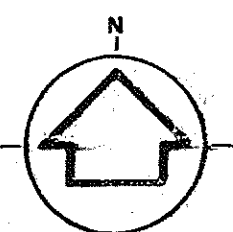
## LEGEND

- EXISTING
- OPEN STORAGE PAD
  - IGLOO
  - BUILDING, PERMANENT
  - BUILDING, TEMPORARY
  - ROADS AND PARKING
  - TRAIL OR EARTH ROAD
  - RAILROAD
  - TRESTLE BRIDGE
  - FENCE
  - RESERVATION BOUNDARY
  - INDEX CONTOUR
  - INTERMEDIATE CONTOUR
  - DRAINAGE CHANNEL
  - DAM AND POND WITH NUMBER, PERMANENT
  - DAM AND POND WITH NUMBER, TEMPORARY
  - MAXIMUM POUNDS CLASS 9 OR 10 EXPLOSIVES ALLOWED
  - LIMITS OF STORAGE AREA FOR MAXIMUM POUNDS OF EXPLOSIVES SHOWN IN ACCORDANCE WITH TECH. INSTRUCTIONS 700-2-57 & ORDM 7-224
  - SAFETY DISTANCE TO PERIMETER FENCE, BLDGS. OR PROTECTED AREAS

## NOTES

CONTOURS SHOWN WERE TAKEN FROM ORIGINAL CONTOURS SHOWN ON TOPOGRAPHIC MAPS BLACK HILLS ARMY DEPOT DATED FEB 28, 1942

ABBREVIATIONS  
DBE = DUNNAGE & EQUIPMENT



SCALE IN FEET  
CONTOUR INTERVAL 10 FEET

**BLACK HILLS ARMY DEPOT**  
IGLOO, SOUTH DAKOTA

A.J. RYAN AND ASSOCIATES, INC.  
ARCHITECT - ENGINEERS  
DENVER, COLORADO

U.S. ARMY ENGINEER DISTRICT, OMAHA  
OMAHA, NEBRASKA

**MASTER PLAN  
BASIC INFORMATION MAPS  
GENERAL SITE MAP  
STORAGE AREA 2**

RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

*Mooney*  
CHAIRMAN

DATE 17 March 1963  
REVIEWED & COMMENTED ON BY MAJOR COMMANDER  
& FORWARDED TO THE CHIEF OF ENGINEERS

DATE 15 DEC 1963  
DRAWING NO. 18-02-02

SHEET NO. 9 OF 53  
FILE NO.

1-6-67 ADD FENCE - BG #1 JEO  
1-6-67 REMOVE BLDG. D 713 JEO  
1-6-67 REMOVE BLDG. D 806 JEO









