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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 96

US Army Corps
of Engineers
HUNTSVILLE DIVISION

Defense Environmental Restoration Program
for
Department of Defense Sites

Ordnance and Explosive Waste
Chemical Warfare Materials

ARCHIVES SEARCH REPORT

FINDINGS

MEMPHIS DEFENSE DEPOT
Memphis, TN

Defense Logistics Agency

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Prepared by
US ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

ORDNANCE AND EXPLOSIVE WASTE
CHEMICAL WARFARE MATERIALS
ARCHIVES SEARCH REPORT
FOR
MEMPHIS DEFENSE DEPOT
MEMPHIS, TN

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APPENDICES

1.0 Introduction

1.1 Authority

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 42 USC 9601 et seq. Ordnance and explosive wastes are included in the CERCLA definition of pollutants and contaminants that require a remedial response.

In 1983, Public Law 98-212 established the Environmental Restoration Defense Account (ERDA). This Congressionally directed fund was to be used for environmental restoration at Department of Defense (DoD) active installations and formerly used properties. The DOD designated the Army as the sole manager for environmental restoration at closed installations and formerly used properties. The Secretary of the Army assigned this mission to the Corps of Engineers (USACE) in 1984.

The 1986 Superfund Amendments and Reauthorization Act (SARA) amended certain aspects of CERCLA, including some directly related to OEW contamination. Chapter 160 of the SARA established the Defense Environmental Restoration Program (DERP). One of the goals specified for the DERP is "correction of environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment."

The DERP requires that a CERCLA response action be undertaken whenever such "imminent and substantial endangerment" is found at:

A. A facility or site that is owned by, leased to, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense.

B. A facility or site that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination.

C. A vessel owned or operated by the Department of Defense.

Passage of the Clean Water Act in 1972 established the National Contingency Plan (NCP) which has since been revised and broadened several times. The NCP provides the organizational structure and procedures for remedial actions to be taken in response to the presence of hazardous substances, pollutants, and contaminants at a site. Section 105 of the 1980 CERCLA states that the NCP shall apply to all response actions taken as a result of CERCLA requirements.

The March 1990 National Oil and Hazardous Substances Pollution Contingency Plan given in 40 CFR part 300 is the latest version of the NCP. Paragraph 300.120 states that "DOD will be the removal response authority with respect to incidents involving DOD military weapons and munitions under the jurisdiction, custody, and control of DOD."

On April 5, 1990, U.S. Army Engineer Division, Huntsville (USAEDH) was designated as the USACE Mandatory Center of Expertise (MCX) and Design Center for Ordnance and Explosive Waste (OEW). As the MCX and Design Center for OEW, USAEDH is responsible for the design and successful implementation of all Department of the Army OEW remediations required by CERCLA. USAEDH will also design and implement OEW remediation programs for other branches of the Department of Defense when requested.

1.2 Subject

Memphis Defense Depot is located in Memphis, Tennessee approximately six miles southeast of downtown Memphis and two miles northwest of the Memphis International Airport.

1.3 Purpose

This Archives Search Report (ASR) compiles information obtained through historical research at various archives and records holding facilities, interviews with persons associated with the site or its operations, and personal visits to the site. All efforts were directed towards determining possible use or disposal of chemical warfare materials on the site. Particular emphasis was placed on establishing the type (agent), munitions or container, quantities and area of disposal. Information obtained during this process was used in developing recommendations for further actions at the site.

1.4 Scope

The scope of this ASR is limited to burials and disposals performed by the Chemical Warfare Service (CWS) in association with Memphis Defense Depot.

2.0 Previous Site Investigations

2.1 Memphis Defense Depot

Installation Assessment of Defense Depot Memphis, Memphis, Tenn. Report No. 191, July 1982, prepared by U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), Aberdeen Proving Ground, Maryland. This was a records search conducted at Memphis Defense Depot to identify past contamination and to assess the potential for contaminant migration beyond the installation boundary. The review of records identified the major contamination areas on both the Main Depot and the Dunn Avenue Area.

The report was reviewed for any possible information on Conventional Ordnance or Chemical Warfare Materials. Original interviews and other records used for the preparation of the Report were reviewed at the Depot Environmental Office and are referenced in this report as appropriate. The entire USATHAMA Report is included in Appendix C of this report.

3.0 Site and Site Area Description

3.1 Location

The Memphis Defense Depot is located within the city limits of Memphis Tennessee. The Depot is on the south side of the town, on Airways Road. It is two miles northwest of the Memphis International Airport.

3.2 Past Uses

The original 500 acre track was generally farm land when purchased by the Army in 1941.

3.3 Current Uses

The Memphis Defense Depot is still in active use by the Department of Defense. The Depot is operated by the Defense Logistics Agency and is under the control of the eastern region.

4.0 REAL ESTATE

4.1 Current Site Ownership

The Memphis Defense Depot is currently owned by the Department of Defense (DoD) and operated by the Defense Logistics Agency. The main depot and the Dunn Avenue Area total 642.11 acres.

4.2 Previous Site Ownership

The original Depot site was purchased from two brothers, Abe and Ben Goodman, on 22 May 1941 and contained 500 acres.

4.3 Land Acquisitions and Disposals

An additional parcel was purchased during World War II to the west of the main depot. This area was for open shed storage.

A 3.6 acre parcel, located on the northwest corner of the Dunn Avenue Area was transferred to private ownership (W.W. Robinson) on 26 May 1949. The transfer was performed by the Federal Farm Mortgage Corporation acting as agent for the federal government.

4.4 Leased Facilities

A review of the Plant Protection Regulations used during World War II, indicate that the Depot had use of a warehouse near Webster and Georgia Streets near downtown Memphis. The warehouse and surrounding area was patrolled by an armed guard and was known as Post No. 20. This area is no longer controlled by the Depot and should be listed as a Formerly Used Defense Site (FUDS) (DEGORG 1945).

5.0 OEW/CWM Site Analysis

5.1 Historical summary of OEW operations

The first Pistol Range on the Depot was located just south of K Street, between 1st & 2nd Streets (Map 2). This range has been removed and the grounds are part of the Depot Golf Course.

The second Pistol Range was built on the north end of the Dunn Avenue Area and still stands today (Map 3).

The two igloos were primarily used by the Chemical Warfare Service and conventional ammunition was not stored on a permanent basis. Conventional ammunition may have been stored in the igloos on a temporary, short term basis for reserve units. This type of use would not have been recorded in documents.

Incendiary bombs were stored in Bldg 229. These bombs were shipped out of the Depot after World War II (Traut 1981 & 1994).

Historical summary of CWM operations

WORLD WAR II

The Chemical Warfare Section at the Memphis Defense Depot was activated on 30 April 1942. The mission of the Section remained practically unchanged throughout World War II, and was stated as follows (Memphis 1945):

SUPPLY

Distribution: 1. GENERAL SUPPLIES. a. As a distribution depot. To receive and store CWS general supplies for distribution to installations located within the Fifth, Sixth and Seventh Service Commands, including staging areas under control of the New Orleans Port of Embarkation, and to that port for port stocks.

Filler: b. As a filler depot. To receive and store CWS general supplies for shipment overseas through the New Orleans Port of Embarkation.

Reserve: c. As a reserve depot. To receive and store authorized reserve of CWS general supplies for future distribution.

Distribution: 2. AMMUNITION. a. As a distribution depot. To receive and store training ammunition only for distribution to installations located within geographic area of the Fifth and Sixth Service Commands.

Reserve: b. As a reserve depot. To receive and store authorized reserves of all types of CWS training ammunition.

During World War II, the section prided itself on eliminating unnecessary procedures. One of which was stated as follows (Memphis 1945):

> "The guiding principle used in controlling the administration of records, reports and files has been to simplify and reduce paper work when ever possible...One all too prevalent wasteful practice that this office has studiously avoided is the use of subsidiary or duplicate records where there already exists basic records from which any required information may be gathered."

This accounts for the lack of records of the operation of the Chemical Warfare Section.

The Depot Commander allowed The Chemical Warfare Section to operate independently from the rest of the depot. Most of the mission, direction and guidance came directly from the Chemical Warfare Service. In this fashion the Chemical Warfare Section operated much like an independent, tenet activity.

Manpower for common labor, checkers, equipment operators and all materials handling equipment during World War II were provided by a Depot wide labor Pool. This labor pool provided man power on a day to day basis determined by requests the day before. The labor pool also included some 1600 German prisoners of war. While this system was efficient, institutional knowledge of the Chemical Warfare Section resided with a small core of section personnel (Memphis 1945).

The facilities used during World War II by the Chemical Warfare Section are as follows (Memphis 1945):

Office Space: Approximately 2,000 square feet in AO-1 (Bldg 144)[1]

Warehouse space: Warehouse NC-1 (Bldg 229), NC-2 (Bldg 329) and two sections in NB-1 (Bldg 230). One section in inflammable storage building ND-2 (Bldg 319) and 800 square feet in ND-3 (Bldg T416, which has been partially removed).

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[1]Building numbers are given as they appear in the documents and maps. The building number in parenthesis is the 1994 building number.

Shed Storage: A total of 85,000 square feet in shed SD-22 and SB-22 (both part of Bldg S972). A total of 10,000 square feet of unimproved open storage space restricted to the storage of classified ammunition and 15,000 square feet borrowed from the QMC for the storage of Plant, Impregnating, Z of I, Number 110[2].

Igloos and Magazines: Two standard igloos (Bldgs 783 & 793) and two above ground magazines (both removed).

Storage at Posts, Camps and Stations: Assigned 150,000 square feet of gross storage warehouse area at Camp Ellis. This was used to store approximately two million civilian gas masks which was accounted for on the Section records.

Reviewing various Depot Plans reveals that the Chemical Section also occupied at one time, all of Bldg. 330 and parts of Bldgs. 249, 349 & 429. Open storage was located north of the igloos and also east of the igloos (Map 2).

Shipping documents for the month of October 1942 were reviewed. During this month, at least 270 Set, Gas ident., deton., M1 were shipped. These are more commonly known as Chemical Agent Identification Sets (CAIS). Also shipped during the month were 45 Mine land, cml., w/deton & burster. These mines were shipped empty, but with a detonator and a burster charge (Memphis 1942)

One operation done by the Section was the periodic recanning of bleaching powder (Chloride of Lime). The rapid deterioration of containers in which this item was packed made it necessary to periodically recan large quantities. At one time the Section had approximately 5,000,000 pounds in storage (Memphis 1945).

Repackaging was also required for Agent, Decontaminating, Non-Corrosive (DANC). This was accomplished by 14 prisoners of war. Approximately 25,000 cans were repackaged (Memphis 1945).

At the end of World War II, the Chemical Warfare Material being handled by the Depot was divided into four main groups or classes, as follows (Memphis 1945):

Inert Materials:

1. Example of inert Chemical Warfare Materials are apparatus, decontaminating (various types); gas masks; respirators; bomb bodies, empty; smoke tanks, etc. No particular hazard is attached to the storage or shipment of these articles.

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[2]The Plant, Impregnating, Z of I, was processed and recrated in accordance with overseas packing specifications, by the Chemical Warfare Section. This plant consisted of 45 car loads of heavy laundry equipment (Memphis 1945).

Explosives:

1. The explosives handled by the Chemical Warfare Section at the close of World War II fell into two main classifications:
    a. Burster, nitro-starch and primacord, both of which are high explosives.
    b. Detonators, fuses, etc., which include blasting caps, electric squibs and bomb nose fuses.

Chemical ammunition:

1. Chemical ammunition is divided into four basic groups:
    a. Group "A" - Persistent Gases, which include Mustard Gas (HS), and Lewisite (M-1). Neither of these were currently handled at the depot.
    b. Group "B" - Non-Persistent gases, toxic, irritants and smoke. This group includes the following items stored and handled at the close of World War II:
        (1) Chloracetophenone (CN), tear gas; Adamsite (DM), irritant gas; Sulfur Trioxide, Chlorsulfonic acid mixture (FS), smoke, Titanium Tetrachloride (FM), smoke; Chloracetophenone (tear gas) solution (CNS and CNB).
    c. Group "C" - Spontaneously inflammable agents.
        (1) HC, Smoke pot (Hexachlorethane burning mixture).
        (2) Grenade, frangible, M1, AW filled. The AW filling consists of phosphorus and a rubber-gasoline solution.
    d. Group "D" - Incendiary and readily inflammable agents.
        (1) Burning mixture of CN-tear gas pots and tear gas grenades.
        (2) Burning mixture of DM-DM pots and DM grenades.
        (3) Burning mixture of CN and DM - CN-DM pots and grenades.
        (4) Bombs, incendiary.

Inflammable and/or corrosive or toxic liquids and solids:

1. Flame thrower fuel.
2. Paint, liquid vesicant detector.
3. Ointment, protective.
4. Impregnite, shoe.
5. Acetylene tetrachloride.
6. Chloride of lime.
7. Matches.
8. Paraffin, chlorinated.

Post World War II

After World War II, the tonnage of receipts and issues declined rapidly. Various divisions and branches within the Chemical Warfare Section restructured or were absorbed. Posts and Camps sent back supplies for re-stocking. Much of the chemical ammunition received had been packed with no regard for lot numbers, causing the depot to open all ammunition crates and repack them by lot numbers (Pittenger 1947).

Eventually, on 1 July 1947, the Chemical Supply Section was transferred to the Chemical Section at the Columbus General Distribution Depot, Columbus , Ohio. The Chemical Section continued to store, classify and dispose of general supplies and maintain war reserve assets (Pittenger 1947, Brophy 1953).

One of the duties of the Chemical Warfare Section was the periodic inspection and testing of flamethrowers. In the interview with Mr. Traut, he stated, that he would test the flamethrowers against the northeast side of the curved loading dock in the Dunn Avenue Area. He recalled using only diesel fuel. The units were then refilled and put back into storage stock
(Traut 1981 & 1994). Testing of Flamethrowers using diesel fuel, was done by Mr. Anderson along Ball Road where Building # 690 is now located (Anderson 1981a,1981d & 1981b). Flamethrowers were also tested in the present golf course area of the main depot, around the area of the 3rd and 9th fairways on the north side of the course (Gross 1981, Jonas 1981, Wages 1981,Whitten 1981).

Korean War

During 1951, major activities of the Chemical Section, included test firing of mechanized flame throwers and the screening gas masks. The gas masks were made serviceable and available for issue. In total, 83,000 masks were screened and either made serviceable or demilitarized and turned to salvage. Requirements and Supply Control Division for Spare Parts was transferred to Memphis Depot. Approximately 3,434 tons of spare parts were received from Eastern Chemical Depot (Edgewood Arsenal) (Brophy 1953).

During the next two years, the receiving, storage and shipping of repair parts was the main function of the Chemical Supply Section. During the first six months of 1953, 469 tons of repair parts, 654 tons of end items and 4 tons of toxics were shipped. The small stock of Chemical Corps ammunition was no longer required, since ammunition supply was deleted from the Depot mission. Shipping instructions were received to transfer the stock of ammunition to Pine Bluff Arsenal, Arkansas (Brophy 1953, Memphis 1953).

Post Korean War

The Chemical Supply Section continued to store Chemical Corps equipment, parts, decontamination materials and Chemical Agent Identification Sets (CAIS). In December 1957, they filled a request to send 6 drums of Tetrachlorethylene (Acetylene tetrachloride) to Edgewood Arsenal for testing. This material is used with RH195 to make Agent, Decontaminating, Non-Corrosive (DANC) (George 1957, Patro 1957, Tomlinson 1957).

In December 1957, there was a request to the Chief Chemical Officer, Department of the Army for new fiber board containers. There were on hand at the Chemical Supply Section 4,736 drums of XXCC3 (26 lb.) which needed replacement containers. It is unknown whether the 123,136 lbs. of XXCC3 was repackaged or destroyed (Dick 1957).

During the first three months of 1960, The storage activities of the Chemical Supply Section were transferred to the Directorate for Warehousing. Under this major reorganization, the National Inventory Control Point and all other allied elements of the former Chemical Supply Section became the Chemical Parts Center. This was an assigned mission of the Memphis General Depot (Memphis 1960a).

By directive of higher headquarters the Chemical Parts Center was transferred to the Army Chemical Center, Maryland, with an effective date of 31 March 1961. This concluded the use of the Memphis Defense Depot by the Army Chemical Corps (Chemical Warfare Service) (Memphis 1960b).

5.2 Historical summary of OEW/CWM disposals

Ordnance Disposals

Mr. Traut, formerly of the Chemical Supply Section, stated that after World War II, Military Police would bring ordnance items to the Depot. These ordnance items had been confiscated from returning service men upon their arrival in Memphis. In the 1981 interview, Mr. Traut stated that one round was a 3.2" mortar round. This may have been either a U.S. 81mm or the similar British 3.2" (81mm) mortar round. Using materials on hand (either chemical or ordnance), Mr. Traut would destroy the ordnance in pits located at the Dunn Avenue Area. He also stated that smoke pots and hand grenades (presumably smoke) were also destroyed in the same pits (Map 3) (Traut 1981 & 1994).

Chemical Warfare Material Disposals

On 13 July 1946, eight railcars containing German Mustard Bombs were sided in the yards of the Missouri Pacific Railroad, Memphis, Tennessee. Upon examination it was discovered, that three of the cars (GN 29105, AT&SF 144258 & I-GN 6742), were leaking Mustard. A decision was made to move the railcars to the Memphis General Depot where the matter could be more properly handled. The cars were moved by 1930 hours to the railroad trackage east of the two igloos. This track was known as track # 27 and has since been removed (Arthur 1946, Carpenter 1994, Meyer 1946, Spahn 1946, Traut 1981 & 1994, Whittenberger 1946).

From 14 to 16 July 1946, personnel from Edgewood Arsenal arrived and work was performed decontaminating all trackage. This included the Missouri Pacific yard and Depot trackage (Spahn 1946).

On 17 July 1946, Lights were installed to allow night unloading of the cars and the task of unloading the leaking cars begun. The trackage to Amory, Mississippi was inspected, with testing at all known stops of train between Amory and Memphis. The five non-leaking cars of bombs were sent with a guard and security detail to Pine Bluff, Arkansas. Chloride of Lime was used to make slurry. To correct for the low Chlorine content of the Chloride of Lime bleach (20.8%), all slurry was made using 30% more bleach (Meyer 1946, Spahn 1946).

On 18 July 1946, Quartermaster warehouses SA-5 (Bldg 650) and SB-4 (Bldg S559) or closed due to being down wind of the unloading. Decontamination of trackage also continued (Spahn 1946).

On 19 July 1946, work was started on preparing a slurry pit, using Post Engineer labor. Two leaking 500 KG bombs were taken to the decontaminating area, Dunn Ave., Memphis General Depot. The pit was 30 feet long, 7 feet wide and 12 feet deep. Bombs were placed over pit and holes shot in noses, using a rifle. The Mustard gas was then allowed to drain into the slurry pit. The first carload of leakers was still only partially unloaded (Arthur 1946, Spahn 1946).

On 20 July 1946, decontamination of trackage continued. The unloading of the first leaking car was completed and the second leaking car started. The second car had a mixed load of 250 KG and 500 KG German bombs[3]. Excessive heat was blamed for the slow progress to date (Spahn 1946).

On 21 July 1946, testing of Missouri Pacific trackage gave negative H (mustard) test. A new rail car was switched in and reloading of 500 KG bombs into this car was started. (Spahn 1946).

On 22 July 1946, because of the objection to the method of shooting holes in the leaking bombs, an Ordnance Officer was requested to care for this situation. To date, no accurate information had been received as to whether or not any of the bombs contained a burster charge. A request for a kit, tool, bomb, venting was sent to Edgewood Arsenal and advice received that one was being air shipped. To date, seven large bombs (500 KG) and three small bombs (250 KG) have been taken to the decontamination area and drained into the slurry pit after shooting holes with a rifle (Spahn 1946).

On 23 July 1946, work was started on exploding of burster charge in bombs after the removal of mustard. Sticks of dynamite were strapped on the noses of the drained bomb cases and some were exploded in shallow pit, with partial earth covering and three layers of railroad ties on top. Examination of exploded casings indicated that so far, of the eleven bombs exploded with dynamite, only the small bomb casings contained a burster charge (Spahn 1946).

On 24 July 1946, the first reloaded car (NKP 9847) was shipped to Pine Bluff, Arkansas. Work continued on the draining of the bombs at the decontamination pit (Spahn 1946).

On 25 July 1946, work continued at the unloading/reloading site and at the decontamination area. Daily additions of 500 lbs. of bleach were added to the slurry pit to keep the chlorine level up. It was decided dry icing of bombs in car shipments was advisable and icing of bombs on the ground would be helpful (Spahn 1946).

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[3]The 250 KG bombs had one green ring mark and the 500 KG bombs had one red ring mark.

On 26 July 1946, a second car was made ready for shipment. By close of business at 0100 hours a third car was ready for inspection. All existing leaking bombs had been drained of liquid and leakers are decreasing (Spahn 1946).

On 27 July 1946, two rail cars were made ready for shipment (AT&SF 148677, MP 29362). Another car (DSS&A 17031) was switched in and loading begun. By 1900 hours loading of the third car was completed and all three cars were sent to the Missouri Pacific Yard for shipment. This completed the reloading operations (Spahn 1946).

On 28 July 1946, area was policed for contaminated items of wood and clothing which were carried to existing burning areas, one being the slurry pit and the other a shallow hole for exploding burster charges. All contaminated material, ties, etc., were saturated with oil and the day was spent in burning this material and policing the area. A total of twenty-four large (500 KG) and five (250 KG) bombs had been disposed to date (Michaels 1946, Spahn 1946).

On 29 July 1946, no activities took place due to heavy rains (Spahn 1946).

On 30 July 1946, the three empty contaminated freight cars (GN 29105, AT&SF 142258 & I-GN 6742) were sent to Pine Bluff Arsenal for removal of contaminated lumber and rebuilding. The cars had been thoroughly decontaminated, inside and out, including undercarriages and couplings. Cars cleared the Missouri Pacific , Sargeant Yard, Memphis at 20:00 hours (Spahn 1946).

The reports by LTC Arthur, indicate the leaking cars were originally beside and blocking the entrance to the Depot Salvage Area (Report of the 16th) and later, moved to a different siding for the unloading/reloading operation with the unloaded bombs being placed on a concrete hardstand (Report of the 24th). The interview with Mr. Traut indicated that the cars always remained east of the two igloos and south of building S559. Former Corporal Carpenter stated that he was burned unloading the cars (night of the 18th) and that the cars were east of the small pond (Arthur 1946, Carpenter 1994, Traut 1994)

The use of track # 14, west of the igloos is improbable. The track is closer to the igloos, to relocate the cars for unloading, would have meant moving them to the north side of the depot and bringing them back through the switching yard to the area east of the igloos. Also track # 14 would not have been beside the salvage area or blocked its entrance.

The positioning of the cars on the "wye" Track # 27A, would be improbable. A wye track is primarily used to turn around engines and cars. Track # 27A is the only track of this type on the Depot. Blockage of this track would have caused operational difficulties for the Depot rail network, causing turnarounds to leave the grounds of the Depot and use the trackage of one of the servicing railroads.

Giving credibility to the accuracy of all three statements, the following is the most likely explanation:

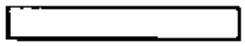
> The train was first placed on Track # 27, west of the Salvage Area and east of the igloos. The cars would not have physically blocked either the north or south entrances to the salvage area, but the safety zone around the cars would have stopped use of the entrances. This would be the original siding that LTC Arthur cites. On the 17th, Major Spahn sorted out five cars for shipment. During this process the remaining three cars of "leakers" were probably relocated to Track # 28 and positioned close to Sixth Street. This track ran east to west and was adjacent to a long concrete hardstand on the south side of the track. This position would free up the south entrance to the salvage area and allow decontamination of the igloo trackage (Track # 27) to begin. It would also allow access to the concrete hardstand south of track # 28. This location would also explain the concern over workers in Quartermaster warehouses SA-5 (Bldg 650) and SB-4 (Bldg S559).

The interview with Mr. Traut indicates that the entire area east of the two igloos and south of building S559 was tested on a monthly basis for a year after the incident with negative results (Traut 1981 & 1994).

One of the findings cited by MAJ Spahn Depot Chemical Officer, is that examination of the 500 KG German bomb casings indicated metal approximately 16 gauge thickness (this was not measured). This metal was entirely to thin to withstand the rigors of shipment (Spahn 1946).

During the archives search, an old reproducible linen cloth drawing of the Dunn Road Area was found. In an erased area of the drawing, the faint remnants of the words "MUSTARD GAS" and the outline of a trench can be seen. By varying the tone and contrast levels of a blue print machine, the erased area becomes fairly readable, as follows:

TRENCH 100" LONG 10' DEEP



MUSTARD GAS

This area may be the neutralizing trench. The outlined area may also include the shallow pit used to destroy the bursters (See Map #3).

On 14 February 1947, MAJ Spahn, Depot Chemical Officer, requested disposition instructions for 32,636 lbs. of Acetylene Tetrachloride, which had been removed from Class "C", Agent, Decon., M4 4 1/2 and 3 gal. containers. He stated that the material contain rust and other impurities. If the material was deemed unsuitable for the WAA (War Assets Administration), then he requested authority to bury the Acetylene Tetrachloride. He stated that the RH 195 had already been buried (Spahn 1947a).

No other documents relating to this request were found during the Archives Search. Given the fact that the material was contaminated, permission to bury was most likely granted. Although no location is given for either the burial of the RH 195 or the Acetylene Tetrachloride, one would assume that the pattern of other burials would be followed. Both materials were probably buried at the Dunn Road Area (Map #3).

On 18 February 1947, 86,100 lbs. of Impregnite, CC-2, were destroyed by burial in a trench varying from 6 ft. to 8 ft. deep, 8 ft. wide and 40 ft. long. Containers were completely macerated by driving a D-8 bulldozer over the material introduced into the trench. Earth coverage of from 4 to 6 ft. was placed over the buried material and the area thereafter properly staked out to indicate that chemicals were buried in that location. Later the area was graded to accept storage of Bauxite (Spahn 1947b).

On 30 July 1947, a large cloud of smoke was observed due to thermal decomposition of the CC-2 buried in the Dunn Avenue Area. An earth dam was placed over the burial area and filled with water. The water was kept over the trench area until 6 August 1947 (Harris 1947, Spahn 1947b).

A comparison of the above documents, photo exhibits, a 3 September 1942 Fence Plan & Details and a 20 November 1942 Electric, Gas & Water Distribution Plan, indicates that the burial area is along the west fence line of the DUNN Avenue Area, approximately 450' north of Dunn Road and 50 to 100 feet inside the fence line (Map 3, Area A, Location # 2).

A second burial of 300,000 lbs. of XX-CC-3 Impregnite, occurred sometime after the above burial. This burial was originally scheduled for early 1946, but due to shortages in personnel and other priorities it was delayed (Owendoff 1946, Traut 1994)

The second Impregnite burial site identified is in the northeast corner of the Dunn Road Area. Two trenches (north to south) were dug for the burial (Traut 1981 & 1994) (Map #3, Area C, Location #3).

Chemical Identification Sets and Chlorinated Lime were buried in 1952-1953, location not specified in an 1981 interview with Mr. Anderson (Anderson 1981c).

Around 1955 or 1956, Chemical Agent Identification Sets (CAIS) were buried in the Dunn Avenue Area. At first they tried to send the broken sets to Pine Bluff, Arkansas, but received instructions to bury the sets on site. Mr. Anderson recalled doing this five or six times. He stated that CAIS sets in wooden boxes were put into pits intact and covered up (Map 3) (Anderson 1981a, 1981b, 1981c & 1994, Traut 1981 & 1994).

Mr. Anderson also recalled the burial of XX-CC-3 Impregnite during the 1955-1956 time frame. He said that most likely DANC, Chlorinated Lime and RH195 were also buried in the same general area (Map 3) (Anderson 1981a & 1994).

During the interview with Mr. Anderson, he stated that the same area (Dunn Avenue) had been used to test heavy engineer equipment (dozers, scrapers, etc.) by the Depot's heavy equipment repair shop and that the surface soil has probably been moved at least a hundred times. More recently the area was used to store vehicles from a Memphis reserve unit for vehicle storage while their armory was undergoing repairs. On weekends, mechanics would come in and work on the vehicles (Anderson 1981a & 1994, Smith 1981).

In a 1980 interview, Mr. Leonard Broyden, who had been an equipment operator at Memphis General Depot stated the following:

> " He didn't know anything of any chemical dumping. He indicated that he used to dig trenches for some of the residue material which was buried. He indicated that they put the perishables and the like, perhaps old food and things of that nature which exceeded the life date, into the Dunn fill site across from the Memphis General Depot on Dunn Road. However , this location has been covered up with bauxite ore."

5.3 Records Review

Records on the Memphis Defense Depot were reviewed at the following locations:

Memphis Defense Depot, Memphis Tennessee
- Environmental Office, Bldg 144
- Facility Engineers, Bldg 270
- Records Holding Area, Bldg 249

Historic Office, Edgewood Arsenal, Edgewood Maryland

National Archives and Records Administration, Suitland Maryland
Record Groups 77, 156, 175

Federal Records Center - Atlanta, Atlanta Georgia

National Personnel Records Center - St. Louis, Missouri

Copies of documents referenced are provided in Appendix A. A list of documents and maps reviewed, but not referenced is also provided at the beginning of Appendix A.

5.4 Interviews

Interviews were conducted with the following personnel associated with the Chemical Warfare Service at the Memphis Defense Depot:

Mr. Paul J. Traut - Worked with the Chemical Supply Section until drafted in 1943. He returned to the Chemical Supply Section in 1946 and worked there until 1960 when he transferred to the Consolidated Surplus Sales Office at the Depot.

Mr. Charles E. Anderson - Worked with the Chemical Supply Section in 1955 and 1956.

Mr. John F. Carpenter - Was a Corporal at Edgewood Arsenal and was flown in for the disposal of the German Mustard Bombs in 1946.

Mr. Edwin C. Pittenger - Was the Assistant Depot Chemical Officer in 1946.

Copies of the interviews are in Appendix D. Information obtained from the interviews has been included in the Historic Summaries of Operations and Disposals (Sections 5.1 & 5.2).

5.5 Aerial Photo Interpretation

The St. Louis District was able to find Aerial Photographs taken at the following times:

26 August 1945
7 February 1946
31 May 1951
8 April 1958
6 March 1963
8 March 1973
12 February 1990

All aerial photos were examined for areas of disturbed earth which might indicate a burial area.

The 8 April 1958 Aerial Photographs, reveal a small rectangular area, devoid of ground cover, at the far north end of the Dunn Avenue Area. This area does not match any of the known locations for disposals and burials at the depot. There is a potential that this area is an unrecorded burial of some type of unwanted material.

5.6 Site Inspection

The Memphis Defense Depot was visited twice during the preparation of this report. The first visit was to perform preliminary archive research and meet with personnel in the Environmental Office of the Depot. This visit took place from 18 April 1994 to 20 April 1994. The second site visit took place during the week of 24 October 1994 to 28 October 1994 and include reviews of depot archives and a site visit of the Dunn Avenue Area.

On the Main Depot, there is no surface evidence of ordnance in the area where the Pistol Range was removed. There also is no evidence of any kind of Mustard contamination in the area east of the two depot igloos.

In the Dunn Avenue Area, all areas which are suspected of burials or destructions were walked. No surface evidence exists in any of these suspected areas. The northeast side of the curved concrete loading dock has a black color in the center of the wall. This is possibly due to the testing of flamethrowers done by the Chemical Supply Section (photo, Appendix F). Surface evidence of any other unknown burials was not discovered during the site visit.

ORDNANCE AND EXPLOSIVE WASTE
CHEMICAL WARFARE MATERIALS
ARCHIVES SEARCH REPORT
FOR
MEMPHIS DEFENSE DEPOT
MEMPHIS, TN

APPENDICES

APPENDIX A

REFERENCES

REFERENCES

Anderson

1981a Team interview, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Anderson

1981b Whitten interview, dated 3 March 1981, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Anderson

1981c Jones interview, dated 3 March 1981, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Anderson

1981d Team interview #2, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Arthur

1946 Report of Investigation Concerning Receipt of German Toxic Gas Munitions at Mobile, Alabama and shipment of these Munitions to Pine Bluff Arsenal, prepared 1946, SS Francis L. Lee Files, Historic Office, Edgewood Arsenal.

Brophy

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DEGORG

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Dick

1957 Impregnite XXCC3, dated 19 December 1957, NPRC-MR 338-59-6363, Box 1/1, Folder 470.6 Oct 57.

George

1957 Procurement in Excess of $10,000, dated 15 August 1957, NPRC 338-59-6364, Folder 400.12.

Gross
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Harris
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Jonas
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Memphis
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Memphis
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Memphis
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Memphis
1960b Historical Information, Depot Files, Historic Office, Edgewood Arsenal.

Meyer
1946 Report on Shipment of Classified Chemical Munitions, dated 20 September 1946, SS Francis L. Lee Files, Historic Office, Edgewood Arsenal.

Michaels
1946 Report on emergency incident at Memphis, Tennessee, dated 11 September 1946,SS Francis L. Lee Files, Historic Office, Edgewood Arsenal.

Owendoff
1946 Report of Offical Travel, dated 11 March 1946, NARA Suitland, RG 175, Entry 4E, Box 75.

Patro
1957 Shipment of Tetrachlorethylene for Test, dated 2 December 1957, NPRC-MR 338-59-636A, Box 1/1, Folder "400.112 October-December Closed R57".

Pittenger
1947 Administration of Chemical Supply Section, dated 1947, Depot Files, Historic Office, Edgewood Arsenal.

Smith
1981 Interview, dated 3 Mar 1981, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Spahn
1946 Report on Shipment of Classified Chemical Munitions, Dated 30 July 1946, SS Francis L. Lee Files, Historic Office, Edgewood Arsenal.

Spahn
1947a Acetylene Tetrachloride, dated 14 February 1947, NARA Suitland, RG 175, 67A4900, Box 309

Spahn
1947b Decomposition CC-2, dated 6 August 1947, NARA Suitland, RG 175, Series 671.

Tomlinson
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Traut
1981 Interview, dated 4 Mar 1981, Supporting Documents, Installation Assessment Report # 191, Prepared by USATHAMA, on file at the Environmental Office, Memphis Defense Depot.

Wages
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Whitten

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Wittenberger

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Area North of Dunn Ave. Showing Bauxite Storage, Memphis General Depot, 16-4-A, no date.

Area North of Dunn Ave., Memphis General Depot, 16-4A, dated 9 April 1948.

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Depot Layout Plan, Memphis General Depot, 11-22, dated 10 February 1950.

Electric, Gas & Water Distribution, North Tract of Reservation, 7-22, dated 20 November 1942.

Fence Plan & Details, Memphis General Depot, 6-6, dated 3 September 1942.

General Layout & Location Plan, Memphis General Depot, 1-3, dated 9 February 1942.

General Site and Building Use Plan, Memphis General Depot, dated August 1951.

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Edgewood Arsenal.

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1946 Report on Shipment of Classified Chemical Munitions, dated 20 September 1946. Edgewood Arsenal Archives Files, Edgewood Maryland.

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Memphis General Depot, Depot Files, Edgewood Arsenal Archives Files, Edgewood Maryland.

Gillet
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Gross, D. & Others
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Matzner
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Meyer, Charles A. First Lieutenant
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Michaels, Harold First Lieutenant
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Unknown
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96 30

INSTALLATION	REPORT CODE

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Charlie Anderson	PRESENT PREVIOUS		

1.) Chem Parts center to memphis in 1951 from Edgewood, things handles included gas masks, smoke generators, flamethrowers (M2A1-M4), calcium hypochloride, squibs blasting caps, XXCC3, -249

2.) Tested flamethrowers along Ball ~~road~~ road in trees then 51-52. Dunn field in 53

3.) Fuel oil used for fuel, of flamethrowers

4.) Smoke generators tested in Dunn field until 54
TNT plant near millington used for smoke generators

5.) Everything came in from camps for reissue some maintenance on flamethrowers, smoke generators

6) 330-229 - repair parts & end items

7.) Pond used to truck mounted decon units

CN, Blasting caps, (WP, FS came in error went to Pine Bluff

INTERVIEWER	DATE
Team	

198a

9.) Training sets, calcium hydrochloride buried in Dunn field
10.) CN capsules burned in burning pit.
11) Chem Corp from '46 through 1958 - to Atlanta
12.) Alcohol in 319 in 50's
13.) Bomb trailers stored in open areas
14) Truck mounted Decon apparatus in shed
15.) XXCC 3 caught on fire in 56 in Dunn field ~~while~~ trying to buried got rained on. 6-8 ft deep hole
16.) Engineers used Dunn field for testing buldozers

~~Jim~~ Colsen - Paul Trout - Chem. Corp. Retired
~~Inspector~~ Chief, QA

17.) Chem Corp Ofc - Chandler, Rock, Chem Storage Ofc. - Christophersen, Ogden
Stopped burning garbage in early 60's
18.) Training sets in wood boxes buried in tact.
19.) Otho taludine in glass containers
20.) Unservicable chemicals buried
21.) Fuming nitric Acid - small bottles
22.) Equip ~~manager~~ since 67 -
Bldg 720 - Depot & ~~Field~~ maint. - vehicle
Electric lifts - 489 Sec. 4
490 - Maint Shop of mechinization of WH equipment
23.) Maint of locomotives in 720 - 2 loco, 12 rolling stock
24.) Lubrication etc
Steam cleaning 770 -
2 portables in 720, 1 water pool 253
253 & 770's - wash rack - underground tank not used since 50's
25.) White oil in 55 gal drums to PDO. Antifreeze - not disposed of

INSTALLATION: Memphis Depot	REPORT CODE
PURPOSE/AREA OF INTEREST	

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Anderson	PRESENT / PREVIOUS	since 1951 29 yrs.	

1) chem. to Memphis in 1951
2) Test flame thrower in general area of bldg 690 — flame throwers, Ca Hypo chloride Training kits, (chemical gas?)
Woods then.
Tested in Dunn field later upto 1954
Regular fuel oil used. 50-75 ft. flame
No jel-gas
3) smoke generators in Dunn field at flame thrower area
4) Dank stored in - Bldgs 330 & 229
5) large pond used to test truck mounted decontam. units
6) Training sets in Dunn field
Ca-hypo chloride
Cn capsules in burning pits in Dunn field 1952-53
7) chem. corp out in 1958
8) 180 proof alcohol in 319
9) Chem. systems in bldg (229, 230, 219, 349, 330 & 227 area)

INTERVIEWER	DATE
Whitten	

1981 B

10) Fire in Dunn field ~1956 after rain on XXCC-3
11) covered over after 6-8 ft. deep.
James R Colson
Paul Traut
> old chem. system. (retired)
Colson - inspector
Traut - chief quality assur. officer
12) Flourspar stored since WW II covered with plaster of paris type mat.
13) burning pitts in Dunn field
CN capsules
14) T.D scls buried in area B in 1955
15) Equip. Manager since 1967
left chem. corp 1957
16) Bldg 770 equip maint vehicle /no rebuilding
17) 490 - mechanical complex maint focal point
489 - electrical lift maint
18) 720 - round house depot maint.
19) steam cleaning installed 770, 720, & motor pool parts (253)
20) drainage from wash rack into drainage
21) storage tank for solvents in 770 (55 gal. drum)
22) underground storage tank in 770 not used now
23) 253 & 770 & 489 battery electrolyte
24) 1088 sand blasting unit for SET
25) Underground tanks in ground since 1941, no testing for leaks (?)
26) med. storage in 859
27) haz. stor in 629

96 34

INSTALLATION	REPORT CODE
MEMPHIS	

PURPOSE/AREA OF INTEREST

CHEMICAL INSPECTOR / 29 yrs ago

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	PHONE
Mr Anderson		29	

1. Edgewood to Memphis : no levi[illegible] —
Gas masks, Cal. hypochlorite,
CN capsules
Blasting caps
Squibbs –
– I.D. kits. training kits – Simulated Gases
wood box + canister
Flame thrower – M-4, tanks only
pressure reg. + hydrostatic test
2. Tested flame thrower
Where were WHS (51 and 52" went to Dwarf[illegible])
Fuel oil + ignited = 50' to 75'
3. Gel GAS Not here
4. Chlorinated Paraffin – on shoes – decontaminate + boots.
5. Smoke generators – same place (whites) SGF-1 + 2 Fog oil

INTERVIEWER	DATE
RL Jones	3 Mar 81

1981c

6. 1954 quit using area and went to TNT plant at Milan (Chickasaw) 96 35

7. Surveillance tests (records kept in chemical corps office + edgwood)

8. Rebuilt F.T. + all returns were repaired for reissue

9. No operational impregnation units

10. DANC Storage : WH 330 + WH 229 (repair parts) (end items)

11. Pond used to clean truck mounted decon. units. (water only)

12. Igloo's blasts cags, cn capsule, WP (etc.) sent to Pine Bluff in error only

13. No live munitions burried

14. ID sets, "CN" chlorinated lime burned 1952-1953 destroyed capsules in burning pit. (since been wooded)

15. End item (Chemical) 1946 — 1958 went to [illegible]

16. Maga. removed prior known of

17. XXCC-3 Stored in 8/4249

18. 190 proof alcohol storage NB 1 + NO-2 (319 mon)

19. OS. storage on bond trailers.

20. No disposal in TNT plant 2 20 mile [illegible] area

21. Fuel oil spillage of anything — at Chickasaw.

22. XXCC-3 caught fire in "56" in demo field 6-8' deep during burning [illegible]

INSTALLATION	REPORT CODE
MEMPHIS	96 36

PURPOSE/AREA OF INTEREST

CHEM. INSPECTOR /

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Mr. Anderson	PRESENT PREVIOUS		

23. "Paul Traut" + "JAMES R. Coleson" CS Prog
Qual. IDs Inspector

24. Chemical officers: Col. Chandler, Major Rock,

25. Christofferson: Chemical Storage officer:
Augsdon depot

26. Sanitary type burning in Dunn field:
CN cap. only burned

27. ID kit burried in tact: Wood box —
DUNN Field: "6" Not ID training kits

28. Fuming Nitric —
(FS + other chemicals in drums - liq smoke)
Sent on to Pine Bluff

29. Egypt Hq 67
left chemical 1957

INTERVIEWER	DATE
R. L. Jones	3 Mar 81

1981c

30. Maintenance shop 770 - rebuild held to min. 96 37
depot & field maint (vehicle)
Fell out maint. Sol guard 2½ type largest
31. Bld 489 - Elect lift
32. 490 - Entire mech. complex
33. Bld 469 refurbish. by mag for electrical
battery recharge etc.
34. Round house - locomotive + 12 pieces of
rolling stock -
depot maint. " annual test by any "
35. Steam cleaning operation - Bld. 770 (2)
mobile units:
bld. 253 & roundhouse area
36. Wash racks 253 + 770 — to drain (??)
Bld 252 closed off washrack 15 years ago
37. Waste oil → 55 gal drum to PDO
38. No antifreeze loss. — drain hold + recycle
39. Small amt of solvents → 10 gal year 770 Bld
55-gal drum
40. "50" when underground. tank used (770 Bld.)
inactive since
41. Batteries storage intact 770 Bld + Bld 253 + Bld 489
Battery storage
42. Sand blasting outside on conc. pad. near TR-2
1088 Sandblaster
operation maintenance
43. Sand on grnd. in area — (Col. Herman)

INSTALLATION	REPORT CODE
MEMPHIS	96 . 38

PURPOSE/AREA OF INTEREST

CHEM INSPECTOR

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	PHONE
Mr. Andersons.			

44. Burning operation between rail road + bank only dunnage 15 year ago stopped
45. ~~[illegible]~~ old PDO area excavated + Blds on — moved dirt around
46. Underground. Tanks - tests - (when installed) 1941 when installed
47. Fac. Eng. 55 gal for railroad greasing op. PDO gets remainder
48. Dust control many years ago.
49. No troop training on post since here
50. Leases None
51. Clinic "since day one" mission ~~[illegible]~~ First Aid etc.
52. Bld. 359 Storage Medical mission — "critical type" in Public health down town Memphis
53. Bld 629 spill clean up materials -
54. 1086 building referred to haz waste storage

INTERVIEWER	DATE
RL Jonas	3 Mar 81

1981c

55. Everyday trash / Refuse Service in house
Sanitary land fill outside
Off Shelb. Drive:
Private own. City operate —
Pay city —

(HH) Contract cont. officer / Maj Hixson

56. 1st. Between Center + Airport: 50's
2nd. Behind Airport
3rd. off "Tulahoma? Rd:" East Memphis

57. City => sewage + water supply ~~[illegible]~~ Dept

58.

INSTALLATION	REPORT CODE
Defense Depot Memphis	96 .40

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Charles E Anderson	Chief Op. Mat Div; PRESENT PREVIOUS Chemical Corps Insp.	1951 - 29 yrs	5201

1. Came to Memphis in 1951 - [illegible] ammo chlorinated paraffin - [illegible] gas mask, Ca hypochlorite, CN [illegible], blasting caps [illegible], flame thrower (M2 A1, M4), XXCC-3, DANC
2. Gas I.D kits - no
3. Simulated gas - identification and instruction kits
4. Tested flame throwers - 690 Bldg. area
5. Used fuel oil in flame thrower (fog oil)
6. Smoke generators - white smoke (smoke-[illegible], fog oil)
7. TNT plant back of Millington - tested smoke generator
8. Built flame throwers - for repair and rebuild
9. materials come in for [illegible]
10. Decon truck units - [illegible] water
11. Fire [illegible] - used to test truck mounted decon units.

INTERVIEWER	DATE
[illegible]	3 Mar 1981

#2

1981d.

12. Igloos – CN capsules, blasting caps,
13. W.P. grenades
FS
Big smoke
} came in by error and was sent to Pine Bluff
14. CN Capsules destroyed in Dunn Field at burning pits (@ 1952)
15. W.P. kept in igloos until sent to Pine Bluff
16. Magazines removed before 1951
17. XXCC-3 was stored in XX CC-3 in B 249
DANC – storage area ?
18. Millington – on HW 51 N about 20 miles N of Memphis (Former TNT plant in W.W. II "Chickasaw"
19. Old open storage > SP-10 truck mounted decon unit
20. Open improved area – bomb trailers
21. @1956 – XXCC-3 fire in Dunn Field by TR 46
22. Dug holes in Dunn Field – as offices for Edgewood Area
23. Fluorspar – covered (plastic of grass) to hold in tact
24. Burning pits (3 freshly covered this year)
– wastes from installation. only chem item. waste (no good) CN capsules.
25 H/L
26. Equip Mtg. since 1967 (Veh maint and Station paint shop
27. Jeff Chem Corp in 1959
28. Rebuild – matching depot [illegible] maint (Bldg 770, 489 (Elect La[illegible]
[illegible] to [illegible] 466 this year

INSTALLATION
Def Depot Memphis

REPORT CODE

PURPOSE/AREA OF INTEREST

PERSON CONTACTED
Mr Anderson

TITLE/POSITION
PRESENT
PREVIOUS

YRS AT INSTALLATION

PHONE

29. 770 - steam cleaning installed
253 } portable units (lotion) used
Round House Area }

30. 253/770 - Wash racks
31. ~~~~ 552 - Wash rack - not used for 15 years.
32. Waste Oil - 55 gal drums -> PDO

33. waste antifreeze - recycle
34. solvents - storage tank (770) 55 gal
35. Underground tank 770 - used in 1950's
36. Veh on paint handled in Bldg 770
37. Get resource work on "fall out" process for
master
38. Sand blasting - sand left on ground
↳ under Col Newman (Ch. Receiving)
39. 55 gal drum waste oil/ yr used to grease railroad
switches - rest to salvage.
40. No laboratory operations
41. Bill Gray in S&T - Haz Waste Storage Area

INTERVIEWER
Tom

DATE
2 Mar 81

A2

1981d

42. Haul trash to privately owned dump through arrangement with Memphis city (4th dump)

1950's - sand dump between levee & airport
2nd - one behind airport
3rd - off Tulsahoma Rd

15√

REPORT OF INVESTIGATION CONCERNING RECEIPT OF GERMAN TOXIC GAS MUNITIONS AT MOBILE, ALABAMA AND SHIPMENT OF THESE MUNITIONS TO PINE BLUFF ARSENAL

[redacted]

SECTION II

INVESTIGATION AT MEMPHIS, TENNESSEE

7. Two inspections were made of the activities at Memphis, Tennessee; one on 16 July 1946 (1215 CST to 2230 CST) and the second on 24-25 July 1946 (1000 CST to 2000 CST 24 July 1946 and 0830 CST to 0830 CST 25 July 1946). A detailed, chronological report is contained in Tab C.

8. 16 July 1946 Inspection.

a. Situation: The Memphis General Depot Chemical Officer, Major Spahn, was informed at 1100 hours, 13 July 1946 that a tank car of poison gas was leaking in the Missouri-Pacific Railway Yards. Upon investigation he located a box car containing chemical munitions. A chemical substance, having an odor similar to U.S. mustard, was leaking from the two doorways and from opposite and diagonal corners of the car. He immediately commenced decontamination of the car and adjacent areas. Another contaminated area was subsequently found 30 feet from where the car was standing. At approximately 1730 hours, 13 July 1946, Major Spahn located an additional seven cars of toxic-filled munitions, two of which were leaking badly. By 1845 hours, 13 July 1946, the eight cars of toxic munitions had been switched to an isolated siding in the Memphis General Depot Area. Decontamination along Track No. 7 in the switching yards was continued until dark 13 July 1946. Guard posts were established at once at the extremities of the contaminated zone in the switching yards, and later around the area on the Memphis General Depot Reservation to which the eight carloads of toxic munitions were moved. These guard posts have been in continuous operation since that time. Report of the situation was made to OCCWS on 14 July 1946. Decontamination of all areas over which the toxic-filled cars had travelled was initiated as early as possible and subsequent decontamination has been performed as required. A CWS Guard and Security Detachment and an Edgewood Arsenal Medical Division officer were flown to Memphis, Tennessee, upon OCCWS order to assist in handling the toxic chemical munitions at that locality. At the time of this inspection only two Memphis casualties had developed. Three Amory, Mississippi, casualties were also being treated in Memphis hospitals.

b. Discussion: It appears that the Memphis General Depot Chemical Officer, Major Spahn, took all necessary precautions for the safeguarding of civilians and private property from damage resulting from chemical contamination. Decontamination of contaminated areas was commenced immediately upon location of the contaminated car. Additional contaminated areas and cars were worked upon as soon as they were located. Steps were taken to isolate the shipment at the earliest practicable

[redacted]

[redacted]

moment. Considering the lack of trained personnel available to Major Spahn on 13 July 1946, it is my opinion that he took all necessary measures and action which a prudent officer would take in a similar situation. Upon arrival of reinforcements from CWS Guard and Security Detachment, Edgewood Arsenal, immediate action was taken to expand the scope of activity to insure a complete and thorough decontamination. The climatic conditions at Memphis, Tennessee, produced difficult working conditions. The average daytime temperature has been in the 90 degree bracket with a 10 to 15 degree differential at night time. The humidity is very high. These climatic conditions, together with the restrictions imposed by security measures including the wearing of protective clothing and other equipment, materially reduced the efficiency of all workers. The fact that positive tests were obtained in the contaminated areas some five days after the original contamination leads to the belief that the chloride of lime has a much lower available chlorine content than is prescribed for standard decontamination. This can only be ascertained by analysis of the substance.

9. 24-25 July 1946 Inspection.

a. Situation: All railway trackage had been decontaminated. All trackage except Track No. 7 in the Missouri-Pacific Memphis switching yards was in use. By 1800, 24 July 1946, negative tests had been obtained for three consecutive days and Track No. 7 was released at that time. The five cars of non-leaking munitions had been shipped to the CWS Depot. The three cars of "leakers" had been unloaded and 15 leaking bombs had been removed. Five of the 15 "leakers" had already been destroyed by chemical means. Six were in the process of being destroyed and four that developed during the night 24-25 July 1946 remained to be destroyed. The "non-leakers" were being reloaded for shipment to the CWS Depot. One carload was ready for shipment. All contaminated areas on the Memphis General Depot Railroad were under constant surveillance and decontamination was performed as required. A total of 21 local casualties (5 Frisco Line Railroad employees, 3 Missouri-Pacific Railroad employees; 7 Memphis General Depot civilians employees and 8 military personnel) and 5 casualties transferred from Amory, Mississippi, have been treated.

b. The second inspection at Memphis, Tennessee, disclosed that all activities outside the Memphis General Depot Reservation were under control. All the railway trackage had been returned to the railway companies for normal usage by 1600 CST, 24 July 1946. The work on the destruction of the leaking bombs and reloading of the good bombs for shipment to the Chemical Warfare Service Depot was progressing slowly. This in part is due to the difficulty of local climatic conditions. Car loading of 1000 lb. and 500 lb. bombs is very difficult when it must be accomplished almost entirely by manual labor. Loading operations are conducted at night in order to obtain maximum efficiency from the working crew. Destruction of the toxic agent while relatively close to inhabited areas appeared to be satisfactory inasmuch as it is strictly controlled with only small quantities of agent being released into the destruction

[redacted]

[redacted]

trench at any one time. Tests made by Lt. Colonel Arthur's Technical Advisor reveals that such practice is safe. No toxic vapors were detected at a distance exceeding 300 yards downwind from the disposal pit, even under favorable inversion conditions. All local casualties with the exception of two military personnel are reported to be very mild. Captain Whittenberger believes that no permanent damage will result to the persons concerned.

10. Comments. The situation at Memphis developed without warning. With no trained military personnel at hand, Major Spahn took immediate action to retard the menace resulting from the leaking gas bombs in the Missouri-Pacific Railroad yards. The Railroad officials were satisfied with the action which had been taken. All areas were kept under constant surveillance until negative information concerning chemical contamination was obtained. The decontamination work has progressed very slowly and it is believed that this is due in part to the rather low available chlorine content of the decontamination agent. Destruction of the toxic gas has been performed with due regard to safety and security measures. Unloading and reloading the railroad cars has progressed slowly. The slowness of this operation is due, in part, to the local working conditions and in part to the small crew available for this job. Within a few day's time from the date of inspection the entire situation should be satisfactorily settled.

11. Recommendations. No specific recommendations are made for improvement of the work being conducted at the Memphis General Depot. Certain general recommendations for incorporation into future standard operating procedures, based upon lessons learned from this and related activities, are contained in Section VIII.

SECTION III

INVESTIGATION AT AMORY, MISSISSIPPI

12. An inspection was made at Amory, Mississippi on 17 July 1946 (1100 - 1400 CST). Telephonic conference was held with Captain Walker and Lt. Katzner on 24 July 1946. A detailed, chronological listing is contained in Tab D.

13. 17 July 1946 Inspection

a. Situation: One railway car containing leaking toxic gas munitions was discovered in the Amory Switchyards by the Guard and Security Detachment assigned to the train which originally contained ten carloads of toxic chemical bombs. The shipment originated at the U.S. Naval Magazine at Theodore, Alabama. One car of leakers was discovered at

[redacted]

bomb removed from the hold was inspected to ascertain whether or not it was leaking. Only non-leaking bombs were loaded into railway cars for inland movement to CWS Arsenals. Leaking munitions or those suspected of being leakers were separated for surveillance. 30 one-thousand pound leaking bombs and 8 five-hundred pound leaking bombs were dumped in the Gulf on approximately 15 or 16 July 1946 as an emergency measure. At the time of the inspection 137 one-thousand pound leaking bombs, 12 five-hundred pound leaking bombs as well as 8 five-hundred pound bombs which were vapor leakers were under surveillance pending decision of OCCWS as to their disposal. During the operation an additional 20 bombs which were vapor leakers were patched and 16 leaking bombs were soldered and after surveillance and inspection were shipped to CWS Arsenals. Not only was each individual bomb inspected before being loaded into railway cars but each car was inspected prior to release to the railway for inland movement. Each car inspection team consisted of a CWS representative, an Inspector of the Bureau of Explosives, Association of American Railroads, a representative of the Ordnance Department and a representative of the Transportation Corps. Unloading operations had been suspended at 15 151600 July 1946 upon direction from Washington. The munitions which were leakers or suspected leakers and the entire pier was under constant surveillance and periodic decontamination. The dock and adjacent area appeared to be safe for use. All military personnel who were interviewed are of the opinion that the majority, if not all, of the injuries sustained by the civilian stevedores resulted from their own carelessness and even negligence.

24. In accordance with decision made in Washington on 19 July 1946, the SS Francis L. Lee was prepared for movement to Charleston, South Carolina, where the remaining cargo was to be disposed of by dumping at sea. By 220530 all non-leaking munitions at the dock had been reloaded and these together with the munitions which had not yet been unloaded totaled 683 tons.

25. A ten car shipment was dispatched from the U.S. Naval Magazine at Theodore, Alabama on 11 - 12 July 1946 with three CWS Guard and Security Detachment NCO's as escort. Prior to this time, shipments had been made in excess of 2500 tons of toxic munitions without incident. Enroute to Pine Bluff Arsenal one of the ten cars developed a "leaker(s)" and was removed from the train at Panola, Alabama. One non-commissioned officer remained at Panola in charge of the leaking car. The remaining nine cars were dispatched for their final destination. At Amory, Mississippi, another car commenced to leak. This was removed from the train and a CWS Guard and Security Detachment non-commissioned officer remained at Amory, Mississippi to decontaminate and control the car. The eight non-leaking cars continued toward Pine Bluff Arsenal under escort of the remaining CWS Guard and Security NCO. At Memphis, Tennessee, three of the eight cars developed leakers and were subsequently moved to an isolated area on the Memphis General Depot Reservation. Prior to the finding of the leaking cars at Memphis, Tennessee, the non-commissioned officer, acting as security escort, became incapacitated and reported to a local hospital for treatment. The

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car which had been removed from the train at Pascola, Alabama, was brought under control and returned to the U.S. Naval Magazine at Theodore, Alabama, without incident. The non-commissioned officer remaining with the car at Amory, Mississippi, developed injuries sufficient to warrant hospitalization and was removed to a local facility for treatment. Subsequently the railway car was isolated on a siding three miles north of the town. A CWS Guard and Security Detachment from Edgewood Arsenal arrived on 14 July 1946 and immediately commenced decontamination of all areas over which the leaking cars had passed. The efficient operation quickly brought the Amory situation under control. By 17 July 1946 nineteen civilian injuries, eighteen of which were railway employees, had been treated at Amory, Mississippi. By 24 July 1946, 21 casualties had developed in the Memphis area, of which ten were military personnel. Three cars commenced to leak after arrival in Memphis, Tennessee. The quick action taken by the military authorities at Memphis, Tennessee resulted in isolating the leaking cars without unfavorable local incident. On 24 July 1946 a total of 21 injuries had been treated at Memphis, Tennessee. Seven of which were at Memphis, are Army General Depot civilian employees who had received mild contamination from vapor in areas adjacent to the isolation site.

26. A detail from the CWS Guard and Security Detachment, Edgewood Arsenal, was sent to Memphis, Tennessee where they were employed to perform the necessary decontamination, to reload the non-leaking munitions for shipment to the CWS Arsenal and to dispose of the leaking bombs.

27. On 25 July 1946 all activity at Memphis was progressing satisfactorily although rather slowly. The slowness of the operation was due to local climatic conditions, as well as to the magnitude of the task.

SECTION VII

Conclusions:

28. After review of all evidence obtained during the inspection, Lt. Colonel Arthur and 1st Lt. Kutschinski conclude:

a. That the initial preparations for handling toxic cargo at the U.S. Naval Magazine Dock, Theodore, Alabama, were inadequate in that change rooms and decontamination facilities were not prepared for the stevedoring crews and that the facilities for storage and issuance of individual protective supplies were not in existence until the operation was under way. These deficiencies were corrected during the operation and prior to the arrival of the inspection team.

b. That initially the storage and care of individual protective equipment was unsatisfactory. This condition was corrected by Captain Allyn when he assumed control of the Transportation Corps activity on 8 July 1946.

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[redacted]

was being concealed from the public. The local news item was satisfactory. However, AP items originating in the Memphis area were inclined to be sensational. Two clippings were obtained from Mr. Farrow to illustrate the general tenure of the Memphis newspaper articles (Annexes I and II). Copies of all clippings appearing in the Memphis papers will be obtained and forwarded with Major Spahn's formal report.

6. The Depot Commander, Colonel Evans, seemed to be satisfied with the progress being made. He is somewhat disturbed because the eight cars of toxic munitions are blocking entrance to his salvage yards. He has considerable quantities of salvage which has been sold and which is merely awaiting shipment. At this time it appeared that the situation could be cleaned up in approximately 5 to 8 days. He did not appear too critical upon receipt of this information.

7. Inspection of the Area Where the Eight Carloads of Toxic Munitions Were Being Held.

The eight loaded cars, three of which contain leakers, are being held on a siding adjacent to the Memphis General Depot salvage yards. At the time of the inspection on 16 July 1946, the three leakers were under control. The area had been sprayed with the standard slurry mixture, the leaking cars had been treated with slurry and DANC. While vapors could be detected by their odor they did not travel too far nor did they disrupt too much activity of adjacent depot facilities. At the time of the inspection none of the cars had been thoroughly investigated and only one had been opened. The entire area in which the cars are located and the immediate adjacent area is off limits. Guards are stationed at the principle entrance ways to prevent unauthorized entrance. These guard posts function on a 24-hour basis. Civilian guard personnel under the Depot Commander are utilized for this function. The guards are equipped with gas masks for their protection when the vapors are strong. The cars and area are under constant surveillance. Necessary decontamination is performed as required. Local Depot facilities exist which will permit transferring the bomb load from leaking cars to non-contaminated cars.

8. Inspection of the Trackage in the Missouri-Pacific Railroad Switch Yards.

Track No. 7 in the Missouri-Pacific Railroad switch yards is off limits and is under 24-hour guard provided by the civilian police detail assigned to the Memphis General Depot. At the time of the inspection faint mustard-like odors were noticeable at several small spots. Use of the M9 detector kit directly over these spots indicated the presence of mustard as follows: 10 pump strokes, negative reaction; 30 pump strokes, very slight reaction; 60 pump strokes, slight reaction. No general area contamination existed. The length of the restricted area in the switch yards is approximately 800 feet although probable contamination is limited to several small spots. The entire area has been decontaminated with slurry mixture, as described in Major Spahn's remarks. The heavily contaminated spots have also had chloride of lime mixed into the

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earth and at two of the heavily contaminated spots, DANC was also used.

9. Interview with Mr. N.N. Hopkins, Superintendent of the Missouri-Pacific Railway and Memphis Switching Terminal.

Mr. Hopkins stated that he was satisfied with the action that had been taken by the Army authorities. He is very anxious to have Track No. 7 released in a useable condition as early as possible. The loss of this track hampers their switching operation to a considerable extent.

10. Interview with Mr. Orie L. Young, Superintendent of Memphis Terminal Frisco Lines Railroad.

During the interview Mr. Young stated substantially as follows: The Frisco Lines Railroad had no knowledge of leakers in Memphis until they were informed by the Union Railroad (the Memphis switching company handling car transfers between the Missouri-Pacific and Frisco Lines yards) that one of the eight cars delivered from the Frisco line switching yards to the Missouri-Pacific Railroad switching yards was leaking badly. The information concerning the leakers was received from the Union Railway 45 to 60 minutes after being moved from the Frisco Lines yard. Mr. Young stated that while the train was being processed in the Frisco yards that the following routine inspections were performed prior to release of the cars to the Union Railway for switching.

a. Two car inspectors (one checking each side of the cars) performed their routine inspection of all cars on the incoming train of which these eight cars of toxic filled munitions were a part.

b. A routine top inspection was made of the entire train.

c. A railway yard clerk "carded" the cars on the right (North) side.

d. The brakes of these cars were tested with the routine terminal air test.

Frisco Lines Railway employees cut the eight cars from the incoming train after the inspections reported above had been performed and held them in front of their switching tower pending pick up by the Union Railway. The eight cars were directly in front of the Frisco Line switching tower for sometime prior to being picked up by the Union Railway locomotive. Persons working in the tower had not noticed a leaking of any substance from the cars nor were any foreign odors detected. Mr. Young further stated that up to the time of the interview (1950 CST, 16 July 1946) no employee of the Frisco Lines Memphis switching yard had reported injury from chemical contamination.

11. Discussion with Frisco Lines Railroad Superintendent of Transportation Concerning Decontamination of Mainline Right of Ways.

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During a telephonic report to OCCWS it was learned that Colonel Gillet, Chief of Supply and Distribution Division, OCCWS, had received a request from the Frisco Lines Claims Agent for the Chemical Warfare Service to decontaminate the entire mainline right of way over which these eight carloads of toxic filled munitions had passed. The inspection team was requested to contact the proper railroad officials and make satisfactory arrangements for insuring the protection of the railroad employees and equipment. Mr. Young, Frisco Lines Superintendent of Terminal at Memphis, endeavored to contact several officials of his company having jurisdiction over that particular sector. He was unable to establish contact with these officials and later referred the matter to Mr. A.M. Ball, Frisco Lines Superintendent of Transportation, who is stationed at Springfield, Missouri. In telephonic conference I discussed the general problem with Mr. Ball and suggested that the Railway furnish a time table of all "delays enroute", whereupon Major Spahn's office would furnish an officer to check each area where the train had halted during the trip from Amory, Mississippi to Memphis, Tennessee. By the use of the M9 detector kit it would be possible to ascertain whether or not chemical contamination existed in those areas. If an area tested negative at these points of stop, which would be the logical zone of heaviest contamination if there were one, there was no use decontaminating the right of way from that point to the next point where the train had halted. Coverage of the entire right of way in this manner would indicate any areas that might be contaminated. If a contaminated area were located further tests would be made to determine the exact length of the contaminated zone. Any contaminated areas could then be satisfactorily decontaminated. Mr. Ball agreed to this proposal and Mr. Young was instructed to furnish the railroad "delay enroute" report as well as a scooter car for coverage of the mainline route. It was also agreed that a Memphis-Frisco Lines official would accompany the officer making the inspection. Captain Whittenberger was designated as the officer to make the reconnaissance.

12. Directive Given to Major Spahn.

At the conclusion of the inspection at Memphis, a conference was held with Major Spahn and Captain Whittenberger. The entire problem was surveyed and the following directive was given to Major Spahn who concurred in all points.

a. Decontaminate Track No. 7 in the Missouri-Pacific switch yards again on 17 July 1946, by using the standard slurry method. Use additional dry mix on the heavily contaminated spots where the leaking cars had stood; further facilitate the decontamination process by raking and spading the dry chloride of lime into the earth at the heavily contaminated zone.

b. Continue daily tests with the M9 detector kit along Track No. 7 in the Missouri-Pacific switch yards and at the earliest possible time, compatible with complete negative tests, release this trackage for use by the Missouri-Pacific Railway.

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c. Inspect the five non-leaking cars at the earliest practicable time to insure that no leakers were present in the load. If the cars do not contain leakers ship them at once by night freight to Pine Bluff Arsenal. Prior to release to the railroad for transportation, and before leaving the Memphis General Depot Reservation decontaminate the undercarriage of these cars.

d. With the highest priority, inspect the three cars of leakers, remove the good bombs for reloading in uncontaminated railroad cars; decontaminate bomb crates or cases which had been contaminated by the leakers prior to loading in the uncontaminated cars; ship these as rapidly as possible to Pine Bluff Arsenal in accordance with the procedure listed above for the other five cars.

e. Destroy or bury the leaking bomb containers in accordance with existing practices outlined by OCCWS. Major Spahn states that area is available on the Memphis General Depot Reservation for this procedure to be accomplished. (A call was made from Columbus directing that an investigation be made of the burster well before destruction to ascertain if an explosive charge were in the bombs. Message was given to Mr. Claxton, Fiscal clerk, during Major Spahn's absence, at approximately 1530, 24 July 1946).

f. Remove contaminated floors and siding from the railway cars and dispose of by burning in the same area indicated in e above. Decontaminate the stripped railway cars prior to their release to the Railroad Company.

g. Make an inspection of the Frisco Lines right of way over which the eight cars had travelled on 17 July 1946.

h. Submit a formal and complete report to the OCCWS, Attention: Assistant Chief, CWS, for Operations, together with a copy of Captain Whittenberger's final formal report and a copy of all press releases appearing in the Memphis papers.

i. Determine, at the earliest practicable date, the chlorine content of the chloride of lime which has been used in decontamination work.

PART TWO - 24-25 JULY 1946 INVESTIGATION

15. Interview with Major Spahn

Major Spahn stated that Track No. 7 in the Missouri-Pacific Memphis switching yards had not yet been released (1100 CST, 24 July 1946). However, for two consecutive days negative tests have been obtained. It was contemplated that the track would be released at 1800 hours, CST, 24

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July 1946, providing that a third negative tests was obtained. Major Spahn stated that tests of the Frisco Lines mainline right of way on 17 July 1946 were completely negative. The five non-leaking cars of the original eight car shipment had been inspected and found in good order. These five cars were shipped from the Memphis General Depot at 2200 CST, 17 July 1946. One NCO and one enlisted man of the CWS Guard and Security Detachment accompanied this shipment. The car received from Amory, Mississippi, cleared Memphis, Tennessee, 22 July 1946. At the time of the interview, 1100-1200 CST, Major Spahn stated that seven 1000 lb. leaking bombs and four 500 lb. bombs had been discovered. The original three carloads of leakers had been unloaded and work was progressing on reloading these munitions into uncontaminated cars. The railway cars furnished for this reloading were smaller than the original cars in which the shipment had been made, therefore, four or five cars would have to be loaded out instead of three. One car had been reloaded and was ready for shipment on the night of 24 July 1946. (This was shipped with one officer, one NCO and one enlisted man as security guard at approximately 2200, 24 July 1946). Major Spahn states that much of the impregnated clothing which has been received has been in poor shape. It appears to be greatly deteriorated and does not stand up under normal working conditions. The bomb venting kit had not arrived on 24 July 1946. Major Spahn is somewhat dissatisfied with the discipline of certain of the CWS Guard and Security Detachment personnel. It appears that there was some trouble on the unauthorized use of motor vehicles by certain of the enlisted men and it also appears that certain of the enlisted men had been very careless of the protective equipment and in the enforcement of security regulations. Major Spahn states that he has the situation well in hand at this time. Major Spahn was particularly critical of Lt. Michael. It appears that Lt. Michael arrived at Memphis, Tennessee, with an erroneous idea as to his mission. Upon being informed of his functions by Major Spahn, Lt. Michael made a telephone call to Edgewood Arsenal asking for reinforcement of personnel. Major Spahn states that his relationships with Lt. Michael are now satisfactory. (Captain Whittemberger believes that the relationship between Major Spahn and Lt. Michael is one entirely based on misunderstanding of orders. Captain Whittemberger believes that Lt. Michael is a capable officer). At the time of the second visit to Memphis, Tennessee, Lt. Michael was at Amory, Mississippi, where he had been sent to relieve Lt. Matzner after the latter became injured due to defective protective clothing. (The protective suit which Lt. Matzner was wearing in a heavy gas concentration suddenly ripped and he was contaminated before proper prophylactic measures could be effected). Major Spahn states that analysis of the chloride of lime shows the available chlorine content to vary from 15 to 20%. Technical assistance from Pine Bluff Arsenal had been provided (an explosive expert, a tonic yard foreman, and skilled car loaders). Additional CWS Guard and Security personnel were also at Memphis.

14. Interview with Mr. _____, Pine Bluff Arsenal Explosive Expert.

Mr. _____ stated that the 500 lb. bombs appeared to contain

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an explosive charge in a peculiar well assembly which could not be removed. The procedure employed by Major Spahn for detonating these explosive charges after the chemical filling has been drained from the bomb is safe. No explosive charges appear to be contained in the 1000 lb. bombs investigated at Memphis, Tennessee.

15. Interview with Captain Whittenberger.

Captain Whittenberger stated that a total of 40 people had reported for medical examinations. An additional 75 to 100 persons were inspected. Of the total number examined, 24 casualties had been treated (4 Frisco Lines Railroad employees, 5 Missouri-Pacific Railroad employees, 7 Memphis General Depot civilian employees, 10 military personnel. Of these 24 total casualties, three are transfers from Amory, Mississippi — Mr. Rorie, Sgt. Steinberger and Sgt. Woronowshima). Four patients have been released, leaving a total under treatment at this date of 20.

16. Investigation of Disposal Area.

The disposal area is located in an isolated section of the reservation. Two 1000 lb. bombs and three 500 lb. bombs had already been destroyed. Six additional bombs were in the process of destruction. (Four additional leakers developed during the night 24-25 July 1946. These were to be destroyed 25 July 1946). The destruction procedure employed is as follows: A large pit 30 feet long, 7 feet wide and 12 feet deep had been excavated. Prior to utilization a heavy rain nearly filled the pit with water. The majority of this had been pumped out by the Depot fire department prior to the destruction proceedings. Ten large drums of chloride of lime had been mixed with earth and placed in the bottom of the pit. The sides of the pit and adjacent area had been well slurried prior to utilization. The bombs to be disposed of are spread out along the sides of the pit and opened by rifle fire into the nose. The chemical content then drains into the pit. During the proceedings one 400 gallon lot of slurry mix is sprayed over the contents. The nearest habitation is approximately 1000 yards from the destruction pit. This house is surrounded by fields and is separated by a considerable distance from other dwellings.

17. Inspection of Original Salvage Siding.

The siding where the original eight carloads of toxic filled munitions had been spotted was inspected. A very strong mustard-like odor still prevails in spite of the fact that the area has been repeatedly decontaminated with standard slurry mix. No cars are on this siding and it is anticipated that within three to five days complete decontamination can be effected.

18. Reloading Operations.

The three carloads of leakers have been moved to another spur to facilitate the unloading and reloading operations. At the time of

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the inspection all three cars had been unloaded. The bombs were stacked on a concrete hard-stand adjacent to the trackage. Fork lifts and flood lights were provided for night operations. The area is thoroughly decontaminated at all times.

19. Technical Inspection of Downwind Drift from Disposal Area.

Lt. Kutschinski, accompanied by Major Spahn, made a technical investigation of the downwind cloud travel and contamination density in the area adjacent to the bomb disposal pit. At a fence approximately 500 yards downwind from the disposal area, negative results were obtained. A very faint odor was obtained at 300 yards downwind from the disposal pit, however, 50 pump strokes with the M9 detector resulted in a negative reaction. At approximately 100 yards from the disposal pit a weak positive test was obtained with the M9 detector kit after using 50 pump strokes.

20. Visit to Memphis Air Base Hospital.

Three military personnel (Lt. Meyer, Cpl. Carpenter and Pvt. Ross of the CWS Guard and Security Detachment) were interviewed. Lt. Meyer is almost recovered from a mild vapor eye contamination. Pvt. Ross' injury was due to torn protective clothing. Cpl. Carpenter's burns cannot be accounted for unless they result from defective protective clothing.

21. Night Inspection of Downwind Cloud Drift from Disposal Trench.

The inspection of the disposal area is discussed in paragraph 16. The technical inspection of the downwind cloud drift from that area is discussed in paragraph 19. Realizing that the daytime conditions prevailing at the time the technical inspection was made were most favorable for the dissipation of toxic vapors arising from the disposal procedures it was decided to check the general area at night time. The check of the area was made by Lt. Kutschinski at approximately the same point investigated earlier in the day. No odors of mustard were detected.

22. Instructions Issued to Major Spahn.

a. Complete destruction of all leakers at earliest practicable date. Use additional quantities of chloride of lime (500 or 600 lbs.) mixed with earth in the bottom of the destruction pit. Use greater volume of spray on the pit side walls and adjacent area.

b. Complete reloading operations at earliest practicable date consistent with necessary safety and security measures.

c. Continue decontamination of salvage siding.

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[redacted]

d. Have an adequate CWS Guard and Security Detachment with each rail shipment.

2 Annexes
Annex One — Item from Memphis, Tennessee. PRESS-SCIMITAR (Front page, 15 July 1946 issue)
Annex Two — Item from Memphis, Tennessee. PRESS-SCIMITAR (Page 14, 15 July 1946 issue)

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CBDCom-HO
RG7 DEPOTS-E-M
"Highlights of History of Chemical Section Memphis Gen Depot 1947-1953 L.P. Brophy"

Highlights of History of Chemical Section, Memphis General Depot

1947 - 1953

1 Jan - 1 Jul 47

p. 1 — Supply mission defined in WD Supply Bulletin, 38-3 CWS, July 46.

p. 3 — Figures on tonnage handled listed and also figures on dollar value of surplus property handled.

1 Jan - 31 Dec 49

p. 1 — Mission on reserve storage set forth in SB 38-3 CML, 14 June 48. Aspects of this mission were modified by letters which are cited.

p. 3 — During year 1949 sixty-two tons of general supplies were received and 293 tons were shipped, 86 tons were sent to salvage, 44 tons were destroyed.

p. 4 — Training program for Junior ROTC units of Memphis high schools. Also demonstrations and lectures were given on 8 Nov 49 to all ORC officers of Memphis and Shelby county as requested by ORC commander and approved by depot commander. 130 officers attended. Chemical equipment featured in Army day parade and Victory day parade of 1949.

1 Jan - 30 Jun 50

p. 1 — Special regulations 780-11-1, 1 June 50, assigned to the section a supply mission for the Fifth Army area less the states of Wyoming and Colorado.

Personnel strength - 1 officer -- 22 civilians as of 30 June 50.

Tonnage handled

Received	Shipped	Salvage	Destroyed	Inspected & Classifie
175	555	174	44	2404

1 Jul - 31 Dec 50

p. 1 — Draft of Change 1 to SR 780-11-1, 18 Dec 50

subject "Change in Depot Missions, Chemical Corps," changes mission to include inspection of Chemical Corps items in station stock and in the hands of troops.

Personnel strenght - 2 officers and 35 civilians as of 31 Dec 50.

Tons handled

Received	Shipped	Inspected & Classified
49	777	880

Feb 51

Major operations: Test firing of mechanized flame throwers and screening of gas masks were the major operations during reporting period. As a result of this screening progr. 5184 masks have been made serviceable and available for issue.

Personnel 2 Officers & 35 civilians

March 51

During the month 70 M3-4-3, mechanized flame throwers were inspected; also 60 of the mechanized M6 models. Screening of gas masks in the Special Gas Mask Storage account is at present the major operation of the section. To date 7,770 masks have been made serviceable and available for issue. Personnel same as in February.

April 51

Screening and reclassification of gas masks was the major operation during the past month. Since inauguration of this program, 22,682 masks have been made available for issue. Personnel - no change.

May 51

Of the 71,340 masks requiring screening, 37,074 were generated serviceable. The

remaining 34,266 were demilitarized and turned in to salvage. 2,800 masks remaining under Repair Schedule 372 should be completed during the month of June. Personnel - no change.

June 51

Screening of gas masks completed during month. Personnel 3 officers and 35 civilian

1 Jan - 30 Jun 51

p. 2

Performance. During this period 230 tons of general supplies were received, 173 tons shipped, and 1,288 tons inspected and classified....The preponderant workload during the period involved 100% screening of approximately 83,000 gas maks. The program required 5½ months for completion, during which time 40,946 gas masks were reclaimed as serviceable, the remainder disposed of as salvage.

Dec 51

Requirements and Supply Control Division for Spare Parts was transferred from sub-office, Supply Division, ACC, with the transfer of 8 civilian employees on 4 November 51, in accordance with Adm O #29, D/A OC CML O, 19 Sep 51. Major duties of this section are to compute requirements and initiate spare parts procurement for approximately 9,300 spare parts for world-wide spare parts mission. There are 20 civilians allocated to this section, 11 of whom were assigned during November. It is anticipated that recruitment for this section will be completed in December. Transfer of spare parts from Eastern Chemic: Depot was completed this month....approxima: ely 3,434 tons of spare parts were received in the transfer.
From 12 - 14 Dec 51 a conference was held a: Memphis General Depot during which the Army Planning and Development group's proposed plan for standard depot stock accounting procedure was discussed.

1 July - 31 Dec 51

p. 4

Effective 1 July 51, 250,000 square feet of gross warehouse space was reallocated from Quartermaster Supply Section to Chemical Supply Section to provide for movement of Chemical Corps spare parts from Eastern Chemical Depot to Memphis. This figure was changed to 246,223 gross square feet in accordance with 2d incl., OQMG, 31 Aug 51.
Personnel strength as of 31 Dec 51 - 6 officers, 1 W.O. and 145 civilians.

1 April - 30 June 52

p. 4

Processing line costing $111,000.00 was installed in Chemical Supply Section for processing of end items and spare parts for care and preservation of in shipment overseas. Space figures given. Also good annex in tonnage handled.

1 Jan - 31 Mar 53

As of 31 March 53 depot had 7 officers and 2 warrant officers. Civilians 82 graded and 152 ungraded.

In the 3 month period the depot received a total of 302 tons of spare parts and 2 tons of end items. In same period it shipped 254 tons of spare parts, 178 tons of end items and 3 tons of toxics (Exhibit "A").

1 Apr - 30 June 53

As of 30 June 53 there were 6 officers and 2 warrant officers, 82 graded and 152 ungraded.
During three month period the depot receive 1247 tons of end items and 366 tons of spare parts. It shipped 476 tons of end items, 215 tons of spare parts, and 1 ton o toxics. (See Exhibit C).

96 62

DEGORD NO. 23

PLANT PROTECTION REGULATIONS

MEMPHIS ARMY SERVICE FORCES DEPOT

Compiled by:

Plant Protection Officer

7. I will allow no smoking in warehouses or within 20 feet of warehouse, box cars or trucks, either loading or unloading.

8. I will make a close check for fire hazards such as oily rags, paint, waste wood containers, waste paper and all inflammable materials. I will be familiar with Depot fire regulations and will be able to recognize a fire hazard should I see one. I will report all violations of Depot fire regulations to Guard Office at once.

9. I will see that all lights, other than those authorized to burn, are turned off.

10. I will be familiar with the location of all electric switches, gas valves, fire extinguishers, and know how to operate them.

11. I will be especially watchful for fire; and in case of fire, I will turn in the alarm on the ADT, go to the nearest phone, call Fire Department, Station # 32, give location of fire, then assist the Fire Department to the scene of the fire.

12. I will be on the alert at all times for fire, for the presence of unauthorized persons, and all attempts at pilfering, on my post. I will check all employees for badges and will question any person found without a badge.

13. Between the hours of 7:00 A.M. and 4:30 P.M., Post No. 19 and Post No. 18 will be converted into one post and will be patroled by one patrolman.

14. I will see that a red safety flag is posted while crews are at work, in box cars.

SPECIAL ORDERS
POST NO. 20, WEBSTER STREET WAREHOUSE

1. My post is on the inside of warehouse and I will make a patrol outside once each hour. I will patrol west on Webster Street to railroad tracks, thence south to Georgia Street to east of warehouse, thence east on Georgia Street to where I can observe along east side of building, returning by same route to starting point.

2. I will patrol inside of building so as to cover all parts of warehouse every thirty minutes.

3. I will be especially watchful for fire and in case of fire I will call the Memphis Fire Department, phone 6-2112, giving location of fire, then call the Depot Fire Department, phone 48-4431, extension # 32, and notify the Guard Office.

4. In case of any disturbance that I cannot handle I will first call the Memphis Police Department, phone 6-0166, then call Guard Office.

5. I will keep all doors and windows closed when not in use by labor parties.

6. I will allow no smoking in warehouse and will collect all matches from working parties and return same upon departure of person.

7. I will allow no unauthorized person to enter the warehouse at any time.

8. I will allow no parking of vehicles on south side of Webster Street near warehouse, except Government vehicles and vehicles making deliveries or picking up load at warehouse.

9. I will allow no loitering in vicinity of warehouse.

10. At any time when troop trains are on siding near warehouse, I will allow no one to smoke near building.

11. I will use .45 Cal. revolver issued to me and turn it over to my relief, having my relief to sign for it on form furnished by Guard Office. At no time will I take or carry revolver home from this post. I will permit revolver to be inspected by Plant Protection Officer, Officer of the Day, and Guard Officers only.

12. I will report by phone upon taking over post and on the hour until relieved.

NPRC - MR 338-59-6363 Box 11
FOLDER 470.6 OCT 57

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CMLAK-H-SYD.5 470.6 19 DEC 1957

SUBJECT: Impregnite XXCC3, Federal Stock No. 6850-551-1296, in 26 lb. drums

TO: Chief Chemical Officer
Department of the Army
Washington 25, D. C.

1. There are 5,736 drums of subject item at Memphis General Depot which require new fiber board containers. The cost of care and preservation including new containers, labor and overhead will be approximately $5,300.00 against the value of the material of $180,000.00.

2. Item is a substitute standard item and is excess to retention limits but is being held in accordance with letter, CMLLP-E, OCCMLO, 22 March 1957, subject: "Retention of Stocks in Excess of Retention Limits (U)."

3. It is requested that this Command be advised appropriate action to be taken.

FOR THE COMMANDER:

DAVID W. DICK
Lt Colonel, CmlC
Chief, Supply Division

Info cy furnished:
CO, Memphis General Depot
Memphis 15, Tennessee
ATTN: GDMEQ-S 1669

M/R: Study of item is being made by DSCLOG, OCCMLO to advise MATCOM of results.

ARMY CML CENTER MD
CML C MAT COMD
HEADQUARTERS

C.C.HOYBACH/6207/dn Typed 19 December 1957

DISPATCHED

Mail and Records

96 66 ~~342-48A-46~~ NPRC
Folder 40042
338-59-6364

40012

[illegible] 1st Ind
(6 Aug 57)
SUBJECT: Procurement in Excess of $10,000

HEADQUARTERS U. S. ARMY CHEMICAL CENTER AND CHEMICAL CORPS MATERIEL COMMAND, Army Chemical Center, Maryland, 15 AUG 1957

TO: Commanding Officer, Memphis General Depot, U. S. Army, Memphis 15, Tennessee

1. This will confirm teletype of 15 August 1957 requesting that you suspend action on IFB for items set forth in basic communication.

2. In view of the fact that some of the items required are currently being manufactured at Edgewood Arsenal, and in one instance is available from the Inventory of Industrial Reserve Components, the following actions should be taken:

a. Place a requisition on Edgewood Arsenal for the following items at the estimated prices shown:

Item	Stock Number	Nomenclature	Quantity	Estimated Unit Price
2	4240-[illegible]-7972	Filter, Gas	41	$ [illegible]
3	4240-307-7806	Purifier, Air (M8A1)	71	156.00
4	4240-[illegible]	Filter, Particulate, M18	42	17.[illegible]
7	[illegible]	Precleaner, Air Purifier	20	148.[illegible]
13	4240-[illegible]-7130	Clamp, Wire	534	[illegible]
16	4240-[illegible]	Carrier, Tank Back	1040	[illegible]
17	4240-[illegible]	Clamp, Wire	534	[illegible]

b. Place a requisition on this Headquarters, Attention: [illegible], for the following item, citing transportation funds only:

Item	Stock Number	Nomenclature	Quantity
[illegible]	4240-[illegible]-7134	Clamp, Wire	534

3. The balance of the items may be procured by local purchase. U. S. Army Chemical Procurement District, New York, has recently purchased similar items and may be of assistance in locating sources for these items.

4. For information and future use, there is inclosed herewith a copy of the current Inventory of Industrial Reserve Components and materials which are available on requisition to this Headquarters.

FOR THE COMMANDER:

HEADQUARTERS
CHL C MAT CMD
ARMY CHM CTR

CONC: [illegible] FURN
(Mr. Jennings Prod [illegible])
(Mr. Cook [illegible])

[illegible]

INSTALLATION | 96 67

[illegible]

PURPOSE/AREA OF INTEREST

PERSON CONTACTED: [illegible] Wages Siden

TITLE/POSITION: Roads & Grds
PRESENT
PREVIOUS

YRS AT INSTALLATION

PHONE

Pond filled in early 50's, Shed [illegible] 1960

Burning pit across from 629 in gravel area early to mid 60's and ~5 years. Burn area in [illegible] field - general San

[illegible] 55-60

Flame Thrower [illegible] in present golf course area, [illegible]

[illegible] (in late 40's

Ammo stored in igloos in past (small amounts) [illegible]

[illegible]

[illegible] 5201

[illegible]

[illegible] built since 1950

Dump truck near 770 [illegible] 972

Johnny Tuckerman (Retired) may have [illegible]

Mr Jameson (Retired) in [illegible] may also have knowledge

Marv [illegible] (")

[illegible]

INTERVIEWER
TEAM
1 Glos 5

DATE
3 Mar 91

oak tree, elm, Hickory - planted Live/Long leaf / Sweet Gum, Green ash, Bald Cypress
Oriental Dogwood & Crab Apple, Red Top Fotinia
Pecan - Native Bermuda.
Fire in grass 24DE MSMA

Squirrels, Fox (Red) Turtles, catfish in Pond / slides & snakes in pond & year - recommended due to those off-site ponds. Canada Geese, Dove (Mourning)
mice / Rat - Cane but to Control

96 69

HEADQUARTERS
ARMY CHEMICAL CENTER
MARYLAND

IN REPLY REFER TO:

OFFICE OF THE POST SAFETY ENGINEER

LH/ef

25 August 1947

SUBJECT: Reports of Inspection

TO : Chief, Management Group, OC-Cml C, Washington, 25, D. C.

Transmitted herewith are reports of plant protection and surveys conducted under provisions of S.O. 45, Par. 6, OC-Cml C, 5 August 1947.

Louis Harris
LOUIS HARRIS
Safety Engineer

3 Incls
Report of Memphis General Depot
Report of Pine Bluff Arsenal, Ark.
Report of Huntsville Arsenal, Ala.

REPORT OF OFFICIAL TRAVEL
AS DIRECTED BY S.O. 45, PAR. 6
OC-CML C - 5 AUGUST 1947

SECTION I - ITINERARY

8	August	1947 -	Lv. Edgewood, Md.
8	"	"	Arr. Washington, D. C.
9	"	"	Lv. Washington, D. C.
10	"	"	Arr. Memphis (Memphis General Depot)
11	"	"	Lv. Memphis
11	"	"	Arr. Pine Bluff, Arkansas
13	"	"	Lv. Pine Bluff, Arkansas
13	"	"	Arr. Memphis, Tenn.
13	"	"	Lv. Memphis, Tenn.
13	"	"	Arr. Huntsville, Alabama
16	"	"	Lv. Huntsville, Alabama
16	"	"	Arr. Washington, D. C.
16	"	"	Lv. Washington, D. C.
16	"	"	Arr. Edgewood, Md.

SECTION II - PURPOSE OF VISIT

The purpose of the visit to Memphis General Depot was to investigate and report on thermal decomposition which occurred on 30 July 1947.

SECTION III - OBSERVATIONS

The writer, accompanied by Major Otto J. Spahn, Chemical Supply Officer, visited the Dunn Ave. Area, which was selected for the destruction of CC2 and XXCC3, resulting, subsequently, in thermal decomposition.

The CC2 (approx. 86,000 lbs.) was destroyed by trench burial to a depth of about 8 ft., 8 ft. wide and 40 ft. long. Trench was covered by earth and area staked for identification and warning.

On 30 July 1947, emission of smoke cloud was observed. An inspection of the surrounding area and vegetation would indicate a concentration of chlorine. Formation of chlorine was neutralized by formation of earth dam filled with water, allowing the gas to percolate through water surface until combustion had ceased.

It was revealed that in order to provide space for storage of bauxite, CC2 area was disturbed by scarification of the surface, which reduced the coverage and removed marking stakes.

About four (4) days were required to completely reduce spontaneous combustion. It is believed that high ground temperatures were a contributing factor.

Report of Official Travel (22 Aug 1947)

SECTION IV - RECOMMENDATIONS

It is recommended that:

(1) A Plot Diagram for burial of chemicals be set up.
(2) An area be set aside restricted for the use of destruction of chemicals, this area to be under the exclusive jurisdiction of the Chemical Supply Officer.
(3) Stakes be employed with suitable markings and remain in the specific locations unless change is authorized by the Chemical Supply Officer.
(4) The Chemical Supply Officer be authorized to have freedom of action in the methods employed for destruction of chemicals. Cont. Contrary to existing W.O Publications.

SECTION V - CONCLUSIONS

It is believed that establishment of a restricted area for the destruction of chemicals will serve to minimize a recurrence of thermal decomposition and aid the Chemical Supply Officer in setting up SOP for this type of activity, observing necessary safety precautions.

SECTION VI

Appreciation is expressed for the cooperation given the writer by the Chemical Supply Officer.

Louis Harris
LOUIS HARRIS
Safety Engineer
Army Chemical Center, Md.

INSTALLATION: MEMPHIS:	REPORT CODE: 96 72
PURPOSE/AREA OF INTEREST	

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
① Mr. Wages ② Mr. Sides ③ Mr. Ingrams	PRESENT PREVIOUS		

1. ① Roofing Slag / asphalt - bld rubble in Dump field area

2. ①② Chemical [redacted] mission

3. ② Filled in (Bad) baseball or soft ball field made ("just a farm pond)
large field: early 50's

4. ①② Shed removed later 50's early 60's
disposed through city -
Sold plywood & desk -

5. ② Wood disposal - (grand fill area) across area 621
burning of dumps: early to mid 60's
lasted 4-5 years

6. ①② Refuse dumped & burned into Dump field
N side of drive way
Early burning - cans - pages 55-60

INTERVIEWER	DATE
RL. JONAS	3/Mar/81

7. ② No contracts for Refuse hauling in 55

8. ① Drain drum field to city system –
pit open + drained into system

9. ②③ Burned a week or two then would be
cleaned up. – + burned into field

10. ①② Bancit Removed – sold to Reynolds Co.
≈ 10 yrs ago – no water table seen
to Bancit Arts. (Holbrowell (cook) ret.) Stud 46-47)

11. ②③ WH's built in 52
PDO previous to new WH's

12. ①② Mulch pits in drum field 5 or 6

13. ② Flame throwers : in Northern area
of Golf. [illegible]
Problem in growing grass –
had to work with grnd. to
Cenders : prior to 52

14. ①②③ Area under new WH's. used to be
pasture land – dirt hauled off to
build :
no known dumping prior.

15. ② Ammo. Storage : ammo storage – in igloo's

16. ①②③ Old mags. Removed bldgs
Empty in "58" '59 removed ①
to 60

17. ② Small arms ammo

INSTALLATION	REPORT CODE (Cont.)
MEMPHIS :	06 74

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
① Mr Wayes ② Mr. Sides ③ Mr. Ingrams	PRESENT PREVIOUS		

18. ② Still being ~~too~~ used as igloo's

19. ② Bldg were there in 48

20. ② Charlie Anderson (with chemicals) (5201 ?)

21. ① Mission for Chemicals in 61-62 ended

22. ② Mission for Engineers: depo. maint.
Bld. 972 related eqpt. –
Bridge ~~[illegible]~~
58-59 Mission "ended"

23. ②① Pond used for boat testing 25-27 boats
GreyMarine / plywood, alum repaired.
(Fire fighting pond. used to pull bridges)
repaired in – "Troop issue" Bridge erection [illegible]

~~24.~~ Memphis tests (Fire dept) their eqpt in this pond –

24. ②①③ Pond filled by surface drainage (Built Early 50's

INTERVIEWER	DATE
R.L. JONAS	3/Mar/81

25. ①③ Rail road maintain (round house) "Anderson"
No knowledge of chemical problems
96 75

26. ①②③ No war gases — known -
would not be in posit. to know
tear or other

27. ①②③ Chemical, Engineer, Quartermaster, Signal
Medical later

28. ①②③ { No Bio known
{ No ~~Heavy~~ Rad materials

29. ② Dipping Vat. dropped off middle 60's pallet dip operation
occ. used for timbers: constr. repairs
(Semi active)
Underground. Storage tank
— Penta cloro phenol —
~~[illegible]~~ clean up + disposal (W.H. Scott
10 years
since 42)
Started approx: early 50's
~~[illegible]~~ large area of Pallet storage around general area
(gravel now) to street + railroad

30. ①②③ Waste oil + solvents : oiling rail joints +
~~[illegible]~~ —
other contracted to be removed
W. Bld 972 hold tank for storage
SW. 770 hold tanks for oils.
~~[illegible]~~ Years past for dust control + with other chemicals
to spray fences + trails for weed control
P.D.O. yard used for road stopped 10 years ago

~~[illegible]~~ 31. ①② Pallet of sodium — yes
was a dumpster fire once

INSTALLATION	REPORT CODE
	06 ·76

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
	PRESENT PREVIOUS		

32. ① Disposal Officer would order a hole and they would bury —
* fire occurred once during an acid dumping

33.

37. ② Johny Testerman (chemical operations)

34. ① Jamison (WH. Sup. Ret) S&T
late 60's *

35. Marie Batts — S1ok

DDMT

INTERVIEWER	DATE
	3/Mar/81

New Orleans

cws 41

WEEKLY STATUS REPORT
ON
CREDITED STOCKS

96 77

MEMPHIS GENERAL DEPOT
Memphis Chemical Warfare Depot

AGENCY New Orleans DATE October 5, 1942

ITEM		AGGREGATE AMOUNT CREDITED TO DATE	AGGREGATE AMOUNT REQUISITIONED AND APPROVED TO DATE	BALANCE OF CREDIT AVAILABLE
Agent, non-corrosive(2 unit)	EA	4,000	2,570	1,430
Alarm, gas	EA	200	0	200
Capsule, CN	EA	10,800	4,835	5,965
Detonator, Number 8	EA	18,300	15,680	2,620
Disinfectant, gas mask,4 oz	EA	2,000	21	1,979
Kit, repair, gas, mask, Univ	EA	125	67	58
Kit, M5, vapor detector	EA	50	50	0
Ointment, protective	EA	71,000	70,141	859
Paint, liquid vesicant detec.	EA	10,000	140	9,860
Paper, liquid vesicant detec.	BK	2,000	782	1,218
Respirator, dust, M1	EA	10,000	3,575	6,425
Set, gas ident., deton., M1	EA	160	160	0

ALL OTHER ITEMS NO CHANGE

AS OF MIDNIGHT SATURDAY OCTOBER 3, 1942

HENRY I. STUBBLEFIELD
MAJOR CWS

CHEMICAL WARFARE SUPPLY OFFICER

V

CWS 41

WEEKLY STATUS REPORT ON CREDITED STOCKS

MEMPHIS GENERAL DEPOT
Memphis Chemical Warfare Depot

AGENCY V Ser Com DATE October 5, 1942

ITEM		AGGREGATE AMOUNT CREDITED TO DATE	AGGREGATE AMOUNT REQUISITIONED AND APPROVED TO DATE	BALANCE OF CREDIT AVAILABLE
Agent, simulated, M1, 4½# pkgs	EA	20,000	14,620	5,380
Agent, simulated, M2, 50# pkgs	EA	2,000	1,120	880
Agent, non-corrosive (2 unit)	EA	1,500	85	1,415
Alarm, gas	EA	200	6	194
Apparatus, decon, 3 gallons	EA	1,275	307	968
Aprons, rubber	EA	175	71	104
Bleaching Powder, grade B	LB	120,000	76,850	43,150
Curtain, gasproof	EA	14,000	11,154	2,846
Disinfectant, gas mask, 4 oz	EA	1,000	358	643
Grenade, hand, gas, irrit., CN, M7 (Rescinded)	EA	0	0	0
Impregnite, shoe, 8 oz	EA	250,000	107,661	142,339
Kit, repair, gas mask, company	EA	1,500	549	951
Kit, repair, gas mask, univer	EA	300	77	223
Kit, M5, vapor detector	EA	75	6	69
Mask, gas, service, small	EA	4,500	2,076	2,424
Mask, gas, service, universal	EA	111,000	89,075	21,925
Ointment, protective	EA	27,500	5,366	22,134
Paint, liquid vesicant detector	CAN	10,000	198	9,802
Paper, liquid vesicant dtr.	BOOK	1,000	40	960
Respirator, dust, M1	EA	5,000	2,316	2,184
Set, gas identn., deton	EA	0	0	0
Set, gas ident., instrust., M1	EA	75	52	23
Buckle, web strap 7/8"	EA	13,296	19	13,277
Button,	EA	15,789	59	15,730
Clip, brass	EA	19,280	28	19,252
Disc, inlet valve, rubber	EA	18,698	128	18,570
Eyerings, brass, Comp C, ½ hard	EA	12,465	7	12,458
Facepiece, M1A2	EA	16,620	42	16,578
Gasket, dull black rubber	EA	7,480	5	7,475
Guard, outlet valve, M7	EA	4,155	32	4,123
Guard, outlet valve, M6	EA	2,494	1	2,493
Head Harness, M4	EA	18,282	86	18,196
Head Harness, M1A1	EA	9,141	22	9,119
Hose, M1	EA	12,465	34	12,431
Carrier, M1A1	EA	24,930	56	24,874
Lens, cellulose acetate	EA	24,930	139	24,791
Nut, Mach. screw, hex 6-32 NC	EA	7,480	5	7,475
Plaster, adhesive, 3/8"	YARD	33,241	1,220	32,021
Plaster, adhesive, ½"	YARD	33,241	300	32,941
Plaster, adhesive, 5/16"	YARD	12,466	30	12,436
Screw, mach. 6-32 NC-2x1½	EA	7,480	5	7,475
Valve, inlet valve	EA	12,465	19	12,446
Tape, [illegible] 5/16"	EA	7,480	10	7,470

4

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 79

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding General, Air Force Technical Training Command, Knollwood Field, Southern Pines, North Carolina.

CHEMICAL WARFARE SERVICE CREDIT # 1086 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depots indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. Units will not be allocated material in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The Chemical Officer, Air Force Technical Training Command, should suballot this material to units under your jurisdiction, including newly activated units, indicate credit numbers and furnish copies of suballocation to depots concerned and Office Chief Chemical Warfare Service. This material will not be shipped by depots until the suballocation to units is accomplished.

ITEM		DEPOTS AND QUANTITIES				
		AQMD	BCWD	MQMD	SAQMD	UQMD
Bomb, incendiary, instr., M2	each	13	9	9	9	4
Capsule, CN	each	2250	1500	1500	1500	750
Pot, tear gas, CN, M1	each	72	48	48	48	24
Set, gas ident., deton., M1	each	58	38	38	38	20
MR (for simulated MS)	lbs.	30	20	20	20	10
Detonator, No. 8	each	4060	2660	2660	2660	1400
Mine, land, eml., w/deton & burster	each	3	2	2	2	1
Grenade, incendiary, M14	each	4	-	-	-	-

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocations of the Air Force Technical Training Command, except in the case of newly activated units wherein material will be furnished automatically by the depot.

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

DISTRIBUTION:

3 copies CG, AFTTC
3 copies CWSO, AQMD
4 copies CO, BCWD
3 copies CWSO, MQMD
3 copies CWSO, SAQMD
3 copies CWSO, UQMD
1 copy CG, SOS (Attn Col. Bourket)
1 copy CG, AGF (Attn Col. Ford)
1 copy CG, AAF (Attn Capt. McCoy)
10 copies Records
3 copies Ammunition Br.
1 copy T & I
1 copy Mail and Records.

MAIL & RECORDS COPY

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 80

October 15, 1942

SPCVS 381/359 (T)

TO: The Commanding General, Mountain Training Center, Camp Carson, Colorado Springs, Colorado.

CHEMICAL WARFARE SERVICE CREDIT # 1078 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depots indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. Units will not be allocated material in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The Chemical Officer, Mountain Training Center, should suballot this material to units under your jurisdiction, including newly activated units, indicate credit numbers and furnish copies of suballocation to depots concerned and Office Chief Chemical Warfare Service. This material will not be shipped by depots until the suballocation to units is accomplished.

ITEM	UNIT	DEPOTS AND QUANTITIES	
		Memphis QM Depot	Utah QM Depot
Bomb, incendiary, instr., M2	each	3	1
Capsule, CN	each	60	27
Detonator, No. 8	each	70	70
Grenade, incendiary, M14	each	5	2
Mine, land, cml., w/deton & burster	each	3	-
Set, gas ident., deton., M1	each	1	1
WP (for simulated HS)	lbs.	39	16
Pot, tear gas, CN	each	18	6

Note: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocations of the Mountain Training Center, except in the case of newly activated units wherein the material will be automatically furnished by the depot.

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

DISTRIBUTION:

8 copies CG, MTC
3 copies CWSC, LGMD
3 copies CWSO, UQMD
1 copy CG, SOS (Attn Col. Bourke)
1 copy CG, IGF (Attn Col. Ford)
5 copies Records
3 copies Ammunition Br.
1 copy T & I
1 copy Mail and Records.

MAIL & RECORDS COPY

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 81

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding Officer, Finance Replacement Training Center, Fort Benjamin Harrison, Indiana.

CHEMICAL WARFARE SERVICE CREDIT # 1043 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depot indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. This does not constitute an authority to exceed authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The unexpended balance of material on this credit will be cancelled as of January 1, 1943.

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	54
	Set, gas ident., deton., M1	each	1
	Detonator, No. 8	each	70

NOTE: Depots will furnish without formal requisition the above material at the request of the unit indicated.

00.000
NOV 8 1942

For the Chief of the Chemical Warfare Service:

DISTRIBUTION:

6 copies CO, Fin R.T.C.
3 copies C.O., MDAD
1 copy CG, SOS (Attn Col. Bourket)
1 copy CG, AGF (Attn Col. Ford)
3 copies Records
3 copies Ammunition Br.
1 copy T & I
1 copy Mail and Records.

MAIL & RECORDS COPY

DUANE Y. CARLES
Major, C.W.S.

NORMAN D. GILLET
Colonel, C.W.S.
Assistant

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

October 15, 1942

SPCVS 381/259-(T)

TO: The Commanding Officer, Medical Replacement Training Center, Camp Grant, Illinois.

CHEMICAL WARFARE SERVICE CREDIT #1045 (TRAINING AMMUNITION FOR NOVEMBER 1942).

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depot indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. This does not constitute an authority to exceed authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The unexpended balance of material on this credit will be cancelled as of January 1, 1943.

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	326
	Set, gas ident., deton., M1	each	8
	Detonator, No. 8	each	560

NOTE: Depots will furnish without formal requisition the above material at the request of the unit indicated.

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C. W. S.
Assistant

DISTRIBUTION:

8 copies CO, Medical RTC
3 copies CWSO, MQMD
1 copy CG, SOS (Attn Col. Bourcet)
1 copy CG, AGF (Attn Col. Ford)
3 copies Records
3 copies Ammunition Br.
1 copy T & I
1 copy Mail and Records.

MAIL & RECORDS COPY

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 83

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding Officer, Military Police Replacement Training Center, Fort Riley, Kansas.

CHEMICAL WARFARE SERVICE CREDIT # 1047 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depot indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. This does not constitute an authority to exceed authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The unexpended balance of material on this credit will be cancelled as of January 1, 1943.

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	107
	Set, gas ident., deton., M1	each	3
	Pot, tear gas, CN, M1	each	5
	Grenade, hand, tear gas, CN, M7	each	22
	Detonator, No. 8	each	210

NOTE: Depots will furnish without formal requisition the above material at the request of the unit indicated.

CO-GEN
FILED
NOV 8 1942
CWS

For the Chief of the Chemical Warfare Service:

DISTRIBUTION:

6 copies CO, MP RTC
3 copies CWSO, MQMD
1 copy CO, SOS (Attn Col. Bourket)
1 copy CG, AGF (Attn Col. Ford)
3 copies Records
3 copies Ammunition Br.
1 copy T & I
1 copy Mail and Records.

MAIL & RECORDS COPY

RECEIVED OCT 28 1942 WASHINGTON D.C.

DUANE Y. SARLES
Major, C. W. S.

NORMAN D. GILLET
Colonel, C.W.S.
Assistant

WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 84

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding General, Sixth Service Command (For State Guards)

CHEMICAL WARFARE SERVICE CREDIT # 1060 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are furnished for the State Guard Units located within the geographical limit of the Sixth Service Command. This credit does not constitute an authority for expenditure in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, C-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. It is desired that suballocation be expedited in accordance with directive letter Office Chief Chemical Warfare Service, dated August 24, 1942, file CWS 471/228, subject: "Supply of Chemical Warfare Training Ammunition in Continental United States".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	332
	Grenade, hand, tear, CN, M7	each	332
	Set, gas ident., deton., M1	each	9
	Pot, tear gas, CN	each	200
	Detonator, No. 8	each	630

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocation of the Sixth Service Command. This material will not be shipped by depots until the suballocation to units is accomplished.

CC-CWS FILED NOV 8 1942

For the Chief of the Chemical Warfare Service:

DUANE Y. CARLES
Major, C. W. S.

NORMAN D. GILLET
Colonel, C.W.S.
Assistant

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 85

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding General, Seventh Service Command (For State Guards)

CHEMICAL WARFARE SERVICE CREDIT #1061 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are furnished for the State Guard Units located within the geographical limit of the Seventh Service Command. This credit does not constitute an authority for expenditure in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C, CWS SHOULD BE SO NOTIFIED AT ONCE.

2. It is desired that suballocation be expedited in accordance with directive letter Office Chief Chemical Warfare Service, dated August 24, 1942, file CWS 471/228, subject: "Supply of Chemical Warfare Training Ammunition in Continental United States."

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	380
	Grenade, hand, tear, CN, M7	each	380
	Set, gas ident., deton., M1	each	10
	Pot, tear gas, CN	each	229
	Detonator, No. 8	each	700

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with the suballocation of the Seventh Service Command. This material will not be shipped by depots until the suballocation to units is accomplished.

OC-CWS
FILED
NOV 8 1942

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 86

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding General, Seventh Service Command.

CHEMICAL WARFARE SERVICE CREDIT # 1065 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are furnished for the Service Command Units, War Department Overhead Units and Tactical Units assigned to the Services of Supply within the respective Service Command Areas, excluding Schools and Replacement Training Centers. Obligations in excess of this credit will not be incurred except by authority from this office. This credit does not constitute an authority for expenditure in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. It is desired that suballocation be expedited in accordance with directive letter Office Chief, Chemical Warfare Service, dated August 24, 1942, file CWS 471/228, subject: "Supply of Chemical Warfare Service Training Ammunition in Continental United States".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Bomb, incendiary, instr., M1	each	3
	Capsule, CN	each	155
	Grenade, incendiary, M14	each	15
	Set, gas ident., deton., M1	each	2
	MR (for simulated HS)	lbs.	15
	Pot, tear gas, CN	each	48
	Detonator, No. 8	each	140

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocations of the Seventh Service Command, except in the case of newly activated units wherein material will be automatically furnished by the depot. This material will not be shipped by depots until the suballocation to units is accomplished.

OC-CWS
FILED
NOV 8 1942
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For the Chief of the Chemical Warfare Service:

DILLON Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

RECEIVED
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WASHINGTON

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding General, Fifth Service Command

CHEMICAL WARFARE SERVICE CREDIT #1095 (TRAINING AMMUNITION FOR NOV. 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are furnished for the Service Command Units, War Department Overhead Units and Tactical Units assigned to the Services of Supply within the respective Service Command Areas, excluding Schools and Replacement Training Centers. Obligations in excess of this credit will not be incurred except by authority from this office. This credit does not constitute an authority for expenditure in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. It is desired that suballocation be expedited in accordance with directive letter Office Chief Chemical Warfare Service, dated August 24, 1942, file CWS 471/228, subject: "Supply of Chemical Warfare Service Training Ammunition in Continental United States".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	32
	Grenade, hand, tear gas, CN	each	20
	Grenade, incendiary, M14	each	3
	Set, gas identification, deton, M1	each	1
	Detonator, No. 8	each	70

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocation of the Fifth Service Command, except in the case of newly activated units wherein material will be automatically furnished by the depot. This material will not be shipped by depots until the suballocation to units is accomplished.

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. [illegible]
Colonel, C.W.S.
Assistant

DISTRIBUTION:

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 88

October 15, 1942

SPCWS 381/259 (T)

TO: The Commanding General, Fifth Service Command (For State Guard)

CHEMICAL WARFARE SERVICE CREDIT # 1059 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are furnished for the State Guard units located within the geographical limit of the Fifth Service Command. This credit does not constitute an authority for expenditure in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. It is desired that suballocation be expedited in accordance with directive letter Office of the Chief, Chemical Warfare Service, dated August 24, 1942, file CWS 471/228, subject: "Supply of Chemical Warfare Training Ammunition in Continental United States".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	170
	Grenade, hand, tear, CN, M7	each	170
	Set, gas ident., doton., M1	each	4
	Pot, tear gas, CN, M1	each	101
	Detonator, No. 8	each	280

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocations of the Fifth Service Command. This material will not be shipped by the depots until the suballocation to units is accomplished.

For the Chief of the Chemical Warfare Service:

DUANE Y. SHULTS
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

October 15, 1942

96 89

SPCVS 381/259 (T)

TO: The Commanding General, Air Force Flying Training Command, Fort Worth, Texas.

CHEMICAL WARFARE SERVICE TRAINING # 1087 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depots indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. Units will not be allocated material in excess of authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The Chemical Officer, Air Force Flying Training Command, should suballot this material to units under your jurisdiction, including newly activated units, indicate credit numbers and furnish copies of suballocation to depots concerned and Office Chief Chemical Warfare Service. This material will not be shipped by depots until the suballocation to units is accomplished.

ITEM	UNIT	DEPOT AND QUANTITIES				
		AQMD	EQMD	MQMD	SAQMD	UQMD
Bomb, incendiary, instr., M2	each	83	56	55	56	28
Capsule, CN	each	304	203	202	202	101
Set, gas ident., deton., M1	each	20	14	13	13	7
Detonator, No. 8	each	1400	980	910	910	490
Mine, land, eml., w/deton & bur.	each	68	45	45	45	22
MR (for simulated H5)	each	2640	1760	1760	1760	880
Pot, tear gas, CN, M1	each	300	200	200	200	100

NOTE: Depots will furnish without formal requisition the above material at the request of the unit in accordance with suballocations of the Air Force Flying Training Command, except in the case of newly activated units wherein material will be automatically furnished by the depot.

For the Chief, Chemical Warfare Service:

RECEIVED OCT 23 1942 C.C.W.S. WASHINGTON

DUANE Y. CARLES
Major C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

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WAR DEPARTMENT
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

96 90

October 15, 1942

SPCVS 381/259 (T)

TO: The Commanding Officer, Engineer Replacement Training Center, Fort Wood, Missouri.

CHEMICAL WARFARE SERVICE CREDIT # 1042 (TRAINING AMMUNITION FOR NOVEMBER 1942)

EFFECTIVE DATE: November 1, 1942

REMARKS: 1. The following items of training ammunition are allocated to your credit in the depot indicated below. Obligations in excess of this credit will not be incurred except by authority from this office. This does not constitute an authority to exceed authorized allowances. IF THIS CREDIT IS NOT DESIRED, O-C CWS SHOULD BE SO NOTIFIED AT ONCE.

2. The unexpended balance of material on this credit will be cancelled as of January 1, 1943.

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	234
	Pot, tear gas, CN, M1	each	24
	Set, gas ident., deton., M1	each	6
	Detonator, No. 8	each	420

96 91

WAR DEPARTMENT
SERVICES OF SUPPLY
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

SB/LEN/ky

October 20, 1942

SPCVS 381/259 (T)

TO: The Commanding Officer, Signal Replacement Training Center, Camp Crowder, Missouri.

CHEMICAL WARFARE SERVICE CREDIT # 889 (CHANGE 1)

EFFECTIVE DATE: October 1, 1942

REMARKS: 1. It is desired that CWS Credit Number 889, dated September 15, 1942, be changed to delete the following items allocated in the depot indicated below. This reduction in allocation is in conformance with request of Hq., Signal Corps Replacement Training Center, Camp Crowder, Missouri, file 400.312, dated September 30, 1942, subject: "Chemical Warfare Service Credit # 889".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Capsule, CN	each	368
	Detonator, No. 8	each	630
	Set, gas ident., deton., M1	each	9

For the Chief of the Chemical Warfare Service:

DUANE Y. SEARLES
Major, C. W. S.

NORMAN D. GILLET
Colonel, C.W.S.
Assistant

DISTRIBUTION:

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WAR DEPARTMENT
SERVICES OF SUPPLY
OFFICE CHIEF CHEMICAL WARFARE SERVICE
WASHINGTON, D. C.

SB/LEN/hy

October 20, 1942

SPCVS 381/259 (T)

TO: The Commanding Officer, Engineer Replacement Training Center, Fort Wood, Missouri.

CHEMICAL WARFARE SERVICE CREDIT # 868 (Change 1)

EFFECTIVE DATE: October 1, 1942

REMARKS: 1. It is desired that CWS Credit Number 868, dated September 15, 1942 be changed to delete the following items allocated in the depot indicated below. This reduction in allocation is in conformance with request of Hq., Engineer Replacement Training Center, Fort Leonard Wood, Missouri, file RTCSO 471.3, dated October 6, 1942, subject: "Cancellation of Ammunition Credit".

DEPOT	ITEM	UNIT	AMOUNT
Memphis Quartermaster Depot	Detonator, No. 8	each	420
	Set, gas ident., deton., M1	each	6

OCT 23 1942

For the Chief of the Chemical Warfare Service:

DUANE Y. SARLES
Major, C. W. S.

FOR NORMAN D. GILLET
Colonel, C.W.S.
Assistant

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96 93

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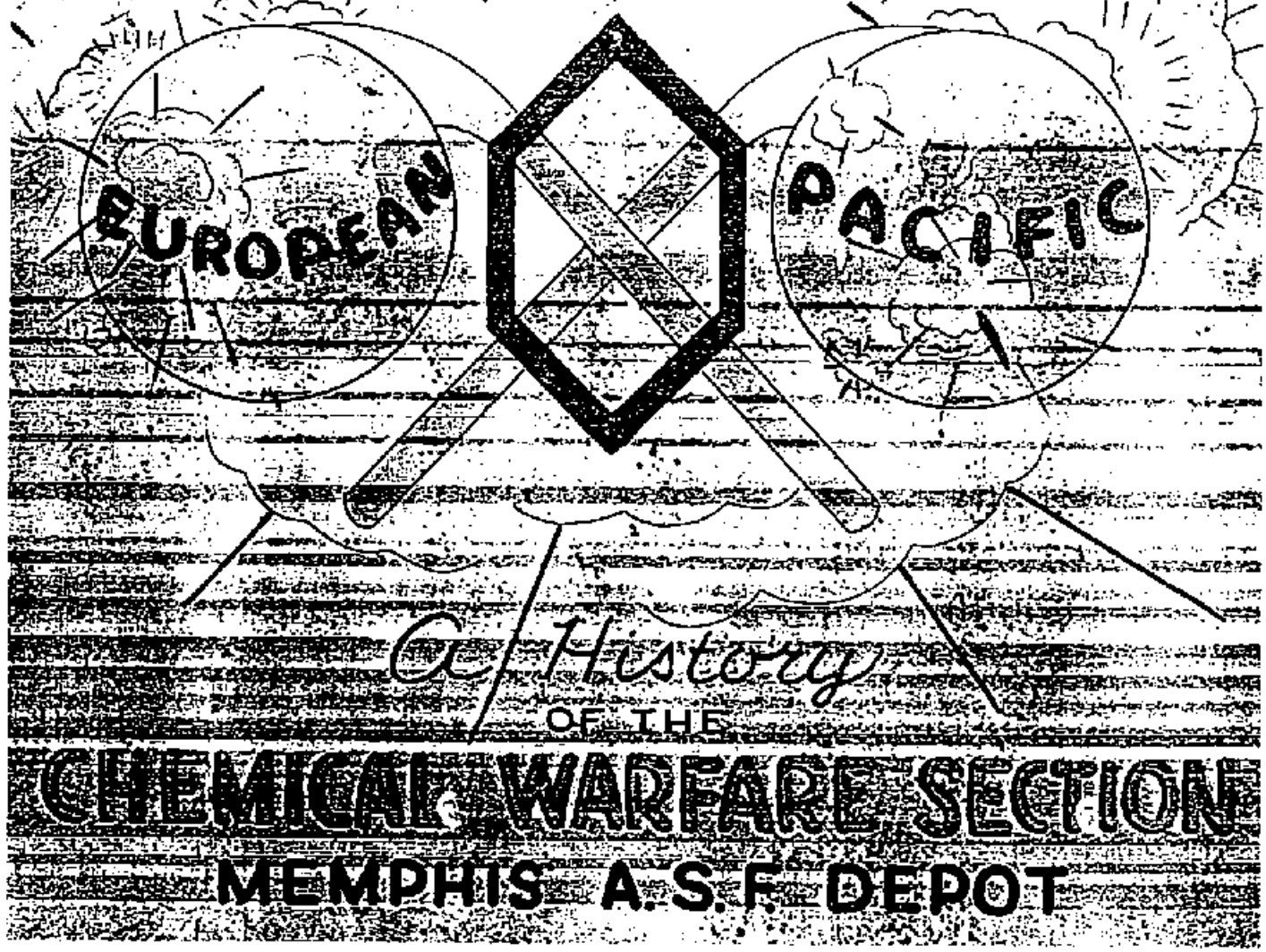

A History OF THE

CHEMICAL WARFARE SECTION

MEMPHIS A.S.F. DEPOT

and 4 per cent by Chemical Warfare Section.

c. Activation. This depot was constituted and activated by the War Department as the then Memphis General Depot, as of 26 January 1942.[1] It will be noted that in the original activation, provisions were made for 3 tenant supply services, i.e., Quartermaster Corps, Corps of Engineers, and Chemical Warfare Service.

The Chief of the Chemical Warfare Service directed that the Chemical Warfare Section of this depot be activated as of 1 April 1942, but this was later amended to make the effective date of activation 30 April 1942.[2]

d. Mission. The directives ordering the activation of the Chemical Warfare Section included the assigned mission as well as the basic procedures to be followed. It will be noted that these directives were amended prior to the activation of this section.[3] The mission of this office has remained practically unchanged, and the current mission as outlined in War Department Supply Bulletin SB 38-3-CWS, Part 2, quoted below, may be considered the assigned mission of this office since activation:

SUPPLY

Distribution: 1. GENERAL SUPPLIES. a. As a distribution depot. To receive and store CWS general supplies for distribution to installations located within the Fifth, Sixth, and Seventh Service Commands, including staging areas under control of the New Orleans Port of Embarkation, and to that port for port stocks.

Filler: b. As a filler depot. To receive and store CWS general supplies for shipment overseas through the New Orleans Port of Embarkation.

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[1] Appendix Number 5.
[2] Appendix Number 6.
[3] Appendix Number 6.

Reserve: c. As a reserve depot. To receive and store authorized reserve of CWS general supplies for future distribution.

Distribution: 2. AMMUNITION. a. As a distribution depot. To receive and store training ammunition only for distribution to installations located within geographical area of the Fifth and Sixth Service Commands.

Reserve: b. As a reserve depot. To receive and store authorized reserves of all types of CWS training ammunition.

To assist in visualizing the geographical area service by this office, a map is attached as Appendix 7.

e. Original Organization. Lieutenant Colonel Edgar A. Vaughan, Chemical Warfare Service, reported to this depot as Chemical Warfare Supply Officer on 17 February 1942, in compliance with WD SO 21, 24 January 1942. Shortly thereafter he was joined by Mr. Bennet A. Pine, then Administrative Assistant, Chicago Chemical Warfare Depot, who was sent to assist in the organization of the section. In addition, Mr. Otis Imboden was transferred to this office from the Chemical Section, Headquarters, Second Army, this city, to serve as Administrative Assistant to the Chemical Warfare Supply Officer and assist in setting up the original organization.

As originally organized under the then current AR 700-10, this organization was in most respects a separate operating entity. Complete responsibility was assumed for such functions as selection and placement of personnel, securing of all equipment, furniture, fixtures and other material required for the operation of the section and the establishment of all necessary policies and procedures, subject only to the directives and orders issued by the Chief, Chemical Warfare Service.

As will be reflected in succeeding paragraphs, many of these functions have since been assumed in whole or in part by other echelons of the depot organization. The effect of these changes in policies and

total personnel authorization for the depot as a whole. Personnel permanently attached to the Chemical Warfare Section and under the direct supervision of the Chemical Warfare Supply Officer are allocated by the Depot Commander from this total authorization. Likewise the common labor, checkers and equipment operators required by the Chemical Warfare Section are secured from the labor pool which is under the direct jurisdiction of the Depot Commander. The same is true of all material handling and automotive equipment required by the Chemical Warfare Section which is likewise obtained from the depot equipment pool. The furniture, fixtures and operating equipment and supplies used by this section are controlled by and on the accountable records of the Depot Property Officer, who, in turn, is responsible to the Depot Commander.

It is very evident that the Depot Commander could, if he so chose, directly control and influence all details of the operations of the Chemical Warfare Section. Actually, the Depot Commander has chosen to leave the full responsibility for the operation of this section in the hands of the Chemical Warfare Supply Officer. No effort is made to establish or directly control operating practices and procedures. Such personnel equipment and other facilities as are required by the Chemical Warfare Supply Officer to accomplish his mission are furnished wholly in accordance with his determination and used under his direct supervision, subject only to the general operating policies of the depot, and the limitation of availability of such labor and equipment as may be desired.

While the Depot Commander makes no attempt to exercise direct supervision over the normal operations of this section, he has always demonstrated a keen interest in our progress and problems, and a ready

willingness to use such authority and facilities as are available to him any time such assistance is requested or would be helpful in the accomplishment of either the normal mission of this section or any unusual task or assignment.

b. Internal Administrative Procedures. The administrative procedures within the section have remained practically unchanged since the original organization. Attached as Appendix 9 is a current functional organization chart which includes a description of the authority and responsibilities of each echelon of this organization. It will be noted that the authority and responsibilities of each echelon is clearly outlined. Every attempt has been made to so delineate the authorities and responsibilities of each individual in this organization that there is no question of individual responsibility for desired results. It has been a basic policy to delegate to each individual such authority as might be required to accomplish the responsibilities with which they are charged.

The usual problems of administration are to a great extent simplified in this operation by virtue of the small number of people involved. This permits a close and continuous contact between all echelons of the organization that is conducive to a thorough understanding of and the expeditious handling and administrative determinations that may be necessary on any problems which may arise.

c. Control Activity. Although this section is not sufficiently large to permit the establishment of a separate Control Division, all required control activities are carried out and correlated as a part of the responsibilities of the Administrative Branch and are accomplished under the direct supervision of the Administrative Assistant. In addition,

all supervisory personnel are charged with the responsibility for efficiently using manpower and for keeping ever on the alert for opportunities to simplify procedures and eliminate non-essential activities.

This section has originated a number of work simplification procedures which have been submitted to higher authority through proper channels. Particular attention has been given to the simplification of clerical procedure and the elimination of surplus forms and records. As an example of this activity there is attached as Appendix 10 a procedure which originated in this office for the compilation of the report "Supply Operations at Technical Service Depots and Sections of ASF Depots," Control Approval Symbol DDI-104. As is reflected in letter included with this Appendix, the procedure was recommended by the Chief, Chemical Warfare Service to all other Chemical Warfare Depots as a satisfactory solution for the problems of compiling this report, and it is believed that this procedure is currently being used by most of the Chemical Warfare Depots. In addition, as will be noted from copy of letter included with this Appendix, this procedure was adopted and is being used by the Engineer Supply Officer at this depot.

Another example of simplification of clerical procedure originating in this office will be found in Appendix 11 which includes a letter from this office suggesting the procedure and form, which were adopted and are currently being used by the Chief of the Chemical Warfare Service, for furnishing equipment to newly activated units.

The guiding principal used in controlling the administration of records, reports and files has been to simplify and reduce paper work wherever possible. Experience has demonstrated that simplification not

only permits more efficient utilization of manpower, but also results in greater accuracy and more effective validity. One all too prevalent wasteful practice that this office has studiously avoided is the use of subsidiary or duplicate records where there already exists basic records from which any required information may be gathered.

Usually, in operations of this nature, these superfluous subsidiary reports will be found in the form of daily records on individual functions or operations where there are already other currently maintained basic records for the purpose of furnishing required monthly reports that actually will furnish any and all data that may be required, thus making these daily reports of very doubtful value.

Another point which has had the close attention of this office is the elimination of all possible clerical work in the Storage Division. Since the principal function of the Storage Division is physical in nature, it is felt that wherever possible any records, reports or other clerical functions should be handled either by the Stock Control Division or the Administrative Branch where clerical work is the main function. This elimination of clerical duties in the Storage Division permits Storage Division supervisory personnel to devote their full time to storage activities.

d. Implementation of Directives from Higher Authority. Due to the fact that the operation of this section includes certain technical problems and differs in many aspects from the operations of other supply services, most basic directives from such authority as Headquarters ASF are actually implemented by the Chief of Chemical Warfare Service rather than through the local Depot Commander or his Control Division. Therefore,

more positions other than the one to which assigned. As a result of this policy, the absence of any individual employee does not cause any work stoppage since there are always other employees who can carry on any required work. In addition when peak loads occur in a particular job or operation, other employees are able to furnish the required assistance.

It has also been found that this broader knowledge of the operation, including an understanding of the work performed by other employees, contributes measureable to the over-all efficiency, and permits a degree of cooperation among the employees which would not otherwise be possible. Undoubtedly, this policy accounts for the statement the Depot Control Division made in reporting on a survey of this office: "The impression acquired by the staff was that all personnel of the Chemical Warfare Section had been well trained and the lack of any confusion in that section was immediately evident."

The most recent training program inaugurated at this depot is the Supervisors' Management Program which is being conducted by the Depot Control Division. All supervisory personnel in the Chemical Warfare Section, both military and civilian, have taken this training. This course included explanations of the work distribution chart and the work process chart which are basic tools that can be used to excellent advantage by all supervisory personnel in intelligently analyzing operations under their jurisdiction.

6. Employee suggestions. Employee suggestions at this depot are handled in accordance with the procedure outlined in Part 1, ASF Circular Number 300 dated 12 September 1944. Attached as Appendix 16

consulted, thus permitting any required rearrangement of the work plan originally contemplated.

Occasionally this office, in common with other echelons of the depot, is faced with unexpected requirements for labor that could not be anticipated. Such requirements usually result from the receipt of orders for large shipments requiring expeditious handling. When these cases arise, the labor pool is furnished complete details and makes the necessary arrangements to secure any required labor or equipment from other echelons of the depot where it is being used on work that is not of an urgent nature. Thus it will be seen that although this plan of labor pool operation permits each section to operate with the minimum amount of labor and equipment at any given time, it also provides for supplying any additional requirements that may be necessary to meet peak loads.

In order to provide each supply service with a source of labor skilled in any technical aspects of their operation, the labor pool forms up squads of experienced laborers which are included in any labor assigned to the section. These specially trained crews form the nucleus of any labor organization that may be required. This procedure satisfies the requirements of each technical service for skilled labor and at the same time provides the desired flexibility to meet any variations in the workload.

At the present time a total of some 1600 German prisoners of war are being used as a part of the depot labor pool organization. These prisoners are formed in squads and distributed in exactly the same manner as all other labor personnel. The same practices with respect to

Chapter VIII

FACILITIES AND EQUIPMENT

a. Facilities. The following described facilities are assigned to the Chemical Warfare Section:

1. Office space. Approximately 2,000 square feet of space in the administration building designated as AO-1 on the Depot Layout Plan is assigned to and used by Chemical Warfare Section for the office of the Chemical Warfare Supply Officer, his administrative branch and the stock control division. This space is located in the extreme west end of the south wing on the second floor.

2. Warehouse space. Warehouse NC-1, NC-2 and two sections in warehouse NB-1 are permanently assigned to the Chemical Warfare Section. In addition, one section in inflammable storage building ND-2 and approximately 800 square feet in building ND-3, which is used for packing and crating ammunition and other hazardous material, is also assigned to this section.

3. Shed storage. A total of 85,000 square feet of shed storage space located in shed SD-22 and SB-22 is assigned to this section. A total of 10,00 square feet of unimproved open storage space restricted to the storage of classified ammunition is assigned to this section. In addition 15,000 square feet of open space borrowed from the the QMC is being used for the storage of Plant, Impregnating, Z of I, Number 110.

4. Igloos and Magazines. This section is assigned and uses two standard igloos, one 60 feet and one 80 feet, and in addition two above ground magazines.

5. Storage at Posts, Camps and Stations. This office is

also assigned 150,000 square feet of gross storage warehouse area at Camp Ellis, which is being used for the storage of approximately two million civilian gas masks which are carried on the accountable records of this office.

b. Equipment. All materials handling equipment such as forklift trucks, tow motors and floats required by this section are secured from the depot equipment pool which is responsible for the housing and maintenance of all this equipment. Likewise all automotive equipment including trucks and passenger vehicles are obtained from the depot automotive pool. The equipment originally procured by this section included 14 mobile lifts, 5 trucks and 1 passenger vehicle has all since been turned over to the depot pool.

Chapter IX

UTILITIES

All utility functions at this depot are under the jurisdiction of and performed by Post Engineer. This office has no responsibility in this connection other than to report to the Post Engineer any deficiencies or need for correction active required in connection with the facilities assigned to and used by the Chemical Warfare Section. The Post Engineer also assumes responsibility for the construction of any additional or special facilities which may be required.

Chapter X

OPERATIONS DIRECTLY RELATED TO THE SUPPLY FUNCTION

Although the basic mission of this office has remained practically unchanged since the beginning, there have been many changes in the

e. Use of materials handling equipment. With the exception of the items stored in the igloos and magazines, practically all materials handling is done with gasoline-driven fork-lift trucks. In cases where it is necessary to move material considerable distances, the usual practice is to use tow-motors and trailers. In the igloos and magazines, it has been found satisfactory to use conveyor lines, which in addition to their other advantages, provided the necessary elements of safety in handling hazardous and dangerous items. In normal receiving and shipping operations, the fork-lift picks up and distributes pallet loads inside the car as close as possible to the stacking or unstacking operation. This reduces to a minimum the distance over which the material being loaded or unloaded must be physically handled by the laborer, and contributes to over all efficiency of the operation.

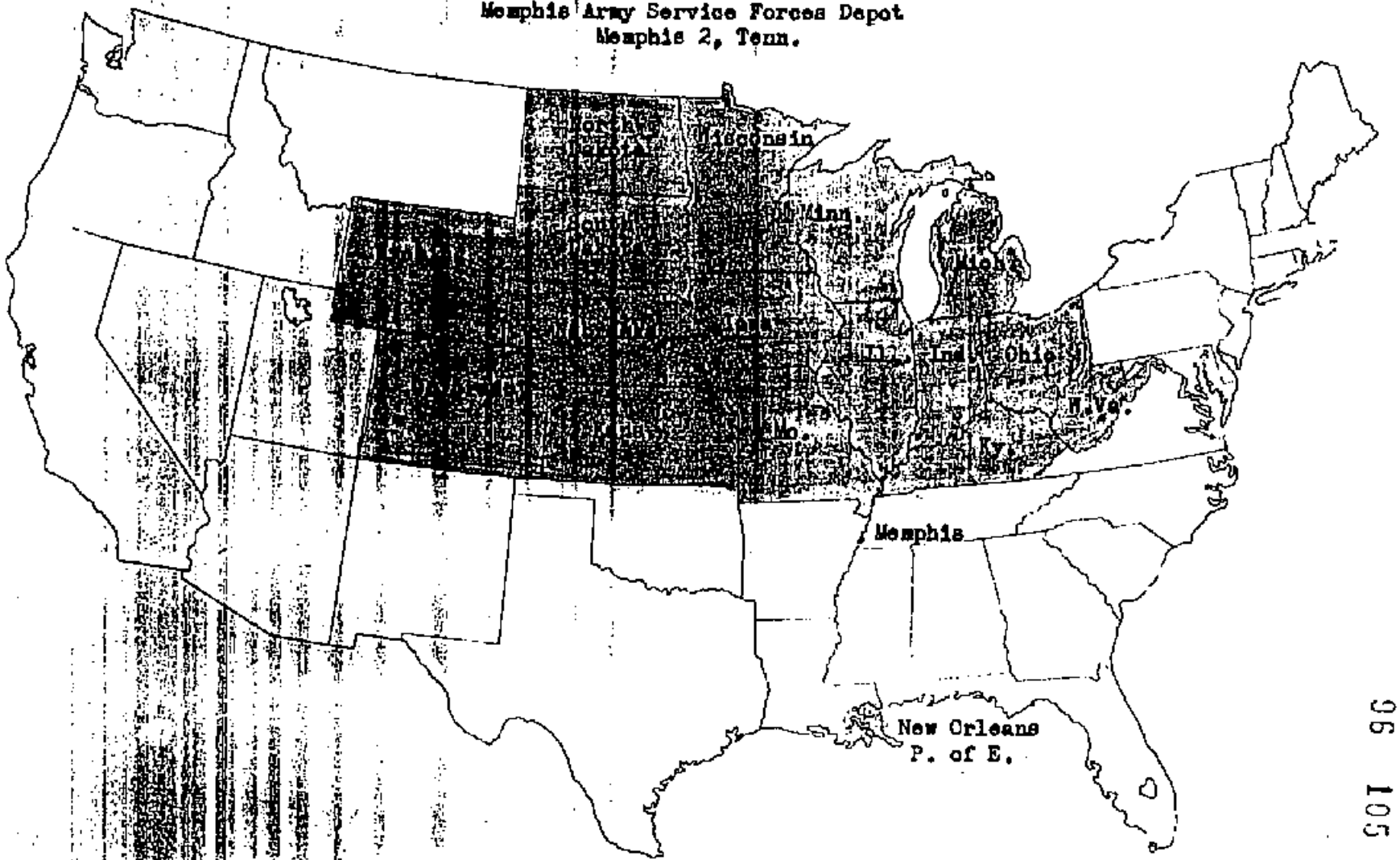
f. Processing. While this section has been required from time to time to perform processing work, it is not a regularly established function, and recent changes in maintenance policies and procedures will undoubtedly eliminate the necessity for future processing operations.

1. Plant, Impregnating, 2 of 1, Number 110. The largest single processing operation conducted by this office consisted of processing and recrating in accordance with overseas packing specifications the Plant, Impregnating 2 of 1, Number 110, which is in storage here. This plant consists basically of approximately 45 car loads of heavy laundry equipment. It was necessary to secure the services of two qualified technicians from the American Laundry Machinery Company, Cincinnati, Ohio, the original builders of this plant, to furnish the necessary technical supervision. In addition, it was necessary to set

26 January 1942

GEOGRAPHICAL AREA SERVED BY

CHEMICAL WARFARE SECTION
Memphis Army Service Forces Depot
Memphis 2, Tenn.



96 105

96 196

Chemical Warfare
Supply Officer

May 12, 1943

MEMORANDUM:

TO : Captain Thomas Forshaw, CWS,
Chemical Warfare Supply Officer,
Memphis Quartermaster Depot,
Memphis, Tennessee.

SUBJECT : STORAGE AND HANDLING OF AMMUNITION AND OTHER HAZARDOUS CHEMICAL WARFARE ITEMS.

I. GENERAL.

1. Included among Chemical Warfare materiels stored and handled by this depot are several types of ammunition and other items involving special hazards.

2. The handling of the subject items in accordance with existing regulations and with the maximum degree of safety is a definite responsibility of the Chemical Warfare Supply Officer.

3. This memorandum is prepared to assist the Chemical Warfare Supply Officer in his discharge of responsibilities outlined in paragraph 2. above. It represents a correlation of the basic information and data contained in regulations and other technical publications available in this office, and as listed in Appendix I. of this memorandum.

II. CARE OF MAGAZINES AND GROUNDS.

1. The grounds around magazines will be kept free from dry grass, leaves and rubbish, and a fifty (50) foot cleared space will be carefully maintained around above-ground magazines. All magazines and igloos at this depot are of the above-ground type.

2. Fire extinguishers, water barrels and other auxiliary fire fighting equipment, such as gunny sacks and brooms, at or near magazines will be arranged in a neat and orderly manner to protect against undue deterioration. They will be placed uniformly in position where they are in plain sight and readily available.

3. Within the magazines, the floors will be clean and free from dirt, oily spots or exudate.

4. Stock in magazines will be arranged in an orderly manner with ample aisle space for inspection and shipment.

5. Loose components or rounds of ammunition, packing material, conveyors,

VI. FIRST AID.

1. To insure proper protection of personnel, adequate first aid equipment should be readily available. The information in this connection available in this Section concerns mostly first aid equipment necessary in connection with the handling of liquid vesicants and the non-persistent casualty agents. Since these items are not at present handled by this Section, these regulations are in a large measure not applicable. See recommendations in Section IX. below.

VII. SHIPPING.

1. Rail Shipments.

a. The Interstate Commerce Commission regulations, as set forth in Agent W. S. Topping's Tariff No. 4, which govern the transportation of explosives and other dangerous articles by rail, are essentially safety regulations and describe in detail how such shipments will be handled, loaded, braced, stayed and placarded. (See also AR 30-995, "Transportation of Supplies"). Bureau of Explosives, Pamphlet No. 6, and American Association of Railroads, Pamphlet No. 27, contain descriptions, photographs and drawings of recommended methods of bracing and staying shipments. In addition, there is a memorandum in the files of this office covering a discussion between the writer and Mr. J. B. Respress, Inspector, Bureau of Explosives, Association of American Railroads, Birmingham, Alabama, which covers proper classification and description of recently developed items of ammunition which are not covered in Tariff No. 4, referred to above. The Bureau of Explosives is charged with the responsibility for determining safe methods of shipping explosives and other dangerous articles by rail, and their representative in this area stands ready to assist us in making the proper determination on any questionable items, or items not covered in current rules and regulations.

2. Motor Truck Shipments.

a. Contracts for transportation of ammunition and explosives by common or contract carriers will be let only to those contractors whose vehicles are licensed by the Interstate Commerce Commission specifically for the transportation of explosives and other dangerous articles. So far as the writer knows, none of the motor carriers at present operating in this territory are so licensed by the Interstate Commerce Commission, and in no case should any of the above items be offered for motor transport without prior consultation with the transportation officer and this office.

3. Water Shipments.

a. Transportation of explosives and other dangerous articles by water will be in accordance with AR 30-1270, "Transportation by Water of Explosives, Inflammables, and Chemical Warfare Material".

VIII. SPECIAL REGULATIONS FOR STORING AND HANDLING OF INDIVIDUAL ITEMS OF CHEMICAL

WARFARE MATERIEL.

1. The Chemical Warfare materiel handled by this depot may, as a matter of convenience, be divided into four main classes or groups, as follows:

a. Inert materiels.
(1) Example of inert Chemical Warfare materiels are apparatus, decontaminating (various types); gas masks; respirators; bomb bodies, empty; smoke tanks, etc. No particular hazard is attached to the storage or shipment of any of these articles.

b. Explosives.
(1) The explosives currently handled by this Section fall into two main classifications:
(a) Bursters, nitro-starch and primacord, both of which are high explosives.
(b) Detonators, fuzes, etc., which include blasting caps, electric squibs and bomb nose fuzes.
(2) An additional class of explosives not being currently handled is bursters containing black powder, such as the burster for the M47 100# chemical bomb. If this item is received or stored, it will add a third class to the explosives being handled at this depot.

c. Chemical ammunition.
(1) Chemical ammunition is divided into four basic groups:
(a) Group "A" - Persistent Gases, which include Mustard Gas (HS), and Lewisite (M-1). Neither of these are currently handled by this depot.
(b) Group "B" - Non-Persistent gases, toxics, irritants and smoke. This group includes the following items currently stored and handled:
1. Chloracetophenone (CN), tear gas; Adamsite (DM), irritant gas; Sulfur Trioxide, Chlorsulfonic acid mixture (FS), smoke, Titanium Tetrachloride (FM), smoke: Chloracetophenone (tear gas) solution (CNB and CNB).
(c) Group "C" - Spontaneously inflammable agents.
1. HC, Smoke pot (HEXACHLORETHANE burning mixture).
2. Grenade, frangible, M1, AW filled. The AW filling consists of phosphorus and a rubber-gasoline solution.
(d) Group "D" - Incendiary and readily inflammable agents.
1. Burning mixture of CN- tear gas pots and tear gas grenades.
2. Burning mixture of DM- DM pots and DM grenades.
3. Burning mixture of CN and DM - CN-DM pots and grenades.
4. Bombs, incendiary.

d. Inflammable and/or corrosive or toxic liquids and solids.
(1) Flame thrower fuel.
(2) Paint, liquid vesicant detector.
(3) Ointment, protective.
(4) Impregnite, Shoe.
(5) Acetylene tetrachloride.

(6) Chloride of lime.
(7) Matches.
(8) Paraffin, chlorinated.

2. The following is detailed information on each of the items mentioned in the paragraph above, and outlines all special considerations that must be given in the storage and handling of these individual items.

a. Explosives.

(1) The general rule to be followed in storing explosives is that it is forbidden to store together any two substances of such a nature that one may "step up" or explode the other.

(2) High explosives (nitro-starch and primacord bursters).

(a) Storage.

1. All high explosives must be stored in magazines or igloos of approved construction, in accordance with the provisions of Ordnance Safety Manual O.O. Form #7224. They may not be stored with any other type of explosive, nor with any chemical ammunition. Regulations with reference to stacking, temperature control, etc., as outlined in subject Ordnance Safety Manual should be strictly observed. Containers or boxes must not be opened in such magazines, but must be removed to a building especially provided for this purpose, or out into the open at least one hundred (100) feet from the magazine. Boxes from which part of the contents have been removed must be resealed in accordance with approved factory methods before being replaced in the magazine.

(b) Fire Protection.

1. If a fire occurs in explosives stored in wooden boxes, as is the case with all explosives handled by this Section, they usually will burn quietly, but may detonate. If the fire has gained considerable head-way before it is discovered, no attempt should be made to fight the fire. The magazine shall be abandoned and the efforts of the fire fighting force shall be directed toward preventing the spread of fire to other magazines. Fire fighting forces will not go closer than adjacent magazines of eight hundred (800) feet, and will protect themselves against a possible explosion by taking advantage of available cover, or by lying flat on the ground.

(c) Guard Protection.

1. Explosive areas will be guarded adequately at all times in accordance with the provisions of Section IV. "Guard Protection", of this memorandum.

(3) Detonators.

(a) Included in this group currently handled by this Section are various types of detonators, blasting caps, fuzes, electric squibs and bomb nose fuzes. While regulations permit the storage of all of this class of materiel in a magazine, this should be avoided, if possible, because a fire or explosion would probably result in the loss of the entire quantity, in view of the fact that all such items are very easily detonated

and the explosion of one box would probably detonate the entire mass. All loaded components, even when properly packed, must be handled with care. Under no circumstances should they be thrown or dropped on the floor or on other boxes. Boxes should not be opened in the magazine, but must be removed to a building especially provided for this purpose, or to a safe distance in the open. No opened boxes shall be placed in the magazine. Any boxes from which part of the contents have been removed shall be carefully resealed before returning to the magazine. Loaded components offered for shipment will be supported or so packed in containers that they will not strike against each other. If the containers in which the components were originally packed are not available, boxes and trays which will insure protection against shocks and rough handling will be constructed.

(e) Fire Protection.

1. Test made at Aberdeen Proving Ground with pile of fuzes in boxes showed that in case of fire, boxes usually detonated one at a time. The missiles are light and have a very limited range, usually not over two hundred (200) yards. Although under some circumstances it may be permissible to put out a fire which occurs in the magazine in which this type of ammunition is stored, this action must be based on very careful consideration. If the fire has reached any magnitude, or there is any reason to believe that it can not be controlled, the magazine shall be abandoned and the efforts of the fire fighting force confined to protecting adjacent magazines. Personnel fighting the fire should seek such cover as is available, or protect themselves against missiles by lying on the ground.

(f) Guard Protection.

1. Guard protection for this type of ammunition shall be of the same type provided for other explosive and dangerous items.

b. Chemical Ammunition.

(1) Whenever possible, each individual item falling into this classification will be stored separately. However, unless prohibited in Ordnance Safety Manual O.O. Form #7224, chemical ammunition items of the same group may be stored together. Chemical ammunition of two or more groups of fillings will not be stored together, except on specific approval of Chief of Ordnance.

(2) Group "A" - Vesicant Agents.

(a) At the present time none of these items are stored at this depot. If this depot is called on to store any of these agents, it is probable that a cadre of trained gas handlers from one of our Chemical Warfare Arsenals will be furnished. In no event should this depot attempt to receive or store any of these items without such personnel, as the hazards involved are too great.

(3) Group "B" - Non-Persistent Gases, Mixtures, Irritants and Smoke.

(a) Chloracetophenone CN.

1. We are currently storing CN capsules which fall within this classification, inasmuch as CN is a solid, melting at 130 degrees Fahrenheit. Heat in some form would be required to produce any effects from these capsules. For this reason, they should be stored so as to provide the maximum protection from fire or heat.
2. Although the CN grenades, pots and candles stored by this depot, and covered separately herein, are classified as Group "D" ammunition, a fire would produce CN gas requiring the same protection and first aid necessary in connection with this agent.

(b) CNB AND CNS Solution.

1. These items are liquid solutions of CN used to produce tear gas clouds through spray. The liquids are corrosive and toxic, and in the event of leakage, gas masks should be worn and protection provided against spillage or other contact with the skin of personnel.

(c) Adamsite (DM).

1. Covered under Group "D" below.

(d) FS, Smoke Mixture.

1. This materiel is a highly corrosive mixture, which if exposed to air produces a dense smoke screen, the smoke of which is likewise corrosive to metals, although as a rule it is not injurious to personnel. However, in strong concentrations, gas masks should be used, keeping in mind that if the smoke is confined within a room or building it would undoubtedly decrease the oxygen content of the air to a point where the gas mask would be of no avail. In such a case, adequate protection for personnel entering such confined space could be obtained only through using a hose mask, one of which is available in this Section.

(e) FM, Smoke Mixture.

1. This chemical has the same purpose and characteristics in general as FS, and the above paragraph will apply.

c. Group C - Spontaneously Inflammable.

(1) HC smoke pots.

(a) The smoke produced is generally non-toxic, nevertheless no one shall remain in the cloud for more than fifteen minutes, or in very dense smoke for a shorter period without wearing a gas mask.

(b) Storage.

1. In handling and storing HC smoke pots, care must be taken to prevent them coming in contact with water. They should be stacked on rails or sills at least 4" high, in order to keep them from coming in concontact with any water on the floor. Frequent inspection will be made of all containers to see that they are not in a leaking condition. The officer in charge of the magazine will inspect once each month, paying particular attention to water, the condition of the roof of the magazine, and the possibility of rain or snow being driven in on ammunition through windows, doors, or ventilators. All leaking containers will be removed from

magazines as soon as possible and destroyed by burning in a location where there is no fire risk.

(c) Fire Protection.

1. HC smoke pots are subject to spontaneous combustion. Under no circumstances should water be used in combating a fire involving this item, as the use of water would serve only to create special hazards and would not extinguish fires. Same applies to carbon dioxide, carbon tetrachloride, and other fire extinguishers. The efforts of the fire fighters should be confined to preventing spread of the fire, keeping in mind that no explosive hazard is involved. Containers or ammunition filled with HC smoke mixture that have been exposed to fire will be considered a potential fire hazard and will be kept under surveillance for a period of one week before they can be considered safe for storage.

(d) Guard Protection.

1. There will be maintained at all times periodical inspection by fire guards of magazines containing this Group "C" ammunition. Guards walking post near these magazines will be especially instructed to report any smoke seen issuing from the magazine.

(e) First Aid.

1. Any burns as result of accidents with HC smoke pots involves no special consideration and may be treated as any other burn. Any personnel overcome by smoke from the HC smoke pots will be treated as any other case where the person was overcome by smoke, as there is no special toxic effect from the HC smoke.

(2) Grenade, frangible, M1, AW filled.

(a) This grenade is a glass bottle filled with a mixture of white phosphorus, gasoline and liquid rubber. Extreme care should be exercised in handling these glass bottles, as any droppage or rough handling, which would cause them to break, would result in an immediate and serious fire.

(b) Fire Protection.

1. There are special hazards to the fire problem in handling fires from this grenade. Ordinarily any fires from white phosphorus may be readily extinguished with water. However, in this case the presence of flaming gasoline and rubber would cause any application of water to result in spreading the fire, rather than extinguishing it. In view of this fact, it is believed that efforts of fire fighters should be confined solely to preventing the spread of fire.

(c) Guard Protection.

1. Same as for the smoke pots above.

c. Group D - Chemical Ammunition (Incendiary and readily inflammable).

(1) Incendiary Bombs

(a) Incendiary bombs are of two types, one of mag-

nesium and the other of thermit. When ignited, they produce fires of extremely high intensity, but no explosive hazard is involved in the types currently stored at this depot, nor do they produce any toxic smoke or gases. Included in Chemical Warfare Nomenclature are types of bombs which do have an explosive hazard, and in the event any of these are stored, special instructions covering these items shall be issued to all concerned.

(b) Fire Protection.

1. Under no circumstances should water or any type of fire extinguisher be used on or near a fire of this item. Efforts of the fire fighters should be confined to preventing any spread of the fire.

(c) Guard Protection.

1. The same type and degree of guard is required as for high explosive as described in paragraph 2. a. (2) (c), above.

(2) Burning Mixtures of CN.

(a) When ignited, CN grenades, pots and candles produce clouds of CN, which has the same physiological effects as described under Group "B" Chemical Ammunition CN above.

(b) Fire Protection.

1. The efforts of fire fighters shall be confined to preventing spread of the fire. All fire fighters shall be provided with gas masks. In addition, all persons living two miles down wind from the fire will be notified to vacate until all danger is past.

(c) Guard Protection.

1. Same as for high explosives.

(3) Adamsite, Burning Mixtures, DM.

(a) The ignition of grenades, pots or candles of DM burning mixtures produce a toxic suspension of solid particles of DM in the air. The cloud is not a gas, but a yellow colored smoke which has the effect of quickly overcoming unprotected personnel; causes irritation of the eyes, violent sneezing and extreme nausea. In addition, mental depression may be so marked that an individual will have to be forcibly restrained to prevent self-injury. Because of the delayed action of this agent, symptoms may not appear in slightly exposed individuals until after the gas mask has been put on. The uninformed person believing his gas mask to be inefficient may then remove it and become a casualty from further exposure to this agent.

(b) Storage.

1. DM candles, packed in boxes, shall be piled in stacks with battens separating each tier, so as to facilitate the immediate removal of any single box. Ample ventilation shall be provided, and since the fuel in these candles is smokeless powder, temperature control in magazines con-

taining smokeless powder shall be exercised, and if the magazine exceeds 100 degrees Fahrenheit for a period of more than 24 consecutive hours, or 80 degrees Fahrenheit for a continuous period of more than 72 hours, consideration shall be given to cooling the magazine with water or to removing the contents. The magazines shall be equipped with a maximum and minimum thermometer during a hot spell of summer weather, and thermometer shall be read daily or as often as deemed necessary.

(c) Fire Protection.

1. If fire breaks out in any magazine in which DM is stored, all persons living within two miles down wind from the fire will be notified to vacate until all danger is past. All persons fighting the fire will wear gas masks. In the case of the DM candles, since the fuel in these candles is smokeless powder, there is a high degree of hazard from explosion and this shall be taken into consideration in fighting any such fires.

(d) Guard Protection.

1. Same as for high explosives.

(4) Burning Mixtures CN-DM.

(a) A combination of the general characteristics of CN and DM, individually.

e. Inflammable and/or corrosive or toxic liquids and solids.

(1) Flame Thrower Fuel.

(a) This is a combination of gasoline, kerosene and other oils. The storage, handling, guard, and fire protection of this item shall be that provided for any readily inflammable liquid of this nature.

(2) Paint, Liquid Vesicant Detector.

(a) The chemical content and nature of this paint is not known in this office, but based on the fact that it is a paint, it is believed to be of an inflammable nature and shall be so handled.

(3) Ointment, protective.

(a) This is a compound with a grease base and probably has the same inflammable characteristics of ordinary grease or oils.

(4) Impregnite, shoe.

(a) This is a grease base compound and its inflammability would probably be similar to that of shoe polish or similar items with a grease or wax base.

(5) Acetylene Tetrachloride.

(a) This is a non-inflammable and non-corrosive liquid. However, the fumes in high concentration are toxic to some degree, and ample ventilation shall be provided in any storage area. In addition, it is corrosive to the skin and contact or spillage on the skin of personnel shall be avoided.

(6) Chloride of Lime.

(a) This is a finely divided solid with a high, but relatively stable chlorine content. In storage the

amount of chlorine given off is probably not high enough to cause serious toxic effects, but ample ventilation shall be provided, inasmuch as relatively low concentrations of chlorine will produce irritation of the nasal passages and discomfort. In addition, personnel called on to transfer or authorized to handle this item in bulk or open containers shall be provided with gas masks, as it produces a concentrated dust that will produce sickness on the part of personnel if breathed in any concentration over an extended period of time. It is also to some degree irritating to the skin, and any spilled on the skin should be washed off immediately. Men called on to work with it can secure added protection by using protective ointment or some grease compound to protect the skin.

(7) Chlorinated Paraffin.

(a) This item is a heavy, sticky liquid consisting of paraffin containing chlorine. Chlorine is relatively stable, and it is not believed that any concentration of chlorine might develop in storage. No doubt this compound has the same burning characteristics of normal paraffin.

(8) Matches.

(a) The matches handled by this Section are of the safety type and shall require no other consideration than careful storage in inflammable storage space.

IX. RECOMMENDATIONS:

1. The above study incorporates only the basic information considered necessary to a working knowledge of the above items. More detailed information is available in various publications in this office, which have been used freely in the preparation of this text. A list of these publications will be found in Appendix I, attached. The following recommendations are submitted for your consideration:

a. School.

(1) It is recommended that a school or series of conferences be organized for all personnel, military and civilian, of this Section, in any way concerned with the handling of these items.

(2) It is further recommended that the Provost Marshal, Fire Marshal, and the Intelligence Officer of this depot be invited to attend or have representatives attend these conferences. In the event that the Provost Marshal or the Fire Marshal desire instruction in the subject matter for their personnel, properly qualified instructors from this Section will be detailed for that purpose.

(3) It is also recommended that the Provost Marshal, Fire Marshal and Intelligence Officer be invited to review the technical publications from which this memorandum was prepared as listed in Appendix I., and institute steps to secure any of these publications that they may desire for the use of their organizations.

b. Storage Location.

(1) It is recommended that the Provost Marshal, Fire Marshal and Intelligence Officer be kept currently informed at all times

Chemical Activities

1. Since the last annual general inspection conducted by this office, this section has been greatly expanded to include world wide supply of Chemical Corps spare parts in addition to the normal supply of Chemical Corps end items furnished to the Fifth Army Area. It is the opinion of the inspecting officer that this activity has been organized into a capable and efficient unit which is performing the assigned mission in a very commendable manner.

2. It was pleasing to observe that aggressive action was being taken to protect the interests of the Government in respect to the receipt of spare parts showing rust, corrosion and corrosion damage. Said parts were received from the Reed Manufacturing Company.

3. The entire section is aware of, and alert to, the cost consciousness program and supply economy program as is indicated by the inclusion of a period devoted entirely to these subjects in the regular training course required for civilian personnel. An examination, which contains questions concerning cost consciousness and supply economy, is given upon the completion of this aforementioned course.

4. An excellent stock location system has been established since the last audit.

5. The Depot Chemical, Biological and Radiological Defense Plan was briefly reviewed and found to compare favorably with those reviewed at other installations.

6. Physical storage and maintenance of stock is in compliance with current regulations and compares favorably with other installations visited which have been in routine operation for a much longer time.

7. The small stock of Chemical Corps ammunition presently stored at this installation is no longer required since ammunition supply is not included in the mission. Shipping instructions have been received to transfer the stock of ammunition to Pine Bluff Arsenal, Arkansas.

8. Assigned storage space appears to be adequate and efficiently used.

9. A very badly needed spare parts processing line is partially completed and will be ready for use in the near future.

10. Stock records and accounting have been transferred from a manual to a machine-controlled system since thelast annual general inspection.

11. During an examination of Account No. 3-340, it was noted that the method of picking up accountability, in respect to supplies transferred to the Depot from the Eastern Chemical Depot during September 1951, was not in accordance with pertinent regulations. These supplies were entered on

CHEMICAL PARTS CENTER
MEMPHIS GENERAL DEPOT, U. S. ARMY
MEMPHIS 15, TENNESSEE

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QUARTERLY HISTORICAL REPORT
3d Quarter - FY 1960
1 January - 31 March 1960

I. Policy:

A. Change in mission and responsibilities resulted by the implementation of AR 780-10 at the Memphis General Depot, which transferred all Storage Activities of the Chemical Supply Section to the Directorate for Warehousing.

B. Acquisition and/or disposal of physical facilities: None

II. Organization and Administration:

A. Major organizational revision: With the reorganization as outlined in Ia above, the National Inventory Control Point and all other allied elements of the former Chemical Supply Section became the Chemical Parts Center, an assigned mission of the Memphis General Depot.

B. Significant developments in administrative procedures: None

III. Personnel:

A. Change in Key Personnel:

Effective 21 March 1960, Mr. Rexford R. Strickland, Chief, Requirements and Distribution Division was transferred to the Quartermaster Corps at Richmond, Virginia. Mr. Wm. C. Clasgens, Assistant Chief, assumed the vacancy.

B. Personnel Strength:

1. Total military strength, authorized and actual by MOS:

a. Authorized:

(1) Officers - 3

b. Actual military strength by MOS - 31 March 1960

Colonel	MOS 4500	1
Major	MOS 4500	1
2nd Lt.	MOS 4500	1

2nd 9

1960

HISTORICAL INFORMATION
1 October - 31 December 1960

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I. Policy

A. Change in mission and responsibilities: None

B. Acquisition or disposal of physical facilities: None

II. Organization and Administration

A. Major organization revision: None

B. Significant developments in administrative procedures: None

III. Personnel

A. Changes in key personnel:

Mr. Paul J. Traut, Deputy Chief, Chemical Parts Center, transferred to the newly organized Consolidated Surplus Sales Office at this depot.

B. Personnel Strength:

1. Total military strength, authorized and actual by MOS:

a. Authorized: Officers - 3

b. Actual military strength by MOS, 31 December 1960:

Lt. Colonel	MOS 4500	1
Captain	MOS 4500	1

2. Authorized civilian personnel for period ending 31 December 1960: Graded - 50.

IV. Plans

A. Mobilization Plan: Mobilization Plan for Chemical Parts Center is being maintained in a current status to cover responsibilities in accordance with mission.

B. Current Planning:

1. The Third Quarter of FY 1961 will bring to a close the Chemical Parts Center at Memphis General Depot, Memphis, Tennessee. By directive of higher headquarters the Chemical Parts Center will be transferred to Army Chemical Center, Maryland, effective 31 March 1961. This report brings "30" to historical reporting started in early 1952 after the activation of the then Chemical Supply Section at this depot.

1960 b

2. This Parts Center will continue to carry out its mission and perform all duties required of it until 31 March 1961.

3. The official historical report was discontinued in June 1960, however, at the request of your office this informal type of information has been furnished your headquarters every quarter.

V. Events

1. Visitation by liaison personnel to post, camps, stations, and Class I Installations (semi-annual), Class II Installations and United States Property and Fiscal Office (annual) within the area of distribution.

2. Two (2) Outstanding Performance Appraisals were received and two adopted.

3. Two (2) Sustained Superior Performance Awards were received and three (3) approved (one held over from previous quarter) for a total of $450.00.

4. Three (3) suggestions were received and two (2) adopted for a total of $25.00. No tangible benefits.

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9710 TECHNICAL SERVICE UNIT-CML C
GUARD AND SECURITY
Edgewood Arsenal, Maryland.

20 September 1946.

SUBJECT: Report on Shipment of Classified Chemical Munitions.

TO : Chief, Chemical Corps, Washington, 25, D. C.

THRU : Commanding General, Army Chemical Center, Edgewood Arsenal, Md.

1. Under instructions contained in paragraph 2, SO #144, Hq., Edgewood Arsenal, Md. dtd 13 July 1946, the following named O and EM departed this station, 2200, 13 July 46 by Military Aircraft enroute to Memphis Tenn.

1st Lt.	CHARLES A. MEYER	01037877
T/5	Rushie R. Wright	RA34279459
Pfc	Floyd L. Twigg	RA35322088

Detail arrived 4th Ferrying Group Airport, 0050, 14 July 46. A taxi was employed in an endeavor to locate 8 cars of poison gas (German-Red Ring 1-Mustard) which had been left in Memphis with no guard detail and which was enroute to Pine Bluff, Arsenal, Ark.

2. These cars had been left in the MP RR yards and it was there the detail went. Arriving there the detail was informed that the train had developed a le aker and had been sent back to the Frisco RR yards. Arriving there the detail was informed that the train had been taken to the Memphis ASF General Depot by the Depot Chemical Officer, Major Otto J. Spahn Jr. The detail then proceeded to the General Depot, arriving there at 0200 14 July 1946.

3. At that time the situation was as follows:

a. The seals on all 8 cars were intact.
b. Three of the 8 cars had definite leakers, one of which was very serious.
c. Approximately 10 miles of RR tracks in Memphis had been contaminated by the moving of the train from Yard to Yard.
d. The 8 cars stood on a RR spur which led to the Cml Ammo. area.
e. Two civilian guards had been detailed to keep all personnel away from the area.

At 0300, 14 July 1946, the detail retired in quarters on the Post.

4. At 0700, 14 July 1946 this Officer arose and called Washington, D. C. for instructions. The call was placed before a conference had been held with Major Spahn as he was fishing. The situation was explained to Col. Hayes and Col. Gillett of the Chief's Office and a request was made for additional personnel. Major Spahn arrived in Mid-morning accompanied by Lt. Pittinger, Asst. Depot Cml. Officer.

This officer then requested transportation for the purpose of making a reconnaissance of contaminated RR yards in Memphis. This detail plus Maj. Spahn and Lt. Pittinger then went to the MP RR yards. Contamination there was very heavy on one track where the train had stood. Using 3 gal decons and dry mix with bleach the area was partly worked over that afternoon with about 8 drums of bleach.

5. As the contaminated area was inaccessable by truck the material had to be carried. A considerable distance by hand. This operation was continued until early evening and the contaminated track was ~~xxx~~ roped off and a civilian guard was placed at each end of it.

6. At approximately 0200, 15 July 1946, Major Spahn and I met Capt. James Wittenberger MC, and 6 EM from G & S at the 4th Ferrying Group Airport.

7. At 0800, 16 July 1946, Major Spahn told this Officer and his detail to continue decon. work at the MP yards with 3 gallon apparatus. I then asked the Major if he had any power-driven apparatus and he said he had 14 of them, but none in serviceable condition. Six men were then sent to the MP yards to decontaminate by hand and two were kept at the depot to aid civilian mechanics get a decon truck in operation. The entire day was spent in this manner.

8. On the morning of the 16th of July 1946 the decon truck was mounted on a flat car by arrangements this Officer had made with the MP Frisco RR yards. Thirty cans of bleach were stacked on the flat car with the decon and water was obtained from the engine water tower. A locomotive was used to pull the flat car at about 5 or 10 miles per hour and both hoses were used to spray the tracks as the train moved. Ten miles of contaminated tracks were sprayed in this manner on 16th of July.

9. On 17 July the tracks were again sprayed. With a small detail this officer set up a personnel decon. station approx 100 yds. from the contaminated cars. The leakers were separated from the good cars and on 18 July 1946 the good cars were sent on to Pine Bluff with a small detail of the men there.

10. On the night of 17 July 1946 the leaking cars were opened and the dunnage was removed from same. At 0200, 18 July 1946 the three cars were free of dunnage and work was halted for the day.

11. During this work the men had worn impermeable suits. Their underwear, wet with sweat, was left out to dry. It rained most of the day on the 18th of July and the underwear and impermeable clothing were thoroughly wet. Maj. Spahn told me we were to start unloading the bombs that night from the cars. I asked the Major if he had any protective clothing at the depot and was told that there was none there. Despite the fact that I informed the Major as to the condition of the clothing and the danger of working under those conditions, I was ordered to work.

1$. The rain ceased at approximately 1800. At 1900 work was begun with the men dressed only in impregnated coveralls (which were dry) wet shoes, and wet socks & gloves. At this time I again protested working in

(Continued) (5)

these clothes and was again ordered to work by Major Spahn thru his assistant, Lt. Pittinger. Work was carried on until 0505, 19 July 1946. During this period, 96 500 KG bombs, the contents of one car, were unloaded.

13. At 1100, 19 July 1946 2 EM and myself were hospitalized at the 4th Ferrying Group hospital with mustard vapor burns. The burns these men received from the lack of proper protective clothing which Maj. Spahn had denied having a supply of. However, about a week later bales and bales of brand new protective clothing was found on the depot. The Major had been the Depot Cml Supply Officer for over 6 months, yet he did not know he had protective clothing.

14. During the week covered by this report Major Spahn told this Officer on several occasions that he knew nothing about toxic gas handling and that he had never had occasion to witness or work on or near an operation of this type. Yet, he would reject every suggestion made by this Officer and by the experienced non-coms present. The Major made no plan of operation nor did he plan the next logical phase of the operation until the phase underway was completed thus delaying immeasurably the entire operation. It is the opinion of this Officer that Major Spahn's lack of knowledge and his complete refusal to accept suggestions from subordinates directly resulted in so many men being burned.

16. This Officer was hospitalized until 1 August 46 and departed 2 August 46 with 1st Lt. Michaels from Guard and Security who arrived there 19 July 1946.

CHARLES A. MEYER
1st Lt., Cml C
Guard and Security Division.

96 123

File copy

9710 TECHNICAL SERVICE UNIT-CWS
GUARD AND SECURITY
EDGEWOOD ARSENAL, MARYLAND

HM/rer
11 September 46

SUBJECT: Report on emergency incident at Memphis, Tennessee

TO : Chief Chemical Warfare Service, Washington 25, D.C.

THRU : Commanding General, Edgewood Arsenal, Maryland

On 19 July 1946 ordered per Par 14, SO #150 to proceed by military airplane to Memphis, Tenn. Reached Fourth Ferry Command airfield, Memphis, Tenn., 1830, 19 July 1946. Arrived at destination, Memphis General Depot, Memphis, Tenn., 2000, 19 July 1946.

On arrival Memphis General Depot was taken to B. O. Q. so detail could be quartered. Immediately after all quarters given, this officer met:

1. Major Otto J. Spahn, CWS - Depot Chemical Officer
2. Capt. James Whittenberger, MC - Medical Research officer from Edgewood Arsenal, Md.

Major Spahn gave this officer a very rough picture of the situation with emphasis more on the inefficiency of 1st Lt. C. Meyer, CWS, the inefficiency and lack of experience of the men, who had reported there prior to this officer from Guard and Security. This resulted, according to the Major, in men being hospitalized from vapor burns and blisters. This officer was questioned as to whether he knew his job and when this officer tended the knowledge of having successfully handled the Manchester, Ga., and Atlanta, Gas expeditions. The Major said that may be true but since this officer couldn't operate a fork lift or a 400 gal decon apparatus, Guard and Security must be a pretty poor outfit. When I told the Major I was an experienced toxic gas handler, with two experienced non-coms he said he hoped so but doubted it.

I was ordered to have men prepare to go to work. This officer offered the suggestion that

1. Would like to see leaking cars so could formulate a plan of action.

2. Enlisted personnel were inexperienced and I would need time to acquaint them with situation and each man's part in it.

3. Men had been on duty all day until time left Edgewood Arsenal and would need rest so as to be refreshed for coming unloading and decontaminating job.

The Major then told me: "I am a Major and you are a Lieutenant and I order You to have your men ready to go to work in one hour". As he was in complete charge and I would take orders directly from him. I was to be given a list of instructions each day to be carried out by me which I was to follow to the letter, see attachment No 1. I had been sent to the Memphis General Depot to take care of the leaking cars that was the most important thing in my mind. I hadn't been there one hour and had run into an officer with no experience or knowledge of toxic gas but who ranked me and wanted everyone at the Depot to know he was running this much publicized job.

That same evening 1st Lt. Frank Swain, CWS, Huntsville Arsenal, Ala., arrived from Huntsville Arsenal, Ala. with five (5) EM to assist in operations. Since that detachment arrived with no protective clothing they did not go into action that evening, or the following 24 hours.

At approximately 2130, 19 July 1946, the detachment under this officer went to the scene of operations in a storage area on the depot, and prepared to go to work.

On arriving at the leaking cars the following situation was found:

1. 8 cars had originally been leaking. One large car had been completely unloaded and two cars remained to be unloaded.

2. The contents of the large unloaded car, 96 500 Kg E-filled German Aerial Bombs had been unloaded by 1st Lt. C. Meyer and his Guard and Security Detachment.

3. The 96 bombs were laying out in a triangular area with no protection from the heat of the sun's rays. Temperature during days in Memphis ranged usually from 90 degrees to 97 degrees (see appended table.)

4. The two unloaded cars had been opened to air and the dunnage removed.

5. 1st Lt. C. Meyer and 2 EM of his 4 man detachment were in the hospital with vapor burns and blisters.

This officer suggested that bombs on the ground be reloaded back into car originall taken from so as to clear area as rapidly as possible of agent and get bombs to Pine Bluff. This procedure I was informed was regulations of Bureau of Explosives, by Mr. Conley, Atlanta Office. This officer was told he would devote himself and his men to the unloading of the two remaining cars in compliance with written instructions, see Amend No. 1 attached. These instructions were followed and work was discontinued between 2 to 2:30 AM.

It took a good long hour from the time this officer stopped unloading to the time the men could retire due to the following:

1. The removal of clothing and showering.

2. Something to eat, with the result that the men were not in bed before 0330 the morning of the 20 July 1946.

On 20 July 1946 at 0900 this officer called 1st Lt. A. Nelson, Executive Officer, Guard and Security, Edgewood Arsenal, Md. in compliance with specific instructions from that officer, requesting that more impermeable clothing and six (6) more men be sent to Memphis General Depot. The situation was explained to Lt. Nelson so he would have knowledge of why men and more equipment was needed. The men had been wakened so that they could prepare for work, at the Major's orders.

At 1100, 20 July 1946, I was ordered to go by Major Spahn to Capt. Wittenberger's quarters for a staff meeting. Present there was:

1. 1st Lt. Lang, QMC - witness for Major Spahn.
2. Capt Wittenberger - witness for me, although at that time neither of us knew a witness was needed.

1. The Major told me I had made a telephone call to Edgewood Arsenal and by doing so I had gone over his head.

2. He had received a call from Capt Pettine, Adj, Edgewood Arsenal, Md., verifying my requests to Lt. Nelson for men and clothing, and had cancelled my requests.

3. He had given orders to the telephone operators not to accept any calls from me for Edgewood Arsenal and that if I did succeed in getting a call thru to Edgewood Arsenal he had been told by Capt Pettine, Adjutant, that Edgewood Arsenal would accept my call but would disregard any requests, or suggestions made by me. At no time would he consider that I was doing anything for the good of the job at hand.

4. On attempting to explain my compliance with specific instructions I was ignored, and when the Major listened, manner and word implied I was lying.

5. I was then relieved of command of the job and told I would serve under Lt. Swain, Huntsville Arsenal, Ala., who was a depot OW officer and not experienced in handling this type emergency E agent.

6. I was told if I failed to cooperate or called Edgewood arsenal or failed to obey any orders, I would be confined to quarters under arrest. I offer my record since commissioned in 1943 with all excellents.

7. The Major claimed the work was progressing too slow to please him and when I explained I had to personally show the men, with my non-coms aid, how to unload, remove from car, and put on ground due to their inexperience he remarked he couldn't understand why Edgewood would send him inexperienced men when he had requested experienced men. Major Spahn expressed his opinion of Edgewood Arsenal and personnel in no uncertain terms.

This observation made me grit my teeth since during my discussion with him the previous night and the discussion of the meeting proved to me, Major Spahn knew very little about CWS, toxic gas handling, treatment of officers and men and even a knowledge of equipment in CWS warehouse under CWS command. An example of this was: Capt Wittenberger was asked by Major what he attributed the number of casualties to and he said: "defective clothing, impregnated coveralls." I then informed the Major I didn't use impregnated clothing on the men working in the car but had them use impermeable suits. (I offer the lack of gas casualties in Atlanta, Ga as evidence that my idea is sound). The Major did not know the difference between the two and was in confusion until I straightened him out. The Major's pretense of knowing what should be done made it more difficult to follow his orders.

The Major informed me that 1st Lt. Pittenger, CWS, A Depot Officer, would be in charge of supply and see that everything was ready for use when we reported to work. He had 4 men to do this and take care of decon jobs around railroad and at pit. Our first nights operation was slowed down due to the following:

1. No experienced fork lift operators; finally used Sgt Wright and Pvt Whitlach, Guard and Security men.

2. Had to remove lumber, empty and unemptied DANC and chloride of lime containers from immediate area, to give us room to operate around doors of cars.

3. The 400 gal truck loaded with DANC was inoperative. Could not get pressure up, then nozzles wouldn't operate.

On 20 July 1300 men ready for work but nothing could be done due to intense heat. Vapor in area from 96 bombs placed on ground very evident. Heat of sun, caused pressure in bombs, with result , a number of pin-point holes appeared spurting Mustard. This continued as long as the bombs remained uncovered and on the ground. The leaking bombs were moved to the side of the road and removed to the pit for dreinage and disposal as rapidly as possible.

The Major had given Lt. Swain instructions which he passed on to me since they still had no clothing, especially underwear, to wear. We had everything but underwear to give them. These instructions were:

1. Area DANC'd before operations began. The truck being inoperative this instruction could not be complied with.

Detail was present at 0930, 20 July truck still inoperative. This resulted in men policing area but no bomb unloading being done. Finally Lt. Swain permitted the detachment to return to quarters but we had to be back ready to work at 1830. This kept men in impermeable suits all day and a part of the night.

During these operations the Major rode about in a sedan and summer uniform questioning breaks, rest periods, men standing about the water cooler and many other inconsequential things.

Men ready to work but becoming disgruntled with dressing in protective clothing and hanging around for hours trying to comply with Major Spahn's instructions. In effort to protect men I made the suggestion that since heat was so great we operate only at night, and letting the men rest during the hot day. Since suggestion was made by me it was ignored.

During period 20 July to evening 24 July Major Spahn completely ignored this officer preferring to give orders to Lt. Swain or asking how the situation looked from Sgt. Wright, Guard and Security. This placed this officer in an embarrassing position when men wanted to know why he wasn't asked situation. I gave the men the complete picture, as they were so discouraged with instructions received from Major Spahn that did not help to get unloading completed.

On 23 July 46 at 1700 this officer was informed by Major that he was to go to Amory, Miss. and pick up 9 men that had not been burned seriously in a leaking car situation down there. These instructions, according to Major Spahn from Capt Pettine at Edgewood. I did not question this order even though I felt these men could have made the 3 hour journey to Memphis with ease. It was the opinion of this officer, and a good possibility in the opinion of Capt Wittenberger, and Lt. Swain that this officer was sent solely to get him off the scene so that Lt. Col. Arthur, who was expected could not see or speak to him.

On 24 July 46 this officer requested T/R's and orders to go to Amory. The Major had informed me that everything had been taken care of yet I received no orders or T/R's. Transportation informed me they had no authority to issue me T/R's.

I tried to locate the Major which was impossible and finally put in a call thru the civilian guard radio room to his car. No reply came directly to me, but Lt. Pittenger came and told me the Major had instructed him to tell me the following: "Lt. Michaels will make that train with or without orders, or T/R's, I don't care how he does it. He can buy his ticket." Since to do this would be in direct disregard of orders from my CO I tried to get some better authority and when the Major came I tried to reason with him, with the result I was Ordered to make that train. By my leaving for Amory and with Lt. Swain enroute to Pine Bluff that left no officer on the scene, with any previous experience in handling toxics of any kind.

On 26 July returned to Memphis with men, from Amory. These men had vapor burns and were tired and proved my original request for more men which the Major had cancelled. Lt. Col. Arthur left that same morning and I did not see him. Work continued along most of the week; work finally being done soley at night.

On 26 July 46 I was ordered to Pine Bluff Arsenal, Ark., with 3 cars of reloaded bombs. These cars were the last of the bombs. The Major had no written orders to give me so again I went without orders. Knowledge of this trip going was known at least two days in advance so orders could have been cut in advance. As a safety measure cars were placed 11 cars from caboose and guard caboose placed directly behind reloaded cars. This officer suggested to the Major that the guard caboose be a few cars away just in case of a leak but this suggestion was countermanded with indication wouldn't that be too bad, and we rode directly behind the cars. Pine Bluff had to cut orders on us to cover the issuance of T/R's from Arkansas back to Memphis Tenn. On return to Memphis General Depot orders were cut and received.

Just prior to going on trip to Pine Bluff this officer asked Capt Wittenberger to intercede with the Major and have the 3 empty cars that had carried the leakers be placed with the newly loaded cars, but this was disallowed by the Major on orders from Col. Hays's office according to Major Spahn.

On 30 July this officer took the 3 empty cars to Pine Bluff but this time had orders. On return found decontamination to be started following forning.

Everything this officer was ordered to do was on a personal basis as far as the Major was concerned. By sending me to Pine Bluff we were on duty night and day while the remainder of the detachments were off-duty.

Due to removing the bombs from one leaking freight car and placing on ground instead of immediately reloading into another freight, a total of twenty nine (29) leakers developed. The job took 5 weeks to accomplish instead of 10 days which I feel would have been ample time to complete the job in.

In every case I tried to protect the men whenever possible during the operation. The Major refused passes into town until towards the end of operations when 50 per cent remained on call on the Depot. This was an unnecessary order because:

1. Most of the men were too tired to go.
2. It tended to reduce moral since there was no means of entertainment on the depot.
3. Major usually had some plan to use the men during the day so passes were no good.

On asking the Major about passes he told me the men could play horse shoes and use the Pool. Since there was no swim suits for sale none could swim; as the pool was a community thing.

Originally 8 cars leaked. Four new cars were necessary to take the bombs to destination with a result that in addition to the original leaking cars, 5 more were added when the new cars came into Pine Bluff in leaking condition. Then instead of the government having to pay for 3 cars to be torn down on the inside, 8 cars had to be done.

It is the opinion of this officer that half the men burned (16 out of 25) would have escaped injury if it hadn't been for:

1. Major Spahn's lack of knowledge in a situation like this.

2. Constant changing of instructions causing morale to be so low , that men preferred burns to continuing the operations.

3. The Major working the men day and night.

4. His presence everytime he made an appearance antaganized the men present because he made suggestions of what to do with no knowledge of the situation.

5. Lack of change of impermeable and impregnated clothing due to worn out coveralls, torn underwear, holes in socks.

6. Constant change from one operation to another such as having to remove leakers or receiving last minute instructions totally different from operations planned by Lt. Swain and myself.

Major Spahn constantly went in the contaminated area without protective clothing against the advice of this officer. This gave us all the impression he was deliberately exposing himself to the agent; to show he was doing a good job; and secondly, that this officer's precautionary measures were not necessary. When Major Spahn did get a burn he let everyone on the depot know it, which it's a fact gave us all a laugh.

This officer left Memphis General Depot 2 Aug 46 for Edgewood Arsenal, Md., after having moved all the casualties, not hospitalized to Edgewood Arsenal, Md. Four (4) men were flown back by ATC and four (4) remained to leave 8 Aug 46.

Harold Michaels

HAROLD MICHAELS
1st Lt., CWS

96 130

19 July 1946

Lt. Michaels, CHS.,

Following steps will be taken this evening:

1. Unload to ground two open cars of bombs.
2. Dane down cars and reload decon if empty for use tomorrow.
3. Secure additional decon from SB 22 - Boat Shop - and mix bleach in usual proportions plus 33% additional bleach by weight. (Bleach you are using averages 20% available chlorine)
4. At 12:00 midnight take 30 minute rest period.
5. Segregate all leakers for removal to pit.

Lt. Pittenger will show you where supplies may be obtained.

/s/Major Spahn
MAJOR SPAHN

A CERTIFIED TRUE COPY:

DONALD G. KENAMARK
Captain., Cml C
Summary Court Officer.

INFORMATION FURNISHED BY U. S. WEATHER BUREAU -8-5868 MEMPHIS, TENN.

DATE	PERIOD MIDNIGHT TO MIDNIGHT MAXIMUM	MINIMUM	WET BULB 7:30 AM	1:30 PM	REL. HUMIDITY 7:30	1:30
13 July	90	67	67.5	68.8	90	83
14 "	93	64	66.1	67.3	92	90
15 "	95	68	68.1	69.3	86	86
16 "	94	70	71.2	72.0	90	90
17 "	97	74	73.9	73.3	87	79
18 "	95	74	76.6	79.5	86	84
19 "	93	72	71.5	72.6	89	88
20 "	94	73	72.1	74.0	92	84
21 "	86	68	71	72.5	87	85
22 "	93	66	66.9	75.0	98	61
23 "	95	65	65.9	75.9	89	48
24 "	95	69	74.8	75.2	77	40
25 "	96	73	72.1	78.5	90	59
26 "	92	74	71.5	76.5	85	64
27 "	91	71	68.1	75.2	84	60
28 "	80	69	64.6	75.7	76	89

APPENDIX I

Meterological Data

ENDORSEMENT OF LT. MICHAEL'S REPORT.

1. I agree with the facts and spirit of Lt. Michael's report, with a few minor exceptions as indicated. In my opinion Lt. Michaels has understated his description of the unreasonable attitude Major Spahn adopted toward him.

2. In retrospect, I believe that Major Spahn did the job at Memphis to the best of his ability, but it was a serious mistake on the part of Col. Hayes' office in Washington not to put an experienced toxic gas handler in complete charge of the operation. Major Spahn was in daily telephonic communication with the Washington office as a result of which it was practically a "remote control" operation, with Major Spahn being held responsible. Since it was a new experience for him, decisions had to be made on the spur of the moment, with frequent changes in plans; the effect of this on the men under Major Spahn was disastrous so far as morale was concerned. Pressure of various forces at the Depot and elsewhere to get the job done quickly also caused considerable tension and instability in the Major. The men had to be ready to work at literally a moments notice day or night; consequently they were unduly fatigued, even though they seldom actually worked more than 6 to 8 hours a day. My observation of Lt. Michaels' approach to the problem indicated that he would have done a very capable job of handling the situation if he had not been confronted with the extremely unreasonable attitude of Major Spahn. The result of this difficulty was reflected in low morale and poor performance on the part of all concerned. On several occasions this officer looked for an opportunity to ease the situation, but on every occasion found the Major not amenable to reasoning.

3. Poor planning resulted in considerable delay in operations. For example, the officer responsible for supply usually did not have things ready for the night's work of car loading. Specifically, equipment such as fork lifts, "decon" trucks, etc were not serviced and ready for operation. This meant delaying the whole crew while gasoline was obtained for a fork lift, or a new fork lift procured from the Motor Pool. Secondly, leaking bombs which should have been disposed of by the day crew were left in the loading area, causing unnecessary exposure to the night crew, or delay in the operation until the leakers could be removed.

4. Some unnecessary casualties were caused when men worked without protection at the decontamination pit under the supervision of Mr. Joseph Matasserin of Pine Bluff Arsenal, Ark. The men were warned by this officer, but Mr. Matasserin himself wore inadequate protection (he was burned) and did not require his men to be protected. Two of these men were hospitalized with moderately severe eye and lung damage.

A CERTIFIED TRUE COPY:
DONALD G. McNAMARA
Captain, Cml C
Summary Court Officer.

/s/ James L. Whittenberger
JAMES L. WHITTENBERGER
Capt. MC.

Endorsement of Lt. Harold Michaels' Report

1. I agree essentially with the facts and spirit of Lt. Michaels' report.

2. One of the most deleterious effects of Major Spahn's being in command of this operation was a disastrous loss of morale among both officers and men involved. Unfortunately this is not in itself easily measured in a concrete manner, but was mirrored rather in poor results, inefficiency, and most important medically - prolongation of a relatively dangerous job with the attendant burns and injuries to the personnel involved.

3. Poor management of manpower, due perhaps to Major Spahn's lack of experience in toxic gas handling, poor planning of operations, and poor preparation of equipment also resulted in continuous delay.

4. Failure of Major Spahn either to seek advice and indeed failure on occasion to accept advice when it was offered by both the medical officers and the experienced C. W. S., Guard and Security officer present resulted in unnecessary exposure of men to mustard gas with resultant injury of personnel and prolongation of the operation.

JAMES A. CAMPBELL
1st Lt., M. C.

96 134

1st Ind.

9710 TECHNICAL SERVICE UNIT-CML C, GUARD AND SECURITY, Edgewood Arsenal, Maryland. 20 September 1946.

TO : Chief, Chemical Corps, Washington 25, D.C.

THRU: Commanding General, Army Chemical Center, Edgewood Arsenal, Md.

1. The above report has been carefully read and studied by the undersigned and the facts contained therein have been investigated completely. Said investigation was accomplished through the interrogation of the Officers and Enlisted Men; e.g., Memphis, Tenn., and Emory, Miss., Lt. Meyer (see report dated 20 Sept. 1946), Lt. Matzner (see report dated 20 September 1946), and Lt. Campbell, M.C. It is the opinion of the undersigned that the facts as stated are substantially correct.

2. It is hereby requested that a statement of policy be made, whereby a Guard and Security Officer dispatched on a mission will operate through command channels and be held responsible for his actions through said channels.

3. It is further requested that appropriate disciplinary action be taken against Major Otto J. Spahn, Chemical Officer, Memphis General Depot, both for the misuse of his rank by insulting and humiliating a junior officer of another Command while engaged in the performance of his properly assigned duties, and for flagrantly disregarding the advice of both the officer in charge of the detail and the Medical Officer on duty. Major Spahn by direct order compelled men to work to a point of overexertion and while exposed to a highly toxic agent, thus needlessly causing many casualties.

GARLAND M. WHITE
Lt. Col., Cml C
Chief, Guard & Security

1537

Chemical Warfare Service
Gravelly Point, Washington 25, D.C.

SUBJECT: Report of Official Travel — 11 March 1946

TO: Chief of Chemical Warfare Service (Thru: Control Division)

1. In accordance with paragraph 3e, Office Order No. 12, dated 1 June 44, attached hereto is Report of Official Travel made by

Major R. A. Owendoff

a. Places visited Huntsville Arsenal, Gulf CW Depot and Memphis ASF Depot.

b. Authorization (Verbal) (Letter) (~~CWS Order~~) dated 1 March 1946.

2. This report consists of the following sections:

SECTION I: ITINERARY (Date and hour of departure and return to Washington D.C., also the same information for each place visited in tabular form.)

SECTION II: PURPOSE OF VISIT.

SECTION III: OBSERVATIONS (State what was seen, heard or discussed in connection with purpose of visit. Name all persons contacted. Make separate observations for each place visited. Nothing is to be withheld. The report must embody all facts found, good or bad.

SECTION IV: a. RECOMMENDED ACTION (State all recommendations including those made other than the undersigned should be noted. Key each to corresponding paragraph under Section III.)

b. REPORT OF ACTION (Follow each Recommended Action with a Report of Action. State whether action has been taken and by whom, is in process or pending or that none has been taken.

SECTION V: CONCLUSIONS (A summary of the above report.)

SECTION VI: ADDITIONAL REMARKS. (Observations, recommendations and reports of action not directly connected with the purpose of the visit may be reported under this section.)

3. Attached hereto is copy of letter addressed to Commanding Officer of each installation visited. Name to Commanding Officer, Huntsville Arsenal.

(SIGNED) R. A. Owendoff

R. A. OWENDOFF
Major, CWS
Rank or Civilian Status

(DIVISION) Readjustment
(BRANCH) Property Disposal
(TELEPHONE EXTENSION NO.) 74740

(The space below will be used by the Division in forwarding the report)

DATE: 12 March 1946 TO CONTROL DIVISION

FROM: Chief, Readjustment Division

R. H. Talmage Col, C.W.S.
(Signature of Division Chief)

CWS Form No. 03504
24 May 44

REPORT OF OFFICIAL TRAVEL TO HUNTSVILLE ARSENAL, GULF CW DEPOT AND MEMPHIS ASF DEPOT

SECTION I. ITINERARY

Lv. Washington, D. C.	1630	4 March 1946
Arr. Huntsville, Alabama	1305	5 March 1946
Lv. Huntsville, Alabama	0300	8 March 1946
Arr. Memphis, Tennessee	0830	8 March 1946
Lv. Memphis, Tennessee	2000	9 March 1946
Arr. Washington, D. C.	2100	10 March 1946

SECTION II. PURPOSE OF VISIT

a. Huntsville Arsenal - Disposition of surplus materials resulting from Gas Mask Reclamation Program and also corrective action to be taken on Redistribution & Salvage procedures at Huntsville Arsenal.

b. Gulf CW Depot - Disposition of spare parts and other surplus materials arriving from Indianapolis CW Warehouse.

c. Memphis ASF Depot - Destruction of XXCC-3 by burying, and general procedures relating to Redistribution & Salvage activities.

SECTION III. OBSERVATIONS

a. Huntsville Arsenal - Generally discussed present procedures at Huntsville Arsenal in connection with the determination as salvage of certain classes of material. Members of the Disposal Board were interviewed and oriented in changes to regulations which have not been reflected in Huntsville Arsenal activities. Discussed details of surplus property resulting from Gas Mask Reclamation Program and also resulting from letter this office SPCUG 8 February 1946, subject, "Disposition of CWS-Owned Materiel". Discussed with Colonel Wallington increases in civilian personnel allotments which are required by the Redistribution & Salvage activities over and above present ceilings. Discussed with Colonel Wallington and Lt. Colonel LaBolle the possibility of establishing a collection center at Huntsville Arsenal for surplus CW munitions and other materiel to be dumped at sea.

b. Gulf CW Depot - Discussed with Major Cochrane and Redistribution & Salvage personnel the proposed disposition to be made of spare parts being shipped from the Indianapolis CW Depot and also action to be taken on unserviceable spare parts and end items. In general it appeared that certain material which was in effect salvage had been declared to RFC, in spite of the fact that some portion of these items could have been disposed of by the salvage officer at Huntsville Arsenal.

c. Memphis ASF Depot - Discussed with Major Spahn, Chemical Supply Officer, details of letter this office 15 February 1946, subject, "Disposition of Obsolete and Unauthorized Items", and the effect this would have upon automatic shipments from posts, camps and stations served. Major Spahn indicated that subject automatic shipment would not be desirable in view of the critical storage space situation and resulting inability of the depot to properly handle uncoordinated shipments. Major Spahn explained the details of the destruction of approximately 300,000 pounds of XXCC-3 to be accomplished by burying at a nearby location to a depth of approximately four feet.

SECTION IV. a. RECOMMENDED ACTION

1. Huntsville Arsenal - It is recommended that:

   (a) all gas mask components resulting from the Gas Mask Reclamation Program be determined salvage and disposed of at Huntsville Arsenal.
   (b) a more lenient attitude be adopted by the Disposal Board in respect to the determination as salvage of unserviceable items heretofore declared to disposal agencies.
   (c) the Redistribution & Salvage Officer attempt to obtain concurrence of the disposal agencies for withdrawal of certain unserviceable items for which a civilian market is extremely questionable, and to dispose of these items as salvage in the event the details can be accomplished.

2. Gulf CW Depot

   (a) Recommendation was made that the Redistribution & Salvage Officer, Gulf CW Depot, review the entire list of surplus items with the Salvage Officer at Huntsville Arsenal with a view toward determining which items are salvage and should be disposed of by Huntsville Arsenal.

3. Memphis ASF Depot

   (a) Recommended that Major Spahn review surplus quantities now declared to disposal agencies with the appropriate regional offices in an attempt to obtain scrap certificates for a certain item which appeared to have questionable civilian market.

b. REPORT OF ACTION

1. Huntsville Arsenal - Action as follows will be taken:

   (a) The Redistribution & Salvage Officer, Capt. Etter, will follow the recommendation.
   (b) Disposal Board will follow the recommendation.
   (c) The Redistribution & Salvage Officer will contact the War Assets Corporation Regional Office in an attempt to accomplish the recommended action.

2. Gulf CW Depot - The recommended review will be accomplished sometime during the month of March.

3. Memphis ASF Depot - Major Spahn will accomplish the recommended review within the next 10 days.

SECTION V. CONCLUSIONS.

Too large a portion of unserviceable items and material have been declared to disposal agencies. Since no reasonable prospect of sale is apparent,

the action recommended by the undersigned in each instance will, it is believed, provide greater quantities of salvage ateach installation and thereby alleviate the critical storage situation.

SECTION VI. ADDITIONAL REMARKS None

I certify that all the objectives intended in connection with this travel have been accomplished and completed.

R. A. Owendoff

R. A. OWENDOFF
Major, CWS
Chief, Property Disposal Branch

ARMY SERVICE FORCES
R U N T S V I L L E A R S E N A L
Huntsville, Alabama

7 Mar 1946

MEMORANDUM

TO: Colonel E. O. Ellington

1. The undersigned has worked very closely with Lt. Col. LaBelle and Captain Eder, of the Property Division, and the various members of the Property Disposal Board and also Lt. Gunder, R & S Officer of the Gulf CW Depot, for the purpose of reviewing with them problems arising in connection with property disposal activities.

2. The following is a summary of those points which may be of special interest to you:

a. Present personnel assigned to the R & S function are inadequate to perform present tasks, and an attempt will be made when I return to Washington to obtain increases in civilian personnel allotments.

b. It appears that establishment of a "Collection Center" at this Arsenal for the purpose of sorting operations of surplus munitions and toxic chemicals is feasible and would require additional personnel as shown on the study prepared by Lt. Col. LaBelle. However, it must be borne in mind that this matter is merely in the planning stage at this time, and any operating directives on the subject will emanate in the official manner from the CG/CWS.

c. The Property Disposal Board and the two R & S Officers involved appear to have approached a better understanding with respect to the problems and responsibilities involved in disposition as scrap or salvage of certain items heretofore determined to be of the type to be declared to disposal agencies.

3. In the event additional personnel allotments are obtained for the R & S activity, it is recommended that serious consideration be given to employment of a portion of this personnel on those items recently determined to be surplus in accordance with letter CG/CWS, SPOUD, SUBJECT: "Disposition of CWS Owned Material" dated 8 Feb 1946, and also to the segregation and removal from existing warehouse space of those items which are determined to be salvage.

R. A. OPPENDOFF
Major, CWS

NPRC-MK
338-59-6364
Box 1/,
Folder "400.112 October-December Closed RS"

96 140

CMLAN-M-STD.6 400.112

2 DEC 1957

SUBJECT: Shipment of Tetrachlorethylene for Test

TO: Commanding Officer
Memphis General Depot, U. S. Army
Memphis, Tennessee
ATTN: Chief, Storage and Materials Handling Section

1. References:

a. Letter, CMLAN 400.112, Memphis General Depot, 4 November 1957, subject: "Surveillance Samples for Test," and inclosures thereto.

b. Voucher Number 12205, DD Form 1149-3, directing shipment of six samples of FSN 6810-270-9982 for test purposes.

2. Six drums of FSN 6810-270-9982 were shipped to this installation under reference 1b.

3. Drawing of samples and testing will be accomplished in accordance with inclosure 1 to reference 1a and results will be furnished Eastern Chemical Depot.

4. Accountable records of this Command will be amended to reflect a change of location of this material from Memphis General Depot to Eastern Chemical Depot.

FOR THE COMMANDER:

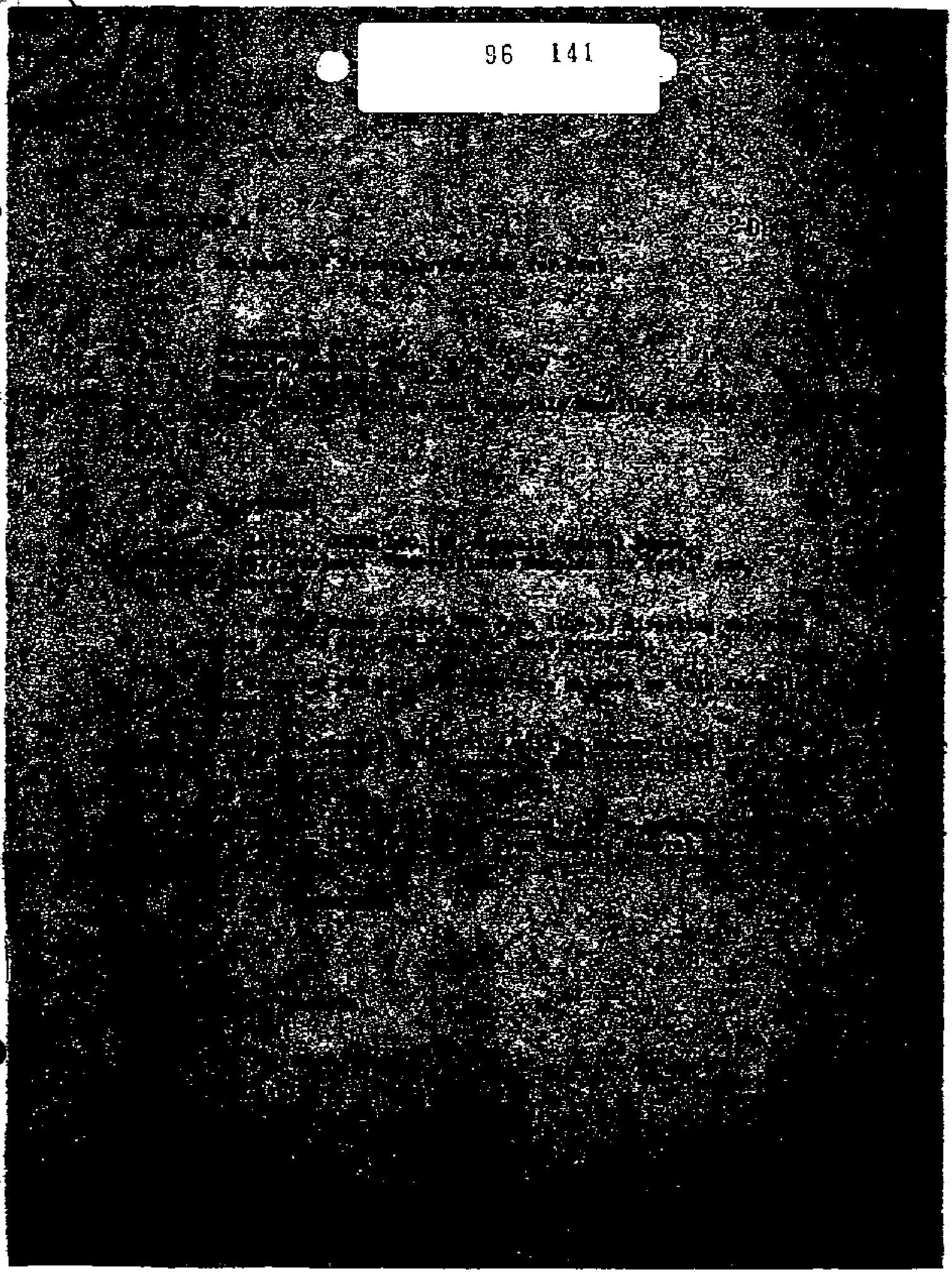
WALTER J. PATRO
Assistant Supply Division

Info by furn:
CO, USChemDep, Eastern

CO, QMA
ATTN: Mr. Johnson, Bldg 30

M/R: Mr. Sterling, Transp Office, advised 6 dr Tetrachlorethylene rcd on Vou 12205 for test at Bldg 30. Mr. Johnson at Bldg 30 said he had no space for storage of 6 drums and no facilities for drawing samples. Arranged with Major Davies to accept the 6 dr and furn samples to Mr. Johnson. Accountable records will be changed from Mfs to Eastern to preclude additional transp charges. Documents in BYD 2 are filed under [illegible].

WJP/Howard/51952b


96 141

ADMINISTRATION OF THE CHEMICAL SUPPLY SECTION

MEMPHIS GENERAL DEPOT 1942-1947

BY

EDWIN C. PITTENGER, JR.
1st Lt., Cml C.

Chemical Corps School Monograph

Series 1947-8

containers from the acetylene tetrachloride. The undamaged acetylene tetrachloride was stored in 55 gallon drums and the RH 195 was stored in wooden drums. A crew of prisoners of war were able to handle about 1000 cans of [illegible] per day.

The largest single processing operation conducted by this section was the processing and recrating for overseas shipment at the Plant, Impregnating, Z of I. This plant consisted of approximately 30 car loads of heavy laundry equipment. The work was completed in approximately 60 days at a cost of $85,000.[22]

b. Ammunition Section.

The Ammunition Section furnished direct supervision of all activities in connection with the receipt, storage, and shipment of ammunition. The storage facilities for ammunition consisted of two earth covered igloos, two magazines of wooden construction, and an improvised shed for the storage of smoke pots. Ammunition was taken to a fireproof building in preperation for a shipment. At no time was ammunition permitted in the warehouse. The chemical training ammunition handled by this section was as follows:

Bomb, Incenn. Instr.	Grenade, Tear, M7.
Burster, Deton. Cord.	Grenade, Smoke, Colored.
Burster, Cml Land Mine.	Grenade, Incend. AN M14.

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[22] Ibid., p 32.

Capsule, CN. Grenade, Smoke, WP M15.

Detonators, all types. Pot, Smoke, HC M1

Grenades, CN-DM M6. Pot, Tear Gas, CN M1.

Squib, electric.

[illegible] SF 9 contained CN capsules, CN pots, and all types of grenades with the exception of the WP grenade. [illegible] was used for the exclusive storage of detonation [illegible] while SF 2 contained squibs and detonators. [illegible] was used for the storage of the WP grenades. [illegible] were stored in an improvised building in the [illegible] area.

[illegible] the latter part of 1945, and early 1946, it was necessary to open each box of ammunition that was returned to the depot from post, camps, and stations. Many stations and activation shipped mixed lots in one box, with the box being marked as one lot only. This caused increased work for the Stock Accounting Branch, Inventory Branch, and Ammunition Section. To overcome this problem of having many small lots of ammunition on hand the Ammunition Section combined three or four small lots into one large depot lot.

VI. CONCLUSION

With the ceasing of hostilities the total tonnage for receipts and issues declined rapidly. With this decline in the work load it was necessary to discharge personnel and consolidate positions within each division. In the Inventory Control Division, the Administrative Branch, Incoming Property Branch, and Outgoing Property Branch were consolidated into the Property Branch. The Stock Accounting Branch was adsorbed by the Inventory Control Branch and the Property Disposal Branch remained unchanged. In the Storage Division, the Storekeeping Branch undertook all the duties of the Shipping Section, Receiving Section, Processing and Packing Section, and the Ammunition Section. The Inspection and Classification Section became the Inspection, Classification, and Surveillance Branch, with the emphasis placed on surveillance. The consolidation of divisions was completed on 14 March 1947. (See Appendix IV.)

Effective on 1 July 1947, the mission of the Chemical Section was transferred to the Chemical Section, Columbus General Distribution Depot, Columbus, Ohio.

Cooperation with all services and activities within the depot was a prime requisite for the successful completion of the assigned mission of the Chemical Supply Section.

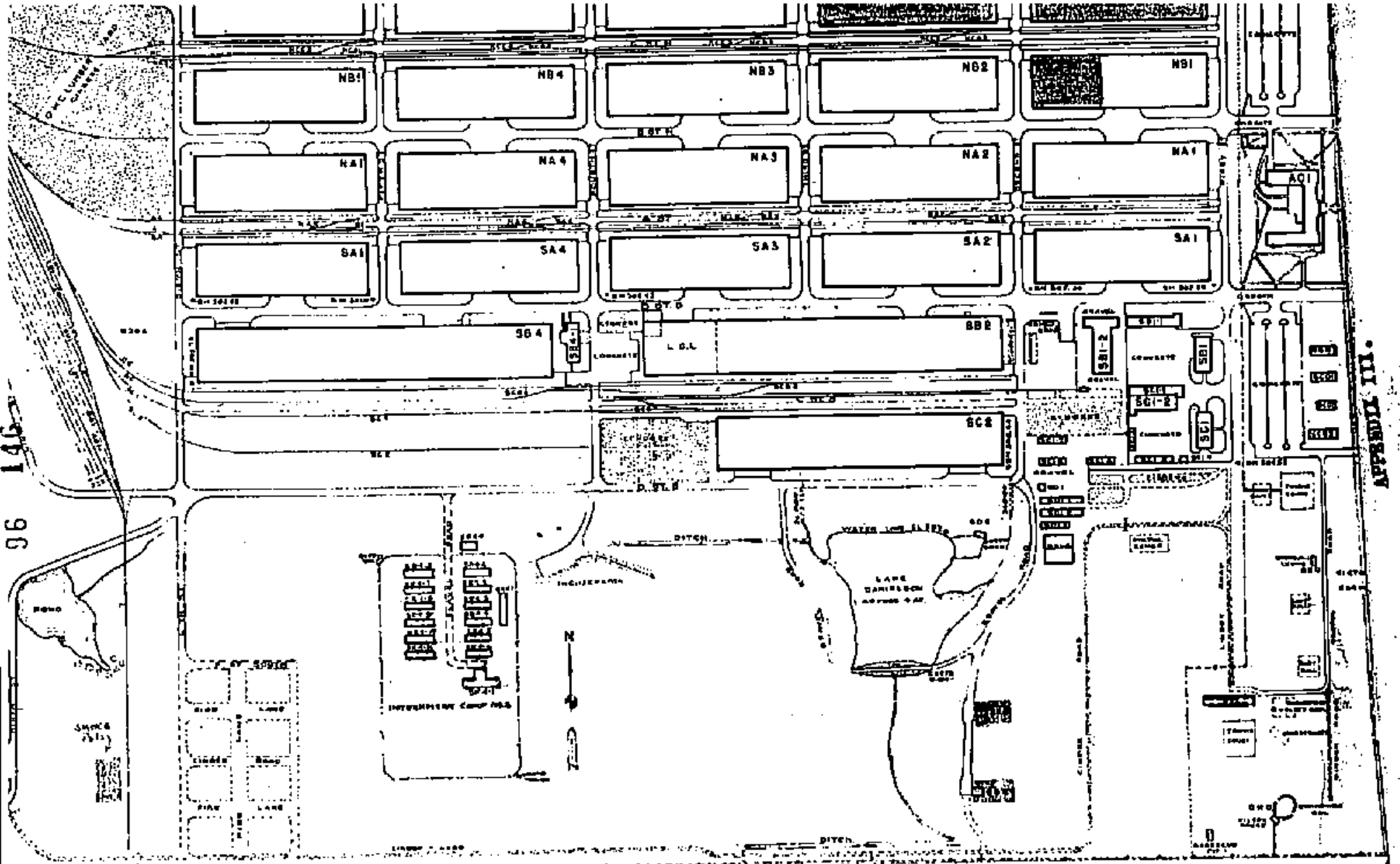

Fig. 2. Map of Memphis General Depot.

APPENDIX III.

Chemical Warfare Section
Memphis A. & T. Depot
Memphis 2, Tennessee

INSTALLATION	REPORT CODE 96 147

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION Chief Utilities	YRS AT INSTALLATION	PHONE
Acie Smith	PRESENT / PREVIOUS	55 - present	5505

1.) New ones have mineral oil.
2.) Most old transformers probably askarel/ 50% old - [Goble testing Watertown, mass]
3.) Samples already drawn, awaiting analysis
4.) PDO used to take transformers, currently holding 2 awaiting analysis by 272
5.) 190 transformers - all in open except 4 in used area
6.) 1954 - Company filter oil in transformers
7.) Switches ~~drained~~ drained in 68 to 55 gallon drum then to PDO.
8.) Prior to 64 - small pintole leak in one transformer
9.) Dipping vat - some mess
10.) Dunn Field used for testing bulldozers, heavy equipment
11.) Pond filled between 50 - 55
12.) Pallets burned w. side of post prior to 64 stopped operation

Chem Corp in 330.

INTERVIEWER	DATE
Jonas / Wienand	B Mar 81

AIR MAIL

CMDDM-CW 319.1

30 July 1946.

SUBJECT: Report on Shipment of Eight Cars, H Type Bombs, Consigned to Midwest Chemical Warfare Depot, Baldwyn, Ark.

TO: Chief, Chemical Warfare Service,
Washington 25, D. C.
Attn: Chief, Operations, Plans and Training Division.
(Asst. Chief for Operations)

1. RESUME OF EVENTS:

a. Reference above shipment, it is advised that the undersigned was directed to examine one car (GH 29105) containing Poison Gas, located in the yards of the Missouri Pacific Railroad, Memphis, Tenn. by Col. H. S. Evans, Commanding Officer, Memphis General Depot at 1100, 13 July 1946. At that time it was mutually decided that, in the event the contamination of the common carrier lines would be such as to create major operational difficulties, it would then be advisable to remove the car from the Missouri Pacific Yards to the Memphis General Depot area where the matter could be more properly handled. The undersigned, accompanied by 1st Lt. Edwin C. Pittenger, Jr., and 1st Lt. William R. Binkelman, arrived at the Missouri Pacific Yards with bleach, dans, and 5-Gallon Decon. Car GH-29105 was attached to caboose and separated from adjoining cars about 700 Ft. from dispatcher's tower on Track No. 7. Decontaminating material was carried to location and slurry of bleach was made of approximately 10% per weight of bleach. Civilian Guards from this depot were posted as soon as operation started, but it was necessary to stop operations and return to the Memphis General Depot because of supply requirements of Military Police for Gas Masks at Amory, Miss., and emergency shipment received by telephone in the interim from Theodore, Ala. These requirements having been fulfilled, operations were again begun at the Missouri Pacific Yards at about 1430 hours, and decontaminating effected until 1800 hours when the undersigned, upon removing his mask, detected odor of mustard coming downwind. Examination of the area revealed seven additional cars of gas, two of which were leaking badly. Inasmuch as only dans remained on hand, it was used as a temporary expedient to decontaminate other contaminated area found. Dry bleach was placed on all the contaminated areas after cars departed. One officer and one guard were placed on the caboose, accompanying the gas cars, and all cars were cleared and dispatched without stop through the Missouri Pacific and Frisco Yards to the Memphis General Depot where the eight cars were placed on igloo trackage of the Chemical Warfare Service at

AIR MAIL 18

the Memphis General Depot. These cars arrived at about 1930. Further decontamination was effected along the trackage where the H Type gas had leaked on to the trackage, and approximately 800 Ft. of trackage was closed off by blue flagging of Track No. 7, Missouri Pacific Yards, with guards posted on both sides of blocked off track. Mr. Hopkins, Supt. of Missouri Pacific Lines, Memphis, was advised of the closing off of the trackage and he stated that he would post notice as to precautions to be taken on adjacent trackage and blocked off trackage.

b. 14 JULY 1946. 1st Lt. Chas. H. Meyers and two enlisted men arrived, and the matter was discussed with Col. Hayes, Supply and Distribution Division, Chemical Warfare Service, concerning the general situation. Because of the scope of the operations required, additional men were requested. Entire day spent decontaminating trackage.

c. 15 JULY 1946. At 0645, Capt. James L. Whittenberger, MC, Edgewood Arsenal, Md., and six enlisted men arrived by plane at the Memphis Airport. The men were sent to the Memphis General Depot, and Capt. Whittenberger and Major Spahn visited Sgt. Steinberg, who had been flown in from Amory, Miss., because of mustard gas burns, for hospitalization at the Fourth Ferrying Group Hospital. There is attached hereto a preliminary medical report, covering this and other cases, through 19 July 1946, as Exhibit "A", and Exhibit "B" lists all military and civilian cases cared for by Capt. Whittenberger while on duty at this depot. Daily operations were carried on both at the Missouri Pacific Yards and the Memphis General Depot, decontaminating trackage. On 15 July 1946, all hospitalized patients were visited by the undersigned and Capt. Whittenberger. At 1900 - 15 July 1946, six additional enlisted men arrived. 7,000 Lbs. of bleach, Class "C", surplus, along with two power driven decons (BEAN) were dispatched to Amory, Miss. to Lt. Matzner, CWS.

d. 16 JULY 1946. Lt. Col. Frank M. Arthur, Plans and Training Division, office of the Chief, Chemical Warfare Service, arrived at 1200 hours, and the general situation was reviewed with him. Conference was held with Mr. Hopkins, Supt. of the Missouri Pacific, and Mr. R. L. Young, Supt. of the Frisco Lines, until 2200 hours when Col. Arthur departed. One civilian was reported burned by mustard, in the Memphis General Depot Area, a Mr. Stephens. In this connection Capt. Whittenberger's report indicates a negative report in connection with any effects from mustard gas. (See Exhibit "B") except minor irritation of eye and forearm.

e. 17 JULY 1946. Flood lights were installed and operations commenced on night work of unloading cars of leaking bombs. Due to high temperature it was impractical to work the men in the daytime on unloading operations because of the necessity of wearing impermeable suits. One employee of the Missouri Pacific Lines was reported burned by mustard gas this date, as set forth in Exhibit "B". Capt. Whittenberger, accompanied by a Frisco Railroad official, rode the entire trackage from Memphis to Amory, Miss, and tested for gas in areas where Dispatch Sheet indicated

train had stopped. He returned at 0430, the following morning, and reported negative tests the entire length of the lines. In the interim period, daily decontaminating of Frisco and Missouri Pacific trackage, over which cars had travelled, was made using a decon, mounted on a flat car, using standard bleach mix, plus 30% additional bleach. Average analysis of bleach had shown 20.8% available chlorine. In this connection there is listed below analysis made of surplus bleach:

AVAILABLE CHLORINE

1.	21.69	6.	11.50
2.	24.07	7.	21.66
3.	23.02	8.	21.86
4.	22.26	9.	21.63
5.	19.95		

Inasmuch as there was on hand 1,268 drums of surplus bleach already available to workmen, and for which there was no indication of any future sale, it was decided to use up this bleach even though available chlorine was below standard. However, in every case an additional 30% was used over the usual required weight in the preparation of slurry. At 1930 17 July 1946, the undersigned sorted out five cars of bombs in good condition from the original eight received, placed guard and security detail with cars, and personally saw train clear Missouri Pacific Yards at 2400 hours. These cars were as follows:

TEO 54179
NCAST L 18257
CGW 85104
GN 511465
ACL 20258

Before dispatching these cars all under carriages, coupling and exterior parts of cars were sprayed with Hank and washed down with water in order to create safe condition. Work was begun on unloading cars, placing bombs in an area which would not cause too much operational difficulty within the depot. Prior to this action guards were posted and area blocked off with appropriate signs in order to prevent access to area by unauthorized personnel, and to limit, as far as possible, any vapor burns. Enlisted men worked on removing bombs from car GN 29105 until 0300.

f. 18 JULY 1946: Capt. Whittenberger visited Mr. Burnett, employee of the Missouri Pacific allegedly burned by gas. See Exhibit "B". It was also necessary to close Quartermaster warehouses SA-5 and SB-4, due to wind drift carrying mustard fumes to that warehouse area. Igloo trackage Memphis General Depot, and Missouri Pacific trackage was decontaminated with dry bleach and test was made for gas at Missouri Pacific Lines. A positive test resulted.

The undersigned visited Amory, Miss. accompanied by two drivers who were to return to Memphis with two decons previously dispatched to Amory. Due to the shortage of impermeable and impregnated clothing, air express shipment of 24 suits of clothing was requested of Col. Gillett,

office of the Chief, Chemical Warfare Service, for immediate shipment to Amory, Miss. The undersigned called Memphis and requested 4,000 additional pounds of bleach, 100 gals. Acetylene Tetrachloride, and 100 Lbs. CC-2. (No standard packing was available at Memphis). The enlisted men at Memphis worked until 0300 unloading additional bombs. Due to the temperature, this work has been very slow and the first car has not yet been completed.

h. 19 JULY 1946. At 0500 one enlisted man was reported as a gas casualty with burns. Mr. Thomas, guard, was examined by Capt. Whittenberger for one mustard gas blister on left foot, over third toe. See Exhibit "B". Word was received from Mr. Hopkins, Supt of Missouri Pacific Lines again requesting release of trackage. He was advised on 18 July 1946, that trackage would be released when three successive negative tests occurred on three successive days. Work was started preparing a slurry pit, using Post Engineer Labor. Lt. Meyers and two enlisted men were taken to the Fourth Ferrying Commany Group Hospital for treatment as casualties from mustard vapor. Two leaking 500 KG bombs were taken to the decontaminating area, Dunn Ave., Memphis General Depot. Bombs were placed over pit and holes shot in noses, using .03 rifle, and then allowing mustard gas to drain into slurry pit. At 1730 Lt. Michaels and six enlisted men arrived by air and reported for duty. These men went to work at 2100 and gave every evidence of very poor training and general lack of knowledge of their duties. Four out of five H.B.T. one-piece suits, Stock No. 501-342-8-238, developed holes in the knees. This examination was made by Capt. Whittenberger, M.C. At 2230 six enlisted men, accompanied by 1st Lt. Frank Swain, reported for duty from Huntsville Arsenal. Due to the excessive heat men worked until 0100. The first carload of bombs have not yet been completely moved to the ground.

i. 20 JULY 1946. Decontaminating of Missouri Pacific Lines continued. One civilian guard reported for treatment for vapor burns. See Exhibit "B". Report made to Chief, Chemical Warfare Service, Col. Gillett, Supply and Distribution Division, that clothing continues to break and appears to be badly retted. Mr. Hart of the Frisco Railroad was treated this date for burns. Request was made of Col. Gillett, Chief, Supply and Distribution Division, office of the Chief, Chemical Warfare Service, that twenty-four additional suits of all types of impregnated and impermeable clothing be shipped to this depot by the fastest possible means. Col. Gillett advised that same would come forward by air express from Kansas City Quartermaster Depot. Capt. Mahaffey, one of the guards of the Memphis General Depot, was treated for a burn on the leg. See Exhibit "B". Col. Hayes called to advise that impregnated and impermeable clothing was being shipped by air from Kansas City Quartermaster Depot, and by staff car from Pine Bluff Arsenal, Pine Bluff, Ark. Considerable difficulty has been experienced daily with power driven decons which are continually out of order. Test made at 1800 this date showed positive test for mustard on trackage of Missouri Pacific Lines, Memphis, Tenn. Mr. Hopkins, Supt., was advised. Work was started on 2nd car

CMDDM-CW 319.1, OC, CWS, 30 July '46.

Af&SF 142258 of removal of mixed car of 500 KG and 250 KG bombs. The 500 KG bombs have one red ring mark and the 250 KG bombs have one green ring mark. Work was stopped at 0030 on account of excessive heat. Unloading of cars and segregation of leakers has progressed very slowly to date.

j. 21 JULY 1946. Air express shipment of protective clothing arrived from Kansas City. Daily contact has been made with Mr. Hopkins, Supt. Missouri Pacific Lines and Mr. Craft, Chief Clerk, Frisco Lines, who have been kept currently advised of the existing situation. Mr. Hopkins was assured that every effort would be made to free his trackage as soon as possible. One more car was switched in and 500 kilogram bombs were started being loaded into this car. At 0100 twenty-six bombs had been placed in the new car. The procedure has been to dank down the bombs, segregate and remove leakers, and water wash bombs and crates after demo usage. Missouri Pacific trackage gave negative H test.

k. 22 JULY 1946. Capt. Whittenberger reported to Col. Gillett and Col. Hayes that a total of twenty-one patients, enclisted men and civilians were being treated to date. Because of the objection to the method of shooting holes in the leaking bombs, an ordnance officer was requested to care for this situation. To date no accurate information has been received as to the burster charge contained in the 250 KG and 500 KG bombs. Inspection was made by the undersigned of car NKP 16252 shipped out of Amory, Miss. on 21 July 1946, presently in the yards of the Missouri Pacific Lines. This car had slight oder of mustard, apparently emanating from floor boards. Report was made to Col. Gillett that, in the opinion of this officer, same was safe for transit to Midwest Chemical Warfare Depot. Request was made for a kit, tool, bomb, venting, and advice was received that this item was shipped air express from Technical Division, Edgewood Arsenal. To date seven large bombs and three small bombs have been taken to decontamination area and drained into slurry pit after shooting holes in the noses with .03 rifle. Further search was made at Pine Bluff Arsenal, through Lt. Gray, CWS, for kit, tool, bomb venting. Lt. Gray advised that none could be obtained at that Arsenal. Mr. Matasserin, explosive expert and three carpenters arrived from Pine Bluff Arsenal to aid in the destruction of bombs and the bracing and blocking of cars. Decontamination has been carried out this date as usual. Trackage of Missouri Pacific gave negative test for mustard, using M-8 kit.

l. 23 JULY 1946. Work was started on exploding of burster charge in bombs after removal of mustard. Sticks of dynamite were strapped on the noses of the drained bomb cases and some were exploded in shallow pit, with partial earth covering, and three layers of railroad ties on top. Examination of exploded casings indicated that so far, of the eleven bombs exploded with dynamite, only the small bomb casings contained burster charge. Carpenters were dispatched this date to brace car NKP 9147 containing forty-eight large Aerial Bombs. Bomb

QMDDM-CW 319.1, OC, CWS, 30 July 1946.

venting, tool, made at this depot did not work because of softness of steel used in the manufacture of the tool. Mr. Respess, employee of Bureau of Explosives, arrived to inspect the car loaded with large bombs ready for shipment to Pine Bluff Arsenal, but refused to pass on car until a car inspector approved the mechanical fitness of the car. Accordingly, it was necessary to hold over the departure of this car until 24 July 1946. To date ten bombs have been drained and exploded (7 large and 3 small). Negative test for H at the Missouri Pacific Railroad Yards.

m. 24 JULY 1946. Mr. Matasserin and Major Spahn spent most of the day working on the removal of additional leakers and draining same. At 0900 Mr. Respess, Bureau of Explosives, and Mr. Easley of the Frisco Lines, inspected carload of forty-eight large bombs ready for shipment and it was mutually agreed that additional work must be done on this car with reinspection at 1400. Some time was spent inspecting Salvage Yard Area and other depot areas to declare such portions safe as was possible, due to shifting of wind, and due to a brisk northwest wind. It has been a matter of routine each day to check areas in order to protect depot personnel working outside of existing barriers in order to prevent unnecessary vapor burns of civilian employees. Car MKP 1947 containing 48-500 Lb. kilogram bombs was approved for shipment by the Bureau of Explosives representative and car inspector, Frisco Railroad. Orders were issued to Lt. Swain and two enlisted men to accompany movement at 1800 hours. This car cleared the Missouri Pacific yards at 2000 hours. Lt. Col. Arthur arrived at 11:15 A.M., and interim periods were spent with him going over conditions. At 2200 hours slurry pit, where mustard was being emptied, was tested downwind for mustard vapor up to approximately 500 Ft. No mustard was detected any closer than 150 Ft. from slurry pit. There was no movement of air currents at this time of night. Operations proceeded toward unloading last car of leaking bombs, and men stopped work at 0100.

n. 26 JULY 1946. At 0750 teletype was sent to the Midwest Chemical Warfare Depot advising of shipment of one car of bombs, MKP 1947. Check was made with Quartermaster Supply Officer as to the advisability of allowing personnel to work in Warehouses SA-3 and SB-4. Due to change of wind direction to the southwest it was deemed safe to use these warehouses. Daily additions have been made to slurry pit of 500 Lbs. of bleach in order to keep the amount of available chlorine to proper standards for neutralization of any mustard being placed in the pit. Lt. Col. Arthur departed this date for Washington, D. C. Lt. Michael, who had been at Amory, Miss. since 22 July 1946, returned with nine enlisted men. Capt. Whittenberger reported three additional enlisted men burned because of holes in one-piece M.B.T. suits. 1st Lt. Campbell, MC, reported for duty from Edgewood Arsenal. Daily report was made to Col. Gillett and Col. Hayes at 1715 hours. Conference was held with Mr. Matasserin at 2100 hours regarding speeding up of operation disposing of leakers. At 2200 Col. Hayes advised Major Spahn that, at a conference with Col. Arthur and Col. Gillett, it was decided dry icing of bombs in car shipments was advisable, and icing of bombs on the ground would be helpful. Men worked until 0100 hours.

o. 26 JULY 1946. One additional car loaded and being braced and blocked. This car is now on demurrage. Arrangements have been made for purchase of ice and dry ice, and at 1000 hours 500 Lbs. of dry ice was placed in the one loaded car. 2,000 Lbs. of ice, in 50 Lb. cakes, was placed on all bombs standing on the ground and a tarpaulin placed on the top to retain the benefit of the cooling effect of the ice. At 1100 hours one Sgt. and five enlisted men reported from Theodore, Ala. for duty. Several of these men appeared to be in poor physical condition due to burns. Mr. Respess, Bureau of Explosives, is due to arrive on Saturday morning, 27 July, to inspect a car of 90-250 kilogram bombs ready for shipment. Col. White called from Mobile for an additional 4000Lbs. of bleach by express. At the request of Col. Gillett a further check was made on the movement of cars leaving for Midwest Chemical Warfare Depot to determine if a more expeditious route could be used. It was determined that travelling by first section of Train 265, out of the Missouri Pacific Yards at 2000 hours, was the fastest possible route and cars to depart will be routed accordingly. At 1800 hours seven enlisted men arrived from Edgewood Arsenal. All existing leaking bombs have been drained of liquid this date and leakers are decreasing. At 0100 hours, a second car was loaded with bombs and ready for inspection. Men stopped work at that time.

p. 27 JULY 1946. At 0715 carpenters proceeded to block and brace two cars ready for shipment. These are cars NP 29362, containing ninety small bombs, and AT&SF 148677 containing forty-eight large bombs. In spite of arrangements with Transportation Section, this depot, for personnel to be available to secure additional cars and make switching movements, no personnel had arrived at 1100 hours and it was necessary for the undersigned to go with Mr. Respess, of the Bureau of Explosives, to the railroad yards to secure an additional car. It has not been deemed advisable by the office of the Chief, Chemical Warfare Service, to use existing contaminated car. At 1330 car D&SAA 17031 was switched in place and bulkheads built in both ends of car. Loading started at 1400 hours and car was ready for bracing and blocking at 1630 hours. This car contains twenty-five large and twenty-five small bombs. Additional dry ice was ordered and 1500 Lbs. of dry ice placed in each car. At 1715 hours seals were placed on cars and cars switched out of yard to meet caboose in Missouri Pacific Yards at 1900 hours. Lt. Harold Michaels and three enlisted men were taken to the Missouri Pacific Yards, and the undersigned personally saw movement completed at 2000 hours, departing for Midwest Chemical Warfare Depot, Baldwyn, Ark. Teletype was dispatched to the office of the Chief, Chemical Warfare Service, Washington, D. C., and to Commanding Officer, Midwest Chemical Warfare Depot, advising the time of departure, car numbers and officer in charge.

q. 28 JULY 1946. Three carpenters from Pine Bluff, having completed their mission, were taken to the railroad station at 0815 hours for departure to Midwest Chemical Warfare Depot. All work on

AIR MAIL

QMDUM-CW 319.1, OC, CWS, 30 July 1946.

this day, under the supervision of the undersigned and Mr. Matasserin, was in connection with policing of area for contaminated items of wood and clothing which were carried to existing burning areas, one being the slurry pit, and the other a shallow hole for exploding burster charges. All contaminated material, ties, etc., were saturated with oil and the day was spent in burning this material and policing of area. A total of twenty-four large and five small bombs have been disposed of to date. This completes the disposition of leakers.

r. 29 JULY 1946. Due to heavy rains this date very little has been accomplished in decontaminating and further policing of area.

s. 30 JULY 1946. Permission was secured on 29 July 1946 from Col. Gillett, office of the Chief, Chemical Warfare Service, to ship the three empty contaminated freight cars, I-CW 6742, ATSF 144258 and CW 29106 to Midwest Chemical Warfare Depot for removal of contaminated lumber and rebuilding. These cars have been again thoroughly decontaminated, inside and out, including undercarriages and couplings. 1500 Lbs. of dry ice was placed in each car before departure. Guard and security detail accompanied these cars to Midwest Chemical Warfare Depot. Cars cleared Missouri Pacific, Sargeant Yard, Memphis at 2000.

2. CASUALTIES. - Reference resume of events above, references were made on several occasions to casualties occurring and visits to various patients who incurred burns both at Memphis and at Amory, Miss. An independent report has been made by Capt. James L. Whittenberger, MC, covering all casualties, including military and civilian personnel examined, and a complete summary is appended hereto, indicated as Exhibit "B". In addition there is appended an interim report, Exhibit "A", dated 19 July 1946, and communication written to Mr. M. M. Hopkins, Supt. Union Railroad Co., Memphis, Tenn., Exhibit "C", (covering injuries incurred by employees of the Missouri Pacific Lines (Union Railroad Co.)), and letter to Mr. E. M. Carr, General Claim Agent, Frisco Lines, Springfield, Missouri, Exhibit "D", in regard to Mr. Guy Rorie.

3. PUBLICITY. - There is attached hereto envelope containing newspaper clippings covering publicity both at Amory, Miss. and Memphis, Tennessee, in connection with subject gas shipment. It will be observed that all publicity in Memphis was on the favorable side and reflects no discredit on the Chemical Warfare Service. This was accomplished through the courtesy of Mr. Farrow, Public Relations Officer of this depot, who published the Memphis items at the request of the Commanding Officer, Col. R. S. Evans, Memphis General Depot. However, the information he received came from the Chemical Warfare Supply Officer and was carefully edited before publication. The Amory, Miss. items were not handled or controlled by this depot.

4. PROTECTIVE EQUIPMENT. - Reference is made to protective equipment furnished enlisted men on duty at this depot. Reference is made to letter dated 22 July 1946, subject: "Condition of Protective Clothing," File QMDUM-CW 420, indicating that the following impregnated items:

AIR MAIL

591-342-S-238	H.B.T., One-Piece Suits
591-347-U-15	Undershirts, cotton
591-347-D-26	Drawers, cotton
591-237-G-20	Gloves, cotton.

gave evidence of having breaks in the fabric after use, or in some cases even before being worn. In addition, suits, impermeable with hood appear to have little tensile strength with resulting breaking of surface, causing some slight burns to CWS personnel. Some specimens have been retained at this depot which were not too badly contaminated. In most instances, however, it was necessary to burn contaminated clothing because of heavy contamination. Col. Gillett and Col. Hayes, Supply and Distribution Division, office of the Chief, Chemical Warfare Service, are both familiar with the referred to letter and the protective clothing specimens will be held awaiting further disposition.

5. CWS TROOPS AT MEMPHIS GENERAL DEPOT. - The following general observations are offered in connection with CWS troops on temporary duty at this depot.

a. It appears that CWS enlisted men in several of the details sent here are, for the most part, inexperienced and inadequately instructed in their personal knowledge of toxic gas handling with particular reference to personal protection. Some men insisted on going without their gas masks in spite of repeated instructions not to do so. Others failed to wear impermeable suits, as the need arose, and had to be ordered to do so for their own protection. Several men had no knowledge of the use of M-5 ointment and stated that they thought it should be used when the skin became red.

b. The general attitude of most of the men was one of reluctancy to perform assigned duties and, since the work in the main was done at night under flood lights, it was necessary from time to time to alert men who had slipped off into the darkened areas to avoid working.

c. Eye burns resulted from failure to wear the gas mask and the undersigned personally ordered men from time to time to wear masks. Several men commented on the uncomfortableness of the masks and the impermeable suits, and one stated that he could not see the need for wearing same. In general, gas mask discipline was most unsatisfactory.

d. Sgt. Steinberg, when visited, stated that he had been forced to wear gas mask as long as twelve hours per day and he felt that it was impossible to wear a mask over such a prolonged period. Conversation with Sgt. Steinberg as to how he incurred eye burns was not conclusive but, from his statements, it would appear that he failed to wear the mask at Amory, Miss. when he first examined leaking cars. This could be the reason for his bad eye condition.

e. The discipline of the CWS troops at this depot has been very poor. This matter was commented on by Col. H. S. Evans on 22 July 1946, at a conference with the undersigned. Col. Evans' opinions

CMDDM-CW 319.1, OC, CWS, 30 July 1946.

are substantiated inasmuch as this officer found it necessary to reprimand CWS enlisted men committing the following acts:

(1) Removal of scooters from the Motor Pool and riding same not only in the depot area but on the main highway outside of the depot area.

(2) Unauthorized possession of Government trucks and jeeps. In one instance two enlisted men were attempting to see how fast they could travel over the depot area zig zagging without turning over. This jeep was taken without permission from the Chief Storekeeper, Salvage Yard, Memphis General Depot.

(3) Attempting to climb Salvage Yard man-proof fence after gates were locked, resulting in the guards advising this officer that should this recur it would be necessary to place the men under arrest.

(4) Contaminated clothing was not removed in the contaminated area, and the area adjacent thereto provided by the undersigned, but was brought to the officers' barracks, where the men were quartered, and hung on the fire escapes of the building. At 0200 hours on 21 July 1946, at the time the undersigned had just retired, Capt. Schulman, M. C., advised that he smelled mustard gas. Upon inspection it was found that the wind had shifted and the clothing on the upper and lower fire escapes, ie., impermeable suits, shoes, etc., was the cause of mustard vapor coming into the building. The items were removed by the undersigned and the following day all CWS troops were placed in the Prisoner of War Camp at the north side of the depot area. It is necessary for this officer to repeatedly request officers in charge of troops to have area policed to remove contaminated clothing and other items strewn all over the area because of improper discipline of enlisted men.

6. FINDINGS. - It is believed that the following conditions have a direct bearing on the leaking of the 500 KG and 250 KG bombs:

a. Improper blocking and bracing of load in cars. Attached hereto as Exhibit "E", are two photographs of cars GN 29105 and ATSF 144258. Car GN 29105 was fully loaded with three layers of 500 KG bombs with no aisle space at doorway, and no blocking or bracing, allowing the load to shift. The only blocking and bracing was at the doorway, inside and parallel to the door of the car. There was no method employed in this car to prevent shifting of load. Car ATSF 142258 had aisle space in doorway but the blocking and bracing was insufficient to hold the load and some of

this was found torn out when the car doors were opened. The load had shifted causing leakers.

b. Examination of 500 KG bomb casings indicated metal approximately 16 guage thickness (this was not measured). However, it appears that this casing was entirely too thin to withstand the rigors of shipment. A welded seam ran the full length of the bomb, from nose to tail, and eleven of the twenty-four bombs, which were shot with .03 rifle split on one side the full length of the seam when the casing was punctured.

c. Observation of the effect of heat on these bombs was that sufficient pressure was created to cause some of these bombs to begin to leak in the weld and in two cases small geysers occurred while bombs were laying on the ground exposed to the sun. Three other bombs were removed from cars which were split open along the length of the weld.

7. RECOMMENDATIONS. - It is recommended that:

a. Future shipments, if any, be placed in containers comparable to standard one ton gas containers.

b. That cars be either dry iced or refrigerator cars be used to keep the bombs cool in order to keep internal pressure down.

c. Future shipments, if shipped in aerial bomb casings, be shipped in non-welded casings of sufficient side wall thickness and tensile strength as to preclude the possibility of the occurrence of leakers.

d. That CWS troops, dispatched as guard and security detail, be thoroughly indoctrinated in their duties and that such troops be accompanied by a minimum of one trained officer.

e. Guard and security detail be given sufficient equipment and protective clothing to complete their mission in the event leaking occurs in shipment of toxic gas (Examination of caboose accompanying shipment indicated one 4-1/2 Gal. container of dane, one 100 Lb. can of bleach, two pairs of rubber gloves, and a limited amount of protective clothing).

8. Attached hereto is additional information secured since the preparation of this report was started, relating to maximum and minimum temperature, relative humidity, wind direction and velocity, covering the period of this operation of unloading, segregation and reloading, shown as Exhibit "F". In addition, with further reference to Par. 1d, attached is Exhibit "G", transcript of performance of train 1/34, from

CHDDM-CW 319.1, OC, CWS, 30 July 1946.

Amory, Miss. to Memphis, Tenn. which was secured this date when report was almost completed, shown as Exhibit "G".

OTTO J. SPAHN, JR.,
Major, CWS
Chemical Warfare Supply Officer.

7 Incls.
Incl. 1 - Exhibit "A"
Incl. 2 - " "B"
Incl. 3 - " "C"
Incl. 4 - " "D"
Incl. 5 - " "E"
Incl. 6 - " "F"
Incl. 7 - " "G"

AIR MAIL

MESSAGE FORM

96 160

Date 14 February 1947.

IN REPLY REFER TO File No.

WAR DEPARTMENT

Office of Origin CHEMICAL SUPPLY SECTION,

Address MEMPHIS GENERAL DEPOT, U. S. ARMY, Memphis 2, Tenn.

To: OFFICE CHIEF, CHEMICAL CORPS
ARMY CHEMICAL CENTER,
EDGEWOOD ARSENAL,
MD.
ATTN: CHIEF, PROPERTY DISPOSAL SECTION

PRECEDENCE			
Wire or Radio		Essential Mil. Mail	
Urgent		Air Mail	X
Priority		Special Del.	
Routine		Ordinary	
Deferred		Registered	
Week End			
Any message not x'd will be sent "Deferred."		Initial	

SUBJECT: Acetylene Tetrachloride.

1. With reference to teletype your office dated 14 February 1947, withdrawal of 32,536 lbs. of Acetylene Tetrachloride from surplus has been completed. Withdrawal was approved by WAA.

2. In the opinion of this office this material could not be Class "A", due to the presence of rust and other impurities. This lot was recovered from Class "C", Agent, Decon., M4 4½ and 3 gal. containers, and the RH 195 buried.

3. Item has been picked up on stock record account as Class C-NC. If this item, in its present condition, is not suitable for requirements of your office, authority for burial is requested, or redeclaration to WAA.

4. No further action will be taken pending receipt of instructions from your office.

Otto J. Spahn, Jr.
OTTO J. SPAHN, JR.,
Major, Cml C
Chemical Supply Officer.

Se... 19 Feb

Q. M. C. Form 256 (Old Form 453)
Approved December 1, 1932.

1947a

96 161

MEMPHIS GENERAL DEPOT, U. S. ARMY

MEMPHIS 2, TENNESSEE

IN REPLY
REFER TO: QMDM-CML C 470.6

DATE:
6 August 1947.

SUBJECT: Decomposition CC-2

TO: Office Chief, Chemical Corps,
Supply and Procurement Division,
Washington 25, D. C.
Attn: Chief, Procurement Branch
(Major Owendoff)

Forwarded herewith report on the thermal decomposition (spontaneous combustion) of CC2, destroyed by burial on 18 February 1947, at the Memphis General Depot, along with exhibits pertaining thereto.

Otto J. Spahr, Jr.
OTTO J. SPAHR, JR.,
Major, Cml C
Chemical Supply Officer.

Incl.
Report

WR6863

1947b

THERMAL DECOMPOSITION (SPONTANEOUS COMBUSTION) IMPREGNITE, CC2 AT MEMPHIS GENERAL DEPOT

This report is forwarded as a guide for the future handling of CC2 and XXCC3, when destruction by burial is required. From the information furnished below, it appears that the importance of observation of minimum precautions in burial cannot be over-emphasized.

On 18 February 1947, 86,100 lbs. Impregnite, CC2, were destroyed by burial in a trench varying from 6 ft. to 8 ft. deep, 8 ft. wide and 40 ft. long. Containers were completely macerated by driving a D-8 bulldozer over the material introduced into the trench. Earth coverage of from 4 to 5 ft. was placed over the buried material, and the area thereafter properly staked out to indicate that chemicals were buried in that location.

Subsequently this area was selected for the storing of bauxite, under the strategic stock-piling plan, by the Quartermaster Supply Officer, and the activity later transferred to the Engineer Supply Officer. From information furnished the undersigned and personal observation, it appears that the burial area was disturbed by scarification of the surface, using a bulldozer to establish certain grades. From the removal of the marking stakes, (stating chemicals buried here) it appears that the minimum coverage of the CC2 was somewhat reduced. However, it is not believed that this coverage was reduced more than 1 ft. Further information would indicate that possibly when this trench was closed, and later when grading operations took place, certain foreign substances could have been intermingled with the CC2, or immediately over the surface of it.

At 0520 on 30 July 1947, a large cloud of smoke was observed, the time being shortly after day-break and, as soon as possible thereafter, the Chemical Supply Officer and a representative of the Engineer Supply Officer visited the scene. The air was pungent with smoke which gave a very distinct odor of chlorine, and appeared to be in high concentration. Wind drift was from southeast to northwest, approximately five miles per hour, and the area down-wind, from the point of emission of the chemical smoke, showed that all vegetation had been parched over a distance of approximately 100 ft. in depth and 30 ft. wide. Tomato patch and vegetable truck garden directly west were examined and no evidence found of destruction by acid smoke. (See Exhibit B). Slight fissures (See Exhibit A) were developing in the ground at 0730 and, at various points, considerable pressure appeared to be created by the gas emitting from the ground. Temperature on this day and the previous day was 100 degrees Fahrenheit in the shade (maximum), and ground temperatures were stated to be from 110 to 120 degrees Fahrenheit. Due to the numerous cars of bauxite on the tracks to the east of this location, and the fact that it was too early to switch these cars, no action could be taken until the arrival of the depot force at 0730. Plans were immediately made to switch the cars out and run a hose from the nearest fire hydrant, some 250 ft. away, to wet down the entire area.

At 0800 large fissures developed in the earth, and at one point considerable collapse of the earth's surface took place. At 0815 water was poured on the area (See Exhibit B). This was continued until approximately 0830 when an earth dam was thrown around the periphery. The

WR6863

Thermal Decomposition (Spontaneous Combustion)
Impregnite CC2, (Cont'd.)
at Memphis General Depot.

entire area was filled with water to a depth of 2 ft. and allowed to soak into the subterranean fire. (See Exhibits C & D).

This earth dam was filled twice daily thereafter, and kept filled at all times with a minimum depth of 1 ft. of water. Daily observation on 31 July, 1 August, 2 August, and 3 August, indicated from bubbles percolating through the water surface, that some combustion still existed. On 4 August 1947, at 1400 hours, the bubbling had apparently stopped except for an occasional bubble. The practice of keeping the pool full of water was continued and on 5 August 1947, it was decided that the spontaneous combustion had stopped. As a matter of precaution, water was kept in the pool over the area for the next 24 hours.

The purpose of this report is to bring to your attention the fact that it appears, where high ground temperatures exist, and/or minimum coverage of 4 ft. is not maintained, that thermal decomposition of CC2 (or XXCC3) may take place. It is desired further to point out that the introduction of foreign substances, where CC2 (or XXCC3) is buried, may also be the cause of spontaneous combustion and the resulting combustion of CC2.

4 Incls.
Exhibits A, B & C,
in dupl.

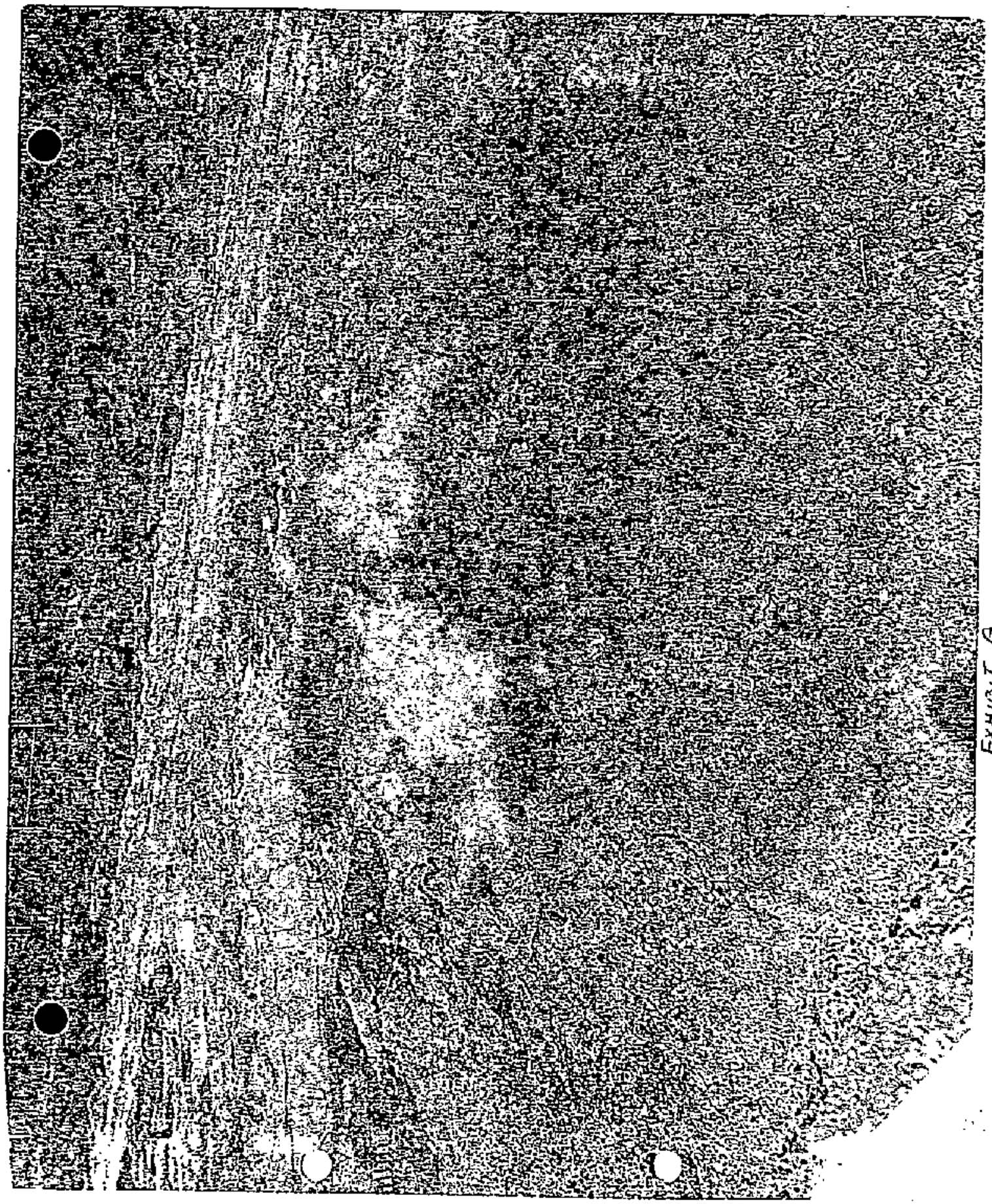

EXHIBIT A

EXHIBIT B

EXHIBIT C

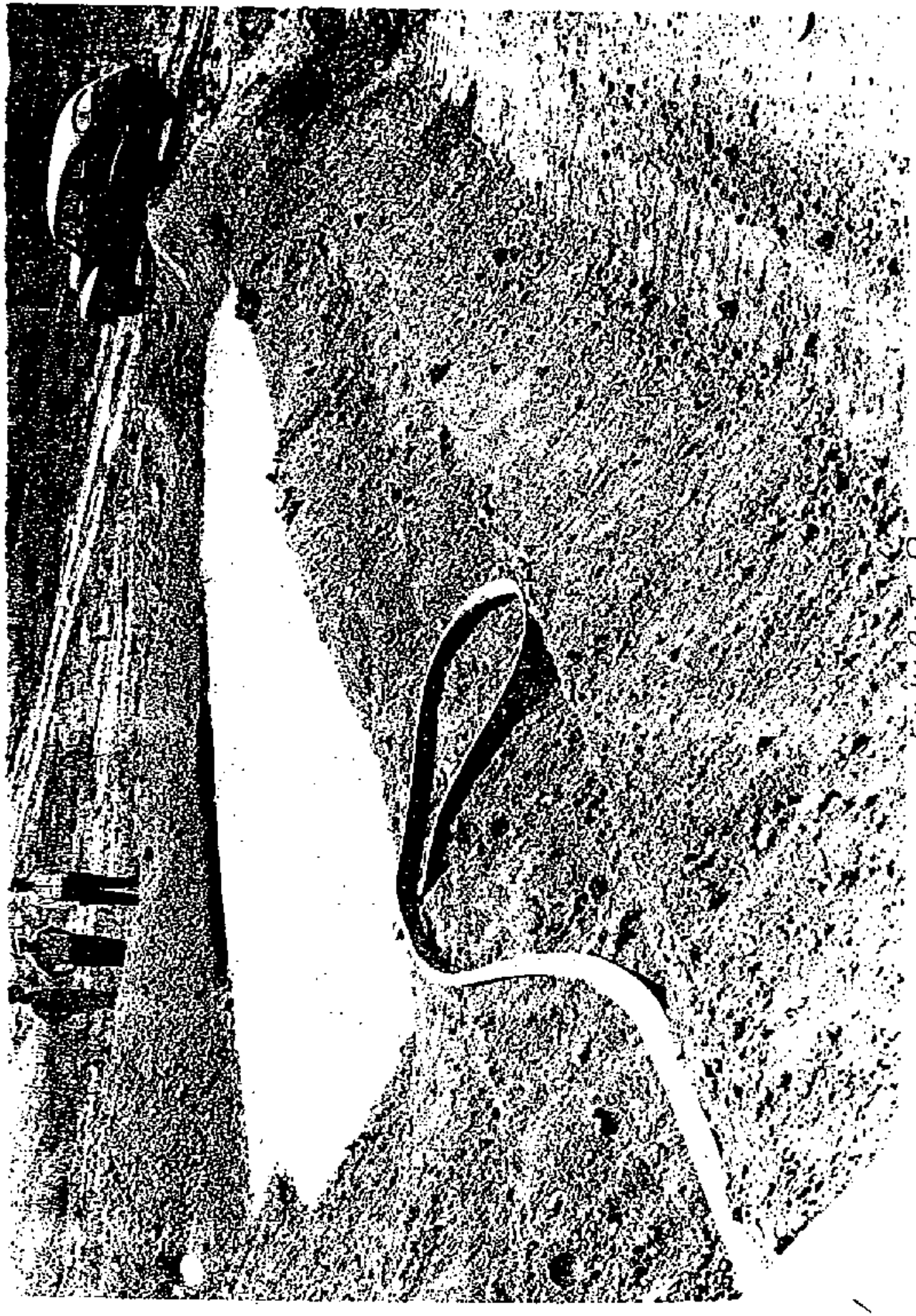

EXHIBIT D

NPRC - MR
338-59-6364
Box 1/1
FOLDER: "400.24 JULY-DECEMBER CLOSED 1957"

96 168

[illegible]

OUTGOING DATE FILE
13 Sept 57

[illegible]

X DA

CO [illegible] ACHLCIN MD

CO [illegible] MEMPHIS TENN

FROM CMLMM-M-STD.7-62-7

Advise Materiel Command, ATTN: CMLMM-M-STD.7, the appropriate Condition in accordance with AR 755-6, Appendix 1, para 174, of 11 ea, Detonating Equip., War Gas Identification, M1, Stock Number 6910-368-6153, (1 ea. CRC 1; 10 ea CRC 3), located at your depot

SEP 13 1 06 PM '57

400.24

COPY
TRANSMITTED
MESSAGE

13 1238
Sep 1957

ARMY CML CENTER, MD
CML C MAT COMD
HEADQUARTERS

CMLMM-M-STD.7-62-7
[illegible]/gc
[illegible]

SEP 13 [illegible]

CHARLES E. [illegible], JR.
Captain, CmlC
Chief, Administrative Officer

[illegible]

[illegible]

INSTALLATION	REPORT CODE
Mengl.	96 169

PURPOSE/AREA OF INTEREST

CHEMICAL SYSTEMS

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Mr Trant	PRESENT PREVIOUS	~~[illegible]~~ Ret. 39 years ago.	

1) Spill handled by Edg. Ars. ≈ late 40's
 Germand G. after WW II

2) Container failure, ~~Amory~~ Miss. started leaking
 moved in Igloo's
 2 or 3 leaken cars

3) Moved cars into spin: tranfered into good containers –
 year or so sealed – decon. operations
 mostly for year
 XX CC 3 – impregnants

4) Decon. cars and containers sent to
 Pine Bluff – terrain sprayed

5) No ~~[illegible]~~ injur. known

6) Mustard + training sets (6) buried –

INTERVIEWER	DATE
RL JONAS	4 Mar 81

"48-58" clean up

7) Lot of materials under old barracks:
mostly foods: Jan/80 ret.

7A) → Impregnite buried:
60'-80' ditches XXCC-3 46-48 clean up "
Near Map St.
6' to 8' deep May 1942 - Jan 8
(clay land)

8) Smoke Pots & H. grenades were burnt.
when old Bauxite Plant was

9) "46" 3.2 mortar etc. turned into MP's at
Meglio HdQ - exploded into pits:

10) DANK rusted cans or DS-2 pit disposal
small scale

11) More than 6 pit - as well as bottles

12) Most was shipped to Pine Bluff Ars.
"Transport Corps."

13) Tropical Bleed ST.B. and Bauxite

14) No bulk chemicals -

15) W-P. Smoke pots — burnt in Bauxite area
CW Teem

16) Operation at Chickasaw —
Impregnite buried 46-48 not large ant.

17) 100lb bomb body empty: WH removed

18) 500lb bomb body — loaded less fuse (WH) NC-1
Mustard PT-1 "1944"

INSTALLATION
Memphis

REPORT CODE
96 171

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/POSITION	YRS AT INSTALLATION	PHONE
Mr. Trant.	Chem IDS PRESENT PREVIOUS		

19) Corp. of Eng. fuse material / prima cord ND-1 3/16 - 1/8" few spools

20) Magazine - colored hand grenade / smoke grenade, WP, CN Blasting C. also.

21) Ton container empty (few only)

22) Bulk storage, decon. trailer, 100 lb bomb cont prior to 1946 - tore down WH.
Maint activity here - repair decon units + modify gas masks
finally & SP-10 long lens + speakers

PDO scrap

23) ND-2 paints & chemical blue + gold

24) Dunn Field D-Day Park Pick rail in it -
Whitehaven ⟷ Colored at Park

INTERVIEWER
R L Jonkes

DATE
4 Mar 81

25) Track #27 NOT #7

26) Decon track on flat car and ran it back to a Mon, Miss.

27) St were always broken — metal steel pipes — everything decon per manual

28) No. RadW or BioW. (all at Pine Bluff)

29) Smoke generator & operation (no supply ords)

30) Flame throwers fired (#2 fuel)

31) Napalm. storage (tapioca type not mixed)

32) 3 stage air compressor —

33) Agitators in Mags (small #)
Every school yard + Rota in Mariana to see

34) No Troop training when I was here
Ord. Field Dept.

35) [redacted]

REPORT CODE 96 173

INSTALLATION
DDMT

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/POSITION	YRS AT INSTALLATION	PHONE
James W Wages	PRESENT Maintenance Foreman PREVIOUS Railroad Foreman	22 May 58 - present	744-5560

1. Bauxite sold to Reynolds Al Co, Bauxite, Ark
2. Property disposal used to be in area of B
3. Tested flame throwers on #3, #9 fairways @ late 1940's
4. Mr Halliwell may have info
5. Chem stamps left in 1961/62
6. Waste oil used to oil points on railroad
7. Used to use waste oil on roads for dust control and along tracks
8. [illegible] - would call over to get hole (Johnny [illegible] - assoc with chem operation)
9. Mr. [illegible] - disposal officer - when had a fire in one of the 14 holes in D area
10. [illegible] Burtts
11. Holes dug about 9 deep with back hoe. [illegible] ground
12. Covered holes and covered [illegible] to [illegible] runoff

INTERVIEWER

DATE

13. Role of sodium in body - different kinds of sodium. Some in and

96 174

14. Major Hixson

15. Materials of historic interest for enrichment activity

INSTALLATION	REPORT CODE
Memphis Depot	96 175

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/ POSITION	YRS AT INSTALLATION	PHONE
Wages Ingram Sides	PRESENT PREVIOUS		

(1) Roofing gravel near golf course (Dunn field)
(2) pond filled in - early 1950's
shed near old pond removed late 50's
(3) Burning pit north of Bldg 629 - used early to mid. 60's
used 4-5 yrs.
Burned in Dunn field prior to 629 pit; closed cut bank; everything burned there 55-60
(4) Hollaway II about digging for bauxite storage (ask)
(5) Roofing materials used to fill old bauxite pit after bauxite sold to Reynolds Alum.
(6) burning remains cleaned out & buried in Dunn field (#3) area 10 on map
(7) mulch pits (6) [redacted] in Dunn field
(8) flame thrower, practice used on fairway 3 & 9 prior to 52
(9) Prop. Disp. salvage yard in area of Bldg 490, 470, 469, 690, 693
(10) ~~Magazines~~ Batteries tore down in 59 of 60
(11) Charlie Anderson telling 5201 worked with old chem. corp (equip Repair)
(12) Eng. Maint in Bldg 972 - rebuilt eng. equip.
(13) large pond for boat testing (25-27 ft. boats)
(14) pond filled by surface drainage — built prior to 1952

INTERVIEWER	DATE
Whitten	

96 176 (sp)

early 50's – still used occassionally

15) Dipping vat for wood preservation ~~mid 60's~~
underground storage tank SW edge of vat
penta-chlor phenyol (sp.)
William H. Scott (retired ~10yrs) for information
drippings from treated materials in area of vat

16.) South end of 972 & Northwest end of 970
Sump tanks for storage of waste oil
Contractors removed oil

17) possibly sprayed on railroad & used on roads &
on fences ← waste oil
used on gravel in PDO yard prior to early 70's (west of 209)

18) burial site area D – all types chemicals, leakers, etc
Na buried
Sulfuric
HCL
etc
near offset on Elk st.
N.W. corner

19. Johnny Patterson ass. with chem.
Marvin Batts (retired) chem.

HEADQUARTERS
XXXXXXXXXXXXXXXXXXXXXXXXXXXX

JLW/mg/mjk

MEDICAL DIVISION

CMSRM

2 August 1946

SUBJECT: Report on Mustard Gas Burns at Memphis, Tennessee from 13 July 1946 to 29 July 1946.

TO: Chief, Medical Division, C.W.S.

1. By order of Par. 1, SO 145, CMC, Edgewood Arsenal, Md. dated 14 July 1946, the undersigned officer was assigned to temporary duty at the Army General Depot, Memphis, Tennessee from 0045, 15 July 1946 to 1305, 29 July 1946. A partial report on mustard gas casualties in Memphis, dated 18 July 1946 has been submitted to the Chief, C.W.S.

2. A technical report on the incident will be submitted to the Chief, CWS by Major Otto J. Spahn, Jr., CWS, Chemical Warfare Supply Officer at the Depot. Major Spahn was in charge of the operation, supervising the work of four (4) CWS officers and CWS enlisted men who eventually numbered forty-six (46). Forty (40) of the enlisted men and two(2) of the officers were from Guard and Security Division, Edgewood Arsenal, Md. There were six (6) men and (1) officer from Huntsville Arsenal, Alabama.

3. Briefly described, the incident resulted when mustard gas was found to be leaking from three (3) boxcars in the Missouri Pacific R.R. yards, shortly after their transfer from the Frisco yards at 0840 on 13 July 1946. The leaking cars were three (3) out of eight (8) containing a shipment of mustard gas in German incendiary bomb casings, loaded at Theodore, Alabama, and enroute to Baldwin, Arkansas (Pine Bluff Arsenal). Two (2) other cars from the original consignment had been set off previously on account of leakers. Only one (1) Guard and Security man (Pvt. Stanley J. Wawronowicz, RA 46073938) remained with the train and he was incapacitated by mustard burns of his eyes and leg.

4. When the leaking cars were discovered, they were rapidly transferred back to the Frisco yards and thence into the Army Depot yards where they were relatively isolated on a spur of track adjacent to the Salvage Yard. The area approximately 150 yds, in width along each side of the track was made a prohibited area, protected by road blocks and by civilian guards when available.

The period from 13 July to 18 July was spent in decontamination of the affected areas in the Depot, Missouri Pacific, and Frisco Railway yards. The roadbed of the Frisco Lines between Memphis and Amory, Miss. was inspected for possible contamination by the undersigned officer on 17 July. The trip was made on a two-man motor car during the hot part of the day, from 1100 to 2000. At each of six (6) points where the train had stopped on the morning of 13 July, the roadbed was traversed on foot on each side of the track, for a distance greater than the estimated length of the train. The M9 detector kit was used at these points, with sixty (60) strokes of the pump. No evidence of contamination was found. The undersigned officer was accompanied by Frisco roadmasters, J. R. Trower and J. E. Moore.

On 18 July 1946 unloading of the three (3) leaking cars was begun, after the five (5) apparently intact cars had been sent on to Pine Bluff Arsenal. At least one (1) of the cars was obviously very poorly stowed, and it was a very difficult task to remove the 500 kg and 250 kg bombs without adequate tools and without men trained for that kind of work. It was impossible to say exactly how many leaking bombs were removed from the cars because there were several obvious ones and many questionable ones. In two (2) instances there were large rents in the seams of the bombs, with at least 75% of the mustard spilled on the floor in one case; in the other the spilling occurred on the legs of the workers when they unknowingly turned the bomb crate over. The bombs were stacked in rows on the ground outside the cars and during the next few days, many new leakers appeared among them. This was especially true before the crates were iced down and covered with shelter halves for protection against the heat. Ultimately twenty-four (24) large (500 kg) and five (5) small (250 kg) bombs had to be destroyed. The intact bombs were reloaded into uncontaminated boxcars, the operation being completed at 1545 on 27 July 1946.

3. The only serious burns incurred at Memphis were among the military personnel engaged in bomb handling operations. Mr. Guy Norris, Frisco conductor, was hospitalized at the St. Joseph's Hospital, Memphis, but was exposed to the mustard at Amory, Miss. (see preliminary report to the Chief, CWS) Sixteen (16) other civilians, (three (3) employees of the Frisco R.R., three (3) employed by the Missouri Pacific R.R., and ten (10) civilian employees of the Army Depot) had minor burns, actually or allegedly due to mustard gas exposure. Two (2) CWS enlisted men were hospitalized in Memphis after being burned enroute. Seventeen (17) others were burned at Memphis seriously enough to interfere with duties. A brief description of each case is listed in the appendix.

4. Burns of civilians occurred among those who had to work too close to contaminated areas for long periods of time or who were exposed to high concentrations of wind-borne vapor. Most of these were guards posted at the periphery of the area. Two (2) railroad men had to work close to a badly contaminated track in the Missouri Pacific yards. One (1) Depot Trainman suffered mild burns on his legs when he walked through tall grass near the contaminated area.

5. Mustard burns of military personnel occurred because of inexperience, lack of instruction, defective clothing, and carelessness. Of thirty-one (31) men sent directly to Memphis from Edgewood Arsenal or Huntsville Arsenal, fourteen (14) stated that they had had no instruction in CWS procedures such as decontamination and first aid; the majority of the fourteen (14) had recently completed basic training. The same charge of inexperience must be applied to some of the officers in charge of the operation; on one occasion the men were asked to work inside a contaminated car without adequate protection; as a result several men were burned. This was an error of judgment resulting from inexperience.

After the first group of men were burned, it was found that much of the clothing sent from Edgewood was defective. There were holes of various sizes in both outer garments and underwear. It was determined that impermeable suits should be worn in all operations around the leaky bombs. One man in each group was assigned the task of inspecting the protective equipment of all men going into the danger area. In addition, each man thoroughly inspected his clothing before putting it on, and the officers made frequent checks of protection. Wearing of impermeable clothing prohibited most daytime operations on account of excessive heat (see appended table No. 2) and slowed down night operations.

Instruction was given to the new men both informally and in two (2) short formal sessions. In spite of these precautions, men continued to be burned, usually because the suits were torn or the protective rubber coating wore off. Most of the burns were around the knees. Examination of many of the impermeable suits before they were issued to the men revealed small rips in the fabric, denuded areas, etc. Some of the suits were folded into a gummy mass which could not be opened for wear. Samples of clothing were saved to demonstrate these defects.

6. Military personnel were hospitalized at the Station Hospital of the Fourth Ferrying Group, ATC, about 2½ miles from the Depot. A majority of those burned did not require hospitalization; they were kept on light duty and treated in quarters. One (1) of the latter developed a right radial nerve paralysis one(1) week after incurring mustard burns on his legs and upper chest. All patients in the Station Hospital were seen by the undersigned twice daily. The Kennedy Veterans' Hospital and St. Joseph's Hospital (one patient each) were visited every two or three days. Civilians with mustard burns or possible mustard burns were seen and treated

at the Depot Dispensary or in their homes. The Dispensary was operated by Capt. Herschel Shulman, MC with the aid of two nurses and a secretary.

7. Summary

(a) Thirty-two (32) individuals incurred injuries of varying severity from leaking mustard gas at Memphis, Tenn. between 13 July and 29 July 1946. Three (3) more, hospitalized in Memphis, and a fourth (4th) seen by the undersigned at Byhalia, Miss., were exposed to the gas at Amory, Miss.

(b) Eight (8) military personnel had to be admitted to hospitals; eleven (11) more were sufficiently burned to interfere with duties and to require treatment. Three (3) others had very minor burns not interfering with duties or requiring treatment. These are not included in the appendix.

(c) Only one (1) civilian was seriously burned (Mr. Guy Morris). Sixteen (16) others had minor burns or skin lesions reasonably attributable to exposure to mustard gas. No one lost more than three (3) days of work and in the opinion of the undersigned, there were only two (2) or three (3) individuals who could justify staying home even that long.

(d) The operation of transferring the bombs to clean cars was delayed by several factors. Progress in the first few days was largely by trial and error since there was no special equipment or trained personnel for the task. The bombs were moved largely by man-handling, very difficult under the conditions existing. Defective clothing hindered the operation by leading to incapacitation of personnel and by impairing morale. Impermeable suits made day operation impossible and night operation slow. Four (4) men in one night had to be returned to quarters suffering from heat exhaustion.

8. Recommendations

(a) Steps should be taken to prevent the shipment of cargoes such as the one causing the trouble at Mobile and elsewhere. If similar shipments are enroute, they should be destroyed at sea, if possible. If these steps were taken, there would be little need for further recommendations.

(b) Guard and Security teams should be organized for the handling of emergencies such as the one in Memphis, since the same situation could develop if a train-load of American chemical munitions were wrecked and some of the containers ruptured. The Guard and Security team should be responsible for the operation, with close cooperation with local authorities on the command level.

(1) Provisions should be made for adequate instruction and training of team members in personal protection and first aid as well as in area decontamination, munition destruction, etc.

(2) Teams should be provided with better protective equipment; this means larger quantities and better quality of impregnated and impermeable clothing, more up-to-date comfortable gas masks, larger supplies of M5 ointment and first aid kits, etc. The first aid kit should be re-evaluated in the light of recent experiences; each kit should contain a copy of TM8-285 for the use of doctors on the spot.

(3) Train crews handling dangerous chemical munitions should have protective equipment available and definite instructions about what to do in case of a gas emergency, such as might occur in a train wreck which killed or injured the Guard and Security detail.

James L. Whittenberger

JAMES L. WHITTENBERGER
Captain, M.C.

APPENDIX I

METEOROLOGICAL DATA

INFORMATION FURNISHED BY U.S. WEATHER BUREAU - S-5868 Memphis, Tenn.

Date	PERIOD MIDNIGHT TO MIDNIGHT MAXIMUM	MINIMUM	WET BULB 7:30 AM	1:30 PM	REL. HUMIDITY 7:30 AM	1:30 PM
1946						
13 July	90	67	67.5	68.8	90	83
14 "	93	64	66.1	67.3	92	90
15 "	95	68	68.1	69.3	86	86
16 "	94	70	71.2	72.0	90	90
17 "	97	74	73.9	73.3	87	79
18 "	95	74	76.6	79.5	86	84
19 "	93	72	71.5	72.6	88	88
20 "	94	73	72.1	74.0	92	84
21 "	86	68	71	72.5	87	85
22 "	93	65	66.9	75.0	98	51
23 "	96	65	65.9	75.9	89	48
24 "	96	69	74.8	75.2	77	40
25 "	96	73	72.1	78.5	90	59
26 "	92	74	71.5	76.5	85	64
27 "	91	71	68.1	75.2	84	50
28 "	80	69	64.5	75.7	76	89

APPENDIX II

CASE HISTORIES OF MUSTARD BURNS

CASE 1. Guy Rorie, 48, Frisco conductor, burned while setting off a leaky car at Digbee, Miss., hospitalized at St. Joseph's Hospital, Memphis, with mild conjunctivitis, multiple first and second degree burns of both legs from the mid thigh down, some third degree areas on the toes of the right foot. There were several second degree burns of the right forearm, wrist, and hand, with possibly a small area of third degree on the forearm; there was first degree burn of the upper part of the chest, with several small areas of second degree below the right scapula. At the end of a week the eyes were entirely healed, and after two weeks most of the burns on the left leg were almost healed. Hospitalization duration is estimated at 3 to 4 weeks with disability of 2 to 3 months, depending on the rate of healing of the third degree burns and the possible necessity of skin grafting.

CASE 2. W. Y. Jackson, Frisco car inspector, was exposed to mustard when he examined one of the leaky cars when it was returned to the Frisco yards. He recognized the odor, left the area and took a strong soap bath within a matter of minutes. He developed some redness of the eyes, slight burning of the feet, and a small blister on his lower lip. The first two symptoms disappeared within 24 hours and the blister dried up and healed within a few days. No time lost.

CASE 3. J. S. Hart, Frisco engineer, was exposed to the gas when his engine passed the leaking cars on 13 July 1940. He estimated the contact at 2 to 5 minutes. He had a slight temporary burning of the nose at that time, and next morning noted an increase in nasal and pharyngeal secretions. The nature of the phlegm could not be described. Mr. Hart also stated that he had a burning sensation in his throat and chest. Physical examination on 20 July was negative.

CASE 4. John Parker, Frisco Railroad employee, was exposed to mustard vapor at Amory, Mississippi. Twenty-four hours later he developed a blister one centimeter in diameter on his left wrist. He had no other lesions when seen by the undersigned officer on 17 July 1940.

CASE 5. C. C. Coke, Jr., employee in the Missouri Pacific Railroad yard at Memphis, was exposed to mustard vapor along the contaminated track on 15 July 1946. At approximately the same time he noted nausea, headache, fever, and a blister on his left small toe. One hour later soreness developed in the left groin. Three or four hours later he developed tearing and burning of his eyes which persisted for about 24 hours. Examination by the undersigned officer at 1800 on 15 July revealed fever, slight conjunctival injection, enlarged tender lymph nodes in the left inguinal region. He had dermatophytosis with an inflamed open blister of the left small toe. This patient was treated by the Company physician, Dr. James O. Gordon, with local treatment to the toe and sulfathiazole by mouth. When seen again by the undersigned officer on 18 July 1946, the eyes appeared normal. There was obviously no etiological relationship between the exposure to mustard vapor and the affection of the toe.

CASE 6. William M. Willis, a worker in the yards of the Missouri Pacific, was exposed to mustard vapor from the contaminated track on the night of 14 July. He developed vomiting, headache, burning of his eyes, and itching of the skin on his legs. When seen by the undersigned officer on the afternoon of 15 July he had moderate conjunctivitis and slight erythema of his legs. Two days later he appeared perfectly normal.

CASE 7. J. B. Burnett, an employee of the Missouri Pacific, checked air couplings on the leaky cars on 13 July wearing a gas mask and rubber gloves. He later developed burning and redness of the anterior part of his neck and a small burn on the right forearm. These findings had completely disappeared by 28 July.

CASE 8. Joseph P. Stevens, crane operator at the Army General Depot, was exposed to wind-borne vapor on 15 and 16 July. He noticed slight burning of his eyes and marked itching and burning of his forearms. Examination on 16 July revealed slight erythema of the forearms.

CASE 9. Luther M. Goins, an employee of the railway in the Depot, was engaged in switching operations in the vicinity of the leaking mustard bombs on the evening of 19 July, was exposed for a total of about one hour, and one hour later noticed burning of his legs. At this time he washed his legs with soap and water and came to the dispensary. He was treated with calamine lotion and when seen on 22 July his legs appeared normal.

CASE 10. Bedford Lowe, Depot guard, was exposed to wind-borne mustard for six and one-half hours on the afternoon of 20 July. On the following day he noticed burning of his neck and nose. These symptoms had disappeared by 28 July. Physical examination on 20 July was negative.

CASE 11. Eugene B. Thomas, Depot guard, was exposed to mustard on 13 July. He developed a blister one centimeter in diameter on the dorsum of the foot at the base of the left great toe. The blister was treated with petrolatum dressing and it was almost healed by 28 July.

CASE 12. Willie F. Doris, Depot guard, was exposed to mustard vapor for one day and the following day he developed blistering of his lower lip which was seen by the undersigned officer on 20 July. The lip then had the appearance of a crusted erosion.

CASE 13. Capt. P. H. Mahaffey, Chief of the Depot guards, was exposed on 13 July. He later developed redness and burning around his axillae and on the medial aspect of the left leg below the knee. These lesions were treated with calamine lotion and had disappeared by the 28 July.

CASE 14. D. E. Stubblefield, Depot guard, was exposed to vapor over a period of several days beginning 15 July. On 20 July, his eyes began to tear and burn. Examination on 23 July showed slight conjunctival injection and increase in secretions. The eyes were much improved by 28 July.

CASE 15. F. M. Pace, Depot guard stationed near the contaminated area on 18 July and subsequently. On 24 July he first noted itching and stinging of several pimple-like areas on the back of his left forearm. Examination on that date revealed 10 pinhead-size papules on the back of his left hand; there was no erythema.

CASE 16. John B. Caswell, Depot crane operator, was exposed to mustard vapor briefly on the morning of 24 July. He shortly noted burning and lacrimation of his eyes which continued during the day and became worse at night, interfering with his sleep. His lids stuck together in the morning. Examination at 0800 on 25 July revealed slight but definite hyperemia of the conjunctivae. Two days later his eyes were slightly improved.

CASE 17. B. F. Johnson, Depot guard, worked around the contaminated areas daily after 13 July. On 15 July he first noted burning of his eyes, lips, and backs of his hands. These symptoms continued and his eyes were stuck shut every morning. Examination on 15 July revealed no lesions of the eye; the lips were dry but not blistered. There was one 4 millimeter red area with a central blister in the palm of the left hand and two smaller red areas on the back of the right hand.

CASE 18. Sgt. Abraham Steinberg, ASN 12007939, member of the Guard and Security detail on the train, was hospitalized at the Station Hospital of the Fourth Ferrying Group after being burned enroute to Memphis. He had a mild conjunctivitis and tracheobronchitis. Before leaving Mobile he developed slight coughing and exertional dyspnea which became aggravated by the time the train reached Amory, Mississippi. His voice became hoarse and his cough worse. He developed slight pain in the left side of his chest. After seven days in the hospital his eye and lung symptoms had disappeared and he was ready for discharge.

CASE 19. Pvt. Stanley J. Woronowicz, RA 46073938, member of the Guard and Security detail on the train, suffered mustard burns of his left foot while decontaminating near Aliceville, Alabama, on 12 July. He was admitted to the Kennedy Veterans' Hospital on the morning of 13 July with conjunctivitis and vesication around his left ankle. The conjunctivitis improved rapidly and the burns of his left leg were almost healed by 28 July.

CASE 20. Pfc. James Davis, RA 33914819, was exposed to mustard while unloading a carload of leaky mustard bombs on the night of 18 July. He was wearing no impregnated underwear. At 0800 on 19 July there were splotches of erythema around both knees. At 2200 of the same day the erythema had spread and there were numerous blisters around both knees, the lower half of the thighs and the legs for about one foot below the knee. New blisters appeared and the older ones became larger throughout the next two days. There were never any systemic symptoms. This man was kept on light duty around the barracks and appeared to be doing very well until 25 July. That night at 2300 he was awakened by another man and at that time noted wrist-drop and a feeling of numbness in his right hand. The following morning the paralysis persisted although the numbness had disappeared. There was no apparent etiology for the radial nerve paralysis and the patient was admitted to the Station Hospital.

CASE 21. Pfc. Bernard W. Thompson, RA 36943137, worked in the contaminated car on the night of 18 July without impregnated underwear. During the succeeding two days he developed multiple first and second degree burns of his arms, legs, and the upper part of trunk and genitalia. He had no systemic symptoms except loss of appetite for two days. The blistered areas on extremities were bandaged and he was allowed to continue light duties around the barracks. The progress of his injuries was uneventful.

CASE 22. Cpl. John F. Carpenter, ASN 39441457, was exposed to mustard during the car unloading operations on the night of 18 July. He wore no impregnated underwear and later found a small hole in the knee of his impregnated trousers. He noticed a burning sensation of his left thigh at about 0100 on 19 July; he continued working until 0500 without change of clothing or decontamination. When seen at 0500 he had marked erythema of his knees and left thigh with a large pale indurated area covering the lower two-thirds of his left thigh. Erythema also involved the genitalia. He complained of nausea, vomiting, weakness, and pain on the left thigh. He was admitted to the hospital and went on to develop extensive second degree burns of both lower extremities and genitalia. There were first degree burns of his trunk and neck. He developed a very mild conjunctivitis which lasted only one day.

CASE 23. Pvt. Elvin D. Ross, ASN 37814217, was exposed to mustard on the night of 18 July when he worked in the contaminated car without benefit of impregnated underwear. During the following day he developed extensive first and second degree burns of the large part of his entire body accompanied by nausea, vomiting, fever, and malaise. After hospitalization he continued to feel ill for about 3 days and developed vesication over large areas of both legs, lower abdomen, and left forearm and wrist. First degree burns were largely confined to the front of his trunk and neck. His progress in the hospital was satisfactory.

CASE 24. 1st Lt. Charles A. Meyer, O-1037877, was freely exposed to mustard vapor in decontaminating and unloading operations. In spite of mild inflamation of the eyes beginning on 14 July he did not wear a gas mask. On 19 July his eyes were so bad that he had to be admitted to the hospital. In addition to the mustard vapor he was exposed to high concentrations of vapor from DANC and bleach. Examination of the eyes on admission to the hospital revealed moderate inflamation of the bulbar and palpebral conjunctivae. There was marked photophobia, but no evidence of corneal involvement. Under routine therapy the eyes rapidly improved over the next 7 days and the patient was ready for discharge on 27 July.

CASE 25. S/Sgt. Robert E. Connell, RA 35414916, had very minor exposure to mustard vapor when accompanying a shipment of 5 carloads of mustard to Baldwyn, Arkansas. He had previously had severe mustard burns at Charleston, South Carolina, within the month preceding. Within 24 hours he developed severe generalized pruritus accompanied by generalized erythema and edema of the skin with numerous areas of exudation and crusting about the face, neck, thighs, buttocks, and trunk. This was apparently a hypersensitivity reaction to mustard. Except for inability to sleep the patient felt fairly well so he was allowed to return home on the 22nd of July to be admitted to the Station Hospital at Edgewood.

CASE 26. Pfc. Raymond DePrato, RA 31486948, was exposed to mustard on the night of 18 July when he worked in the car without impregnated underwear. On 20 July he had moderately severe erythema and edema of the anterior part of the neck and a small blister just below the left knee. On 22 July he developed erythema of the toes of the left foot and a blister about 4 centimeters in diameter on the lateral aspect of the left foot.

CASE 27. Cpl. John Tronolone, RA 42152089, was exposed to mustard at 2300 on 18 July. After about twenty minutes working in the car he noticed burning of his eyes, nausea, and vomiting. By 0800 he felt well except for the burning of his eyes and photophobia. On treatment of the eyes with eye-drops and dark glasses their condition rapidly improved and there was no interference with light duty.

CASE 28. Pvt. Anthony Borek, 46076070, developed burning of his right knee on 24 July after working in the car in impermeable clothing. Although blisters developed on the knee the patient was allowed to continue light duties.

CASE 29. Pfc. Oral S. Tillman, RA 37820284, developed blisters on his right wrist on 25 July after helping to decontaminate a man who was splashed with liquid mustard on the night previously. Additional small blisters developed on the fingers of the left hand but were not of much consequence.

CASE 30. Pvt. Jerome A. Schmitz, RA 46078106, developed small blisters on the dorsum of the left foot and above the left ankle on 25 July after working in the car in impermeable clothing on the night of 24 July. On account of the location of the blisters there was considerable interference with performance of duty.

CASE 31. Pvt. James A. H. Mann, 46076225, wore impermeable clothing on the night of 24 July and noticed redness and burning of his legs after 2 or 3 hours of work. He continued working, however, without decontamination or change of clothing. Developed nausea and vomiting and felt quite ill. Examination the following morning showed diffuse erythema of the legs, genitalia, and left forearm. The patient was admitted to the Station Hospital where some of the reddened areas on the legs went on to blister.

CASE 32. Pvt. Vito N. Ercol, 46076163, first noticed redness and burning of his right knee after working in impermeable clothing during the evening of 24 July. Blisters appeared in this area on the following day. There was moderate impairment of duty performance.

CASE 33. Sgt. Julian R. Shake, RA 35682254, developed blisters on the left large toe and the lateral part of the right foot and right knee in spite of the fact that in the previous night's operation every item of protective clothing was new. This man had very little impairment of duty performance.

CASE 34. 1st Lt. Edwin C. Pittinger, RA 0-38378, was exposed to mustard vapors intermittently from 13 July through 25 July. On the 15th of July he noticed small blisters on his neck and redness of the skin of his chest. These symptoms gradually became worse and on 25 July his eyes became very red. He did not wear full protection until 25 July. Examination on 26 July revealed redness of the scrotal skin with small areas of exudation. There were chafed areas on adjacent surfaces of the thighs. There were exfoliating areas in both antecubital fossae, axillae, and around the neck. There was moderate conjunctival injection. The officer was treated and confined to quarters for 3 days.

CASE 35. Pfc. Floyd L. Twigg, RA 35322088, worked on the day crew engaged in decontamination and emptying leaking bombs. He worked under the direction of Mr. Matasserin of Pine Bluff Arsenal and wore no protection except for one day. He rarely wore a mask. The eyes were slightly iritated for several days, much worse on the morning of 26 July at which time he was removed from duty.

CASE 36. Pfc. Laurence Mason, RA 38592643, worked with Pfc. Twigg on the day shift in high mustard concentrations without the benefit of protective clothing or mask. In addition to mustard he was exposed to DANC and bleach. On 24 July he developed a slight cough which later grew worse. On 25 July he noticed redness of his eyes which likewise became worse on the following day. Examination on 26 July revealed moderate edema and marked injection of the conjunctivae. The lungs contained sticky rales and prolongation of expiration on the right side posteriorly. The patient was admitted to the Station Hospital, with a moderately severe tracheobronchitis and conjunctivitis.

APPENDIX A

TECHNICAL REFERENCES

FATE OF CHEMICAL
WEAPONS IN
THE ENVIRONMENT

USATHAMA

RCRA FACILITY ASSESSMENT REPORT
EDGEWOOD AREA
ABERDEEN PROVING GROUND, MARYLAND

Gary Nemeth

WASTE DISPOSAL ENGINEERING DIVISION
US ARMY ENVIRONMENTAL HYGIENE AGENCY

November 1989

Prepared for:
ABERDEEN PROVING GROUND
TEST AND EVALUATION COMMAND
US ARMY MATERIEL COMMAND

significant environmental contaminant only locally for relatively short periods of time.

e. Chlorinated Lime, HTH, and STB. Chlorinated lime has the approximate chemical formula $CaCl(OCl)\cdot 4H_2O$, and is also referred to as bleach and bleaching powder. Supertropical bleach (STB) is made by mixing calcium oxide (lime) with hot chlorinated lime. Calcium hypochlorite has the chemical formula $Ca(OCl)_2$ and is commonly referred to as HTH. Other names for HTH included calcium oxychloride and bleaching powder.

(1) Chlorinated lime, STB, and HTH are chlorinating agents. Chlorinating agents have been used to decontaminate mustard, Lewisite, and nerve agents. Chlorinated lime was the most commonly used decontaminant used during WWI [Mankowich et al., 1970a].

(2) When introduced into the environment, these inorganic chlorinating agents will react and yield calcium, chloride, and hydroxide. Naturally occurring organic compounds in the environment will be oxidized by these chlorinating agents. The hydroxide will be neutralized in soil and ground water, and neutralized and diluted in surface water. Environmental impact from use of these chlorinating agents is expected to be localized and short term.

f. Sodium Carbonate. Sodium carbonate has the chemical formula Na_2CO_3 and is also known by the name soda ash. The Army has used sodium carbonate as a decontaminating agent for G-agents. The decontamination is through alkaline hydrolysis of the agents. The potential environmental impact related to the use of sodium carbonate as a chemical decontaminant is small in most situations, and would be most significant if usage resulted in very high levels of sodium in ground water near water supply wells.

g. DANC. The decontaminant DANC was an organic N-chloroamide compound in solution with 1,1,2,2-tetrachloroethane [Mankowich et al., 1970b]. DANC was an abbreviation for Decontaminating Agent, Non-Corrosive. At least two organic chlorinating compounds have been used in DANC. The first used was CC1[40], and the decontaminant solution was referred to as DANC(M3). The second used RH-195 as a chlorinating agent, and was referred to as DANC(M4). The latter solution was the more commonly used decontaminant, and when literature refers to DANC, it is DANC(M4) that is being discussed. RH-195 was the military designation for the compound 1,3-dichloro-5,5-dimethylhydantoin, which is a white powder. Solutions of DANC typically contained 90-95% by weight 1,1,2,2-tetrachloroethane [Mankowich et al., 1970b]. The solution ingredients were not mixed until ready for use. The decontaminant DANC is obsolete and is no longer used.

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[40]CC1 is an abbreviation for chlorinating compound number 1. The identity of this compound is not known, but it is known to have been an N-chloroamide.

(1) The decontaminant DANC was a chlorinating agent and has been used to decontaminate mustard, Lewisite, VX, and other agents which can be destroyed by chlorination. DANC was not effective against G-agents.

(2) The use and introduction of DANC into the environment would have involved the solvent 1,1,2,2-tetrachloroethane, the N-chloroamide, and the amide. The N-chloroamide, being an oxidizing agent, would have been reduced in the environment, with the amide being the expected degradation product. The most significant impact from the introduction of DANC into the environment will be due to the 1,1,2,2-tetrachloroethane. Because the use of DANC was widespread and common, its past usage provides high potential for long term impact on ground-water quality.

(3) A mixture similar to DANC formulations was the S-210 suspension formulation. This mixture contained 1,1-methylenebis(3-chloro-5,5-dimethylhydantoin) (S-210), tetrachloroethylene or tetrachloroethane, barium hydroxide, Aristowax, and potassium oleate.

h. DS-2. The decontaminant DS-2 was developed around 1960, and contains 70 wt % diethylenetriamine ($NH_2C_2H_4NHC_2H_4NH_2$), 28 wt % 2-methoxyethanol[41] ($HOCH_2CH_2OCH_3$), and 2 wt % sodium hydroxide [Davis et al., 1975]. The 2-methoxyethanol serves primarily as a solvent for the mixture.

(1) This decontaminant is effective against mustard, G-agents, and V-agents. The reaction of DS-2 with mustard is fast, but not as fast as with DANC [Fielding, 1964; Davis et al., 1975]. DS-2 decontaminates mustard by eliminating HCl from the molecule. The sodium hydroxide in the DS-2 mixture accelerates the decontamination reaction of diethylenetriamine with mustard [Jackson, 1960].

(2) The organic constituents of DS-2 are water soluble and undergo biodegradation in the environment [Benford and Wenz, 1985]. The diethylenetriamine may undergo microbial induced reactions to produce nitrosamines.

i. CD-1. The decontaminant CD-1 is a mixture of 55 wt % monoethanolamine, 45 wt % 2-hydroxy-1-propylamine, to which is added 2.5 wt % lithium hydroxide hydrate [Davis et al., 1975]. CD-1 is effective against multiple agents including mustard, VX, and GB. The decontaminant reacts with mustard by eliminating HCl from the molecule, as does DS-2.

j. C-8 Emulsion. The C-8 emulsion is also referred to as the Improved Chemical-Biological Agent Decontaminant (ICBAD) [Benford and Wenz, 1985]. The emulsion contains approximately 76% water, 15% tetrachloroethylene, 8% calcium hypochlorite (HTH), and 1% emulsifier consisting of calcium dodecylbenzene

[41]Also referred to by trademark name of Methyl Cellosolve, a registered trademark of Eastman-Kodak Co., Rochester, New York. Another chemical name for this compound is ethylene glycol monomethyl ether.

21. ENVIRONMENTAL CHEMISTRY AND TOXICITY. This report section presents information concerning the environmental fate and toxicity of chemicals which have been identified as being introduced into the environment at APG-EA, or which are known to be significant environmental degradation products of these chemicals. With this information, an analysis of the potential exposure pathways and hazard from these chemicals is presented. Not all chemicals identified in previous sections of this report are addressed in the section. Only those which are significant with respect to either quantity or toxicity are discussed. Emphasis has been given to those compounds which analysis indicates are most important when exposure and hazard to human health or the environment are considered. For additional information, the reader may refer to the source references. It should also be noted that several very good summary documents addressing chemical agents have been prepared in recent years. Durst et al. [1988] provides a very good summary of chemical agent decontamination and decontamination products. The final programmatic environmental impact statement for the chemical stockpile disposal program [PMCD, 1988] contains an appendix with a very thorough summary of toxicity information available for the chemical agents GB, GA, VX, H/HD/HT, and Lewisite.

a. Phosgene. The compound phosgene is an easily liquified gas which has an odor like new-mown hay, moldy hay, or corn when dilute. Phosgene has the chemical formula $COCl_2$ and a molecular weight of 98.92. The CAS number is 75-44-5. Other chemical names for this compound are carbonic dichloride, chloroformyl chloride, carbon oxychloride, and carbonyl chloride, with the latter name being the most commonly used alternate name [Hawley, 1981; Windholz et al., 1983]. The military abbreviation for phosgene is CG.

(1) Usage Information. Phosgene was produced and stockpiled by the US Army as a chemical warfare agent. It was also used at APG-EA as a raw material in the production of the clothing impregnating material CC2 and the pilot scale manufacturing of the agent GB. Phosgene is also commonly used in the chemical industry as a raw material in the synthesis of organic compounds.

(2) Physical Properties. The liquid density of phosgene is 1.37 g/ml at 20°C and the vapor density relative to air is 3.4 [Kibler, 1942; US Army Edgewood Arsenal, 1974]. The freezing point is -128°C and the boiling point is 8.2°C [Hawley, 1981]. The vapor pressure of phosgene is 1180 mm Hg at 20°C [Kibler, 1942; Sax, 1984]. The vapor condenses at about 0°C to a clear, colorless, fuming liquid [Windholz et al., 1983]. It decomposes at a temperature of 800°C [US Army Edgewood Arsenal, 1974].

(3) Solubility. Phosgene is slightly soluble in water, and is hydrolyzed. It is soluble in most organic solvents, including benzene, toluene, glacial acetic acid, xylene, and common hydrocarbons [Hawley, 1981; Windholz et al., 1983; US Army Edgewood Arsenal, 1974].

(4) Partition Coefficients. Not applicable because of non-persistence.

(5) Hydrolysis. Phosgene undergoes hydrolysis in water, with the rate depending on the pH. The hydrolysis products under acidic conditions are HCl and CO_2; under basic conditions chloride and carbonate are formed. The hydrolysis rate is very rapid in low pH conditions. Under normal or high pH conditions the hydrolysis rate is slower.

(6) Reactivity and Reaction Products. Phosgene is noncombustible under normal conditions [Hawley, 1981]. It is not corrosive to iron or steel when dry, but is very corrosive in the presence of water due to the acid formed by hydrolysis. Phosgene reacts violently with aluminum, potassium, sodium, and isopropyl alcohol [Sax, 1984]. Combustion products from incineration are CO_2, HCl, and H_2O.

(7) Oxidation. Phosgene is not oxidized under normal environmental conditions.

(8) Biotransformation. Not applicable because of non-persistence.

(9) Toxicity. The median lethal concentration via inhalation for humans is 3200 mg/m^3. Concentrations of 3-5 ppm in the air cause irritation of the eyes and throat. A level of 25 ppm in air is dangerous for 30-60 minute exposures, and 50 ppm is rapidly fatal after even a short exposure [Sax, 1984]. The exposure to toxic concentrations of phosgene causes little irritation and therefore little warning of fatal exposure. The toxic action of phosgene is through the hydrolysis of the phosgene in the tissues of the lungs forming hydrochloric acid which results in pulmonary edema. Symptoms of exposure usually occur 2-24 hours later, and death may occur within 36 hours after a severe exposure [Sax, 1984].

(10) Analytical Methods. Methods of analysis in water or soil are not considered necessary because of non-persistence.

(11) Behavior in Environmental Media. Phosgene is not persistent in surface water, ground water, or soil containing moisture because of the relatively rapid hydrolysis. It is also not persistent in dry soil because of it's high volatility.

(12) Summary Discussion. Because phosgene in not persistent in soil or water, and because the hydrolysis products are non-toxic at environmental concentrations, the release of phosgene to the environment during previous activities at APG-EA did not result in hazard to the environment beyond it's immediate toxic effects.

b. Mustard. Mustard is the common name for the vesicant dichlorodiethyl sulfide. Mustard is an amber to dark brown oily liquid with a garlic or horseradish like odor. The pure compound has the chemical formula $(ClCH_2CH_2)_2S$, and a molecular weight of 159.08 [Kibler, 1942; Windholz et al., 1983]. The CAS registry number is 505-60-2. Other chemical names include bis(2-chloroethyl)sulfide, and 2,2'-dichlorodiethyl sulfide.

(1) Usage Information. Mustard has been used by the military as a vesicant chemical agent. It was developed and first used as such during WW1. Various military abbreviations have been used to designate mustard. During WW1 mustard was referred to as "MO", which was short for "mustard oil". During the period from shortly after WW1 until approximately WW2 mustard was referred to by the abbreviation "HS", for sulfur mustard, and "DHS" was used for distilled mustard. The abbreviations "H" and "DH" were used for undistilled and distilled thiodiglycol mustard during the WW1 to WW2 timeframe. From that time until the present the abbreviation used for all undistilled mustard has been "H", and distilled mustard has been referred to as "HD". Mustard has normally been used by itself in chemical munitions, although some experimental work has been done at APG-EA with mixtures of mustard and other chemicals. The most common mustard mixture had the acronym "HT" and was typically 60% HD and 40% bis([2(2-chloroethylthio)ethyl]ether (T) by weight [US Army Edgewood Arsenal, 1974]. HT had a lower freezing point than H or HD. The actual product of mustard manufacturing using the ethylene and sulfur monochloride which was employed at APG-EA is a mixture of dichlorodiethyl sulfide, colloidal sulfur, polysulfides of mustard, acid, small amounts of ether, and higher chlorinated compounds and unsaturated compounds similar to mustard [Carmack and Handrick, 1942; Wheeler et al., 1945; Fuson et al., 1946a and 1946b]. In addition, the mustard sometimes contained a significant amount of crystalline or gummy sulfur. Crude mustard was typically 65-80% in purity. Distilled mustard was commonly greater than 90% pure, with sulfur and polysulfides of mustard being the principal materials removed from the crude product. The odor and color of mustard are in large part due to the impurities. The composition of distilled mustard used in chemical agent munitions is roughly H, 92%; free sulfur, 7.4%; $FeCl_2$, 0.5%; HCl, 0.11%; aluminum, 0.01%; nickel, 0.0025%; and copper, 0.0004% [PMCD, 1988].

(2) Physical Properties. Mustard has a melting point of 14.4°C, and when the liquid is cooled it solidifies forming prisms. The boiling point is dependent on the purity, and distilled mustard boils at approximately 217°C, but also decomposes at temperatures above approximately 180°C. The density of the liquid is 1.27 g/ml and is fairly independent of purity. The solid is slightly more dense, with a density of 1.34 g/ml. The vapor density is 5.4 times that of air at standard temperature and pressure. These values are from Kibler [1942], Windholz et al. [1983], and US Army Edgewood Arsenal [1974]. The vapor pressure of mustard is dependent on the purity, with higher molecular weight impurities lowering the value for crude undistilled mustard. Reported values for vapor pressure include 0.11 mm Hg at 20°C [Kibler, 1942], 0.11 mm Hg at 25°C [US Army Edgewood Arsenal, 1974], and 0.090 mm Hg at 30°C [Windholz et al., 1983]. The viscosity of HD is 3.95 cantistokes at 20°C and the volatility is 920 mg/m^3 at 25°C [PMCD, 1988].

(3) Solubility. Mustard is soluble in most oils and organic solvents, including alcohol, acetone, ether, kerosene, tetrachloroethane and carbon tetrachloride. The solubility of mustard in water is very low. The reported value for the solubility in water is 920 mg/L at 22°C [Northrop, 1942; US Army Edgewood Arsenal, 1974].

(a) The concentration of mustard is water is limited by relatively rapid hydrolysis. Because of this, the rate of solution is more important than solubility when evaluating the behavior of mustard in the environment. The rate of solution of liquid distilled Levinstein mustard in distilled water was determined by Brookfield et al. [1942] to be represented by the following equation for temperatures of 15°C to 35°C:

$$S = 233.7 \times e^{-12350/RT}$$

In this equation a value of 1.987 is used for R, T is in degrees K, and S has units of $g/cm^2/sec$. The rate of solution in seawater was determined to be lower than for distilled water. Measurements of rate of solution of mustard in seawater have also been made by Demek et al. [1970]. The rate of solution in water containing detergents is higher, as would be expected. Another factor affecting the rate of solution in the environment will be flow rate in the surface or ground water. It is likely that the solidification of mustard at temperatures below it's freezing point (approximately 58°F) will also affect the rate of solution.

(b) Northrop [1942] found that the solubility of mustard in water, or at least the rate of solution, was dependent on the concentration of thiodiglycol in the water. This is discussed in a following paragraph containing information concerning hydrolysis. The polysulfides of mustard which are present in significant amounts in undistilled mustard have a solubility much lower than mustard. These polysulfides also reduce greatly the solution rate of mustard in water [Price and Bullitt, 1943]. Abbreviations used to designate these polysulfides of mustard are HS_2, HS_3, etc.

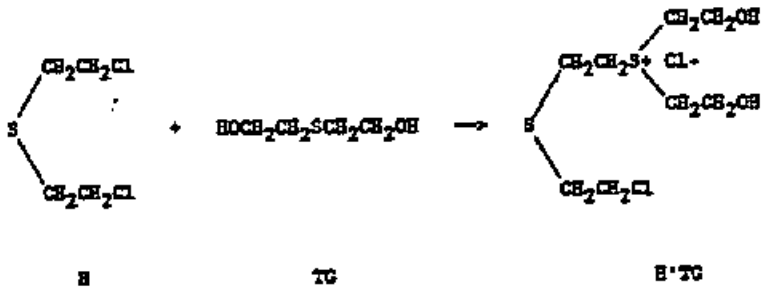
(4) Hydrolysis. Mustard in solution in water undergoes relatively rapid hydrolysis. The hydrolysis reactions for mustard are:

$$\underset{\text{mustard}}{ClCH_2CH_2SCH_2CH_2Cl} + H_2O \longrightarrow \underset{\text{mustard chlorohydrin}}{HOCH_2CH_2SCH_2CH_2Cl} + HCl \qquad (1)$$

$$HOCH_2CH_2SCH_2CH_2Cl + H_2O \longrightarrow \underset{\text{thiodiglycol}}{HOCH_2CH_2SCH_2CH_2OH} + HCl \qquad (2)$$

The rate constant for the second hydrolysis step is approximately 1.4 times that for the first step. The half-life in distilled water of the two steps together has been determined to be 60 minutes at 10°C, 8 minutes at 20°C, and about 1 minute at 40°C [Price and Bullitt, 1943]. Lower temperatures and dissolved chlorides slow the rate of hydrolysis [Grant and Kinsey, 1943]. In the situation where a significant concentration of thiodiglycol is created, such as when the ratio of water to mustard is low, or when the water is not well mixed, as in ground water, thiodiglycol reacts with mustard as shown by

the following equations [Stein et al., 1946; Reichert, 1975; Price and Bullitt, 1943]:



(3)

H TG H·TG

(4)

H·TG TG H·2TG

This reaction between mustard and thiodiglycol acts to increase the solubility of mustard in water [Northrop, 1942]. The sulfonium salts formed by these reactions were found to decompose by hydrolysis in dilute alkaline aqueous solutions. The salt in equation (3), H·TG, is hydrolyzed with the chlorine on the ethyl group being replaced and HCl being formed. The salt of equation (4); H·2TG (bis-2(bis(2-hydroxyethyl)-sulfonium ethyl) sulfide dichloride), is hydrolyzed with the formation of thiodiglycol and HCl.

(a) The hydrolysis of mustard dissolved in water is quite rapid, but liquid mustard in water undergoes hydrolysis very slowly because of the low rate of solution for mustard. Hydrolysis studies with mustard have shown that the polysulfides of mustard, present in significant amounts as impurities in undistilled mustard, are not hydrolyzed rapidly as is mustard [Fuson et al., 1946a]. This is probably due to the even lower solubility of these polysulfides in water. Both the sulfonium salts and the polysulfides discussed in this paragraph are toxic, but not as toxic as mustard. The mustard chlorohydrin[42] formed in the first step of the hydrolysis of mustard is also toxic.

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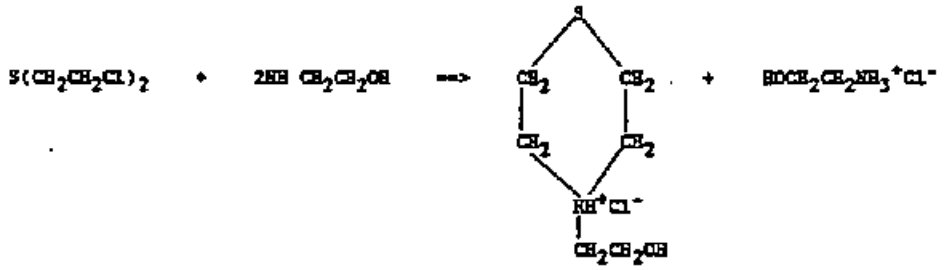
[42]Other names for this compound include hemisulfur mustard, 2-(2-chloroethylthio)ethanol, and 2-chloro-2'-hydroxydiethyl sulfide. The British abbreviation for this compound, CH, was also used in the United States.

(b) Studies have also shown that the mustard hydrolysis reaction is also affected by the presence of other compounds in solution. Price and Bullitt [1943] indicate that a large variety of compounds change the reaction from hydrolysis to metathesis, without changing the reaction rate. Compounds such as thiols or sulfides commonly act in this manner. An example is sodium thiosulfate, in which thiosulfate is substituted for chlorine.

(5) Reactivity and Reaction Products. Mustard will react vigorously with oxidizing agents, and may be ignited. Reaction products associated with mustard are formed during manufacturing, and also during decontamination and disposal. The simple products of hydrolysis and oxidation/chlorination are discussed in other subparagraphs in this report section. Other reactions related to manufacturing or disposal which are likely to have occurred at APG-EA are discussed in this paragraph.

(a) The reaction chloramine-T, $CH_3C_6H_4SO_2NNaCl$, with mustard suspended in water is reported to result in the formation of sodium chloride and an insoluble sulfilimine derivative, $CH_3C_6H_4SO_2N{=}S(CH_2CH_2Cl)_2$ [Mann and Pope, 1922; Price and Bullitt, 1943].

(b) Another chemical decontaminant for mustard is monoethanolamine (MEA). The primary reaction between MEA and mustard is described by the equation [Brankowitz, 1978]:



mustard | MEA | N-(2-hydroxyethyl)-thiomorpholine hydrochloride | MEA hydrochloride

The compound bis(hydroxyethylaminoethyl)sulfide is also produced in very small amounts as a reaction byproduct.

(c) The decontaminants DS-2 and CD-1 react with mustard primarily through an HCl elimination reaction. This is a two step reaction producing first 2-chloroethyl vinyl sulfide, and then divinyl sulfide. Both steps proceed very rapidly with DS-2. The second step is slower with CD-1, but the half-life of the reaction at 25°C is still only 10-12 minutes [Davis et al., 1975]. The HCl elimination reaction is the primary, but not the only, reaction involved in the decontamination of mustard with these two materials.

(d) The decontamination of mustard in hot sodium hydroxide solution was studied by Jarman and Faber [1940]. That work indicates that the reaction

product may have been 1,4-dithiane. Work by Wheeler et al. [1945] showed that decontamination of mustard by hot caustic resulted in the creation of wastes having a mercaptan odor and including insoluble plastic-like solid. The solid was probably a polymer of 1,4-dithiane.

(e) Thermal methods can also be used to destroy mustard. Complete combustion during incineration will result in the complete destruction of the mustard to yield sulfur dioxide, carbon dioxide, hydrogen chloride, and water [Yurow, 1981]. Decomposition of mustard occurs at temperatures as low as 180°C yielding decomposition products including dithiane, 1,2-dichloroethane, ethylene, hydrogen chloride, and 2,2'-dichloroethyldisulfide; and at higher temperatures vinyl chloride and hydrogen sulfide are also formed [Williams, 1947; Cheselske, 1970].

(f) Perhaps the best information concerning reaction and environmental degradation products of mustard is from field studies at disposal sites. Analysis of ground-water samples from the vicinity of Old O-field at APG-EA have revealed the presence of a wide variety of contaminants. Those which can be related to mustard include 1,4-dithiane and 1,4-thioxane. Thiodiglycol was not detected. Thiodiglycol may have not been detected because of a high detection limit (50 mg/L), or perhaps because thiodiglycol, being miscible with water, has already migrated from the site. Both chemical decontamination and burning have been employed in Old O-field.

(6) Oxidation. Oxidation is the most rapid means of chemically altering mustard. The oxidation reactions and reaction products depend on both the reaction medium and the oxidant.

(a) When mustard is oxidized in an aqueous solution the initial reaction product is mustard sulfoxide, $(ClCH_2CH_2)_2SO$. Further oxidation results in the formation of mustard sulfone, $(ClCH_2CH_2)_2SO_2$. The initial oxidation reaction to form mustard sulfoxide occurs rapidly with oxidizing agents such as ozone, hydrogen peroxide, calcium hypochlorite, and other oxidizing and chlorinating agents. Both the sulfoxide and sulfone of mustard are very resistant to hydrolysis in distilled water. Both are soluble in water to the extent of slightly more than 1% at 25°C. Oxidation with chlorinating agents will also result in chlorination. Chlorination of mustard sulfoxide forms trichloro- and tetrachloro- mustard sulfoxides. The chlorination of mustard sulfoxide tends to inhibit the further oxidation of the sulfoxide to the sulfone. Mustard sulfone is not stable in alkaline solutions, but reacts to form chloroethyl vinyl sulfone and divinyl sulfone. These are also reported to react in aqueous solution, yielding thiodiglycol sulfone and thioxane sulfone. Thioxane sulfone has the chemical formula $O\underline{CH_2CH_2SO_2CH_2CH_2}$. These oxidation/chlorination reactions of mustard are described by Price and Bullitt [1943]. It is apparent that the oxidation reactions of mustard are complex and dependant on the chemistry of the solution. Some of the reaction products are also vesicant and/or otherwise toxic, but not as toxic as mustard. Mustard sulfoxide is not vesicant, but mustard sulfone is vesicant.

(b) When an excess of a strong oxidizing agent, such as chlorinated lime, is used and temperature is not controlled, the products of the reaction are though to be primarily inorganics including sulfates and chlorides [Block and Davis, 1978]. An excess of oxidizing agent is common for situations involving deliberate and thorough decontamination. The actual number of oxidation products is roughly 20 [Durst et al., 1988].

(c) The polysulfides of mustard which are present in undistilled Levinstein mustard are readily oxidized in aqueous solution. The oxidation reactions involve cleavage of sulfur-sulfur bonds [Price and Bullitt, 1943].

(d) Chlorination of mustard in a nonaqueous solution will result in the formation of different reaction products. For example, during manufacturing there was some over-chlorination of mustard to produce higher chlorinated compounds similar to mustard. This situation was most significant during wild runs. If the chlorination was extensive enough, chlorinated methanes, ethanes and ethylenes would also have been formed [Jarman and Faber, 1940].

(e) Oxidation of mustard with concentrated nitric acid produces mustard sulfoxide [Durst et al., 1988].

(7) Toxicity. Mustard is a very dangerous vesicant. Exposure of eyes to vapor causes conjunctivitis and may cause blindness. Exposure may also cause edema, ulceration, and necrosis of the respiratory tract and exposed skin. The mortality rate from exposure is low, but permanent eye damage and severe respiratory impairment may result. The intravenous LD_{50} in rats and mice has been measured at 3.3 and 8.6 mg/kg, respectively [Windholz et al., 1983], and in rabbits at 1.1 mg/kg [Sax, 1984]. The median lethal vapor concentration is 0.209 mg/L for a 10-minute exposure to mice, and 0.05 mg/L for a 30-minute exposure to dogs [Kibler, 1942]. Sax [1984] reports lowest published lethal concentrations for humans as 23 ppm for 10 minutes with inhalation, and as 64 mg/kg for dermal exposure. The effects of exposure to mustard are delayed, with symptoms appearing from 1 to more than 24 hours after exposure. Mustard must be removed from the skin immediately after exposure if effects are to be minimized. The median concentration of vapor from undistilled mustard in air which is detectable by odor is 0.001 mg/L [Kibler, 1942]. Mustard is also a suspected carcinogen of the lungs and larynx [Sax, 1984]. Toxicities of hydrolysis products are rat (oral) LD_{10} of 250 mg/kg for bis-2(bis(2-hydroxyethyl)-sulfonium ethyl) sulfide dichloride, and guinea pig (oral) LD_{50} of 3960 mg/kg for thiodiglycol [National Academy of Sciences, 1953; Biochemische Zeitschrift, 1923; as cited in PMCD, 1988]. Reported toxicities of decontamination products mustard sulfoxide and mustard sulfone are rat LD_{10} of 150 mg/kg and cat/rabbit (inhalation) LD_{10} of 1430 $mg/m^3/10$ min [Ishidate et al., 1952; NDRC, 1942; as cited in PMCD, 1988].

(8) Analytical Methods. Analysis of environmental samples for trace levels of mustard can be performed using solvent extraction and gas-liquid chromatography with flame photometric or electron capture detectors. High

performance liquid chromatography can also be used. Detection limits of high ppb and low ppm levels are possible.

(9) Behavior In Surface Water. The behavior of bulk mustard in water has been described by Epstein et al. [1973]. When introduced into water, three distinct regions will generally exist. A small amount of mustard may remain on the surface as a film. The surface film will be gradually dissipated by hydrolysis and vaporization. Wave action will cause the mustard film to form droplets which sink to the bottom. The film will disappear within 1 to 2 days with some agitation. Most of the bulk mustard introduced into water will sink to the bottom where it will exist as an oily mass. The mass of mustard on the bottom will slowly go into solution where it will be hydrolyzed. The rate of solution will depend on many factors, including water current velocity over the mustard (agitation and mixing), temperature, purity of the mustard, and dissolved constituents in the water. The "rate of solution" factors along with other factors such as quantity of mustard and exposure area will determine the length of time the bottom mustard deposit will persist. Periods of at least several months are expected when larger quantities of pure mustard are involved. The third region of consideration is the water column itself. Because of the low rate of solution and relatively high rate of hydrolysis, the water will contain hydrolysis products, but very little mustard.

(10) Behavior in Soil. The persistence of mustard in soil will depend on the soil type, the amount of mustard in the soil, on the depth of the contaminated soil beneath the surface, and on the climate/weather conditions. Mustard contamination of surface soil may persist for weeks, and deeper soil may remain contaminated for years. Epstein et al. [1973] reported that mustard has been found in the soil at the O-field disposal site at APG-EA thirty years after disposal. A very important factor affecting mustard persistence in soil and marsh sediments is the composition of the waste mixture. If the mustard was introduced in a mixture with impurities, especially sulfur, the mustard could persist in the environment for decades until it is disturbed and exposed to environmental degradation processes. Wastes with high levels of sulfur and impurities would have been common for manufacturing wastes such as wild runs, ton container steamout operations, and wastes of undistilled mustard. The mustard mixture HT will also be very persistent in the environment.

(11) Behavior in Ground Water. Because of relatively rapid hydrolysis once in solution, mustard will not normally be subject to transport via the ground-water pathway. An exception is the situation in which liquid mustard is released in a karst or fractured rock environment and it enters the ground-water system as liquid or suspended droplets. For example, a mustard spill to a sinking stream could result in ground-water contamination and transport through solution channels. The mustard could travel large distances in such circumstances, but the bulk of the material would tend to sink

downward or "pool" in low areas.[43] It should also be noted that in many, but not all, instances the temperature of ground water is below the freezing point of mustard.

(12) Summary Discussion. Because of its physical and chemical properties, mustard would only rarely be a potential ground-water contaminant. It would not be a long term surface water contaminant, but could persist for hours/days/weeks in a surface water system. Persistence in sediment would be greater, and in soil it may persist for many years, especially if protected from degradation/loss processes such as hydrolysis and volatilization. Persistence will be greatly affected by the composition of the waste mixture introduced into the environment.

c. Thiodiglycol. The compound thiodiglycol is a syrupy colorless liquid with a characteristic odor [Hawley, 1981]. Thiodiglycol has the chemical formula $(HOCH_2CH_2)_2S$, a molecular weight of 122.18, and the CAS number is 111-48-8 [Windholz et al., 1983]. Other names for thiodiglycol include 2,2'-thiodiethanol, thiodiethylene glycol, bis(hydroxyethyl)sulfide, and dihydroxyethyl sulfide.

(1) Usage Information. A very small amount of thiodiglycol was produced at APG-EA during experimental production of mustard by the thiodiglycol process. The principal source of thiodiglycol at APG-EA is expected to be the hydrolysis of mustard during manufacturing and disposal operations (see paragraph addressing hydrolysis of mustard in this section of report). Commercial uses of thiodiglycol include organic synthesis, as an antioxidant, and as a solvent for dyes in textile printing [Hawley, 1981].

(2) Physical Properties. Liquid thiodiglycol has a density of 1.18 g/ml, a melting point reported as -10°C and -16°C, a boiling point of 280°C, and a viscosity of 0.652 poise at 20°C [Hawley, 1981; Windholz et al., 1983].

(3) Solubility. Thiodiglycol is miscible with water. It is also soluble in acetone, alcohol, chloroform, and slightly soluble in benzene, carbon tetrachloride and ether [Hawley, 1981].

(4) Partition Coefficients. Specific data have not been found concerning partition coefficients for thiodiglycol. Because thiodiglycol is miscible with water, it is expected that partition coefficients are very low.

(5) Hydrolysis. Thiodiglycol is itself a hydrolysis product of mustard, and will not undergo further hydrolysis.

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[43]Mustard at temperatures above its freezing point is a DNAPL. However, because of its relatively high viscosity, will not normally move through granular soils as do other DNAPL materials such as chlorinated solvents. The entry of neat liquid mustard into a fracture rock ground-water system is less likely than entry into karst solution channels, because overburden soils will not normally allow entry.

(6) Oxidation. Thiodiglycol reacts with oxidants in much the same manner as mustard. Reported oxidation products are thiodiglycol sulfoxide, $(HOCH_2CH_2)_2SO$, and thiodiglycol sulfone, $(HOCH_2CH_2)_2SO_2$. On heating the sulfone of thiodiglycol loses a molecule of water to form thioxane sulfone [Price and Bullitt, 1943]. These three oxidation products are soluble in water and are expected to have low toxicity.

(7) Reactivity and Reaction Products. Thiodiglycol will react with hydrochloric acid to produce mustard. It can react violently with strong oxidizing agents. It has been reported that thiodiglycol reacts with mustard in aqueous solution to form sulfonium salts, which undergo hydrolysis in alkaline solution to form thiodiglycol and HCl. These reactions are discussed in a previous section discussing the environmental fate of mustard.

(8) Biotransformation. Thiodiglycol is environmentally biodegradable [Reichert, 1975].

(9) Toxicity. Thiodiglycol is reported to have low toxicity [Hawley, 1981]. Reported median lethal doses reported by Sax [1984] are 3000 mg/kg intravenously to rabbits, 3960 mg/kg orally to guinea pigs, and 4000 mg/kg subcutaneously to rats. Water containing an appreciable amount is unpalatable, having a "slick" taste [Price and Bullitt, 1943].

(10) Analytical Methods. Analysis for thiodiglycol in environmental samples can be accomplished using liquid chromatography with electrochemical detection (LCEC) [Bossle et al., 1985]. Detection levels of less than 50 picograms are possible in water and aqueous extracts of soil and sediment, yielding detection limits in the part per billion or low part per million range.

(11) Behavior in Water. Because thiodiglycol is miscible in water and chemically stable, it will be mobile in surface water and ground water. Its persistence will be affected by biodegradability.

(12) Behavior is Soil. Under environmental conditions of higher precipitation where there is infiltration of water, thiodiglycol may be leached from soils and enter the ground-water system. Biodegradation rates will be highest in the soil. Persistence in the soil will depend on many factors including soil type and hydrologic conditions.

(13) Summary Discussion. Because of only low to moderate toxicity, and biodegradability, thiodiglycol would not normally be a contaminant of concern. Concentrations resulting from hydrolysis of mustard in the environment are very unlikely to be signifitcant from a toxicological standpoint.

d. Lewisite. Lewisite is the name of the vesicant chemical agent dichloro(2-chlorovinyl)arsine. Lewisite is a colorless oily liquid when pure, but production quality Lewisite normally is amber to dark brown in color.

Lewisite is reported to have a geranium-like odor, but as with mustard, the odor is primarily due to impurities. The chemical formula is $ClCHCHAsCl_2$ and the molecular weight is 207.32 [Kibler, 1942; Windholz et al., 1983]. Other chemical names for Lewisite include 2-chlorovinyldichloroarsine, beta-chlorovinyldichloroarsine and chlorovinylarsinedichloride [Hawley, 1981]. The manufactured product is not pure, but contains impurities, the most significant of which are dichlorovinylchloroarsine and arsenic trichloride.

(1) Usage Information. Lewisite was developed during WW1, but was not produced until after that war had ended. It was manufactured on a large scale during WW2, but was never actually used, and is now considered obsolete as a chemical warfare material. Lewisite is primarily a vesicant, but also acts as a lung irritant and a systemic poison. The military abbreviation for Lewisite during and prior to WW2 was "M_1" or "M-1". The designation is recent times has been "L", which was originally used by the British. The designations for production impurities in the agent, dichlorovinylchloroarsine and trichlorovinylarsine, were M-2 and M-3, respectively.

(2) Physical Properties. The density of Lewisite is 1.88 g/ml at 20°C. The melting point is approximately -18°C and the boiling point is 190°C. Lewisite has a vapor pressure of 0.39 mm Hg at 20°C, 0.087 mm Hg at 0°C, and 0.58 mm Hg at 25°C. The vapor density is 7.15 times that of air. These data are from Kibler [1942], Windholz et al. [1983], Sax [1984], and US Army Edgewood Arsenal [1974]. The volatility of Lewisite is 6500 mg/m^3 at 25°C [PMCD, 1988].

(3) Solubility. The solubility of Lewisite in water and dilute mineral acids is very low, but it is soluble in most ordinary organic solvents; including alcohols, ether, chloroform, and benzene [Kibler, 1942; Windholz et al., 1983]. Because of rapid hydrolysis, the rate of solution is of more importance that the solubility. In contact with water, liquid Lewisite forms a hard, solid surface which may be a polymer of the arsine oxide [Buswell et al., 1944]. This hard material dissolves in water only very slowly, and greatly reduces the rate of solution of liquid Lewisite. The solubility of the impurity dichlorovinylchloroarsine is less than that of Lewisite.

(4) Hydrolysis. Lewisite is hydrolyzed by water and alkalies [Buswell et al., 1944; Hawley, 1981; Windholz et al., 1983]. The hydrolysis of Lewisite in aqueous solution is immediate [Kibler, 1942; Buswell, 1944]. The hydrolysis reaction is [Buswell et al., 1944]:

$$\underset{\text{Lewisite}}{ClCHCHAsCl_2} + 2H_2O \longleftrightarrow \underset{\substack{\text{chlorovinyl-}\\\text{arsine oxide}}}{ClCHCHAsO} + 2HCl$$

This reaction is reversible in strong hydrochloric acid. The chlorovinylarsine oxide is also called chlorovinylarsenous oxide, and is commonly referred to as Lewisite oxide. Lewisite oxide is soluble in water to

the extent of 1.2%. Lewisite oxide is hydrated in water to form the dihydroxyarsine of Lewisite:

$$\underset{\text{chlorovinyl-arsine oxide}}{ClCHCHAsO} + H_2O \longleftrightarrow \underset{\text{chlorovinyl-dihydroxyarsine}}{ClCHCHAs(OH)_2}$$

Both the dihydroxyarsine and the arsine oxide of Lewisite are approximately as toxic as Lewisite itself, therefore hydrolysis of Lewisite does not result in decontamination. Lewisite oxide is oxidizable, and these reactions are discussed in a subsequent paragraph.

(a) Arsenic trichloride is hydrolyzed instantly to form hydrochloric and arsenious acids. Dichlorovinylchloroarsine is hydrolyzed in water, but the rate has not been determined and is expected to be lower that for Lewisite [Epstein et al., 1973].

(b) Neat Lewisite in water reacts rapidly to form hard lumps that are soluble only slowly and are apparently polymeric modifications of Lewisite oxide [Valis and Kolakowski, 1981].

(5) Oxidation. Both Lewisite and Lewisite oxide may be oxidized. The oxidation products, in which arsenic is in the pentavalent state, are far less toxic than Lewisite or Lewisite oxide, in which arsenic is in the trivalent state. Lewisite oxide in solution is oxidized to form beta-chlorovinylarsonic acid, $ClCHCHAsO(OH)_2$. Buswell et al. [1944] determined that Lewisite oxide in water is oxidized by dissolved oxygen, with approximately 25% being oxidized within several days. Epstein et al. [1973] reported that Lewisite oxide stored in seawater for ten weeks was still a strong vesicant, and that solutions of Lewisite oxide in seawater aerated for 20 hours did not loose vesicant effectiveness. The dissociation constants for the arsonic acid have been determined to be 6 to 8 x 10^{-4} and 1 to 2 x 10^{-8}. The acid is resistant to further oxidation, but continued exposure to a very strong oxidizing environment (as with some forms of decontamination) will result in degradation to arsenic acid or arsenate salts [Buswell et al., 1944][44]. These arsenates are toxic, but not nearly as toxic or hazardous as Lewisite. Some arsenates, such as sodium arsenate, are soluble in water.

(6) Reactivity and Reaction Products. Both chlorinating agents and caustic decontaminate Lewisite [Windholz et al., 1983; Hawley, 1981]. Alcoholic sodium hydroxide has been listed as a decontaminant, with the alcohol serving to increase solubility and speed decontamination [Kibler, 1942]. Lewisite and Lewisite oxide react with sodium hydroxide. The reaction with Lewisite is:

$$\underset{\text{L-1}}{ClCHCHAsCl_2} + \underset{\substack{\text{sodium}\\\text{hydroxide}}}{6NaOH} \longrightarrow \underset{\text{acetylene}}{HCCH} + \underset{\substack{\text{sodium}\\\text{arsenate}}}{Na_3AsO_3} + 3NaCl + 3H_2O$$

[44]Such a strong oxidizing situation would not occur in the natural environment, but could be encountered during decontamination.

The reaction of M-1 Lewisite with sodium hydroxide in aqueous solution is rapid, even at cold temperatures.[45] M-2 Lewisite will also react with sodium hydroxide, but only at temperatures above 37°C. M-3 Lewisite does not react with sodium hydroxide. The reactions of Lewisite and Lewisite oxide with sodium hydroxide are discussed in greater detail by Valis and Kolakowski [1981].

(7) Toxicity. Lewisite is a powerful vesicant, lung irritant, and systemic poison. As little as 0.5 mL on the skin may result in sufficient absorption to cause severe systemic effects, and 2 mL may cause death [Windholz et al., 1983]. The median concentration is air which is detectable by humans is 0.011 mg/L, which causes faint irritation [Kibler, 1942]. Median lethal concentration in air determined to be 0.045 mg/L with a 10-minute exposure for mice or with a 30-minute exposure for dogs [Kibler, 1942]. Lewisite is a recognized carcinogen [Sax, 1984].

(a) Lewisite oxide in water is very toxic to aquatic life. A study by Buswell et al. [1944b] indicated that Lewisite oxide was lethal to fish at concentrations as low as 0.2 mg/L.

(8) Analytical Methods. The reaction of Lewisite and Lewisite oxide with sodium hydroxide to form acetylene is the basis of current analytical methodology for detection of these compounds. Analysis of Lewisite samples by acetylene generation from reaction with sodium hydroxide was performed during WWI. The analytical approach was first applied to trace level analysis of Lewisite and Lewisite oxide in environmental samples by Valis and Kolakowski [1981]. During recent years, high performance liquid chromatography (HPLC) methods have also been used to analyze environmental sample extracts for Lewisite; chlorovinylarsenous oxide, chlorovinyldihydroxyarsine, and chlorovinylarsonic acid, with detection limits in the part per billion and low part per million range.

(9) Behavior in Water. Because of chemical and physical properties, Lewisite and Lewisite oxide will not be persistent contaminants in surface water or ground-water systems. If neat Lewisite is introduced into a surface water body, Lewisite and its oxide may persist in the sediment for longer periods of time. A rapidly flowing surface water stream could also transport small lumps of Lewisite and Lewisite oxide for long distances. The actual time of persistence in sediment would depend on many factors including rate and quantity of water movement, quantity of agent released, temperature, pH, and sediment type. It is expected that Lewisite oxide would be more persistent than Lewisite. Lewisite and Lewisite oxide would not normally be an important consideration when considering ground-water contamination, except

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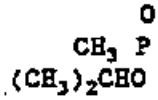
[45]The cis and trans isomers of Lewisite have different reaction rates. One undergoes nearly complete reaction in 16% aqueous NaOH in 2 minutes, while the other requires about 1 hour [Durst et al., 1988; Bartlett, 1942].

possibly in situations involving karst and/or fractured rock.[46] Potential ground water contaminants would more likely be soluble inorganic arsenic.

(10) Behavior is Soil. As in water, the persistence of Lewisite in soil will depend on many factors, and Lewisite oxide will be more persistent than Lewisite. When neat Lewisite is introduced to soil (or water), the hydrolysis/oxidation/polymerization products will tend to increase the persistence of the remaining Lewisite. An additional factor affecting persistence of Lewisite spilled or otherwise released to soil is volatility. Residual Lewisite and Lewisite oxide in the soil will be subject to further degradation by oxidation. Under certain conditions where protected from environmental degradation processes, Lewisite and/or Lewisite oxide could persist for decades in the soil.[47]

(11) Summary Discussion. Release of Lewisite to surface water could be a significant short term environmental problem. Ground water will not normally be a movement pathway of concern, except for certain more soluble inorganic arsenic degradation products. The long term environmental impact in most situations will be primarily related to the inorganic arsenic degradation products. Lewisite and similar organic arsenicals formed by hydrolysis and oxidation will normally be a significant long term consideration only near the point of release.

e. Isopropylmethylphosphonofluoridate. The compound isopropylmethylphosphonofluoridate is a chemical which inhibits the action of the enzyme cholinesterase. The military code for this compound is "GB". GB is a liquid which has no odor when pure. The structural formula for GB is:



The molecular weight is 140.09 and the CAS registry number is 107-44-8 [Windholz et al., 1983]. Other chemical names for GB include methylisopropoxyfluorophosphine oxide; methylphosphonofluoride acid, isopropyl ester; methylphosphonofluoridic acid, 1-methylethyl ester; and isopropoxymethylphosphoryl fluoride. A common name for GB is sarin.

(1) Usage Information. The compound GB is a military chemical agent. There are no known industrial or civilian uses of the material. The composition of GB used in chemical agent munitions is roughly GB, 93%; N,N'-diisopropylcarbodiimide (DICDI), 4%; tributylamine (TBA), 1.95%; methyl

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[46]See discussion for mustard.

[47]Some soil samples at another US Army military installation where Lewisite was manufactured during WWII have been found to contain Lewisite and/or Lewisite oxide 40 years after release to the environment.

g. Chloropicrin. The compound chloropicrin is a colorless, slightly oily liquid with a strong sweet odor. Chloropicrin has the chemical formula CCl_3NO_2, a molecular weight of 164.39, and the CAS number is 76-06-2. Other chemical names for chloropicrin are trichloronitromethane, nitrotrichloromethane, nitrochloroform, and acquinite [Hawley, 1981; Windholz et al., 1983]. An obsolete name for chloropicrin is chlorpicrin. The military abbreviation for chloropicrin was PS.

(1) Usage Information. Chloropicrin was produced and used as a chemical agent during WWI. It was stockpiled at APG-EA into the post-WWII period, but was not considered to be a principal military chemical agent after the 1920s. Chloropicrin has been used by industry in organic synthesis, and has been produced for use in fumigants, fungicides, insecticides, and rodenticides [Hawley, 1981].

(2) Physical Properties. Chloropicrin has a specific gravity of 1.692 at 0°C, a boiling point of 112°C, and a freezing point of -69.2°C [Kibler, 1942; Hawley, 1981]. It is a refractive liquid with an index of refraction of 1.4611 at 20°C [Windholz et al., 1983]. The vapor density compared to air is 5.6 and the vapor pressure is 18.28 mm Hg at 20°C and 5.91 mm Hg at 0°C [Kibler, 1942; Franke, 1967]. Chloropicrin decomposes at temperatures above 150°C.

(3) Solubility. Chloropicrin is slightly soluble in water; at 25°C the solubility is 1.621 g/L [Windholz et al., 1983]. It is soluble in alcohol, benzene, chloroform, and carbon disulfide [Kibler, 1942; Hawley, 1981].

(4) Hydrolysis. Chloropicrin is relatively stable in water. Kibler [1942] reported that a 0.003 molar solution hydrolyzed 0.03% in 60 minutes at 37°C. Hydrolysis rates are increased with elevated temperatures. Hydrolysis is also more rapid in caustic and alcoholic caustic solutions.

(5) Reactivity and Reaction Products. Chloropicrin reacts with, and is decontaminated by, aqueous ammonium sulfide, sodium sulfide, or an alcoholic solution of sodium sulfite [Kibler, 1942; Franke, 1967]. The reaction can be violent, and produces nitrogen oxide, carbon monoxide, carbon dioxide, nitrogen, carbon disulfide, sulfur, and sodium chloride. When exposed to light, it takes on a greenish yellow color, due to decomposition into chlorine and oxides of nitrogen.

(6) Oxidation/Reduction. The nitro group can be reduced by strong reducing agents, the chlorine atoms being simultaneously split off [Franke, 1967]. Methyl amine is a product of reduction.

(7) Toxicity. The oral LD_{50} (rat) of chloropicrin is 250 mg/kg. Chloropicrin causes lachrymation, vomiting, bronchitis, and pulmonary edema. It also causes irritation to the skin. An additional toxic effect is it's reaction with SH-groups in hemoglobin, interfering with oxygen transport. In most persons, 2 mg/m^3 causes closing of the eye lids and tearing in 3 to 30

seconds. Higher concentrations lead to stomach distress, vomiting, and stupor. Damage to the respiratory organs occurs at concentrations above 100 mg/m^3, and a concentration of 2000 mg/m^3 is lethal within a few minutes.

(8) Summary Discussion. Chloropicrin is relatively persistent as a chemical warfare agent, and will persist in soil and water for moderate periods of time. Because of moderate persistency and high toxicity, a spill of chloropicrin in the environment could have significant impact. However, because of volatility and slow hydrolysis, chloropicrin will not persist for many years or decades under normal circumstances. Persistence would be greatly increased if it was mixed with a more persistent organic compound.

h. Adamsite. The compound Adamsite is a light yellow to dark yellow-green crystalline solid. The chemical formula for Adamsite is $NH(C_6H_4)_2AsCl$. The molecular weight is 277.57 and the CAS number is 578-94-9 [Windholz et al., 1983]. Chemical names for Adamsite include diphenylamine chloroarsine, phenarsazine chloride, and 10-chloro-5,10-dihydrophenarsazine. The US military abbreviation for Adamsite is DM.

(1) Usage Information. DM was produced and stockpiled by the US military as an chemical agent. It has been classified as a vomiting agent, an incapacitant, and as an irritant. It has been used commercially in wood treating solutions to protect against marine borers.

(2) Physical Properties. DM has a density of 1.65 g/cm^3, a melting point of 195°C, a calculated boiling point[32] of 410°C, and sublimes readily [Hawley, 1981]. The vapor pressure is 2×10^{-13} mm Hg at 20°C and 4.5 x 10-11 mm Hg at 25°C [Windholz et al., 1983; US Army Edgewood Arsenal, 1974]. The bulk density of the ground solid is less than 1 g/cm^3.

(3) Solubility. DM is nearly insoluble in water; 64 mg/L at room temperature [US Army Edgewood Arsenal, 1974]. It is slightly soluble in benzene (2.3 g/100g at 15°C), xylene, carbon tetrachloride, chlorobenzene (1.06 g/100g at 16°C), acetone (13.03 g/100g at 15°C), furfural, chloroacetone, tetrachloroethane (1.16 g/100g at 17°C), and dichloroethylene [Hawley, 1981; Kibler, 1942; US Army Edgewood Arsenal, 1974].

(4) Hydrolysis. DM is hydrolyzed by water to form DM oxide and hydrochloric acid [Kibler, 1942]. The hydrolysis rate is rapid for DM in solution, but because the solubility and rate of solution is slow, solid DM may persist in the environment for long periods of time. Hydrolysis of solid DM is further slowed by the formation of a nearly insoluble film of DM oxide on the surface of the solid DM. Hydrolysis is most rapid for small particles. Because of it's very low volatility, it's use as an agent is by dispersing small solid particles (commonly aerosol size). DM released to the environment

[32]DM decomposes at temperatures above the melting point. At 250°C the thermal decomposition rate is 0.15% per minute [US Army Edgewood Arsenal, 1974].

during testing or training activities from candles or other types of munitions would rapidly hydrolyze. The hydrolysis rate of DM is also dependant on pH, with acidic conditions greatly slowing the rate. The hydrolysis product DM oxide has the chemical formula $[NH(C_6H_4)_2As]_2O$.

(5) Toxicity. The median lethal inhalation dosage of DM for man is 11000 mg min/m^3 in pure form; as dust, in solvent spray, or by volatilization-condensation [US Army Edgewood Arsenal, 1974]. The minimum detectable concentration is 0.22 mg/m^3, which causes irritation of the throat [Kibler, 1942]. "DM produces a feeling of pain and a sense of fullness in the nose and sinuses, accompanied by a severe headache, intense burning in the throat, and tightness and pain in the chest. Irritation of the eyes and lacrimation are produced. Coughing is uncontrollable, sneezing violent and persistent. Nasal secretion is greatly increased, and quantities of saliva flow from the mouth. Nausea and vomiting are prominent. Mild symptoms, caused by exposure to very low concentrations, resemble those of a severe cold. The onset of symptoms may be delayed for several minutes after initial exposure, and effective exposure may, therefore, occur before the presence of the smoke is suspected. Symptoms of exposure to field concentrations usually disappear in 20 minutes to 2 hours, leaving :no residual injury" [US Army Edgewood Arsenal, 1974]. Tolerance to the eye and nose irritation effects of DM will develop with chronic very low exposures. However, serious chronic effects develop, including dermatitis and lung changes.

(6) Behavior in Surface Water. The persistence of solid DM in water will depend greatly on it's particle size, with very small particles hydrolyzing rapidly. DM of larger particle size will persist for long periods of time due to the forming of a protective film of DM oxide on the surface of the solid DM.

(7) Behavior is Soil. DM dispersed as aerosol particles in testing and training operations will be hydrolyzed relatively quickly, forming DM oxide and hydrochloric acid. Solid DM introduced into the soil by disposal or handling operations will persist for long periods of time because it's low solubility and the forming of a protective DM oxide film.

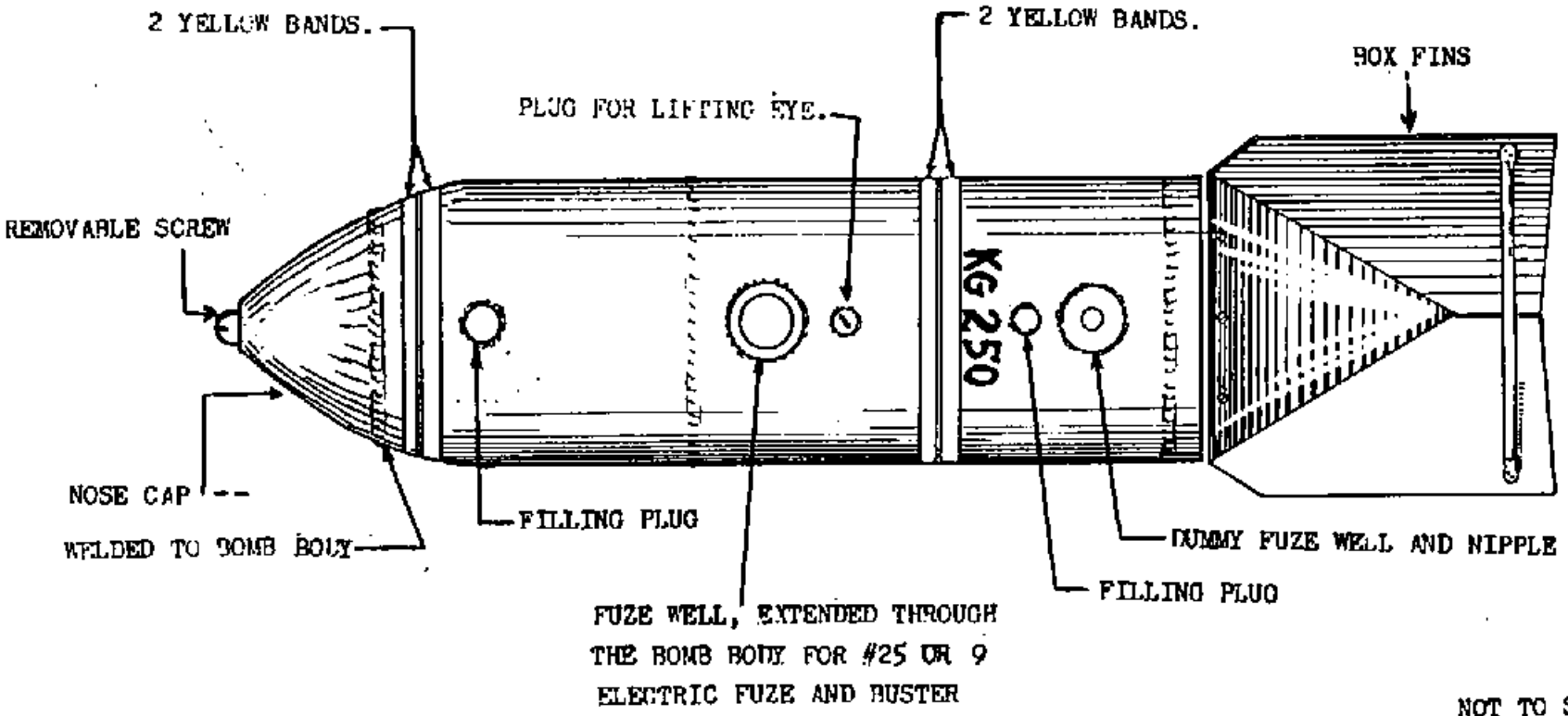
(8) Behavior in Ground Water. DM is not expected to be mobile in water in either the saturated or unsaturated zones. It's mobility is low due to low solubility and rate of solution, rapid hydrolysis of the DM in solution to DM oxide, and the very low solubility of DM oxide.

(9) Summary Discussion. Because of its low mobility, high persistence in soil, and very low volatility, exposure to DM would most likely occur if contaminated soil or structures were disturbed and particulate introduced into the air. Because DM is an arsenical, toxic contamination will remain in soil even when degradation to lesser toxic compounds does occur.

i. Chloroacetophenone. This compound is a white to yellow crystalline solid with a sweet floral odor. The compound discussed in this section is the alpha isomer, as distinguished from the para isomer. The chemical formula for

GERMAN GENERAL PURPOSE HE BOMB ADAPTED TO FILLING OF BLISTER GAS

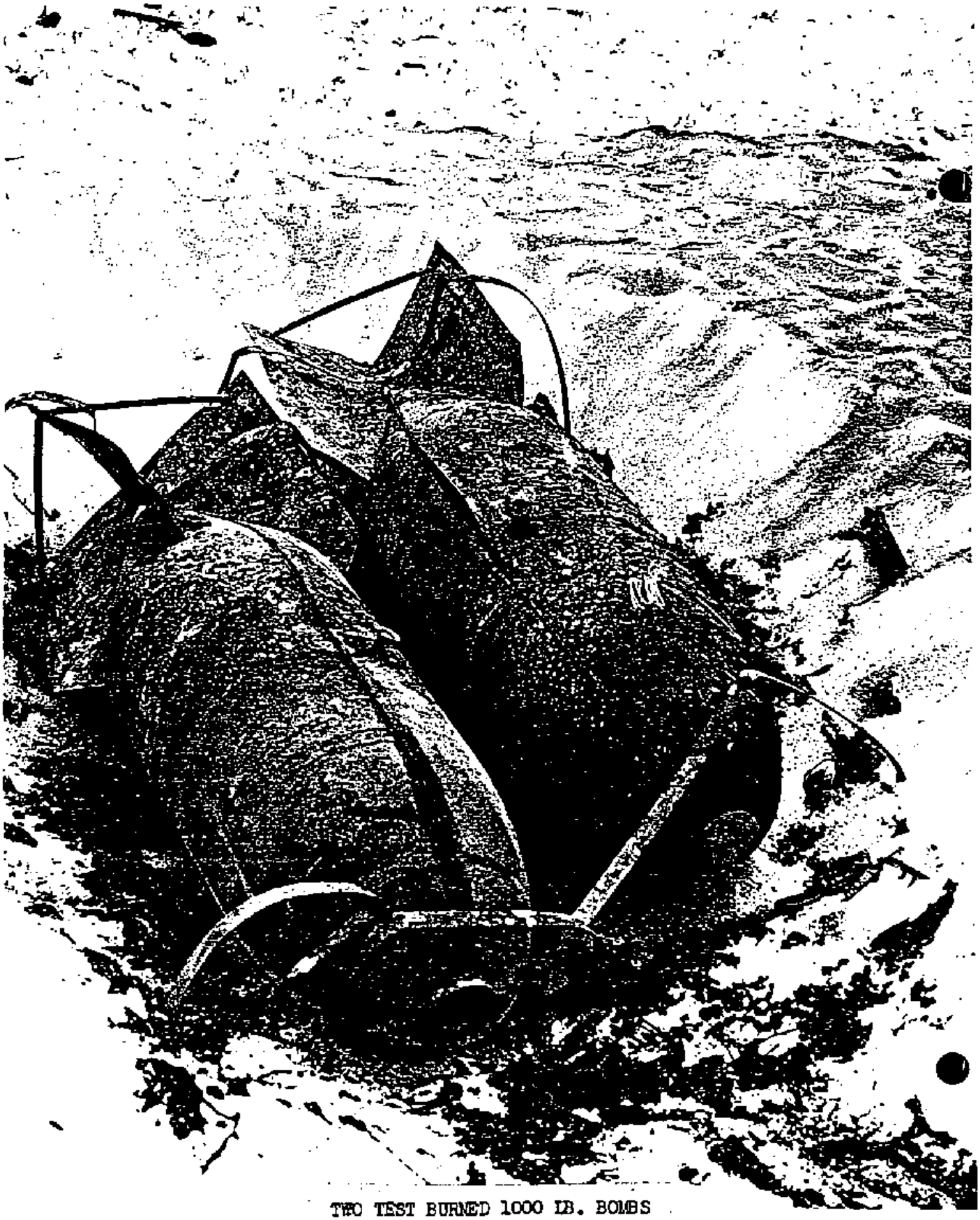
2 YELLOW RINGS FILLING



NOT TO SCALE

NOTE 1. Label in shipping box is marked K.G. 250 W, but no W appears after K.G. 250 on the bomb itself.

NOTE 2. The filling of this bomb is reported to be Mustard Gas, a thickener and other material.



TWO TEST BURNED 1000 LB. BOMBS

MIL-I-285B
4 AUGUST 1960
SUPERSEDING
MIL-I-285A
7 MARCH 1958
MIL-I-285
6 OCTOBER 1954

MILITARY SPECIFICATION

IMPREGNITE, UNSTABILIZED (CC2) AND STABILIZED (XXCC3)

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 Scope. This specification covers two compositions of impregnite for impregnating clothing used to protect personnel against the action of vesicant-type chemical agents.

1.2 Classification. Impregnite shall be of the following compositions, as specified (see 6.1):

Type I — Unstabilized impregnite (CC2).

Type II — Stabilized impregnite (XXCC3).

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

RR-S-366 — Sieves, Standard for Testing Purposes.

MILITARY

MIL-Z-291 — Zinc Oxide for Chemical Warfare Use (Pyrotechnics or Stabilizer).

MIL-D-14258 — Drum, Fiber, 20-Gallon Capacity, for Chemicals.

STANDARDS

MILITARY

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 — Marking for Shipment and Storage.

DRAWINGS

CHEMICAL CORPS

D5-67-30 — Drum, Fiber — Assembly, Detail and Bill of Material.

C6-16-1 — Drum, Fiber, 20-Gallon — Assembly, Detail and Bill of Material.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with

FSC 6850

specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

INTERSTATE COMMERCE COMMISSION

49 CFR 71–90 — Interstate Commerce Commission Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(The Interstate Commerce Commission regulations are now a part of the Code of Federal Regulations (Rev. 1956) available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Orders for the above publication should cite "49 CFR 71–90 (Rev. 1956).")

3. REQUIREMENTS

3.1 Materials. All materials shall conform to specifications and drawings forming a part of this specification.

3.2 Particle size.

3.2.1 *Type I impregnite.* No type I impregnite shall be retained on a 2,000 (U. S. Std. No. 10) micron sieve when tested as specified in 4.5.1.1.

3.2.2 *Type II impregnite.* The type II impregnite shall conform to the particle size requirements of table I when tested as specified in 4.5.1.2.

TABLE I. *Particle size*

Particle size	Percent minimum (min)	Test method
Less than 44 microns (U.S. Std. No. 325).	99	4.5.1.1
Less than 8 microns	86	4.5.1.2
Less than 6 microns	65	4.5.1.2
Less than 4 microns	45	4.5.1.2

3.3 Chemical requirements.

3.3.1 *Type I impregnite.* The type I impregnite shall comply with the chemical requirements in table II.

TABLE II. *Chemical requirements*

Material	Percent by weight		Test method
	Minimum	Maximum	
Volatile matter		0.20	4.5.2
Chloroform insoluble (dry basis).		4.25	4.5.3
Chlorides, as NaCl (dry basis).		0.50	4.5.4
Active chlorine (on the dry, chloroform-soluble basis).	14.2	14.8	4.5.5

3.3.2 *Type II impregnite.* The type II impregnite shall be a mixture of type I impregnite and zinc oxide and shall comply with the requirements specified in table III (see 6.3).

TABLE III. *Chemical requirements*

Material	Percent by weight		Test method
	Minimum	Maximum	
Volatile matter		0.18	4.5.2
Type I impregnite	89.9	91.8	[2]
Chloroform insoluble (dry basis).		3.9	4.5.3
Chlorides, as NaCl (dry basis).		0.46	4.5.4
Active chlorine (on the dry, chloroform-soluble basis).	12.8	13.4	4.5.5
Zinc oxide[1]	8.1	10.1	4.5.6

[1] Zinc oxide shall conform to grade III of Specification MIL-Z-291.

[2] % Type I impregnite = 100 — (% zinc oxide + % volatile matter).

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services ac-

ceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Objective evidence. The supplier shall present objective evidence as required by the Government representative that all requirements of section 3 and section 5 have been met (see 6.6).

4.3 Alternative inspection (including testing) procedures. The supplier may utilize any alternative inspection procedure which will assure equal or better quality by submitting a written proposal with justification and obtaining written approval from the Government prior to its institution. In case of dispute, the procedures of this specification will govern.

4.4 Inspection provisions.

4.4.1 *Lotting.* A lot of type I impregnite shall consist of that material produced by one manufacturer, under essentially the same conditions, in not more than 24 consecutive hours. A lot of type II impregnite shall consist of that material produced by one manufacturer, under essentially the same conditions, in one work shift. In the event of a batch operation, each batch shall constitute a sublot (see 6.2).

4.4.2 *Sampling.* A representative one pound sample shall be taken from each sublot of type I and type II impregnites. Equal portions of each of the sublot samples shall be thoroughly mixed to form a composite sample. The tests specified in 4.5 shall be conducted on the composite sample.

4.4.3 *Examination.* Level A preparation for delivery requirements shall be examined in accordance with the classification of defects and with Standard MIL-STD-105.

4.4.4 *Classification of defects.*

4.4.4.1 *Drum, fiber, type I and type II impregnite packing* (Dwgs. D5-57-80, C6-16-1 and sec. 5).

Category	Defects
Critical:	None defined
Major—AQL 0.6 percent defective	
101.	Container incorrect.
102.	Container damaged or leaking.
103.	Container closure incorrect.
[1]104.	Quantity per container incorrect.
105.	Marking incorrect, missing or illegible.

[1] Check prior to closing.

4.5 Tests. Distilled water and analytical reagent grade chemicals shall be used. Where applicable, blank determinations shall be run and corrections applied when significant.

4.5.1 *Particle size.*

4.5.1.1 *Type I impregnite.* Nest a sieve as indicated in 3.2.1, complying with Specification RR-S-366, with a receiving pan. Place 100.0 ± 0.5 gram (g) of the sample on the sieve and cover. Place the sieve in a single-eccentric type mechanical shaker which imparts a rotary motion and tapping action at a uniform speed of 300 ± 15 gyrations and 150 ± 10 taps of the striker per minute. Shake for 3 minutes and weigh the material retained on the receiving pan and calculate the percentage retained on the sieve.

4.5.1.2 *Type II impregnite.* Determine the particle size of the impregnite in accordance with the short method of appendix I.

4.5.2 *Volatile matter.*

4.5.2.1 *Type I impregnite.* Break up all lumps due to caking in the container, pass the entire sample through a 590 micron (No. 30) sieve conforming to Specification RR-S-366 to assure uniformity and return

to the bottle. Weigh to the nearest milligram (mg) approximately 5 g of the sample in a tared glass-stoppered weighing bottle approximately 50-millimeters (mm) high. Remove the stopper and dry for 4 hours in an oven maintained at a temperature of 50° to 55° C. and under a partial vacuum corresponding to pressure of not more than 80-mm of mercury. Cool in a desiccator and weigh. Calculate the percent volatile matter as follows:

$$\text{Percent volatile matter} = \frac{100\ (A-B)}{A}$$

Where:
A = weight of sample before heating.
B = weight of sample after heating.

4.5.2.2 *Type II impregnite.* The procedure for the determination of the volatile matter in type II impregnite shall follow that described in 4.5.2.1.

4.5.3 *Chloroform insoluble.*

4.5.3.1 *Solvent.* Use U.S.P. or reagent grade chloroform and purify it on the same day it is to be used as follows: Place 1 liter of the chloroform in a 2 liter separatory funnel and shake with four changes of distilled water, 500 milliliters (ml) each. Filter the washed chloroform through two thicknesses of dry filter paper. Do not use chloroform which does not give a slight blank when 50 ml are tested as described in 4.5.5, as it contains a reducing agent. If a blank greater than 0.20 ml of 0.1N sodium thiosulfate is obtained, repurify the chloroform as above, adding 10 (g) grams of potassium iodide in the first wash water. In case of dispute, retest using reagent-grade chloroform purified on the same day it is used as follows: Place 1 liter of the chloroform in a 2 liter separatory funnel and shake with three changes of distilled water, 500 ml each. Filter the washed chloroform through dry filter paper and dry for 1 hour over calcium chloride with occasional shaking. Remove the chloroform from the calcium chloride and distill, discarding the first 100 ml of distillate.

4.5.3.2 *Procedure.* Weigh to the nearest mg approximately 2 g of the sample and transfer to a 250 ml beaker, add 100 ml of the purified chloroform (see 4.5.3.1), and stir thoroughly. Filter through a dry, carefully weighed Gooch crucible, using suction, and wash the beaker and residue with an additional 100 ml of the purified chloroform. Dry to constant weight at 105° to 150° C., cool in a desiccator and weigh. Retain the crucible and residue for the determination of chlorides (4.5.4.3). Calculate the percentage chloroform insoluble as follows:

$$\text{Percentage chloroform insoluble (dry basis)} = \frac{A(10000)}{(100-B)C}$$

Where:
A = weight of insoluble matter.
B = percentage volatile matter (see 4.5.2.1).
C = weight of sample.

4.5.4 *Chlorides.*

4.5.4.1 *Potassium thiocyanate solution.* Dissolve 10 g of potassium thiocyanate in distilled water and dilute to 1 liter. The solution is adjusted by titration against 0.1N silver solution. It is advisable to have 1 ml of the thiocyanate equivalent to 1 ml of the silver nitrate solution. Owing to the deliquescence of the thiocyanates the exact amount for a 0.1N solution cannot be weighed.

4.5.4.2 *Ferric ammonium sulfate indicator.* Dissolve 80 g of clear crystals of ferric ammonium sulfate, $(FeNH_4(SO_4)_2 \cdot H_2O)$ in water and make up to 1 liter. A few drops of sulphuric acid may be added if necessary to clear up the solution.

4.5.4.3 *Procedure.* Wash the residue obtained in the determination of chloroform insoluble (see 4.5.3.2), together with the asbestos mat from the crucible, into a 300-ml flask with 100-ml of distilled water. Shake the flask vigorously for 3 to 5 minutes to break up the mat and dissolve the chlorides. Add 2 to 3 ml of concentrated nitric acid,

mix and determine the chloride by the Volhard method.

$$\text{Percent chlorides, as sodium chloride (NaCl) (dry basis)} = \frac{5.84\ (VN - V_1 N_1)\ 100}{(100 - A)\ B}$$

Where:

V = ml of silver nitrate solution used in titration of sample.
N = normality of silver nitrate solution.
V_1 = ml of potassium thiocyanate.
N_1 = normality of potassium thiocyanate.
A = percentage of volatile matter (see 4.2).
B = weight of sample.

4.5.5 *Active chlorine.* Weigh from 0.550 to 0.600 g of the sample and wash through a funnel into a 300-ml glass-stoppered Erlenmeyer flask with 50 ml of the purified chloroform (see 4.5.3.1). Stopper the flask and agitate gently to dissolve the sample. As soon as the sample has dissolved, add a freshly prepared potassium iodide solution consisting of 4 ml of distilled water, 2 g of potassium iodide, and 5 ml of 1 to 1 hydrochloric acid (dissolve the potassium iodide in the water, then add the hydrochloric acid). Stopper the flask and shake vigorously for 5 minutes. Cool the flask in cold water, open and wash the stopper and walls of the flask with distilled water. Titrate the liberated iodine with 0.1N sodium thiosulfate solution. During the titration, swirl the contents of the flask continuously and vigorously so there will always be an excess of iodine in the acid-aqueous layer until the final end point is reached. Near the end point, stopper and shake the flask vigorously after each addition of thiosulfate. When the iodine color has almost disappeared, add starch indicator and titrate to the disappearance of the blue color. Run a blank on 50 ml of the chloroform by the same procedure. Calculate the percentage active chlorine as follows:

$$\text{Percentage active chlorine (on dry, chloroform-solution basis)} = \frac{1.773(A - B)N(10{,}000)}{W(100 - C)\ (100 - D)}$$

Where:

A = ml of thiosulfate used in titration of sample.
B = ml of thiosulfate used in titration of blank.
N = normality of thiosulfate solution.
C = percentage volatile matter (see 4.2).
D = percentage of chloroform insoluble (see 4.5.3).
W = weight of sample.

4.5.6 *Zinc oxide content (type II impregnite).*

4.5.6.1 *Standard solution.* Dissolve 32.31 g of potassium ferrocyanide and 0.3 g of potassium ferricyanide in distilled water and make up to a volume of 1 liter. Standardize the solution by titration against a 0.3-g sample of pure metallic zinc, or equivalent quantity of pure zinc oxide, in accordance with the method specified in 4.5.6.2. Calculate the weight of zinc oxide equivalent to 1.00 ml of the solution.

4.5.6.2 *Determination.* Weigh to the nearest mg approximately 1 g of type II impregnite and transfer the sample to a 400-ml beaker. Add 15 ml of methyl alcohol, 6 ml of concentrated hydrochloric acid, and 25 ml of distilled water. Place the beaker on a steam bath and heat for 15 minutes. At the end of the 15-minute heating period, add 200 ml of hot distilled water, transfer the beaker to hot plate, and with constant stirring and 3 ml of concentrated ammonium hydroxide and 2 drops of a 0.25 percent solution of ferrous ammonium sulfate. Titrate the hot (75° to 95° C.) solution with the standard potassium ferrocyanide - potassium ferricyanide solution until the color changes from blue to greenish white. Run a blank determination and calculate percent zinc oxide as follows:

$$\text{Percent zinc oxide} = \frac{100\ (A - B)C}{W}$$

Where:

A = ml of standard solution used for sample.

B = ml of standard solution used for blank.
C = g of zinc oxide equivalent to 1 ml of standard solution.
W = weight of sample, g.

4.6 Acceptance / rejection criteria. If a sample of type I or type II impregnite fails to comply with any of the requirements and tests of this specification, the lot represented shall be rejected.

5. PREPARATION FOR DELIVERY

5.1 Packing.

5.1.1 *Level A.*

5.1.1.1 *Type I impregnite.* The material shall be packed in a fiber drum conforming to Specification MIL-D-14258. The drum shall be sealed as specified on Drawing C6-16-1.

5.1.1.2 *Type II impregnite.*

5.1.1.2.1 *For general issue.* Seventy-five pounds of the material shall be packed and sealed in fiber drums as required for unstabilized impregnite (see 5.1.1.1).

5.1.1.2.2 *For use in the M3 clothing impregnation chemical set.* Sixteen and one-half pounds, plus 0.4 pound of the material shall be packed in fiber drums as specified on Drawing D5-57-30.

5.2 Marking. Each shipping container shall be marked in accordance with Standard MIL-STD-129 and ICC Regulations. In addition, each container shall be marked in 2-inch letters with the following: "Do not store over 120°F." This marking shall be placed approximately 4 inches above the regular marking and also diametrically opposite on the other side of the drum. Each container shall also have the following precautionary markings: "Keep away from open fires and all heated surfaces; avoid inhalation of fumes." Such markings shall not interfere or obscure other markings on the shipping containers.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Type I or type II impregnite.

(c) Type of packing for type II only.

6.2 Batch. A batch is defined as that quantity of material which has been subjected to some unit chemical or physical mixing process intended to make the final product substantially uniform.

6.3 Precautions. Mixtures of finely ground impregnite and zinc oxide are flammable and all necessary precautions should be taken for protection of personnel.

6.4 Storage. Appendix II describes a method for the storing of unstabilized and stabilized impregnite. Prolonged storage without proper ventilation is conducive to spontaneous combustion of impregnite.

6.5 Stock numbers. The Federal stock numbers for these items are:

Type I Impregnite (CC2) — 6850-281-4243

Type II Impregnite (XXCC2) — 6850-281-4244

6.6 Objective evidence. Provisions for objective evidence and inspection records, and maintenance of inspection records will be specified by the procuring activity.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Commodities:
Army—Chemical Corps
Navy—Bureau of Supplies and Accounts

Preparing activity:
Army—Chemical Corps

APPENDIX I
DETERMINATION OF PARTICLE SIZE OF MICRONIZED IMPREGNITE I (PIPETTE METHOD)

10. GENERAL. The purpose of this appendix is to describe a method for the determination of particle size of micronized Impregnite I, using a sedimentation pipette.

20. PREPARATION OF SOLUTION.

20.1 Preparation of 3½-percent PVA solution. The ingredients required for the preparation of sufficient 3½-percent PVA solution for approximately 133 tests are as follows:

Water	2900 g
Emulsifying agent ("Duponol" G or equivalent)	1 g
Polyvinyl alcohol (O.W.S. Spec. No. 197-54-236)	100 g

Nine hundred grams of water is placed in a 2-liter beaker and 1 g of "Duponol" G dissolved with minimum of stirring. One hundred grams of polyvinyl alcohol is next added slowly with agitation. In order to avoid lump formation the polyvinyl alcohol should be slowly sprinkled in over a period of about 30 minutes. After 30 minutes additional stirring, the beaker and contents are placed on a steam bath where stirring is continued while heating to between 65° and 70° C. The steam is shut off and stirring continued for about an hour. The resulting solution is then diluted to 3½ percent with the remainder of the water (2,000 g), in a large stoppered bottle. After thorough initial mixing, the 3½ percent solution is allowed to stand several hours and only the relatively clear supernatant liquid used, discarding any undissolved residue at the bottom of the container.

20.2 Preparation of 1 percent dispersion of type I impregnite.

Weigh 7.50 g of dry type I powder into a 50 ml beaker.

Fill a burette with 3½-percent PVA.

Run 5.0 ml of 3½-percent PVA into the 50 ml beaker.

Stir contents with glass rod until "breaking" occurs, i.e., the mixture takes on first a dough-like and then a syrupy consistency.

Continue stirring for an *additional* 5 minutes, taking care to work in any dry material adhering to the sides of the beaker and rod without, however, exerting any appreciable grinding action.

During stirring, rotate both the beaker and rod in the hands.

Add 5.0 ml 3½-percent PVA and stir 1 minute.

Add 12.5 ml 3½-percent PVA and stir 1 minute (a total of 22.5 ml of PVA solution is used).

Rinse contents of small beaker into large 32-ounce (oz) stoppered bottle using 720 ml distilled water. Do not scrape dry material off edge of beaker.

Finally "rock the bottle" by hand for 3 minutes (the "rocking" procedure is described in 30).

30. CALIBRATION OF SEDIMENTATION BOTTLES. The sedimentation bottle, figure 1, is doubly calibrated so as to give the weight of suspension which will fill the assembled apparatus to two different heights above the pipette tip, the distance being 20.00 centimeters (cm) of 5.00 cm respectively. Two initial calibrations are made by determining the weights of water that fill the assembled bottle to the above-mentioned levels. In each case, the calibration is checked by adding to the sedimentation bottle a weight of a 1 percent suspension of type I impregnite which is 30 g greater than the initial calibration value obtained with water. Three 10 ml samples are then withdrawn by means of the pipette, using the procedure

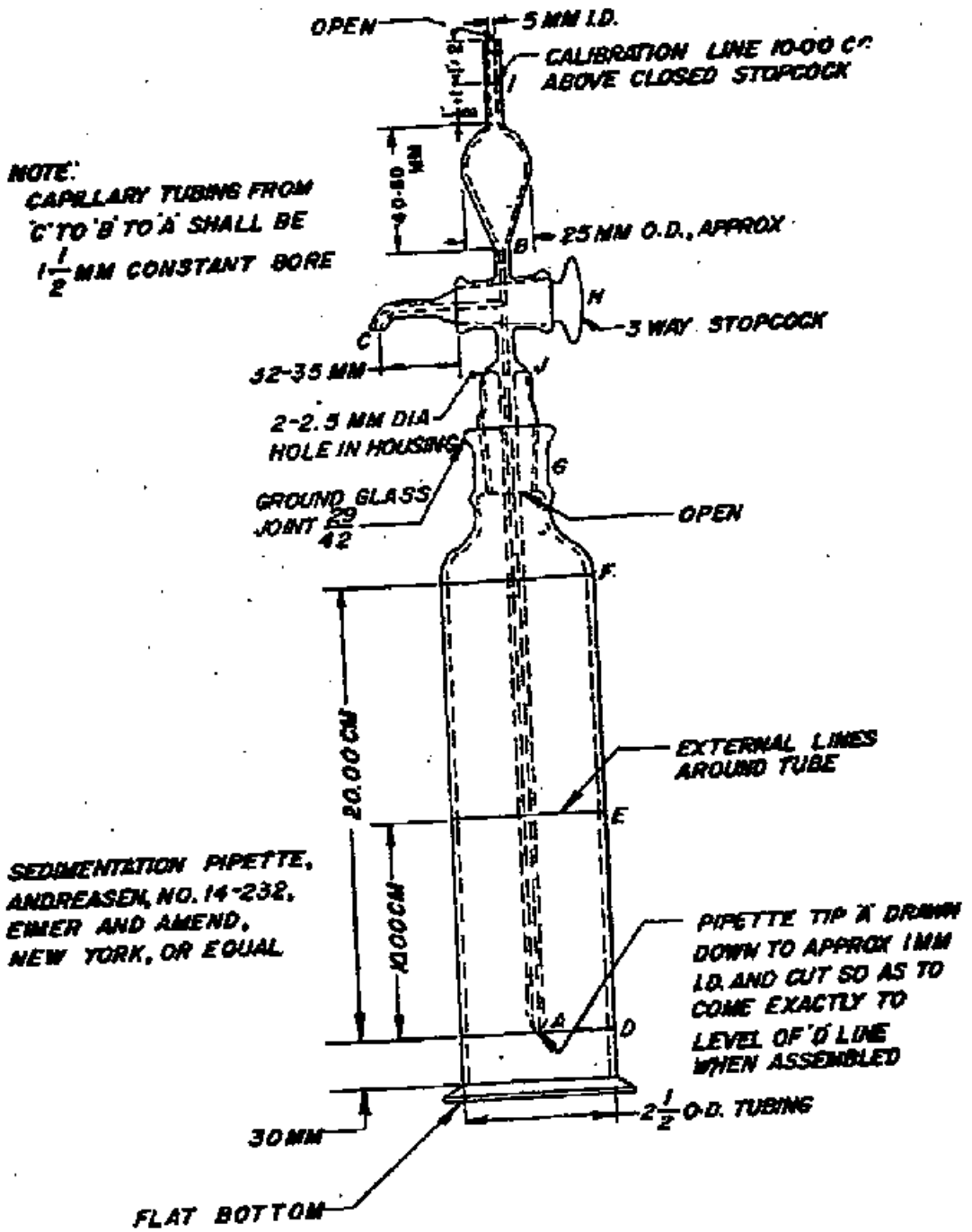


FIGURE 1.

given in 50 for withdrawal of samples by means of the aspirator. About 10 minutes later, the foam will have subsided sufficiently so that the true level of the liquid can be determined. If the resulting level is not exactly right (i.e., at 20.00 cm or 5.00 cm), the requisite weight of the 1 percent type I impregnite dispersion is corrected to make it so. If the sedimentation bottle is constructed according to the scale specified, about 250 g of 1 percent type I impregnite suspension will be required for the 5.00 cm level and about 650 g for the 20.00 cm level. The 20.00 cm level is used in the "long method" for characterization of the complete particle size distribution, whereas the 5.0 cm level is used for the "short method" for cutting at 8, 6, and 4 microns. When the sedimentation bottle is once correctly calibrated for 1 percent type I impregnite slurry, subsequent filling operations are simplified.

40. **FILLING SEDIMENTATION BOTTLE WITH 1 PERCENT SUSPENSION.** The 1 percent suspension of type I impregnite contained in the 32 oz stoppered bottle is always again homogenized just prior to filling the sedimentation container by "rocking the bottle" as follows: invert the bottle about 135° from its normal vertical position and shake until all sediment on the bottom end disappears. With the bottle held in a horizontal position, continue the mixing by "rocking" (i.e., slowly lifting alternate ends of the bottle about 45° from the horizontal every 2 seconds) about a dozen times. A quantity of the homogenized slurry as determined by the above-described calibration is weighed into a tared beaker from whence it is immediately poured into the sedimentation bottle upon which the pipette is assembled, the bottle then being clamped in a vertical position.

50. **DETAILED PROCEDURE FOR WITHDRAWING A SAMPLE.** The detailed order of procedure is as follows, the letters refarring to the parts of the pipette indicated on figure 1. Particular attention should be given to the necessity for withdrawing the samples at a uniform rate and by a constant procedure.

(a) Turn stopcock (connecting B and C) to drain pipette.

(b) See that leveling bulb of aspirator is on upper ring.

(c) Connect rubber tube of aspirator to top end of pipette.

(d) Raise leveling bulb momentarily to expel drainage through (C).

(e) Close stopcock.

(f) Lower leveling bulb to lower ring support which is clamped at a level which will require about 25 seconds for filling the pipette (see 90).

(g) Open stopcock (connecting B and A) and draw sample into pipette. As the sample level approaches the 10.00 ml calibration line (X), the stopcock is gradually turned off so that flow can be stopped exactly at the mark. (If the level is inadvertently passed, the situation can be remedied by temporarily raising the leveling bulb of the aspirator and allowing the liquid level to come back to the proper mark *slowly*.)

(h) *With the stopcock turned off*, the aspirator leveling bulb is raised to the upper ring.

(i) Place coded sample container under the outlet (C).

(j) Open stopcock (connecting B and C) and allow contents of pipette to drain into sample container.

(k) If necessary to expel the last few drops of sample, a momentary lifting of the leveling bulb above the upper support ring will accomplish the result, the inside of the sample container being touched to the outlet (C).

(l) Close the stopcock.

(m) Lower the leveling bulb to the lower ring.

(n) Place a small beaker of rinse water so that (C) is below the surface of the water.

(o) Again open the stopcock (connecting B and C).

(p) Allow the rinse water to be sucked into the pipette bulb until the latter is about ⅔ filled.

(q) Remove the beaker at this point and allow air to bubble through the pipette for a few seconds (being careful that liquid is not sucked into the aspirator rubber tube).

(r) Close stopcock.

(s) Place aspirator leveling bulb on the upper ring support.

(t) Replace sample container under (C).

(u) Open stopcock (connecting B and C).

(v) Allow rinse water to drain into sample bottle, raising leveling bulb momentarily if necessary.

(w) Close stopcock.

(x) Remove sample container for analysis of active chlorine content.

60. PROCEDURE FOR WITHDRAWING THE THREE CONTROL SAMPLES (FOR EITHER THE "LONG" OR "SHORT" METHOD). With 1 percent suspension of type I impregnite in the assembled sedimentation bottle, the following order of procedure is followed:

(a) "Rock the bottle" by holding the assembled pipette in both hands with the left hand around the large ground glass joint, thumb over the breather hold (J) and with the right hand over the bottom end of the bottle. The actual "rocking" action to be applied to the pipette bottle is the same as described above for the 32-ounce stoppered bottle.

(b) Clamp the pipette bottle in a vertical position and take the first 10.00 ml control sample after about a minute, using the pipette and aspirator as directed in 50.

(c) Code the sample container "Test Number — 1."

(d) Again "rock the bottle" and take the second control sample as before, labeling the sample container "Test Number — 2."

(e) "Rock the bottle" a third time and take the last control sample, labeling the sample container "Test Number — 3."

70. PROCEDURE FOR MAKING THE COMPLETE TEST. Having decided whether the "short method" (i.e., 3 cuts at 5.00 cm) or the "long method" (i.e., 9 cuts at 20.00 cm) is to be used, the order of procedure is as follows:

(a) Fill sedimentation bottle with homogenized slurry to calibrated level determined as explained in 60.

(b) Take three successive 10 ml control samples of homogenized slurry for analysis as explained in 60.

(c) Have sample containers coded according to the particular schedule selected (see sample data sheets that follow).

(d) Set clock at "a very local time" of 11:58.

(e) Homogenize the slurry by "rocking the bottle."

(f) Set the sedimentation bottle down at 12:00 (zero time) and clamp firmly in a vertical position in a place free from drafts, radiation, and excessive vibration.

(g) Open stopcock to let liquid seek its level in the capillary, being certain that no rinse drains into the bottle.

(h) Note temperature.

(i) Take samples at times indicated by the code on the sample containers using the same technique as that described in 60 for taking the

three control samples. Care is exercised in this case, however, that the slurry is not disturbed other than by the simple action of drawing up the 10 ml sample. Between sampling, the suspension in the capillary is *not* allowed to seek its level. The rinse water drainage should be blown out of the outlet cock before each sample is drawn up.

(j) Titrate each sample for active chlorine by the method described in 80.

(k) Taking the average of the three titers of the control samples as representing 100 percent of the type I impregnite occupying 10 ml of homogenized slurry, calculate the "percent undersize" of the subsequent sample cuts by comparing the respective titers of the samples with respect to the average of the control titers.

(l) Record the data obtained on the data sheet.

(m) If the sedimentation was not carried out at 25° C., correct the results to this temperature by increasing the apparent micron diameter to the extent of 1.3 percent for each 1° under 25° C. and by decreasing the apparent micron diameter to the extent of 1.0 percent for each degree over 25° C.

(n) The results are conveniently expressed by plotting on graph paper of the ordinary type. However, a plot on "Logarithmic Probability" paper is preferred (with "micron size" on the logarithmic scale and "percent undersize" and "percent oversize" on the "probability" scale). The resulting curve approaches a straight line and occasional errors may be more readily disclosed.

(o) The "percent undersize" material at any given particle size can be interpolated from the graph.

80. **TITRATION OF ACTIVE CHLORINE CONTENT OF SAMPLES.** Take the sample in the 300 ml Erlenmeyer flask and add 80 ml of purified chloroform and 20 ml of glacial acetic acid. Insert the stopper and agitate gently for a moment to disperse the sample. Add 45 ml of 15-percent potassium iodide solution, stopper the flask, place a little distilled water in the lip of the flask around the stopper to seal the ground joint, and shake vigorously for about 10 seconds. Place the flask in a beaker of cold water for several minutes to reduce the pressure in the flask so that the stopper will not blow out. Remove the flask from the beaker, fill the lip with distilled water, and carefully remove the stopper. Wash down the stopper and the sides of the flask with distilled water and titrate the sample with 0.1N standard sodium thiosulfate solution. Insert the stopper and shake the flask vigorously by hand at frequent intervals during the titration. When the stopper is removed after each shaking, wash it and the sides of the flask with distilled water. Do not add the thiosulfate in a quantity large enough to competely discharge the brown color of iodine from the water layer. Vigorous shaking will transfer the iodine from the water layer to the solvent layer. When the purple color is almost discharged from the solvent layer and the water layer has a slight light straw color, add 10 ml of starch solution and continue the titration until the purple color is changed to white by the addition of one drop of thiosulfate. As the endpoint is approached, shake the flask vigorously after the addition of each drop of thiosulfate. Run a blank determination on the reagents and correct the sample titer for the blank obtained.

90. **NOTE.** More complete details on the pipette method for the determination of particle size will be found in "Pipette Method for determining the Particle Size of CC2," March 10, 1943, N.D.R.C. Misc. Pub. 283.

Sample data sheet for "short method" with 5.00 cm height

Test No. X

Date started __________

Sample __________

Pipette No. __________ Normality of $Na_2S_2O_3$ __________

Weight of 1 percent slurry __________ grams Analyst __________

Apparent micron	Temp. (° C.) and	Sample code				Percent	Micron diameter corrected
		Test					
Diameter	Remarks	No.	Hours	Minutes	Time	Undersize	to 20° C.
∞		X	1 (Controls)		____	100	∞
∞		X	2 (Controls)		____	100	∞
∞		X	3 (Controls)		____	100	∞
8		X	0	23	____	____	____
6		X	0	47.5	____	____	____
4		X	1	28	____	____	____

MIL-I-2855B

Sample data sheet for "long method" with 20.00 cm height

Test No. X

Date started _____

Sample _____

Pipette No. _____ Normality of $Na_2S_2O_3$ _____

Weight of 1 percent slurry _____ grams Analyst _____

Apparent micron	Temp. (° C) and	Sample code				Percent	Micron diameter corrected
		Test					
Diameter	Remarks	No.	Hours	Minutes	Filter	Deposition	to APG
∞		Y	1		____	100	∞
∞		Y	2	Controls	____	100	∞
∞		Y	3		____	100	∞
15.0		Y	0	34	____	____	____
12.5		Y	0	48	____	____	____
10.0		Y	1	13	____	____	____
8.75		Y	1	34	____	____	____
7.50		Y	2	06	____	____	____
6.25		Y	2	57	____	____	____
5.00		Y	4	31	____	____	____
4.00		Y	6	54	____	____	____
2.16		Y	23	20	____	____	____

APPENDIX II
METHOD OF STORING TYPE II IMPREGNITE

10. OBJECT. This directive describes a method for storing type II impregnite in warehouses and depots. A special method of storing is required for type II impregnite since the thermal decomposition of this material is easily initiated and if the material is packed in thin walled containers and compactly stored in a closed room, the heat transfer from one container to the next is sufficient to propagate the decomposition, thereby causing a storage hazard.

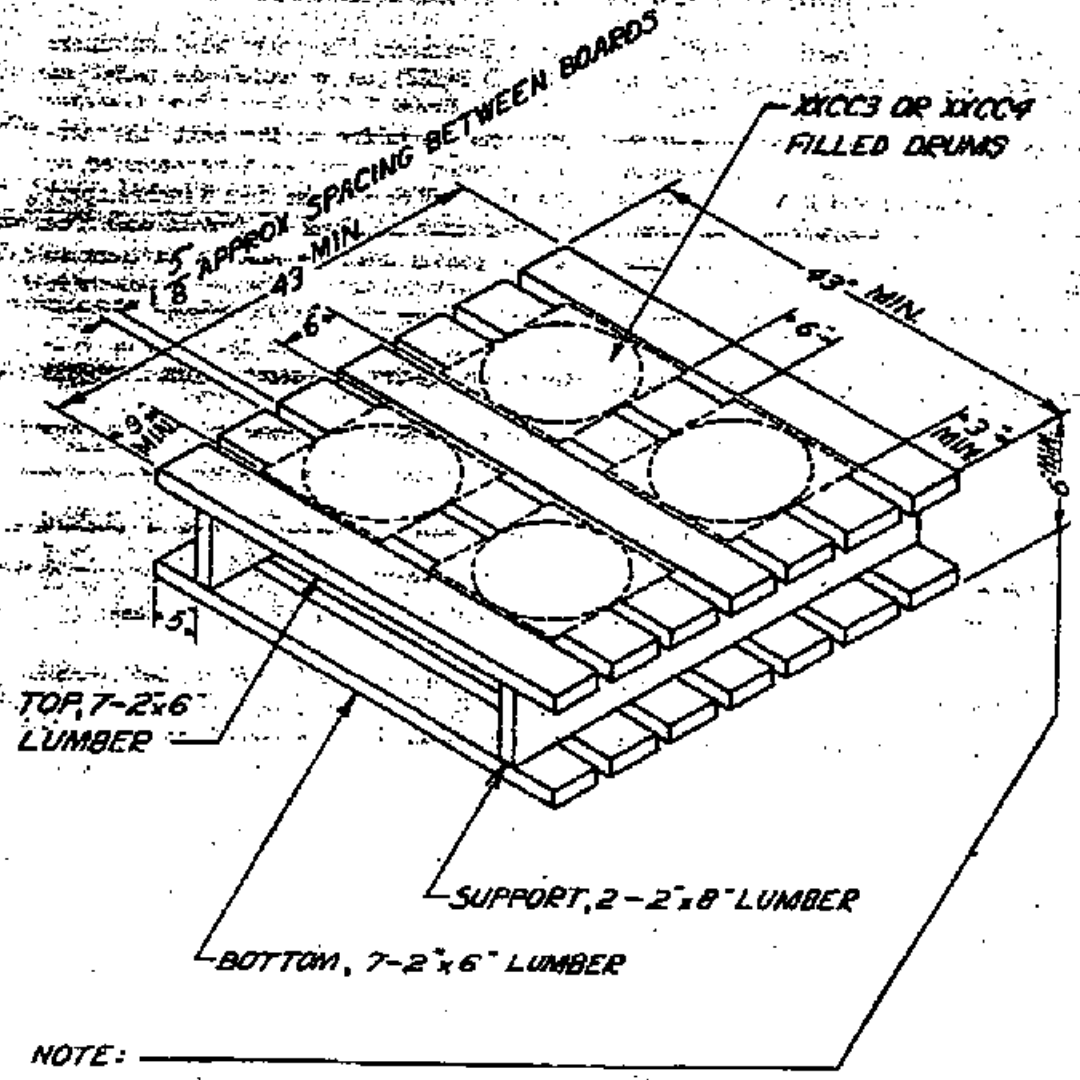
20. SCOPE. The method described in this appendix shall apply to the storage of type II impregnite in warehouses, depots, and at manufacturing plants, but does not apply to filled containers being assembled for a shipment provided they are not held for more than 48 hours prior to shipment. Storage in railroad cars or ships prior to or during shipment does not come within the scope of this appendix, except that railroad cars loaded with type II impregnite should not be allowed to stand in the general vicinity of the micronizing plant.

30. METHOD OF STORAGE.

30.1 Containers. Place four filled containers (MIL-D-14253) on a warehouse pallet as shown in figure 2. To prevent heat transfer from one container to the next, the containers must be in the positions indicated, so that they will be not less than 6 inches apart and not less than 6 inches from a wall. The loaded pallets shall be stacked in tiers so that the vertical space between containers in successive tiers shall be alternately 6 inches and 24 inches, with 6 inches between containers in the first and second tiers. Supports shall be provided for the pallets so that no tier of containers will support more than one tier of containers stacked above it.

30.2 Warning placard. Place a placard carrying a warning to keep material away from open fire and all heated surfaces on or near each exposed side of storage areas.

40. CONSTRUCTION OF WAREHOUSE PALLETS. The pallets used for storing the material shall be constructed as shown in figure 2. The upper surface of the pallet should be marked to indicate the proper position of the containers.



NOTE:

DESIGN OF PALLET IS OPTIONAL PROVIDED IT IS OF SUBSTANTIAL CONSTRUCTION CAPABLE OF SUSTAINING A LOAD OF FILLED DRUMS WHEN STACKED IN TIERS 15 HIGH.

FIGURE 2.

APPENDIX B

ACRONYMS

Ordnance and Explosive Waste
Chemical Warfare Materials
Chemical Investigation Report

APPENDIX B -- ACRONYMS

ASR	Archives Search Report
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEHND	Corps of Engineers, Huntsville Division
CFS	Cubic Feet Per Second
CIR	Chemical Investigation Report
CSM	Chemical Surety Material
CWM	Chemical Warfare Material
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
EOD	Explosives Ordnance Disposal
EPA	Environmental Protection Agency
ERDA	Environmental Restoration Defense Account
FDE	Findings and Determination of Eligibility
FUDS	Formerly Used Defense Sites
FWS	U. S. Fish and Wildlife
GSA	General Services Administration
HTW	Hazardous and Toxic Waste
INPR	Inventory Project Report
IRP	Installation Restoration Program
MCP	Mandatory Center of Expertise
NCP	National Contingency Plan
NGVD	National Geodetic Vertical Datum
OEW	Ordnance and Explosive Waste
SARA	Superfund Amendments and Reauthorization Act
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USADACS	U.S. Army Defense Ammunition Center and School
USAED	U.S. Army Engineer District
USAEDH	U.S. Army Engineer Division, Huntsville, AL
USATHMA	U.S. Army, Corps of Engineers, Toxic and Hazardous Materials Agency
USDA	U.S. Department of Army
WNRC	Washington National Records Center

APPENDIX C

PREVIOUS INVESTIGATIONS (USATHAMA)

DRXTH-AS-IAA-81191

INSTALLATION ASSESSMENTS OF DEFENSE DEPOT MEMPHIS, MEMPHIS, TENN
Report No. 191

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J.D. Wienand, and R.L. Yon

CHEMICALS SYSTEMS LABOROTORY
Environmental Technology Division
Installation Restoration Branch
Aberdeen Proving Ground, Md. 21010

Report for Period Mar. 2-6, 1981

Prepared for
COMMANDER
Defense Depot Memphis
2163 Airways Blvd.
Memphis, Tenn. 38114

and

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Assessment Division
Aberdeen Proving Ground, Md. 21010

INSTALLATION ASSESSMENT

OF

DEFENSE DEPOT MEMPHIS, TN

REPORT NO. 191

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Materials Agency

Unclassified

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Distribution limited to U.S. Government Agencies only for protection of privileged information evaluating another command: July 1982. Other requests for this document must be referred to: Commander, Defense Depot Memphis, 2163 Airways Blvd., Memphis, Tenn. 38114

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An onsite records search was conducted Mar. 2-6, 1981, at Defense Depot Memphis (DDMT), Memphis, Tenn., to determine the presence of any toxic or hazardous material and to assess the potential for offpost migration. Based on the findings of this assessment, a field survey, to be conducted by the Defense Logistics Agency (DLA), was recommended.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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SUMMARY

A records search was conducted to assess Defense Depot Memphis (DDMT), Memphis, Tenn., to determine the existence of toxic and hazardous materials and related contamination, emphasizing those substances posing a potential for migration to offpost areas.

A potential exists for contaminant migration from DDMT via surface and subsurface routes. Locations which have the greatest potential for migration are burial sites at Dunn Field, the old repackaging site, and pentachlorophenol (PCP) dipping vat areas.

Additional potential problem areas include: (1) improper storage of mission and excess stocks of pesticides, (2) lack of leak testing of underground petroleum, oils, and lubricants (POL) storage tanks, and (3) potential safety and contamination hazards associated with improper storage and handling of industrial chemicals at the Defense Property Disposal Office (DPDO) Yard and the current repackaging areas.

Based on the findings of this assessment, a survey by the Defense Logistics Agency (DLA) is recommended to determine if any contaminants are migrating offpost, including ground and surface investigations of: (1) burial sites at Dunn Field, (2) the old repackaging site, and (3) the PCP dipping vat areas.

Additionally, the following actions by DDMT are recommended: (1) upgrade the handling and storage procedures and facilities in the warehouses, repackaging area, and DPDO Yard with regard to hazardous and incompatible industrial chemicals; (2) properly store pesticides; and (3) test underground POL storage tanks on a periodic basis.

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1.0 GENERAL

1.1 PURPOSE OF THE ASSESSMENT

To determine the existence of toxic and hazardous materials and related contamination at the Defense Depot Memphis (DDMT), Memphis, Tenn., emphasizing those substances posing a potential for migration off the installation.

1.2 AUTHORITY

U.S. Army Materiel Development and Readiness Command (DARCOM) Regulation 10-30, Mission and Major Functions of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), May 22, 1979.

1.3 INTRODUCTION

1. In response to a letter from the Commander, USATHAMA, requesting the identification of potentially contaminated installations, the Commander, Defense Logistics Agency (DLA), recommended that DDMT be included in the Installation Restoration Program.
2. Presurvey instructions were forwarded to DDMT on Dec. 15, 1980, to outline assessment scope, provide guidelines to DDMT personnel, and obtain advance information for review by the Records Search Team.
3. Personnel at DDMT were briefed on Mar. 2, 1981, by a representative of USATHAMA on the Installation Restoration Program prior to the onsite records search.
4. Various Government agencies were contacted from Jan. 18 to Feb. 26, 1981, for documents pertinent to the records search effort. Agencies contacted included:
   a. U.S. Army Environmental Hygiene Agency (USAEHA),
   b. U.S. Geological Survey (USGS),
   c. Defense Technical Information Center (DTIC),

d. U.S. Army Engineer Waterways Experiment Station (WES),
e. Department of Defense Explosives Safety Board (DDESB), and
f. Chemical Systems Laboratory (CSL).

5. The onsite phase of the records search was conducted from Mar. 2-6, 1981. The information presented in this report is current, as of the date of the onsite search. The following personnel were assigned to the Records Search Team:
   a. Mr. Donald Gross, team leader (CSL).
   b. Mr. John Bane, chemist (CSL).
   c. LT Joseph Wienand, chemical engineer (CSL).
   d. Mr. Roy Yon, ordnance specialist (CSL).
   e. Mr. Robert Jonas, chemist (CSL).
   f. Mr. Charles Whitten, geologist (WES).
6. In addition to the records review, interviews were conducted with the current and former (retired) employees. A ground tour of the installation was made, and photographs were taken.
7. Document production services were provided by Environmental Science and Engineering, Inc. (ESE), Gainesville, Fla.

1.4 INSTALLATION HISTORY

DDMT is located in the southern portion of the city of Memphis, Shelby County, Tenn. (Fig. 1 and 2). The 260-hectare (ha) site was officially activated on Jan. 26, 1942, as the Memphis General Depot. Construction actually began in June 1941 on an original 200-ha site and was completed in May 1942.

From its inception, DDMT mission and functions have been related to the Army Engineer, Chemical, and Quartermaster Services. DDMT also provided supply, stock control, storage, and maintenance for all three services. During World War II (WW II), DDMT performed supply missions for the Signal and Ordnance technical services and served as a prisoner of war (POW) camp for 800 prisoners.

The storage capacity of DDMT was expanded from 276,789 square meters (m^2) to 387,936 m^2 in 1953 with the completion of six new warehouses.

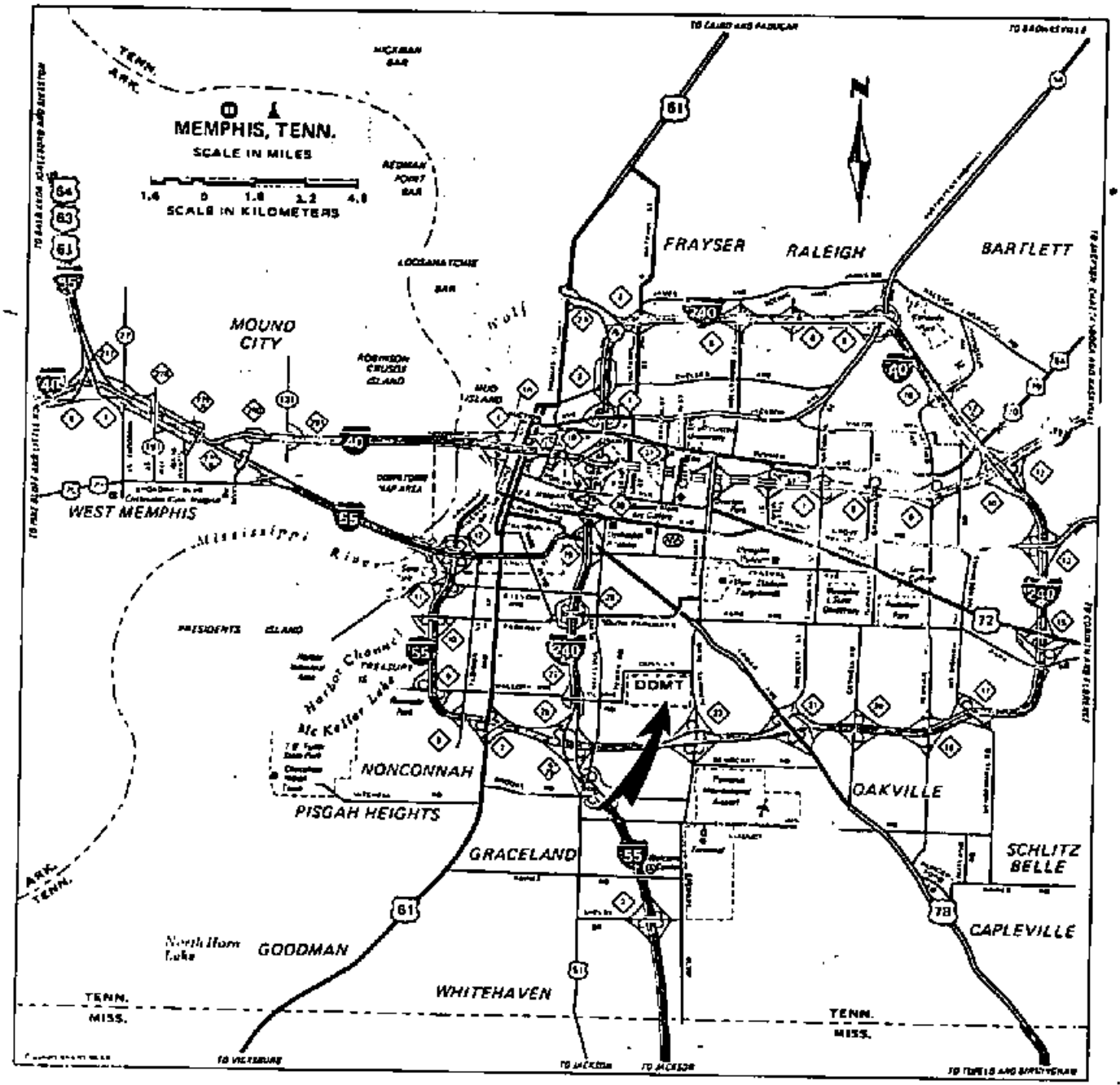


Fig. 1. DDMT General Location Map

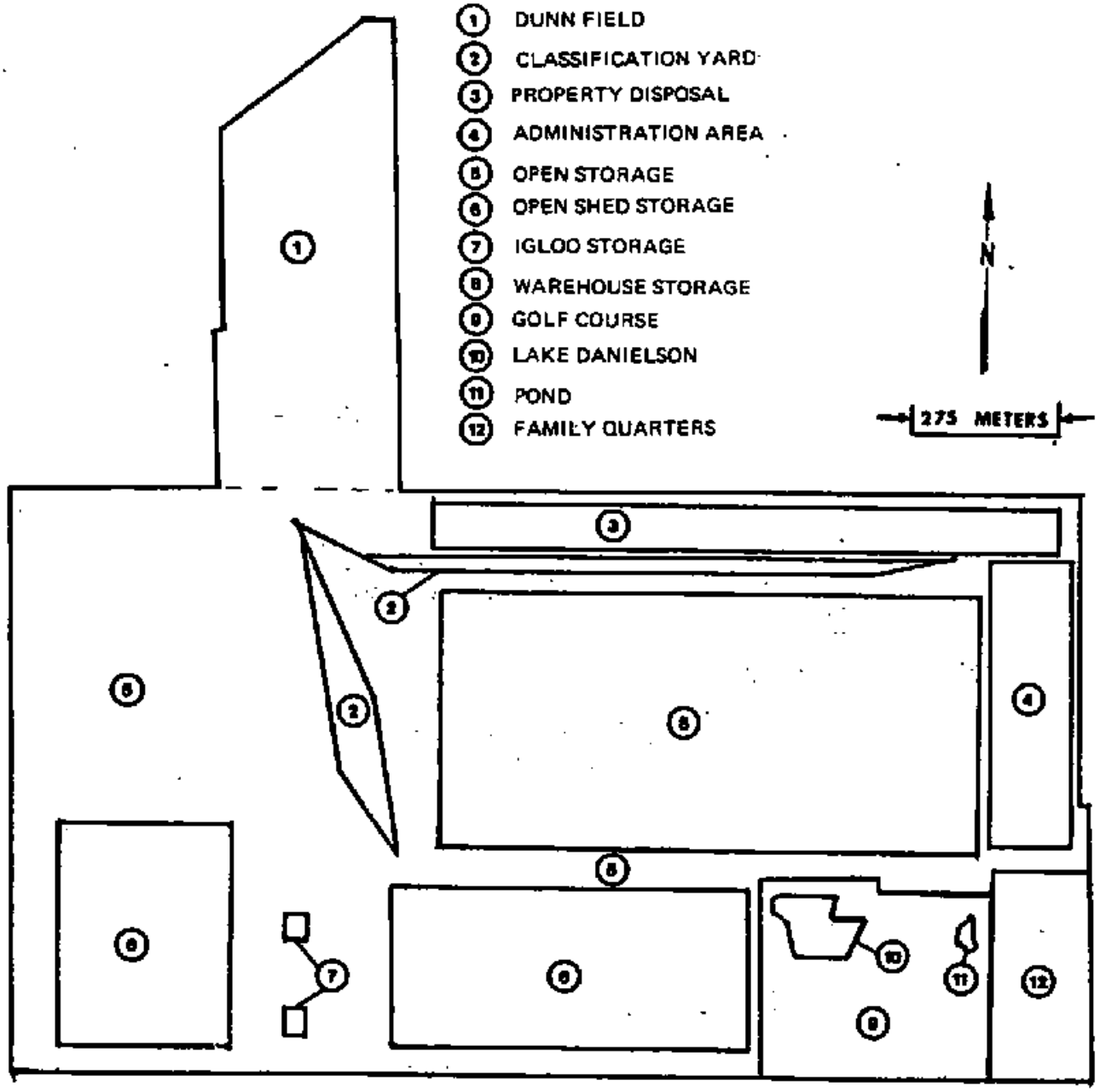


Fig. 2. Locations on DDMT

DDMT has held several designations over the years (see Table 1).

In 1963, the Defense Supply Agency (DSA), now DLA, selected the installation as one of its principal distribution centers for the complete range of DSA commodities. The U.S. Army released the installation to DSA, and on Jan. 1, 1964, the installation became Defense Depot Memphis. As a major DLA field element, it performs mission responsibilities for storage and distribution of Department of Defense (DOD) commodities within the south-central United States region.

1.5 ENVIRONMENTAL SETTING

1.5.1 LOCATION

DDMT is approximately 9.7 kilometers (km) north of the Tennessee-Mississippi State line and 12.9 km east of the Mississippi River. The terrain is relatively level with an average elevation of 92.4 meters (m).

1.5.2 METEOROLOGY

The U.S. Weather Bureau reports an annual nominal temperature range from -25 degrees Celsius (°C) to 41.4°C. The average seasonal temperatures are 26.7°C in the summer, 4.4°C in the winter, and 16.7°C as a mean average.

Average monthly precipitation varies from 6.9 centimeters (cm) in October, to a high of 15.4 cm in January. The average annual snowfall is 15.5 cm. The prevailing winds are from the southwest, and the average relative humidity is 70 percent.

The total yearly rainfall during 1960-80 is shown in Table 2.

Table 1. DDMT Designations

Date	Designation
Jan. 1942	Memphis General Depot
July 1942	Memphis Quartermaster Depot
May 1943	Memphis Army Service Forces Depot
May 1946	Memphis General Depot
Aug. 1962	Memphis Army Depot
Jan. 1964	Defense Depot Memphis (under DLA)

Table 2. Total Yearly Rainfall, 1960-80

Year	Rainfall Amount (Inches)	(cm)
1980	54.43	138.25
1979	70.89	180.06
1978	77.00	195.58
1977	41.20	104.65
1976	45.50	115.57
1975	58.68	149.05
1974	64.57	164.01
1973	62.30	158.24
1972	45.90	116.59
1971	49.69	126.21
1970	48.81	123.98
1969	42.12	106.99
1968	51.87	131.75
1967	46.44	117.96
1966	41.24	104.75
1965	42.79	108.69
1964	57.68	146.51
1963	38.68	98.25
1962	43.01	109.25
1961	49.64	126.09
1960	49.43	125.55

1.5.3 BIOTA

General

The land on which DDMT is situated was originally cottonfields. The city of Memphis has expanded and surrounds DDMT.

Flora

The natural flora in the limited unsurfaced areas are native Bermuda grass and occasional deciduous black oak (Quercus velutina). Several decorative species of scrubs and trees have been introduced over the years, via landscaping programs, and are concentrated in the housing area, golf course, and lake (DDMT, n.d.).

Fauna

Although a U.S. Army Corps of Engineers (COE) study (1975) lists several federally protected animals as occurring in the Memphis area (App. A), none of the listed fauna have been reported as observed on the installation. The most prevalent animal life are pests, i.e., roaches (Blattella germanica), rats (Rattus norvegicus), and mosquitoes (Culex), attracted by subsistence stocks.

Lake Danielson has been stocked periodically with bass (Micropterus) and bluegill (Lepomis), and also contains catfish (Ictalurus). The lake is a closed system; therefore, the population is directly impacted by installation operations. For example, in 1976, a fishkill occurred in the lake, reportedly due to pesticide treatment of the golf course area.

Dunn Field is the only undisturbed natural open ground in the local area. Table 3 lists those animals that have occasionally been observed in this area.

Table 3. Fauna Observed on Dunn Field

Common Name	Scientific Name
Mammals	
Squirrel	*Sciurus niger*
Red fox	*Vulpes vulpes fulva*
Birds	
Mourning dove	*Zenaidura macroura*
Quail	*Colinus virginianus*
Reptiles	
Turtle	*Terrapene carolina*

1.5.4 GEOLOGY

Physiography, Topography, and Drainage

DDMT lies within the East Gulf Coastal Plain section of the Coastal Plain physiographic province. This section is described as youthfully to maturely dissected belted coastal plain.

The terrain of the major portion of DDMT is fairly uniform. The elevation in the area south of Dunn Road, excluding the golf course, varies from 86 to 91 m mean sea level (MSL). The topography of the golf course area, which was not extensively altered by cut or fill for construction purposes, varies from 80 to 91 m MSL. Elevations in the area north of Dunn Road (Dunn Field) are generally around 91 m MSL, except for the northeast corner that varies from 80 to 91 m MSL and the excavated bauxite storage area in the southwest corner, which has a 5- to 10-m cutbank along its west side.

Surface drainage on DDMT is almost completely controlled by an effective storm drainage system. Fig. 3 shows the location of the storm drainage outfalls and the general area that each outfall drains. The crosshatched area along the western border of Dunn Field (Fig. 3) has natural surface drainage that flows off the installation in the area of the outfalls along the western boundary. The excavated bauxite storage site covers most of the crosshatched area. The outfalls on the northern boundary, including all of Dunn Field, flow into city ditches or small unnamed creeks. These creeks flow northerly into Cane Creek, which flows southwesterly into Nonconnah Creek (Fig. 4). The outfalls along the eastern, western, and southern boundaries flow into city ditches or small unnamed creeks that flow southerly into Nonconnah Creek. Nonconnah Creek flows westerly into Lake McKeller, an old river lake that empties directly into the Mississippi River to the west. Lake McKeller is approximately 5 km west of the junction of Nonconnah and Cane Creeks.

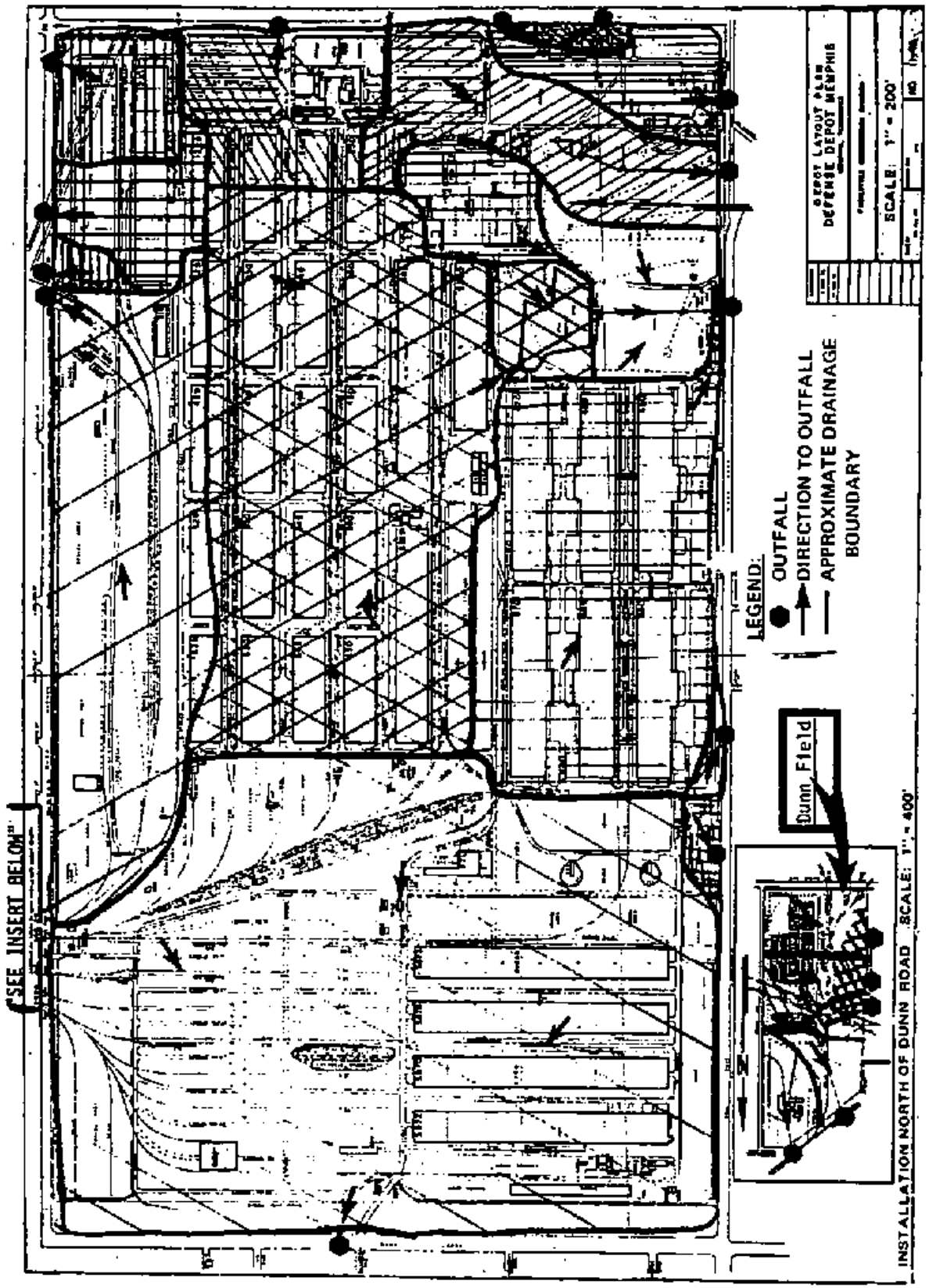


Fig. 3. Storm Drainage Outfalls and the General Drainage Area of Each Outfall

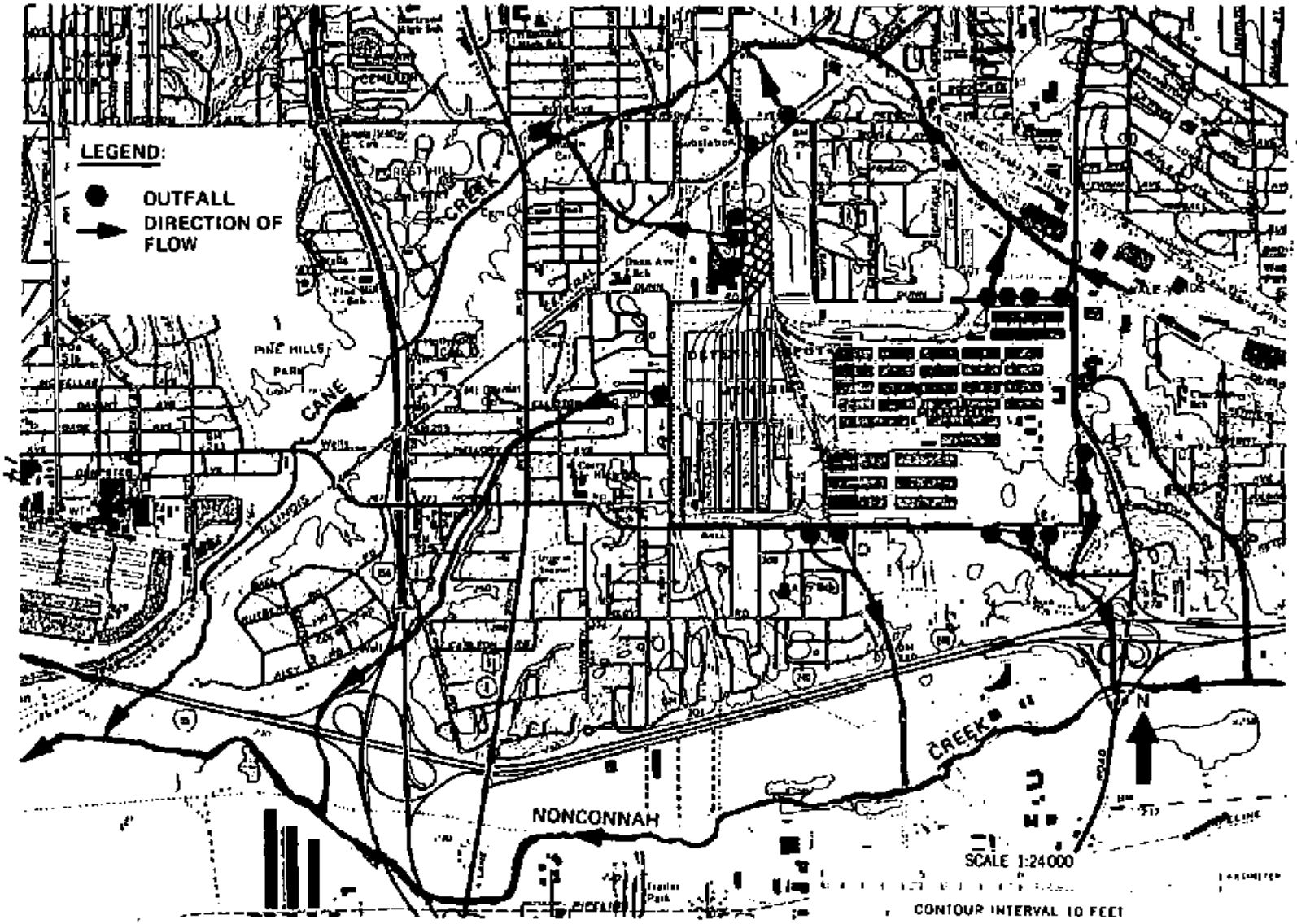


Fig. 4. Surface Drainage

Surface

DDMT is situated in an area of gently rolling loess hills (Fig. 5) with approximately 33 m of relief. The Pleistocene loess, a wind-blown silt or silty clay (Table 4), was up to 12 m thick. Borings made after construction (Fig. 6 and App. B) showed the thickness of the loess to vary from 4.5 m to greater than 9 m.

Subsurface

The geologic formations underlying the loess consist primarily of unconsolidated sand, clay, and gravel. Well-consolidated rocks of significant thickness occur at depths greater than 900 m. The Cenozoic units, which supply potable water for the Memphis area, are described in the stratigraphic column in Table 4.

Structurally, DDMT is in the north-central part of the Mississippi embayment, a geosyncline or broad trough-like structure that plunges to the south. The dip of the geologic formations shown in Table 4 varies from 0 to 35 feet (ft) per mile.

Soil

The Generalized Soil Associations Map compiled by the U.S. Soil Conservation Service (USSCS) (Sease et al., 1970) shows DDMT to be in the Memphis-Grenada- Loring association, which is characterized by nearly level to sloping, well-drained and moderately well-drained, silty soil on broad uplands (Fig. 7). The soil in this association developed in silty deposits more than 6 m deep. Prior to the construction of DDMT, the soil was classified as Memphis soil, which is well-drained soil on the broader ridgetops and steeper hillsides. Memphis soil has a brown, silty surface layer and subsoil. The construction of DDMT destroyed all of the Memphis soil, except in the northeast corner of Dunn Field and in the golf course area; these two areas retain the original Memphis silt loam. The construction areas have been classified as graded land, with silty materials. The soil in the graded land at

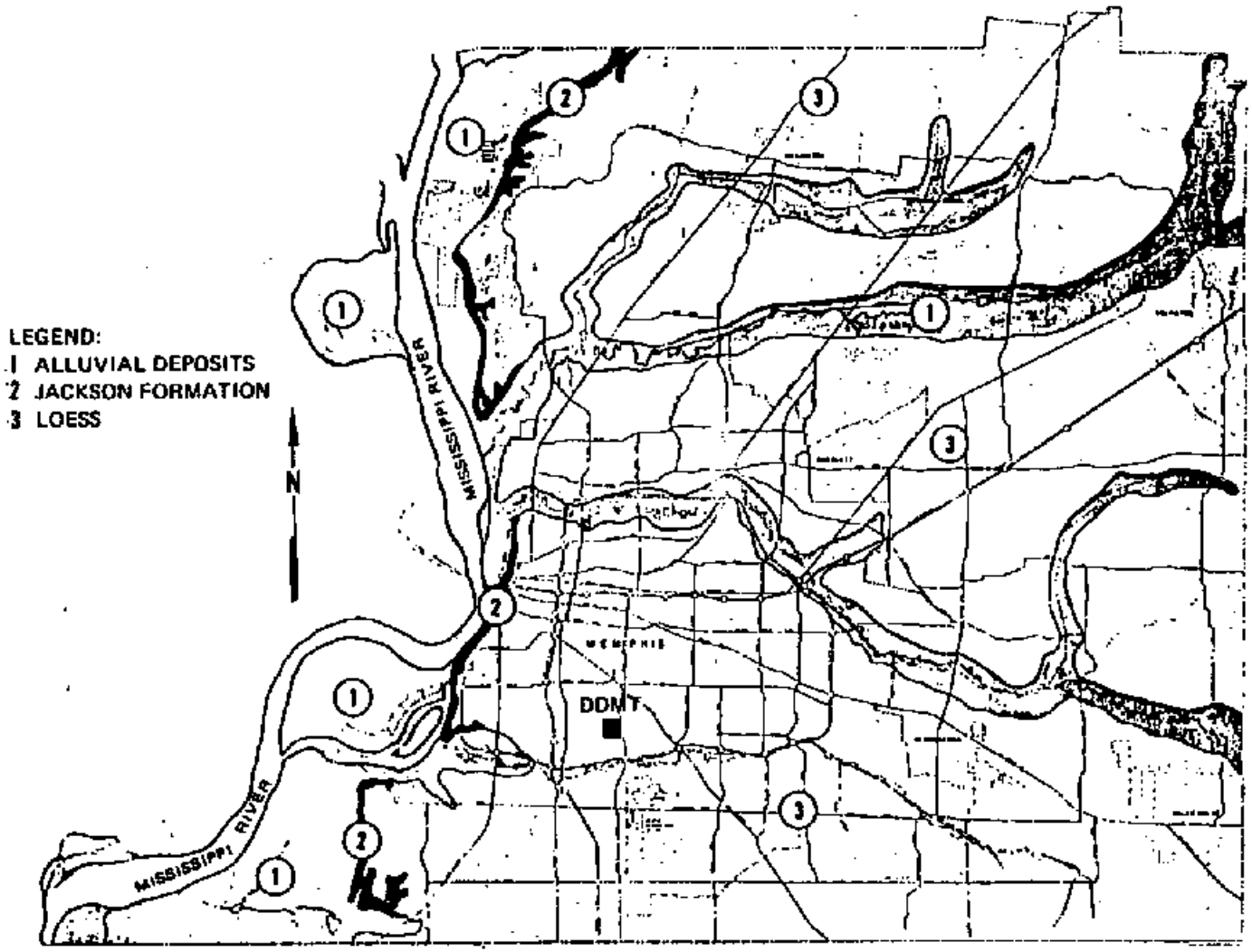


Fig. 5. Generalized Surface Geology

Table 4. Cenozoic Geologic Units Underlying the Memphis Area

System	Series	Group	Stratigraphic Unit	Thickness (feet)	Lithology and Environmental Significance
Quaternary	Holocene and Pleistocene		Alluvium	0-175	Sand, gravel, silt, and clay. Provides borrow material for fills and levees and some aggregates for concrete and bituminous mixes. Used as foundation material or base on which fill is placed for residences and light buildings in flood plains. Lower sand and gravel beneath Mississippi Alluvial Plain used as foundation material for heavy structures. Supplies water to a few industrial wells on President and Mud Islands.
	Pleistocene		Loess	0-65	Silt, silty clay, and minor sand. Used generally as foundation material for residences and light buildings in upland areas. Provides material for fills placed in low places and flood plains. Thick deposits utilized for solid waste disposal.
Quaternary and Tertiary (?)	Pleistocene and Pliocene (?)		Fluvial deposits (terrace deposits)	0-100	Sand and gravel; minor ferruginous sandstone and clay. Provides most commercial aggregates for concrete and bituminous mixes. Used as a foundation material for heavy structures and high-rise buildings in upland areas. Supplies water to many shallow

Table 4. Cenozoic Geologic Units Underlying the Memphis Area - Continued

System	Series	Group	Stratigraphic Unit	Thickness (feet)	Lithology and Environmental Significance
Quaternary and Tertiary -Continued					domestic wells in suburban and county areas. Some abandoned gravel pits utilized for solid waste disposal.
Tertiary	Eocene	?	Jackson Formation and upper part of Claiborne Group ("capping clay")	0-350	Clay, fine-grained sand, and lignite. Used as foundation material for heavy structures and for high-rise buildings where overlying fluvial deposits are thin or absent and where alluvial materials are unsuitable. Supplies water to some shallow wells completed in sands below the fluvial deposits, but generally considered to be of low permeability and to confine water in Memphis Sand. Lower boundary very poorly defined.
		Claiborne	Memphis Sand ("500-foot" sand)	500-800	Fine- to coarse-grained sand; subordinate lenses of clay and lignite. Very good aquifer from which most water for public and industrial supplies is obtained. Upper boundary very poorly defined.
	?	Wilcox	Flour Island Formation	160-350	Clay, fine-grained sand, and lignite. Confines water in Memphis Sand and Fort Pillow Sand.

Table 4. Cenozoic Geologic Units Underlying the Memphis Area - Continued

System	Series	Group	Stratigraphic Unit	Thickness (Feet)	Lithology and Environmental Significance
Tertiary -Continued	Paleocene	Wilcox -Continued	Fort Pillow Sand ("1400-foot" sand)	210-280	Fine- to medium-grained sand; subordinate lenses of clay and lignite. Once used as second principal aquifer for Memphis; now reserved for future use. Presently supplies water to a few industrial wells.
			Old Breastworks Formation	200-250	Clay, fine-grained sand, and lignite. Relatively impermeable lower confining bed for water in Fort Pillow Sand.

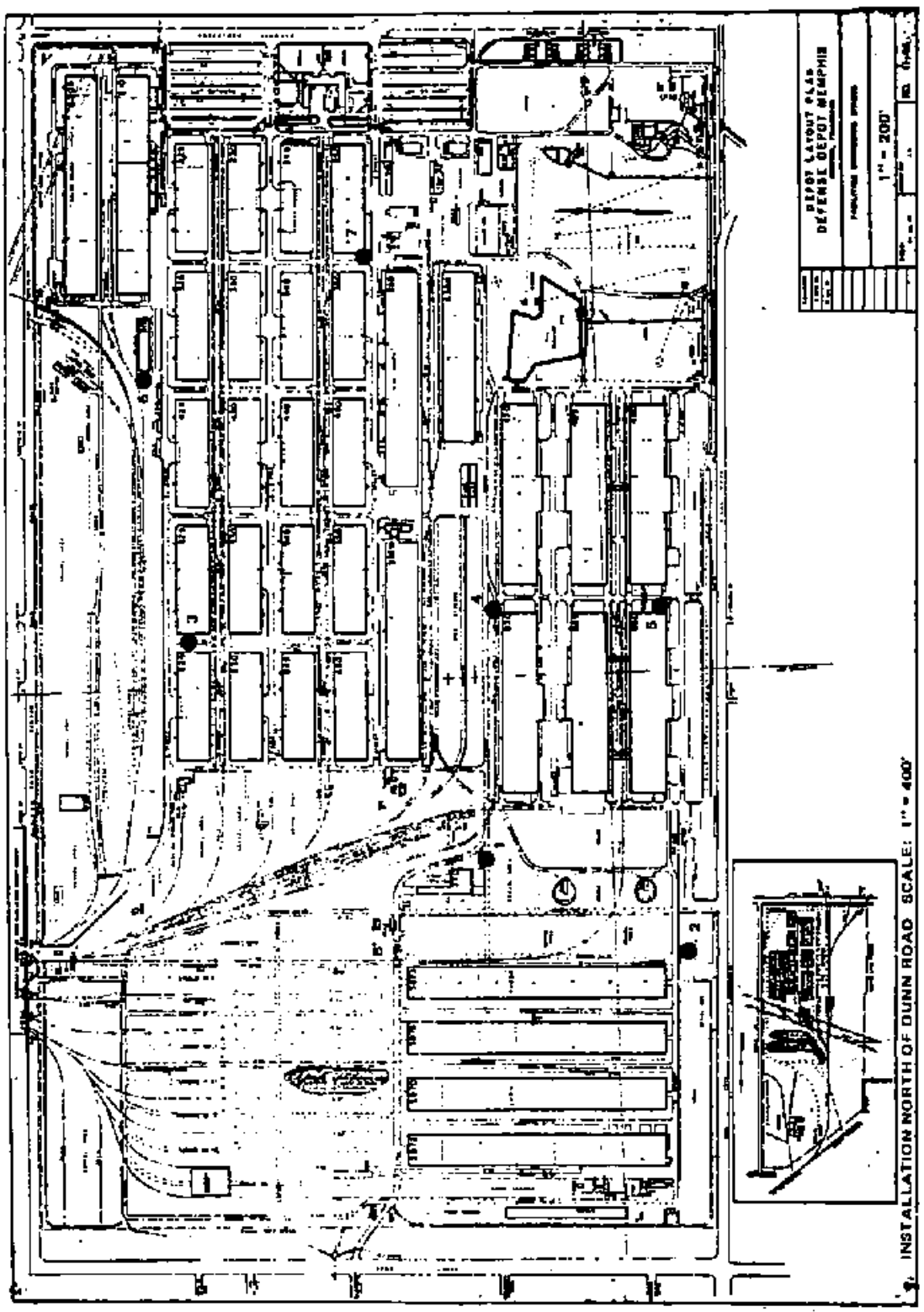


Fig. 6. Locations of Borings

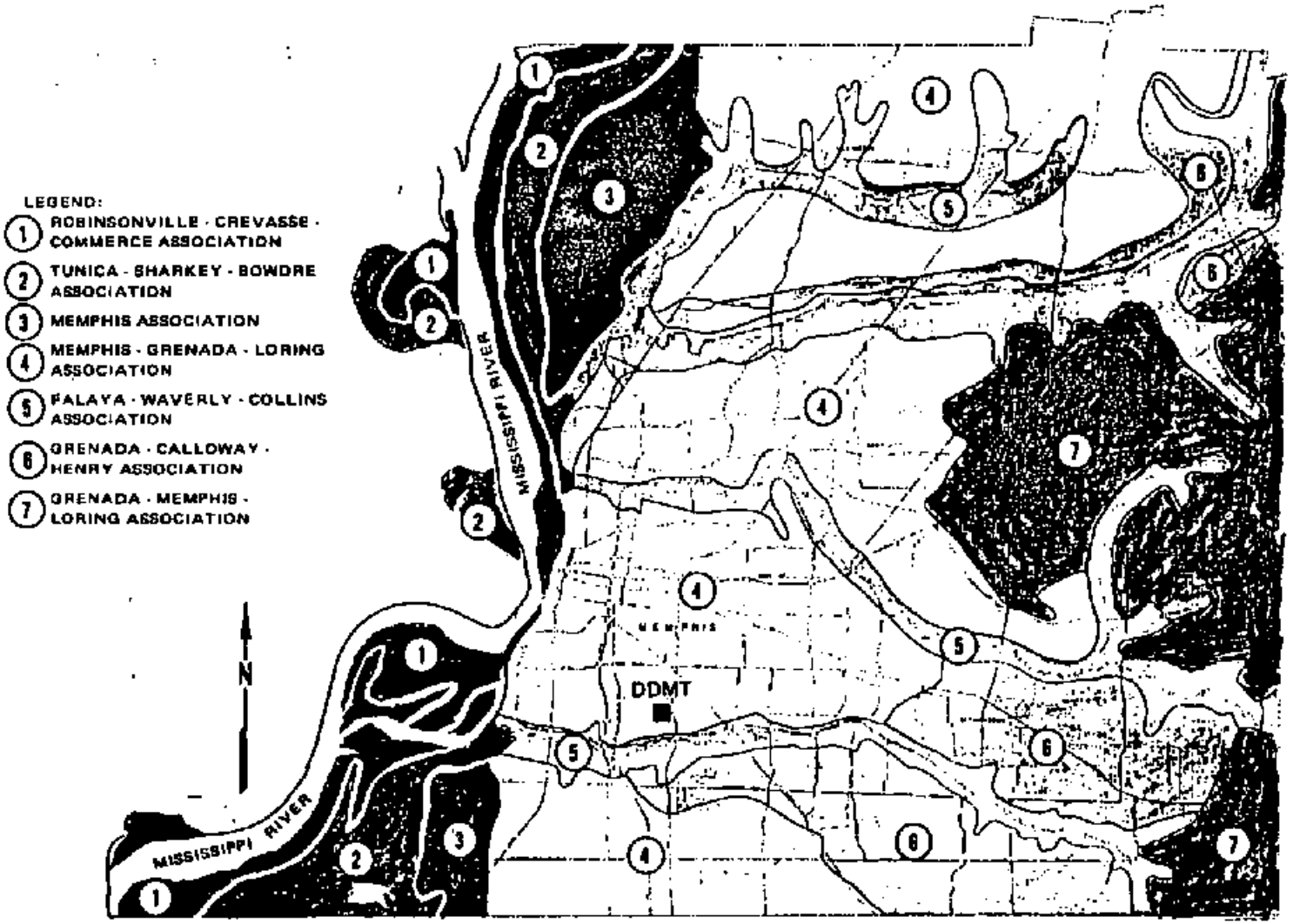


Fig. 7. Generalized Soil Associations

DDMT varies from clay to sandy-silt. The permeability of the Memphis soil and graded land varies from 4.4×10^{-4} to 1.4×10^{-3} cm per second.

Ground Water

The depth to seasonal high water tables in the loess varies from 1.5 m to greater than 3 m. The fluvial sands and gravels that underlie the loess are a source of water in many outlying suburban and county areas. Impermeable clay lenses in the sands and gravels could cause perched groundwater conditions.

All potable water used at DDMT is purchased from the City of Memphis, which pumps more than 95 percent of its water from the Memphis sand ("500-foot" sand) and approximately 5 percent from the Fort Pillow sand ("1,400-foot" sand, see Table 4).

Geological Aspects of Potential Migration

The potential exists for the migration of contaminants via the surface storm drainage system at DDMT. Materials spilled in the warehouse area have the potential of being washed into the storm drainage system. Infiltration of spilled materials to the soil in the warehouse area is minimal, since the open soil areas are small and well drained by the storm drainage system. No data were available as to contaminants migrating via the storm drains, because there is no program to monitor the outflow at the discharge outlets for contaminants. The northwest corner of Dunn Field was used as a burial site until May 1977. There is a potential for contaminants to migrate through the loess into the three zones described below.

1. Fluvial Deposits--The fluvial deposits consist primarily of sand and gravel which underlie the loess (Table 4). These deposits supply water to many domestic wells in suburban and county areas. USAEHA reported a perched groundwater table in the Dunn Field area; however, discharge from the perched water table would go into the fluvial deposits.

2. Memphis Sand--The Memphis sand is the primary aquifer for the City of Memphis water supply. The Memphis sand is overlain by the Jackson Formation that is generally considered to be of low permeability and confines water in the Memphis sand (Table 4). A USGS Water Resources Investigation Report (Parks and Lounsbury, 1976) indicates that there are permeable sandy zones in the Jackson Formation that could allow contaminants to migrate from the fluvial deposits into the Memphis sand.

3. Surface Streams--Contaminants migrating into the fluvial deposits could be discharged into Cane or Nonconnah Creeks. No subsurface data were located for the Dunn Field area. Additional data on subsurface conditions, such as the local thickness and permeability of the geologic units and groundwater conditions, are needed to determine the subsurface potential for migration in this area.

The storm drainage system north of Lake Danielson (also called the Fire Reservoir) empties into the lake. Water and bottom samples are collected and analyzed for contaminants on a regular basis, as the lake is open for fishing.

1.6 LEASES

Reportedly, there have been no industrial, agricultural, or grazing leases at DDMT. There are a number of tenants on the installation, primarily engaged in administrative activities.

1.7 LEGAL ACTIONS

Reportedly, there have been no legal actions at DDMT involving toxic/hazardous materials.

2.0 PAST AND CURRENT ACTIVITY REVIEW

2.1 INSTALLATION OPERATIONS

2.1.1 INDUSTRIAL OPERATIONS

The primary industrial operation at DDMT is warehousing, which includes shipping, receiving, and storing DOD commoditites. Other operations include vehicle maintenance, sandblasting, and spray painting.

Major maintenance and repair on installation vehicles and Materiels Handling Equipment (MHE) are performed in Bldg. 770. Steam cleaning and spray painting are also performed in Bldg. 770.

Bldg. 253 houses the installation motor pool where minor maintenance, such as fluid changes, steam cleaning, washing, and lubrication, is performed on installation vehicles.

Minor maintenance of two locomotives and other rolling stock (e.g., flatbeds and boxcars) is accomplished in Bldg. 720. Batteries for MHE items are charged in Section 4 of Bldg. 489.

Metal parts (e.g., reusable containers, and mission stored bar stock) are sandblasted with a low-silica slag material. The major sandblasting area is located in Bldg. 1088. The work material from this operation is collected in open top 55-gallon (gal) drums and disposed of in the municipal landfill. Sandblasting and painting operations are occasionally performed outdoors on a concrete pad in the open storage area near railroad track No. 2. Wastes were observed spread on the ground around the pad. Past sandblasting operations were conducted in the north end of open shed 1089. There were no analyses available for any sandblasting wastes on the installation.

Items such as drums and containers are spray painted for reuse in a long bay of Bldg. 1087. The area is ventilated by opening the doors at both ends of the building.

Bldg. 737 houses a 224-cubic meter (m^3) dipping vat used for treating wood products, primarily pallets, with pentachlorophenol (PCP). The vat is open and was observed to be full during the onsite visit. Reportedly, the vat has received little use since the late 1960's, except for occasional dipping of platforms used to support electrical transformers and for dipping large timbers for unspecified uses. It was also reported that the vat has not been cleaned or dumped since construction in 1952. This area is mentioned in the Spill Control and Countermeasure (SPCC) Plan, but only the attached pesticide storage room is considered.

The Engineer Depot Maintenance Shop was located in the south end of Bldg. 972 from the 1940's until 1964. Some of the equipment from this shop remained in use until the late 1960's for various repairs on mission stocks. During the period of operation, trucks, graders, snowplows, bridging equipment, forklifts, tugboats, and engines were repaired. This area also contained a variety of equipment for metal parts fabrication. Reportedly, most liquid wastes from this area were placed in 55-gal drums and were turned over to the Defense Property Disposal Office (DPDO), with the exception of small quantities of waste oils used for dust control on DDMT.

From the 1940's until the late 1950's, the Chemical Corps performed maintenance repairs and modifications in Bldg. 229 on items such as gas masks, flamethrowers, smoke generators, fire bomb bodies, and decontamination units. Repair parts and items were stored at the depot until 1964.

Bldg. 770 was used until 1969 as a cleaning and preservation area for heavy equipment prior to overseas shipment. These items were preserved with lubricants and preservative greases.

Coffee-roasting and tea-blending operations were formerly located in Warehouse 649.

2.1.2 LESSEE INDUSTRIAL OPERATIONS

There have been no leases of Government property at DDMT by commercial/ industrial private concerns.

2.1.3 LABORATORY OPERATIONS

DDMT currently has no laboratory facilities. The limited water analysis conducted by the Environmental Health Section at DDMT uses a portable test kit at the sample sites (see Sec. 2.3.2).

It was reported that in the 1940's, DDMT had a testing laboratory that inspected and tested incoming shipments of food stocks. No information was available on the analytical procedures, reagents used, or the precise location of this laboratory.

2.1.4 MATERIEL PROOF AND SURVEILLANCE TESTS

Proof and surveillance tests conducted on chemical and engineer items at DDMT are described in the following paragraphs.

Chemical Items

1. Flamethrowers were tested at the Dunn Field area. The tests were conducted in accordance with Chemical Corps stockpile reliability criteria to determine operational suitability of the end item prior to troop issue. Tests were conducted on the standard flamethrower, high pressure air compressor flamethrower, and ignition cartridges utilizing No. 2 diesel fuel.
2. The standard M2 mechanical smoke generators were tested utilizing SGF 1 and 2 fog oil. These tests were also conducted at the Dunn Field area.
3. Smoke pots were tested at the Dunn Field area.

4. The Decontamination Apparatus/Truck Mounted was tested using water from Lake Danielson.

Engineer Items

1. Bridge building equipment (aluminum and plywood boats) was tested at the areas of Dunn Field and Lake Danielson.
2. Bulldozers were tested for operational suitability at the Dunn Field area.

Other Tests

Lake Danielson has been utilized by installation and municipal fire departments for testing firefighting equipment.

2.1.5 TRAINING AREAS

DDMT had two pistol ranges for security guard practice. One range, operated from the early 1940's to the early 1950's, was located just south of K Street near the current 9th hole of the golf course. The other range, established in the early 1950's, was located in the north-central part of Dunn Field. This area was abandoned in the late 1970's, and the building is currently being used for pesticide storage.

DDMT has a firefighting training program for the employees. Training has been held at many locations on the installation. Classroom training is held in some warehouses and in the headquarters building. Fire extinguisher practice is usually held on a convenient open roadway, employing a controlled fire in a small metal container involving flammable material. DDMT has never had any formal firefighting training pits on the installation.

U.S. Army Reserve (USAR) members train at DDMT for 2 weeks in the summer. The training involves integrating the reservists into the warehousing operations.

2.1.6 TOXIC/HAZARDOUS MATERIALS (HANDLING AND STORAGE)

Industrial Chemicals

Industrial chemicals are currently classified as flammables (primarily liquids), corrosives (acids and bases), toxics (pesticides, herbicides, and rodenticides), oxidizers (various chemicals), petroleum, oils, and lubricants (POL) products, and medical supplies. Storage space occupied by these items is listed in Table 5.

The majority of chemical stock items are stored in Bldg. 629. This building is constructed on a concrete foundation without floor drains and contains five bays separated by brick walls and fire doors. Spill booths containing absorbent material and cleanup equipment are located in each separate area. These booths are marked to preclude incompatible chemicals being placed in the same booth. The area is well organized, but minor examples of incompatible storage were observed during the onsite visit. [Fig. 8 (EPA, 1980d) provides general chemical compatibility information.]

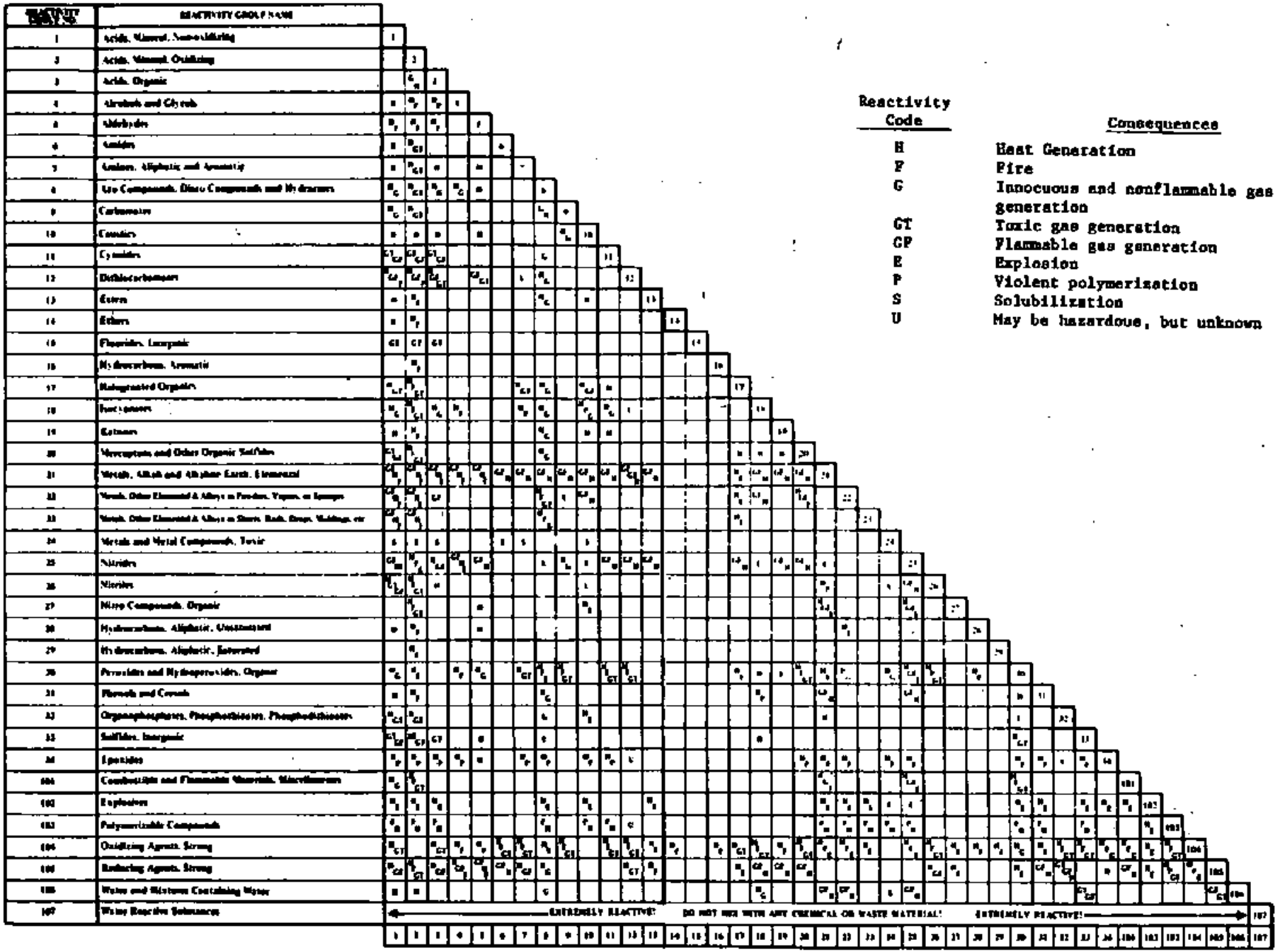
Bldg. 319, the flammable materials storage area, contains mostly alcohols, with lesser amounts of other items (ether, pesticides, and solvents). The building is concrete-bermed and is on a concrete foundation with no floor drains. One mechanically ventilated, separately bermed room in the west end of the building contains cyanide compounds. The building is equipped with explosion-proof lighting and spill booths similar to those in Bldg. 629.

Medical supplies are stored in Bldg. 359. Outdated and leaking items are transferred to the former boiler room in this warehouse to await disposal (see Sec. 2.2.2).

The X-25 area is a bermed, concrete pad in the open storage area on the northwest side of the installation used to store flammable materials. These materials, normally stored in 55-gal drums, include a wide range of industrial-grade organic solvents.

Table 5. Industrial Chemicals in Storage at DDMT

Location	Item
Bldg. 629	Various chemicals (toxics, corrosives, oxidizers)
Bldg. 319	Flammable materials, toxics
Bldg. 359	Medical supplies
X-25	Flammable materials
X-13, X-15	POL products
Bldg. 873	POL products
Bldg. 689	Flammable liquids



Reactivity Code	Consequences
H	Heat Generation
F	Fire
G	Innocuous and nonflammable gas generation
GT	Toxic gas generation
GF	Flammable gas generation
E	Explosion
P	Violent polymerization
S	Solubilization
U	May be hazardous, but unknown

Fig. 8. Hazardous Waste Compatibility Chart

Nonflammable POL products are stored in Areas X-13 and X-15, in open storage between E and B Streets, and between railroad track Nos. 13 and 18. These materials are stored in 55-gal drums, stacked four high, and include such items as rifle bore cleaner, lubricating oil, calibrating oil, cleaning compound solvent, deicing/defrosting fluid, drycleaning solvent, and cutting fluid.

The north end of Bldg. 873 (an open shed) is used for POL and antifreeze storage.

Bldg. 689 houses a small, enclosed flammable liquid holding area where 55-gal drums of flammable materials are received and temporarily stored. Typical items held in this area are alcohols, ketones, aromatics, and esters. This area is not bermed and is adjacent to storm sewer inlets in L Street.

Leaking, damaged, and corroding containers from the storage areas on DDMT are taken to Bldg. 972, an open shed constructed on a concrete pad, for repackaging. Items awaiting repackaging in this unbermed area included potassium hydroxide on a pallet with hydrochloric acid, sulphuric acid on a pallet with methanol, lubrication oil next to sulphuric acid, leaking containers of hydrofluoric acid, and a damaged 55-gal drum of methyl ethyl ketone on the gravel skirt along the outside of the concrete pad. The repackaging operation is performed on a small workbench in the center of the shed. The material from damaged containers is repacked for issue or stored for disposal. A common practice in the past was to dispose of absorbent and cleanup material wastes with general refuse (USAEHA, 1978). The personnel operating the area were again directed by the Commander (at the Team exit interview) to handle this material as hazardous waste. The current required procedure is storage for a future disposal contract, which is also current practice for empty containers.

Until the late 1970's, the repackaging operations were conducted outdoors under a lean-to, on a gravel surface at the corner of 21st and E Streets.

There has not been a hazardous wastes disposal contract for over 3 years, and wastes are currently stored awaiting sufficient quantities to justify a contractor disposal operation. Documentation of past disposal operations and contractors was not available. Hazardous wastes will be centrally stored in Bldg. 1086 by late spring 1981. This building is on a concrete foundation and was under renovation during the onsite visit to include berming and removal of excess equipment. The installation applied for a U.S. Environmental Protection Agency (EPA) Hazardous Waste Permit in the fall of 1980 but had not received a license as of the onsite visit.

DDMT employs local contractors (through DPDO) for the disposal of waste oils and solvents. These materials are stored in drums and underground storage tanks until removed by a contractor for reclamation. It was reported that the storage tanks have not been hydrostatically tested for leaks since their installation in 1953.

DPDO is located in the north end of the installation, adjacent to and south of Dunn Road. It is surfaced with gravel and is surface drained. Potentially, the full range of DDMT stock chemicals may be stored in the yard awaiting resale. Within the yard, containers are separated by classification (i.e., corrosive, oxidizer). The small containers are stored on pallets under tarpaulins. Typical items stored in the DPDO yard are listed in the installation SPCC plan and are categorized as flammable (i.e., acetone) and nonflammable (i.e., drycleaning solvent).

Additional items not listed in the SPCC plan were observed, including various acids, bases, Super Tropical Bleach (STP), and sodium dichromate (App. C). Some items were damaged and/or leaking; for example, a damaged bag of sodium dichromate appeared to have a greenish runoff.

DDMT is in the process of identifying all transformers on the installation that contain polychlorinated biphenyls (PCBs). Samples have been drawn from all transformers and are currently awaiting analysis. Two out-of-service transformers containing an unknown coolant are stored outside in a gravel-surfaced yard behind Bldg. 272.

Chrysotile asbestos is stored in burlap bags which are overpacked in an outer bag of polyethylene. These bags are stored on pallets in Sections 3 and 4 of Bldg. 450. The area is posted as containing asbestos, and personnel entering the area are required to wear protective masks.

The installation SPCC plan identifies nine sites (Table 6). Bldg. 629 and Bldg. 319 are not included in this plan, nor are two underground tanks. One 12,000-gal tank near Bldg. 737 contains PCP for the dipping vat (see Sec. 2.1.1). Another underground tank of unspecified capacity near Bldg. 770 was used for waste oil in the past. Reportedly, it is not currently used; however, fresh oil was observed in the oil catch can mounted on the tank fill neck. The SPCC plan and the Installation Spill Contingency Plan (ISCP) are currently being updated to comply with Federal regulations (EPA, 1980a), and will incorporate a hydrostatic testing program for tanks.

Chemical Agents

DDMT previously stocked ID sets, riot control agent CN, and small quantities of white phosphorus (WP). The ID sets contained small glass ampoules of mustard and Lewisite. The sets, stored within sealed cylindrical metal containers known as "pigs," were periodically checked for leakage and, reportedly, an unknown quantity of leaking ampoules was buried at Dunn Field. DDMT also stocked decontamination materials, such as XXCC3, STB, and chlorinated lime.

Table 6. Facility Sites Included in SPCC Plan

Site No.	Location and Description	Storage Capacity-Type* (gal)
1	Property disposal area—outdoor POL and hazardous material storage	5,000 - A.G., M.C.
2	Bldg. 253—vehicle cleaning facility	—
3	MOGAS storage area	1 - 20,000 - U.G. 2 - 12,000 - U.G. 1 - 2,600 - U.G. 1 - 1,100 - U.G.
4	Bldg. 873—open POL and hazardous material storage shed	500,000 - A.G., M.C.
5	Bldg. 689--flammable liquid holding area	7,000 - A.G., M.C.
6	Outdoor nonflammable and hazardous material storage and handling area (X13, X15)	343,000 - A.G., M.C.
7	Outdoor flammable material storage and handling area (X25)	89,300 - A.G., M.C.
8	Bldg. 720--diesel oil storage tank	12,000 - A.G.
9	Bldg. 737--dipping vat and pesticide storage area	200 - A.G., M.C.

* A.G. = Aboveground, U.G. = Underground, and M.C. = Multiple containers.

Biological Agents

There are no biological agents reported to have been manufactured, used, or stored at DDMT.

Radiological Materials--Permits and Licenses

DDMT has one Nuclear Regulatory Commission (NRC) Byproduct Material License (No. 41-14911-01; expires Nov. 30, 1981). It authorizes the possession and use of a sealed krypton-85 source of 7 millicuries (mCi). The krypton source is used for survey meter calibration.

DDMT stores other materials that do not require an NRC license because of their low levels of radioactivity. They are stored in a Conex container near the west end of Bldg. 319. Items on the inventory include tachometers, a Radiac set, speedometers, a wave guide assembly, glow lamps, and illuminating mantles, which contain either radium or thorium.

There are no reports of radioactive material disposal on the installation.

Pesticides/Herbicides/Fertilizers

The pesticide shop, Bldg. T-267, is equipped with necessary safety equipment (i.e, masks, protective clothing and gloves, safety showers, eyewashes, and laundry facilities) (USAEHA, 1980). The storage areas are well marked, and copies of the storage inventory lists are posted on an outside wall. Building floor plans of all storage areas are furnished to the fire department, medical clinic, and military police.

Pesticide activities and waste disposal containers are handled in accordance with DLA regulations (DLA, 1974) by the DDMT Entomology Division personnel. Phos-toxic residue is disposed of according to manufacturer instructions. Rinse water from spraying operations is now held for the mixing of later batches; previous to late 1980, the rinse water was dumped on the ground (USAEHA, 1981).

Pesticide applications include 2,4-D on grassy areas, Monuron on track areas, Pyrethrum in textile warehouses, Hy-Var-X in gravel areas, and phos-toxin for stack and transit fumigation. The veterinary field inspection section, Medical Department Activity (MEDDAC), Fort Campbell, Ky., determines appropriate treatment for the subsistence warehouses. Fertilizers are not used at DDMT. App. D lists Entomology Department equipment and stocks.

There are two inactive fumigation chambers in Warehouse 549. These were used briefly for protecting subsistence stocks.

The seal between the berm and the floor in Bldg. T-267 leaks, and water flows in from the outside. The situation is compounded by an unsealed floor seam through the center of the building which provides a potential migration route.

Mission pesticide storage is mainly in Warehouse 629. For the most part, pesticides are properly segregated, labeled, and organized. There were a few instances of noncompatibility noted. Masks are required for personnel handling warehouse storage. A cleanup booth, containing absorbent specifically for pesticides, is in the area.

Flammable pesticides for mission use are stored in Bldg. 319, which also contains pesticides in alcohol solution. This building is bermed with the area marked.

DPDO stores large quantities of pesticides. DDMT reported over 70 tons of DDT to EPA. The Resource Conservation and Recovery Act (RCRA) requires that amounts of waste DDT greater than 1,000 kilograms (kg) be managed as a hazardous waste. There are approximately twenty-five 55-gal drums of DDT stored in Bldg. T-308, which is a dry and secure building (USAEHA, 1979). Warehouse 629 is currently storing outdated pesticides and 3,000 gal of DDT for DPDO. The areas are well marked and segregated from other storage.

DPDO also uses Bldg. 1184, at the old pistol range area, for storage of obsolete and banned pesticides. This building, located in an isolated hollow at the north end of Dunn Field, is labeled for pesticides but is not bermed. There are two storm drains in proximity to the building. One is within a few feet and the other is approximately 15 ft downslope from the building. Both drains lead directly off the installation. The amounts of pesticides stored in Bldg. 1184 also exceed the minimum amounts which must be managed as hazardous wastes under RCRA.

Miscellaneous

Igloo 793 is currently being used by the Reserve Officers Training Corps (ROTC) unit of a nearby college for the storage of ammunition and ordnance training items. It was noted that several incompatible items were stored together (i.e., initiators in the same box with TNT block stored adjacent to small arms ammunitions).

2.2 DISPOSAL OPERATIONS

2.2.1 LIQUID WASTE TREATMENT

Sanitary Wastewater Treatment

DDMT has no onpost facilities for treating its sanitary wastewater. Wastewater is treated by the City of Memphis under a sewer use agreement (Permit Number S-NN3-013; effective Nov. 1, 1979, expires Jan. 1, 1985). Under the agreement, DDMT does not monitor the installation effluents.

Industrial Wastewater Treatment

There is no industrial wastewater treatment at DDMT. Since the early 1950s, the limited wastewater generated has been incorporated in the sanitary sewer system, which discharges into the municipal interceptor.

Two vehicle wash racks are in use at DDMT, in Bldg. 770 and Bldg. 253. These wash racks are equipped with oil/water separators. Effluent lines were connected to the sanitary sewer system in 1979.

The painting and sandblasting operations in the open storage area (see Sec. 2.1.1) are monitored under National Pollutant Discharge Elimination System (NPDES) Permit No. TN0022322 for the following storm drainage parameters: flow, pH, oil and grease, suspended solids, and phenol (App. E). Other operations on the installation covered under the NPDES permit include boiler blowdown water, cooling tower blowdown water, storm sewer discharges, and cooling water. The discharge limitations and monitoring requirements for DDMT are discussed in Sec. 2.3.3.

Holding Ponds

The two bodies of water at DDMT are Lake Danielson (a 1.62-ha concrete-lined, manmade pond) and a 0.04-ha unlined pond in the DDMT golf course (see Sec. 2.3.1). Neither pond is or has been used for waste disposal.

Stormwater Drainage

Stormwater drainage is discussed in Sec. 1.5.4.

2.2.2 SOLID WASTE TREATMENT

Sanitary Landfills

The oldest reported landfill, operating from the early 1940s to late 1948, is located in the southwest section of Dunn Field. Large amounts of outdated or damaged food stocks and bulk quantities of STB were buried. This area was covered in 1949 with a General Services Administration (GSA) bauxite storage pile. The pile remained there until August 1972 when the bauxite was sold to Reynolds Aluminum Co., and the pile and 6.1 m of earth below it were removed to Bauxite, Ark. The area was then refilled with building rubble, covered, and seeded.

Asphalt and roofing gravel are now being dumped in a surface fill at the north-central end of Dunn Field.

Sanitary wastes generated on DDMT are collected by the installation refuse services that have an agreement with the city for the dumping of the refuse (App. F contains a copy of this contract). A privately owned

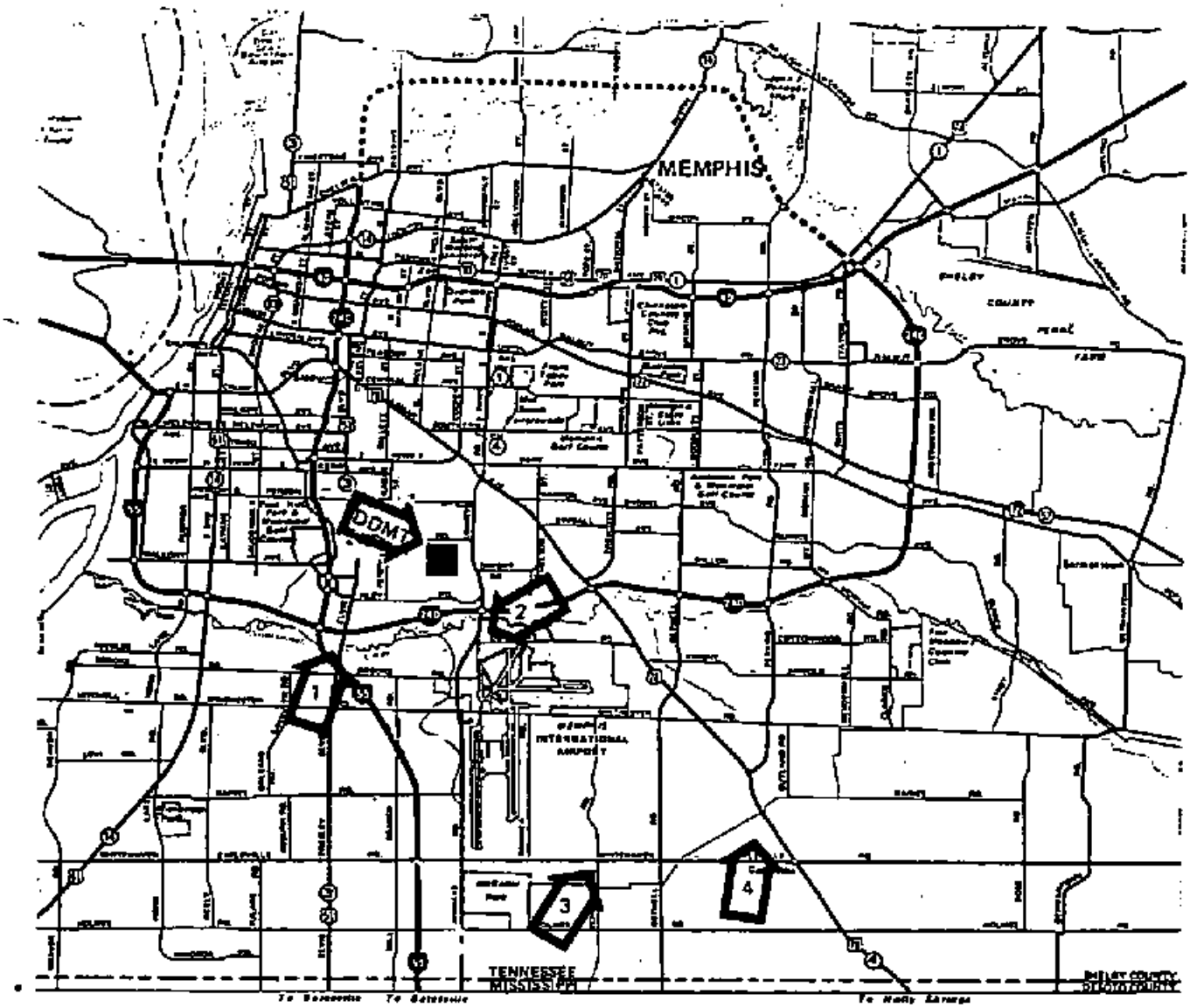
landfill near Shelby Drive, which is operated by the city, is currently being used. The landfill meets all State and Federal regulations. Prior to this, DDMT used three other landfills: a landfill at Nonconnah Creek, a landfill between Democrat Road and Airways Blvd., and a landfill off Tchulhoma Road (Fig. 9).

Contaminated Waste

Contaminated solid wastes (Figs. 10 and 11 and Table 7) are generated in various ways, including the breakage or disintegration of containers or packaging, spillage from open containers, and product degradation as a result of aging. Whenever possible, these materials are repacked and returned to stock. Materials unsuitable for issue are turned over to DPDO where an effort is made to sell them for recycling, refining, or other use. In recent years, unsalvageable items were disposed of through a hazardous waste contractor. These wastes are currently being stored, pending renewal of the contract.

Spilled materials are recovered from floors and other surfaces by means of solid absorbent materials that are preselected and identified as to specific use (for oxidizers, acids, bases, and pesticides). DDMT personnel are instructed to identify and dispose of the resulting contaminated absorbent and contaminated pallets as hazardous waste according to the nature of the spilled material. However, some of these materials have reportedly been put into dumpsters for disposal in the Memphis Municipal Sanitary Landfill.

Contaminated medical wastes are held temporarily in Bldg. 359. They are disposed of by various means based on guidance from USAEHA. DDMT disposes of some medical wastes by discharging them to the sanitary sewer (sterile water and isotonic saline). Small quantities of medical wastes are burned in the classified wastes incinerator located in Bldg. 144. The bulk of medical wastes have been taken to the Memphis Zoo incinerator for disposal. According to installation personnel, the zoo incinerator was last used 3 years ago.



LEGEND:
1 NONCONNAH CREEK LANDFILL (CITY-OWNED), INACTIVE
2 DEMOCRAT AND AIRWAYS ROADS (CITY-OWNED), INACTIVE
3 TCHULHOMA ROAD (CITY-OWNED), INACTIVE
4 SHELBY DRIVE (PRIVATELY-OWNED, CITY-OPERATED), ACTIVE

Fig. 9. Landfills Used by DDMT

1 Pesticides/herbicides

2 Industrial chemicals

3 H-site

4 Decontamination material

5 Radiation material

6 Dipping vat

7 Asbestos storage

8 Medical waste

9 Old burn site outfall

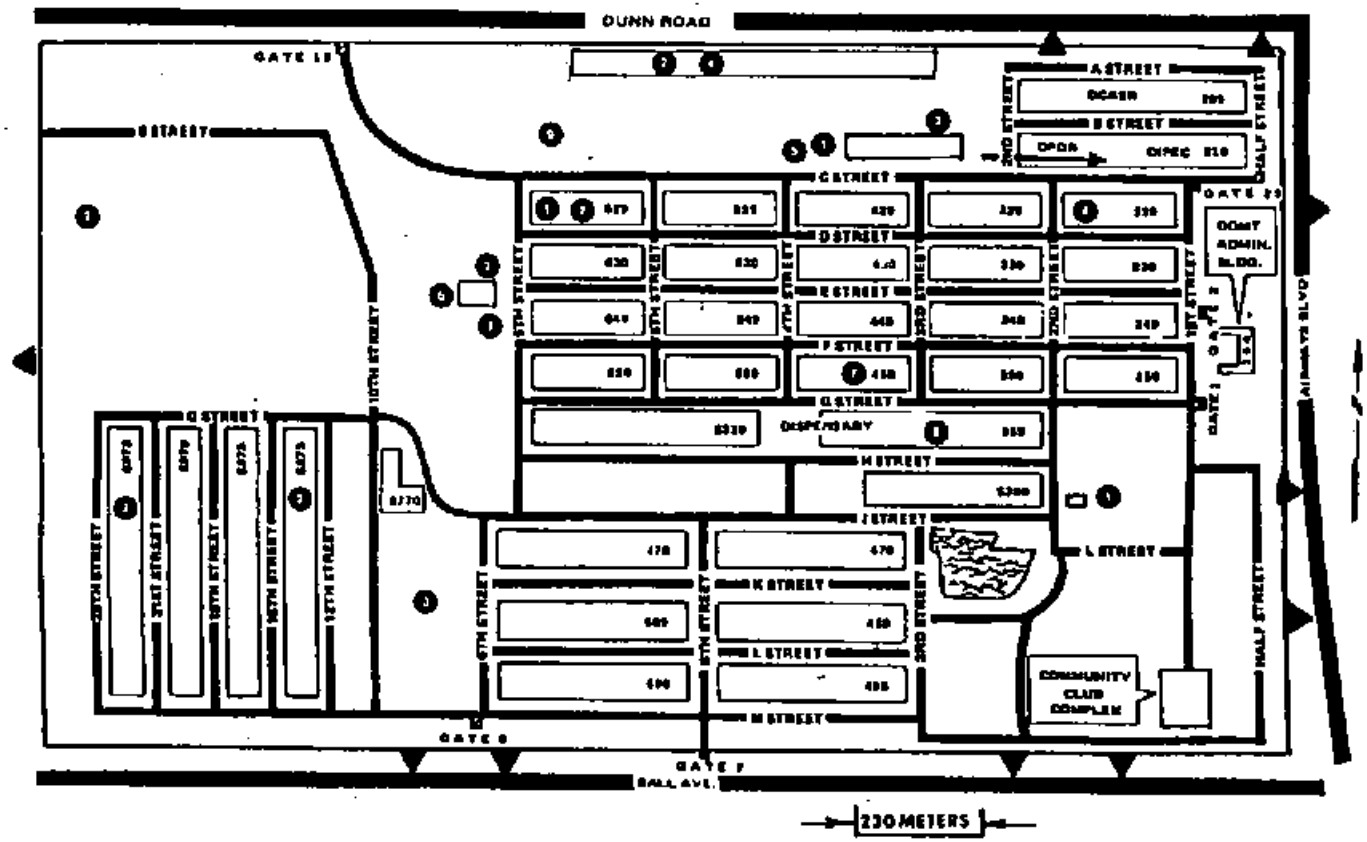


Fig. 10. Activities/Contaminant Sites at DDMT

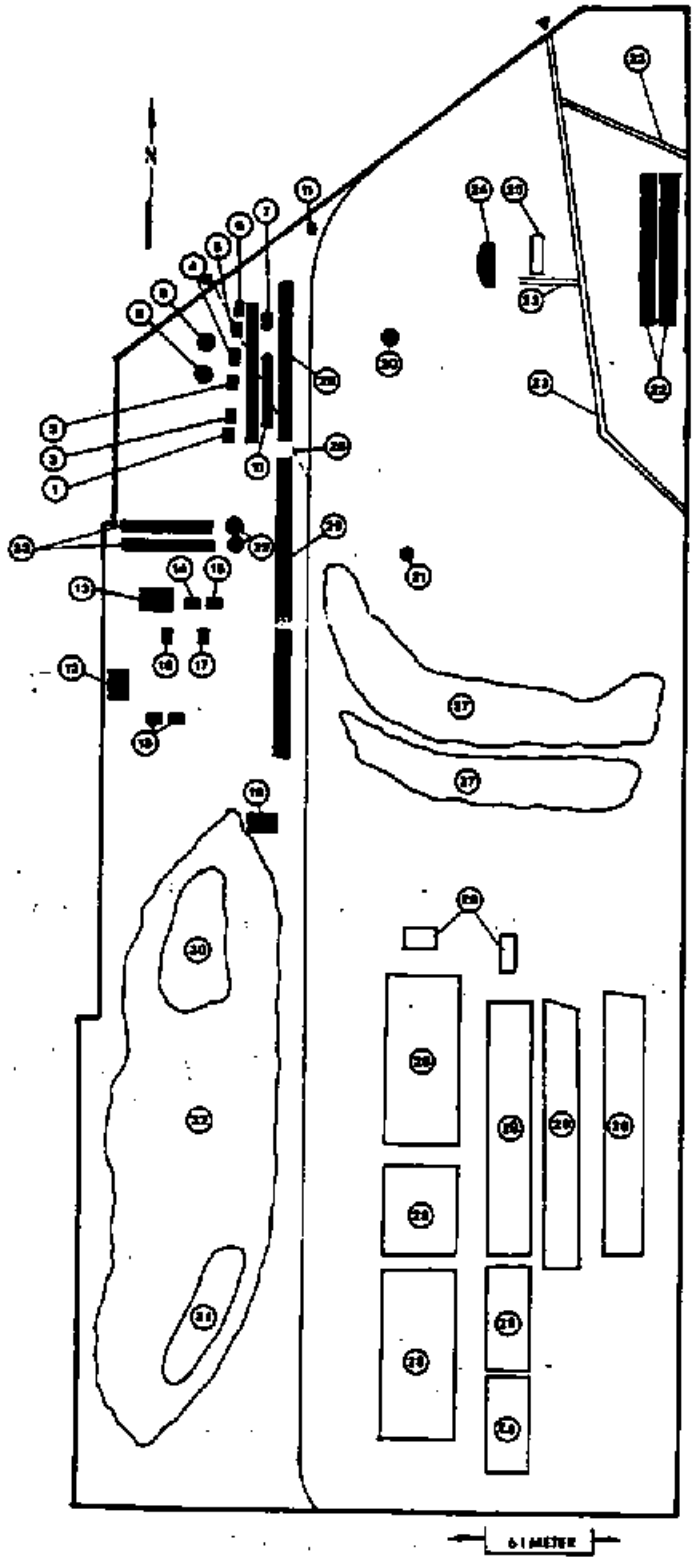


Fig. 11 Dunn Field Disposal and Storage Sites

(See Table 7 for Descriptions of Sites)

Table 7. Description of Dunn Field Disposal and Storage Sites (Locations of Sites are Shown on Fig. 11)

Location	
Burial Sites	
1	Training sets, nine each, mustard and Lewisite, 1955
2	7 pounds (lbs) ammonium hydroxide, 1 gal glacial acetic acid, 1955
3	3,000 quarts (qt) chemicals, 5 cubic feet (ft^3) ortho-tolidine dihydrochloride, 1955
4	Thirteen 55-gal drums oil, grease, and paint, date unknown
5	Thirty-two 55-gal drums oil, grease, and thinner, 1955
6	3 ft^3 methyl bromide, 1955
7	40,037 units ointment (eye), 1955
8	1,700 bottles fuming nitric acid, 1954
9	3,768 1-gal cans methyl bromide, 1954
10	Ashes and metal refuse from burning pit, 1955
11	1,433 1-ounce (oz) bottles trichloroacetic acid, 1965
12	Sulphuric/hydrochloric acids, 1967
13	32 cubic yards mixed chemicals and acid, 900 lbs detergent, 7,000 lbs aluminum sulphate, 200 lbs sodium
14	Sodium, 1968
15	Sodium phosphate, 1968
16	Acid, 1969
17	Herbicide, cleaning compound, medical supplies, 1969
18	Acid, date unknown
19	Hardware (nuts and bolts)
22	XXCC3 impregnite
29	Food supplies
30	Burial site prior to bauxite storage; foods, construction debris burned; 1948
33	14 burial pits containing sodium phosphate, sodium, acid, medical supplies, chlorinated lime; 1970
Burn Sites	
21	Sanitary waste, smoke pots, CN canisters
31	Old burn area, 1946

Table 7. Description of Dunn Field Disposal and Storage Sites
(Locations of Sites are Shown on Fig. 11)
(Continued, Page 2 of 2)

Location	
Storage Sites	
25	Pesticide storage
27	Bauxite
28	Fluorspar
32	Bauxite, 1942-72
Other Sites	
20	Asphalt dump
23	Open drain ditches
24	Pistol range
26	Buried drainpipe

Unidentified contaminated wastes may be brought onpost in empty 55-gal drums used as dunnage to fill out a truckload and provide a stable configuration for transportation (blocking). No information was available on current or former drum contents. Plant personnel had accumulated a sizable number of drums (estimated to be approximately 100) that are awaiting disposal instructions in Bldg. 629. DDMT personnel have also used empty drums of unspecified condition as dunnage in their outshipments of supplies.

Large amounts of bulk chemicals that could not be placed in the sanitary landfill were buried in the north end of Dunn Field. Included were highly toxic and carcinogenic compounds, ID sets, pesticides, and foodstuffs. This chemical burial site operated from the early 1940s to the late 1970s.

2.2.3 DEMOLITION AND BURNING GROUND AREAS

There are no demolition or burning grounds currently in use at DDMT. In the past, DDMT has used several areas in an informal manner for disposal of wastes by burning.

A large trash-burning area (late 1940s to the early 1950s) was located under the current site of Section 5, Warehouse 470. When the new warehouses were constructed, the trash-burning operation moved to a location just north of the Tennessee Valley Authority (TVA) line in Dunn Field.

Burning in this area dates back to the 1940s and included CN canisters, fuses, and smokes, in addition to sanitary wastes. Operations were conducted in pits and incorporated the weekly cleanup of residue and garbage in addition to materiel. The ash was then buried in the north end of Dunn Field.

Another area in the southwest end of Dunn Field was used for burning smoke-pots, CN grenades, and souvenir ordnances (see Sec. 2.2.2). The area was covered by the bauxite storage pile in early 1949.

Wood dunnage was burned in an open area north of Warehouse 629, between the tracks and the road, from the early 1960s to the late 1970s.

2.2.4 DEMILITARIZATION

There are no demilitarization operations of mission stocks at DDMT. Limited quantities of souvenir ordnances were turned into DDMT after WW II for disposal. These items were destroyed at Dunn Field.

2.2.5 MISCELLANEOUS (SPILLS, ACCIDENTS, AND INCIDENTS)

In July 1946, a rail shipment of 250-kg, mustard-filled, German bombs en route from Mobile, Ala., to Pine Bluff, Ark., was sided on the rail classification yard at DDMT. Records indicate that some of the bomb casings were leaking and had contaminated the main rail lines as well as the freight cars that contained the munitions. A detachment from the U.S. Army Technical Escort Unit [old Chemical Warfare Systems (CWS) Guard and Security], Edgewood Arsenal, was dispatched to handle the problem. The freight train with the leaking cars was positioned on a track in front of the igloos referred to as Track No. 7 (later, Track No. 27). After the agent transfer and cleanup operations were complete, the shipment continued to Pine Bluff. The track on which the decontamination and disposal operation took place has been removed and a concrete parking area has been constructed. The area around the track was monitored for 1 year after the incident; tests were negative. Reports also indicate that several persons were treated for mustard burns as a result of this incident.

Currently, wood dunnage (i.e., damaged pallets and crates) is being dumped outside Gate 9. The wood is being removed from Government land by the public on a voluntary basis. This activity first started in the mid-1960s. It is reported that current DDMT policy forbids including pallets that are treated and/or contaminated with chemicals.

2.3 WATER QUALITY

2.3.1 SURFACE

DDMT surface waters include a small pond at the golf course (approximately 0.04 ha in area) and Lake Danielson (also known as Fire Reservoir, approximately 1.62 ha in area). The pond at the golf course receives runoff from surrounding grassland and two nearby parking lots. Influent to Lake Danielson includes golf course runoff and effluent from a storm sewer that collects discharge from approximately one-third of the installation storage facilities and adjacent areas. Overflows from these impoundments discharge to separate storm drains that eventually empty into Nonconnah Creek, approximately 1.2 km south of DDMT.

Lake Danielson effluent is currently monitored as Discharge 010 (Fire Fighter Training Area), under NPDES Permit No. TN0022322. Parameters evaluated include flow (during rain events), pH, 5-day biological oxygen demand (BOD_5), oil and grease, and suspended solids. Installation personnel reported that the discharge was in compliance with permit limits.

2.3.2 SUBSURFACE

The installation has no potable or monitoring wells, and no subsurface or groundwater monitoring data.

DDMT potable water has always been obtained from the City of Memphis. Memphis obtains its raw water exclusively from deep wells that are located in two aquifers. The Memphis sand ("500-ft" sand) is the primary water source. The Fort Pillow sand ("1,400-ft" sand) serves as a reserve for future water needs and currently supplies a few industrial wells. These aquifers are capable of supplying very large quantities of good quality water.

The Memphis water supply is maintained by Memphis Light, Gas and Water Division, a publicly owned utility. Water treatment provided consists of aeration and rapid sand filtration to remove iron, hydrogen sulfide,

and carbon dioxide. Treated water is chlorinated per State law even though the raw water is bacteria free (Parks and Lounsbury, 1976).

DDMT potable water is sampled weekly (eight samples from the distribution system) by personnel from the Installation Environmental Health Section, a tenant activity. Water samples are analyzed for pH and residual chlorine via field test kit when the samples are taken. The samples are then taken to Milan Army Ammunition Plant, Milan, Tenn., where they are picked up by an environmental specialist who transports them to Fort Campbell, Ky., for fecal coliform analyses. Plant personnel stated that the installation has experienced no difficulties with its drinking water quality.

2.3.3 NPDES PERMITS

The installation has one NPDES permit (No. TN0022322), which became effective Jan. 10, 1977, and expires Jan. 10, 1982. The permit authorizes discharges of industrial-type wastewaters (Sec. 2.2.1), along with swimming pool filter backwash water (containing suspended solids), and Lake Danielson effluent to storm drains. Discharges of pollutants from battery maintenance facilities and photographic laboratories (none identified onpost) to storm drains are specifically forbidden by the permit.

NPDES wastewater monitoring (including water sampling and analyses) are handled entirely by outside contractors. At the time of the onsite survey, the installation had no active contract. The contract with Ramcon Environmental Corporation, Memphis, Tenn., had expired at the end of calendar year 1980 (CY80), and a new contract for fiscal year 1981 (FY81) had not been written. Consequently, no current NPDES monitoring data were available.

Review of past monitoring data (last quarter of 1978 through the third quarter of 1980), reported to EPA and Tennessee Bureau of Environmental Health Services, Nashville, Tenn., indicates that DDMT has experienced

difficulties in meeting some effluent limits. During the last quarter of 1978, Discharges 004 (Vehicle Cleaning Facility), 005 (Painting and Corrosion Control Facility), and 007 (Storage and Handling of POL, Flammable, and Nonflammable Solvents) all exceeded NPDES limits for oil and grease and suspended solids. Discharge 006 (Vehicle and Equipment Maintenance Area, Bldg. 770) was subsequently connected to the sanitary sewer and is no longer a monitoring consideration. Although these discharges to the storm sewer failed to meet onpost effluent limits, the combined stormwater effluent leaving the installation (Discharge 012) still met all required NPDES discharge limits (pH, oil and grease, suspended solids, and temperature).

3.0 INSTALLATION ASSESSMENT

3.1 FINDINGS

1. DDMT mission responsibilities include the storage and distribution of DOD commodities within the south-central U.S. region and continued storage and distribution of military supplies.

2. The geology of DDMT is summarized as follows:
   a. The terrain of DDMT is uniform, with relief varying to a maximum of 11 m.
   b. Surface drainage is almost exclusively via storm drains.
   c. DDMT soil consists of moderately drained to well-drained silty deposits. The soil in the graded areas varies from clay to sandy-silt. The permeability range for the soil is 4.4×10^{-4} to 1.4×10^{-3} cm per second.
   d. The upper strata of Dunn Field, adjacent to the DDMT main area, consist of a loess layer underlain by fluvial deposits of sand and gravel, which includes a perched water element.

3. DDMT industrial operations consist of warehousing, care and preservation, and repackaging of DOD commodities; and vehicle maintenance operations.

4. Materiel proof and surveillance tests were conducted on chemical engineer items at Dunn Field.

5. DDMT has two inactive pistol ranges.

6. DDMT stores a wide range of industrial, medical, chemical stock, insecticide, and POL products. Damaged containers of industrial and POL stocks are repackaged (recouped) at Bldg. 972. Prior to

1980, recoupment was conducted at 21st and E Streets. Unserviceable chemical supplies were sold through DPDO or (until 1978) were removed by contractors. Currently, DDMT is stockpiling hazardous, unsaleable chemical stocks.

7. Two unlabeled, out-of-service transformers potentially containing PCBs are stored outside on a gravel-surfaced yard behind Bldg. 272, in violation of Federal regulations (EPA, 1980f). Subsequent to the onsite visit, the transformers were tested and determined to contain fluids of concentrations less than 50 ppm of PCB (which is not in violation of regulations).

8. Past Chemical Corps stocks at DDMT included ID Sets containing mustard and Lewisite, CN, XXC3, STP, and chlorinated lime.

9. DDMT holds a 7-mCi sealed krypton-85 source (NRC License No. 41-14911-01) for survey meter calibration. DDMT also stocks several nonlicense items (i.e., illuminating mantles for Coleman lamps, a Radiac set, and waveguide assembly).

10. DDMT stores large quantities of a wide range of pesticides for installation use and as part of the DOD commodity stockpile. The installation has reported to EPA over 70 tons of excess DDT, since this is a hazardous waste under RCRA. The integrity of the seal between the berm and the floor in Bldg. T-267 (entomology shop) is faulty, and Bldg. 1184, which currently holds excess pesticides, does not meet the recommended criteria for pesticide storage per Federal regulations (EPA, 1980g). Subsequent to the onsite visit, all DDT at DDMT has been disposed of by a DPDO contractor. The entomology shop, Bldg. T267, is scheduled for replacement by a FY83 military construction (MILCON) project. All materials in Bldg. 1184, except several canisters of methyl bromide gas, have been removed.

11. DDMT sanitary wastewater effluent is sewered to the municipal interceptor.

12. DDMT has no industrial wastewater system. The limited amounts of generated wastewater exit via the sanitary sewer or storm drains.

13. DDMT has no holding pond for wastewater. The two existing ponds at DDMT were used for water reservoir and recreational purposes in the past, and are currently used exclusively as recreational facilities. Any waste inputs to the ponds would have occurred inadvertently via surface water runoff.

14. The southwest section of Dunn Field was originally used as the sanitary landfill site for unusable subsistence stocks from the early 1940s to 1948. DDMT has subsequently utilized municipal landfills for sanitary solid waste disposal.

15. Warehouse units, built in the 1950s, were constructed on the site of a former trash-burning ground.

16. Two sections of Dunn Field were used as demolition and burning grounds. Inputs to the burning pits included smoke pots, CN tear gas grenades, trash, fuses, and demilitarized souvenir ammunition turned in after WW II.

17. Wood dunnage was burned in an open area near Warehouse 629 for approximately 20 years.

18. There was no formal demilitarization program at DDMT.

19. In 1946, a rail shipment of captured German mustard agent, in transit to Pine Bluff, was ordered rerouted to DDMT when leaks were discovered. The cleanup was performed by a CWS Guard and Security unit (Technical Escort) from Edgewood Arsenal, Md.

20. Unusable wood scraps are dumped outside of Gate 9 for removal by the public.

21. DDMT has no natural water systems flowing through the installation. All surface water flows off the installation via storm drains. The drains are monitored, under NPDES Permit No. TN0022322, for standard parameters.

22. No data exist on the quality of subsurface water systems directly below DDMT. The regional water supply is from wells into a "500-ft" sand aquifer that supplies the City of Memphis. Memphis provides DDMT its potable water supply.

23. DDMT experienced excursions in the NPDES permit oil and grease and suspended solids parameters for effluents from the vehicle maintenance facility, paint shop, and POL storage area. Subsequent to the onsite visit, these areas have been removed from the NPDES permit and connected to the sanitary sewer.

24. Nine chemical ID sets, known to contain small glass ampoules of dilute quantities of mustard and Lewisite, were buried at Dunn Field.

3.2 CONCLUSIONS

1. A potential exists for contaminant migration from DDMT via surface and subsurface routes. The burial sites at Dunn Field and spill accumulations in the old repackaging and PCP dipping vat areas have the highest potential for such migration (EPA, 1980a, 1980b; DOD, 1981; OSHA, 1974).

2. Potential safety and contamination hazards exist in the warehouses, DPDO yard, and current repackaging areas as a result of improper storage and handling of industrial chemicals (EPA, 1980d).

3. Excess pesticides/industrial chemicals and pesticides/industrial chemicals stored for recoupment or disposal are improperly stored due to lack of facilities. DDMT has requested a Hazardous Materials Recoupment Facility as an exigent minor construction project to alleviate this problem. DPDO Memphis has identified to DPDS (Battle Creek, Mich.) a need for a conforming storage facility at the DPDO yard.

4. There is a potential for leakage from underground POL storage tanks because the integrity of the underground POL tanks has not been checked (DLA, 1974; EPA, 1980e).

3.3 RECOMMENDATIONS

That a survey be performed by DLA to determine if any contaminants are migrating offpost via surface and subsurface waters. It should include as a minimum the Dunn Field burial zones, the repackaging area, and the PCP dipping tank area.

That DDMT do the following:

1. Upgrade the handling and storage procedures and facilities in the warehouses, repackaging area, and DPDO yard with regard to hazardous and incompatible chemicals.
2. Properly store pesticides.
3. Test underground POL storage tanks for leakage on a regular basis.

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APPENDIX A

FEDERALLY PROTECTED FAUNA OF THE MEMPHIS AREA

APPENDIX A

FEDERALLY PROTECTED FAUNA

OF THE MEMPHIS AREA

Mammals

Canis rufus
  Red wolf
Felis concolor coryi
  Florida panther
Felis concolor cougar
  Eastern cougar
Myotis sodalis
  Indiana bat

Birds

Dendrocopos borealis
  Red-cockaded woodpecker
Falco peregrinus anatum
  American peregrine falcon
Falco peregrinus tundrius
  Arctic peregrine falcon
Grus americana
  Whooping crane
Grus canadensis pulla
  Mississippi sandhill crane
Pelecanus occidentalis
  Brown pelican
Vermivora bachmanii
  Bachman's warbler

Fish

Etheostoma nuchale
  Watercress darter

APPENDIX B

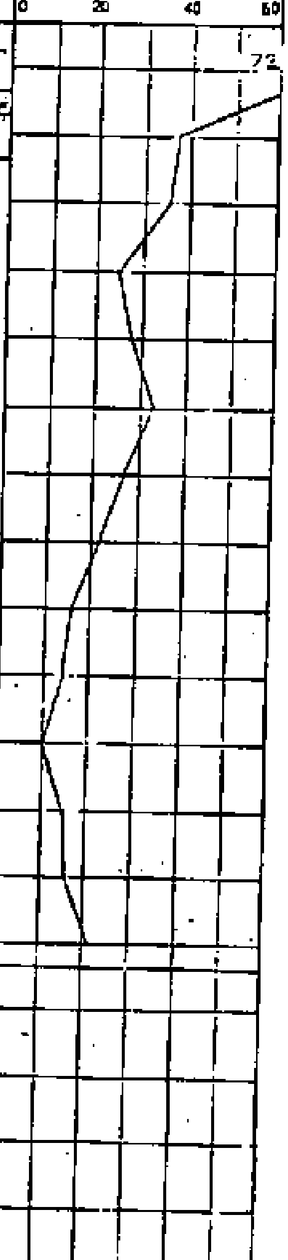
BORING LOGS FOR LOCATIONS 1 THROUGH 7

BORING LOG-S	South Atlantic	INSTALLATION: Mobile District	
1. PROJECT: [illegible] DEFENSE DEPOT		10. SIZE AND TYPE OF BIT	
2. LOCATION: [illegible] 202,660		11. DATUM FOR ELEVATION SHOWN: M[illegible]L	
3. DRILLING AGENCY: MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO.: M-16-73		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	
5. NAME OF DRILLER: B. PARKER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: X VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: NONE	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 11-9-73 COMPLETED 11-9-73	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: [illegible]	
9. TOTAL DEPTH OF HOLE: 21.0'		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR: F. KELLY	

W/C %	DEPTH	CLASSIFICATION OF MATERIALS (DESCRIPTION)
5	0–1.5	BROWN PR. GRD. CLAYEY GRAVEL (GP-GC)
14	1.5–3.0	BROWN LEAN CLAY (CL) W/TR. GRAVEL & LITTLE SAND, LL=47, PL=24, PI=23
17, 18	3.0–	BROWN INORG. SILT (ML) W/LITTLE SAND & TR. GRAVEL
		BROWN INORG. SILT (ML) W/TR. SAND
		BROWN CLAYEY INORG. SILT (ML) W/TR. SAND
	21.0	BOTTOM OF HOLE

Depth scale: 1.5, 3.0, 6.0, 9.0, 12.0, 15.0, 18.0, 21.0, 24.0, 27.0

STANDARD PENETRATION (BLOWS PER FOOT)



ENG FORM 527

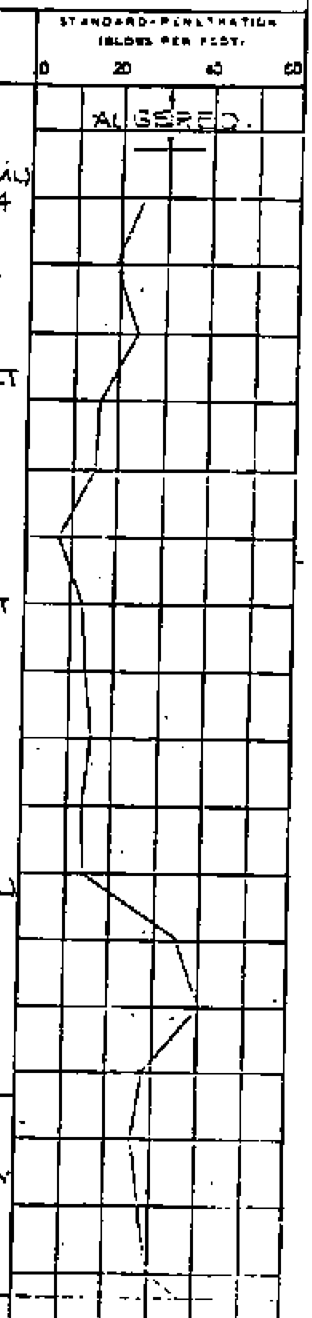
HOLE NO. M-[illegible]-73

Boring Location 1

BORING LOGS	DIVISION South Atlantic	INSTALLATION Mobile District	SHEET
1. PROJECT MEMPHIS DEFENSE DEPOT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station) N 275,748 E 502,144		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number) M-10-78		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	
5. NAME OF DRILLER B. PARKER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NONE	
		16. DATE HOLE STARTED 12-5-78 COMPLETED 12-5-78	
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE 300.4	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	
9. TOTAL DEPTH OF HOLE 30.0'		19. SIGNATURE OF INSPECTOR F. KELLY	

W/C %	DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)
9			BROWN SANDY INORG. SILT (ML) W/ LITTLE GRAVEL
17	3.0		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND, LL=39, PL=25, PI=14
22			BROWN INORG. SILT (ML) W/ TR. SAND
22	6.0		
22			BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND
24	9.0		BROWN INORG. SILT (ML)
24	12.0		BROWN CLAYEY INORG. SILT (ML)
24	15.0		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND & GRAVEL
	18.0		BROWN CLAYEY INORG. SILT (ML) W/ LITTLE SAND
22	21.0		TAN-BROWN CLAYEY INORG. SILT (ML) W/ LITTLE SAND
	22.5		BROWN-GRAY CLAYEY INORG. SILT (ML) W/ TR. SAND
	24.0		
21	27.0		GRAY-BROWN SILTY LEAN CLAY (CL) W/ TR. SAND

STANDARD PENETRATION (BLOWS PER FOOT)

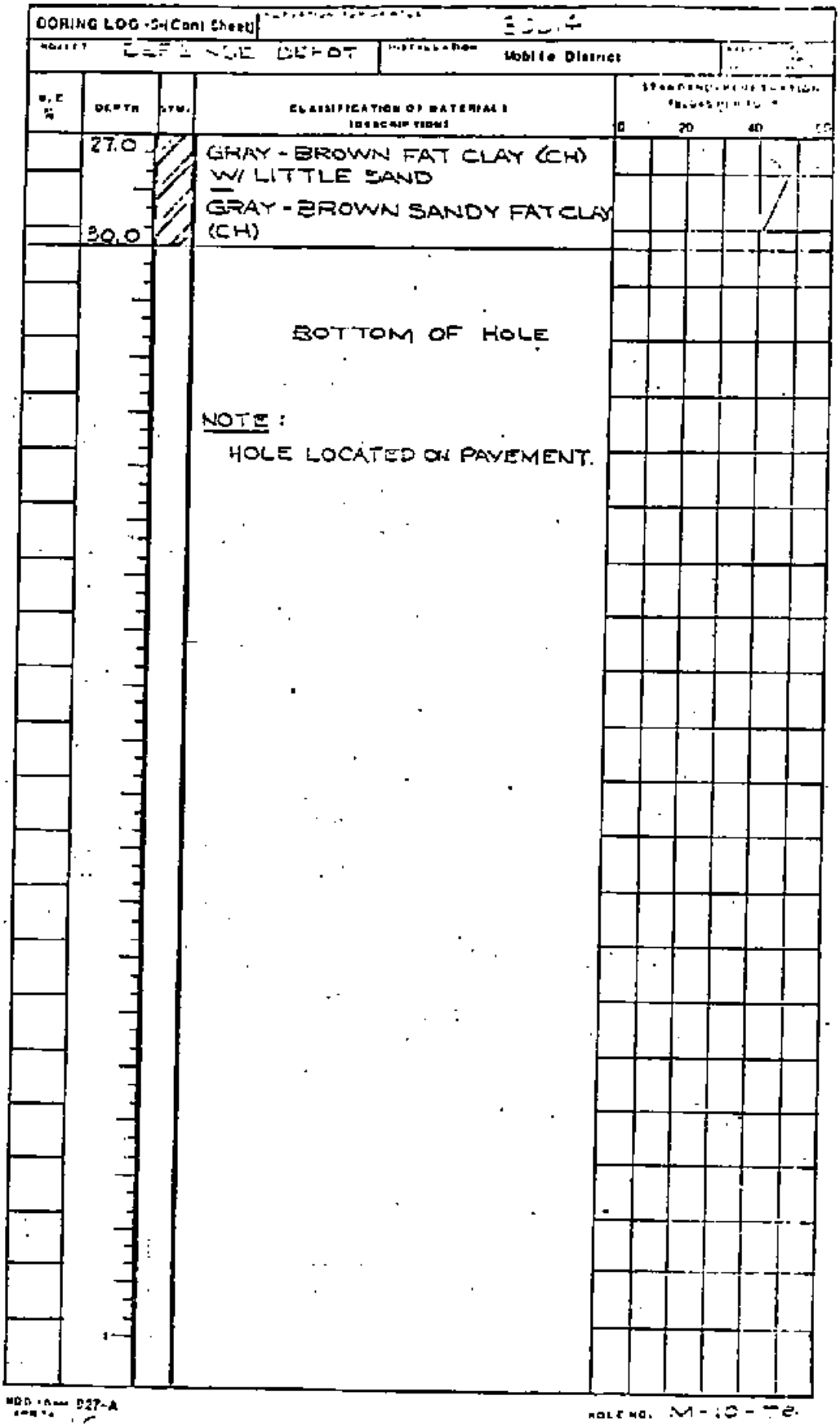


CONTINUED ON SHEET 2

SAD FORM 927

HOLE NO. M-10-78

Boring Location 2 (Sheet 1 of 2)



Boring Location 2 (Sheet 2 of 2)

96 304

BORING LOGS	Division: South Atlantic	Installation: Mobile District	Sheet 1 of 1 sheets
1. Project: MEMPHIS DEFENSE DEPOT		10. Size and type of bit	
2. Location (Coordinates or Station): N 278 230 E 803,974		11. Datum for elevation shown (TBM or MSL): MSL	
3. Drilling Agency: MOBILE DISTRICT		12. Manufacturer's designation of drill	
4. Hole No. (As shown on drawing title and file number): M-22-78		13. Total no. of overburden samples taken: Disturbed / Undisturbed	
5. Name of Driller: B. PARKER		14. Total number core boxes	
6. Direction of Hole: ☒ Vertical ☐ Inclined ____ deg. from vert.		15. Elevation ground water: NONE	
7. Thickness of Overburden		16. Date Hole: Started 12-4-78 Completed 12-4-78	
8. Depth Drilled into Rock		17. Elevation top of hole: 304.9	
9. Total Depth of Hole: 21.0'		18. Total core recovery for boring: %	
		19. Signature of Inspector: F. KELLY	

W/C %	Depth	Sym	Classification of Materials (Description)	Standard Penetration (Blows per foot) 0 20 40 60
18			BROWN INORG. SILT (ML) W/ LITTLE SAND & TR. GRAVEL & ROOTS	
21	3.0			
27				
28	6.0			
29				
	9.0		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND	
23				
	12.0			
	15.0			
	18.0			
	21.0		BOTTOM OF HOLE	
	24.0			
	27.0			

MCE Form 927 APR 76

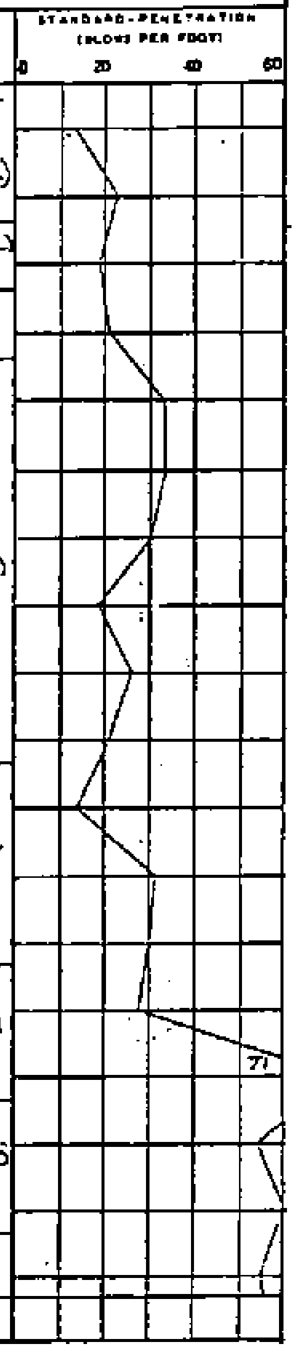
HOLE NO. M-22-78

Boring Location 3

BORING LOG	Division: South Atlantic	Installation: Mobile District	Sheet 1 of 2 sheets

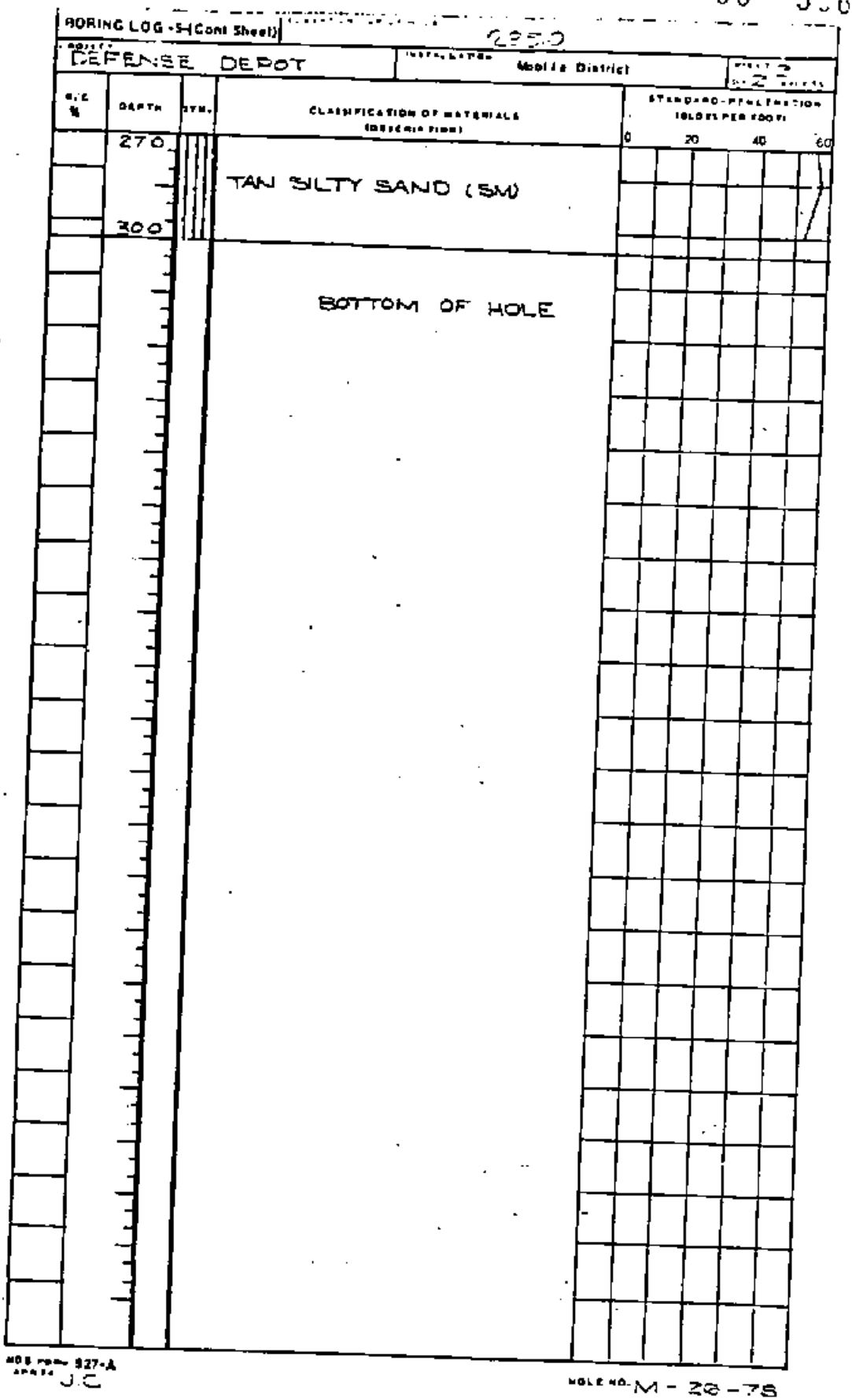
1. Project: MEMPHIS DEFENSE DEPOT	10. Size and type of bit:
2. Location (Coordinates or Station): N 276,535 E 804,009	11. Datum for elevation shown (TBM or MSL): MSL
3. Drilling agency: MOBILE DISTRICT	12. Manufacturer's designation of drill:
4. Hole No. (As shown on drawing title and file number): M-26-78	13. Total no. of over-burden samples taken: Disturbed: / Undisturbed:
5. Name of driller: B. PARKER	14. Total number core boxes:
6. Direction of hole: ☒ Vertical ☐ Inclined ____ deg. from vert.	15. Elevation ground water: NONE
7. Thickness of overburden:	16. Date hole: Started 12-1-78 Completed 12-1-78
8. Depth drilled into rock:	17. Elevation top of hole: 295.0
9. Total depth of hole: 30.0'	18. Total core recovery for boring: %
	19. Signature of inspector: F. KELLY

W/C %	DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)
23			DK. BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND
17	3.0		DK. BROWN CLAYEY INORG. SILT(ML) W/TR. SAND, LL=35, PL=24, PI=11
22	4.5		BROWN SILTY LEAN CLAY(CL) W/ TR. SAND
22	6.0		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND
22			TAN SILTY LEAN CLAY (CL) W/ LITTLE SAND
22	9.0		
	12.0		BROWN SILTY LEAN CLAY (CL) W/ TR. SAND
	15.0		
16			BROWN SILTY FAT CLAY (CH) W/ LITTLE SAND
			REDDISH BROWN & TAN SANDY FAT CLAY (CH)
	18.0		REDDISH BROWN SANDY FAT CLAY (CH)
	19.5		
	21.0		REDDISH BROWN SANDY LEAN CLAY (CL)
	22.5		
	24.0		REDDISH BROWN CLAYEY SAND (SC)
	25.5		TAN SILTY SAND (SM)
	27.0		CONTINUED ON SHEET 2



ENG FORM 1836 — HOLE NO. M-26-78

Boring Location 4 (Sheet 1 of 2)

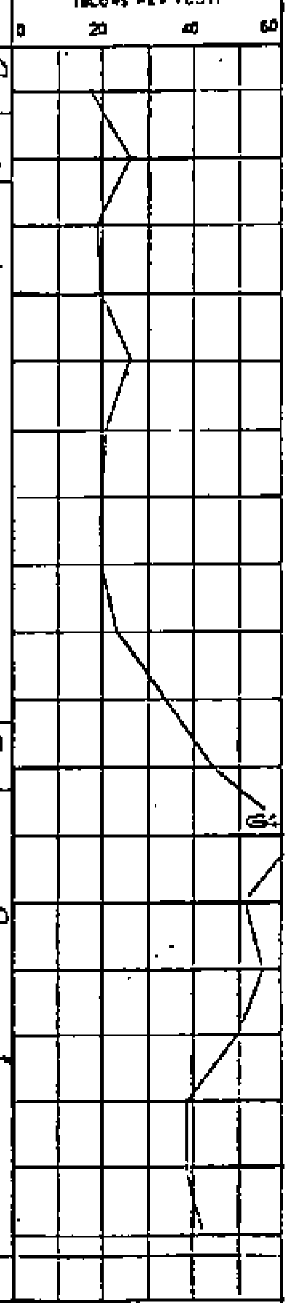


Boring Location 4 (Sheet 2 of 2)

BORING LOG-5	DIVISION South Atlantic	INSTALLATION Mobile District	SHEET 1 OF 2 SHEETS
1. PROJECT MEMPHIS DEFENSE DEPOT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY MOBILE DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number) M-20-78		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER B. PARKER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.		15. ELEVATION GROUND WATER NONE	
		16. DATE HOLE	STARTED 12-4-78 / COMPLETED 12-4-78
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE 30.0'		19. SIGNATURE OF INSPECTOR F. KELLY	

W/C %	DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)
30	0 – 1.5		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND & ROOTS
15	1.5 – 3.0		BROWN LEAN CLAY (CL) W/ LITTLE SAND, LL=36, PL=21, PI=15
22	3.0 –		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND & ROOTS
21			
22	6.0		
24			LT. BROWN CLAYEY INORG SILT (ML) W/ TR. SAND
23	9.0		
	12.0		
	15.0		
18	15.0 – 16.5		REDDISH BROWN SANDY LEAN CLAY (CL)
	16.5 – 22.5 (18.0, 21.0)		REDDISH BROWN CLAYEY SAND (SC)
	22.5 – 27.0 (24.0)		TAN SILTY SAND (SM)
	27.0		CONTINUED ON SHEET 2

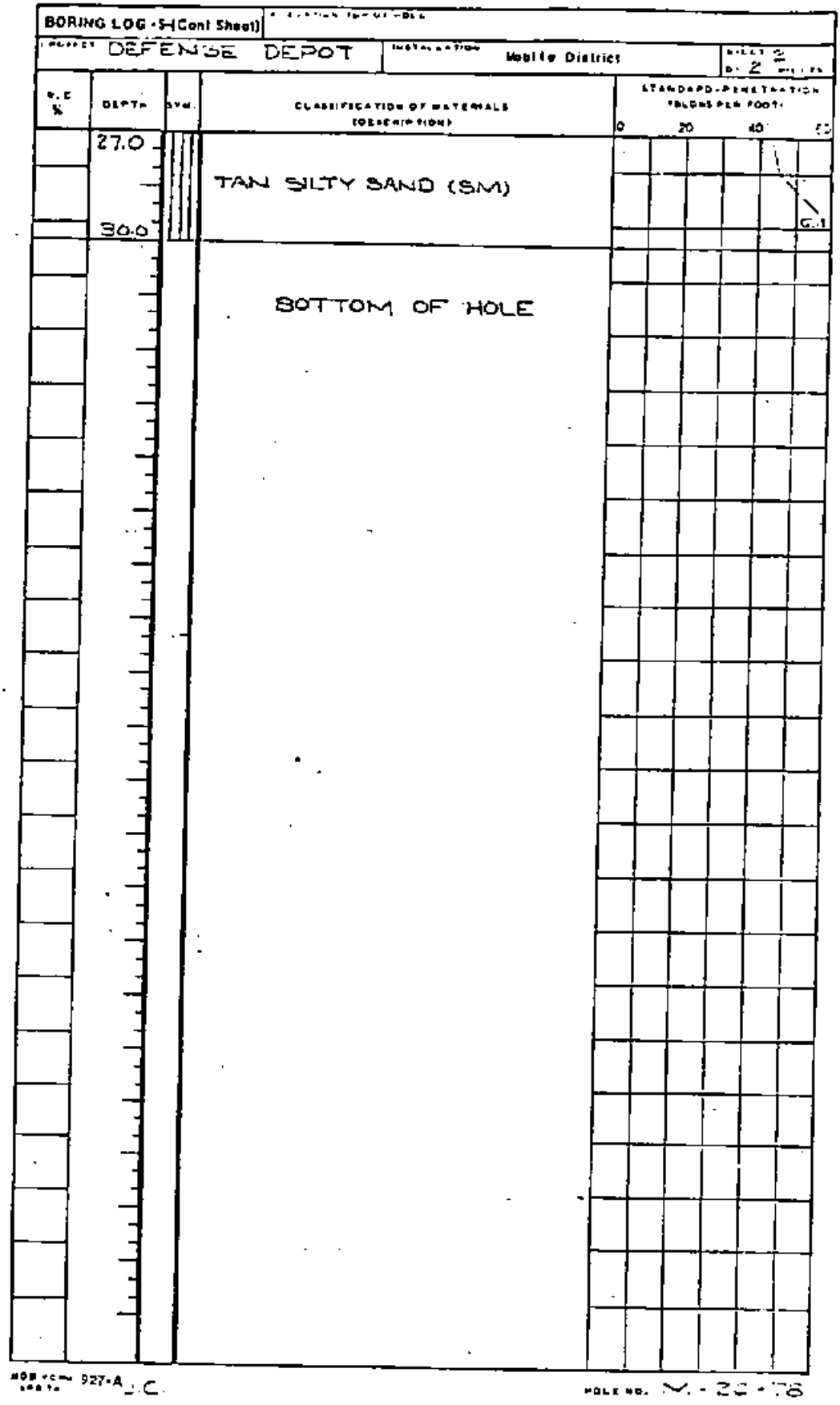
STANDARD PENETRATION (BLOWS PER FOOT)



SAD FORM 827

HOLE NO. M-20-78

Boring Location 5 (Sheet 1 of 2)



Boring Location 5 (Sheet 2 of 2)

BORING LOG-S | Division: South Atlantic | Installation: Mobile District | Sheet 1 of 2 Sheets

1. PROJECT: MEMPHIS DEFENSE DEPOT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: MOBILE DISTRICT
4. HOLE NO. (As shown on drawing title) and sheet number: M-1-78
5. NAME OF DRILLER: B. PARKER
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 30.0'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (MSL or MLW): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED _____ UNDISTURBED _____
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: NONE
16. DATE HOLE: STARTED 12-5-78 COMPLETED 12-5-78
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR: F. KELLY

W/C %	DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	STANDARD PENETRATION (BLOWS PER FOOT) 0 20 40 60
26	1.5		BROWN INORG. SILT (ML) W/ TR. SAND & SOME ROOTS	
20	3.0		BROWN LEAN CLAY (CL) W/ TR. SAND & TR. ROOTS, LL=42, PL=23, PI=19	
24			BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND	
25	6.0			
29				
29	9.0			
30			BROWN INORG. SILT (ML) W/ TR SAND	
	12.0			
	15.0		BROWN CLAYEY INORG SILT (ML) W/ LITTLE SAND	
24				
	18.0		BROWN CLAYEY INORG SILT (ML) W/ TR. SAND	
	19.5			
			BROWN SILTY LEAN CLAY (CL) W/ LITTLE SAND	
	21.0			
			LT. BROWN CLAYEY INORG. SILT (ML)	
	24.0			
23			BROWN CLAYEY INORG. SILT (ML)	
	27.0		CONTINUED ON SHEET 2	

NAVFAC FORM 9-27 | HOLE NO. M-1-78

Boring Location 6 (Sheet 1 of 2)

BORING LOG-S-(Cont Sheet)

PROJECT: MEMPHIS DEFENSE DEPOT

INSTALLATION: Mobile District

SHEET 2 OF 2 SHEETS

R.C. %	DEPTH	SYM.	CLASSIFICATION OF MATERIALS (DESCRIPTION)	STANDARD PENETRATION (BLOWS PER FOOT) 0 20 40 60
	27.0		BROWN CLAYEY SAND (SC)	
	30.0		BOTTOM OF HOLE	

HOLE NO. M-1-TS

Boring Location 6 (Sheet 2 of 2)

BORING LOG-S | Division: South Atlantic | Installation: Mobile District | Sheet: of sheets

1. PROJECT: MEMPHIS DEFENSE DEPOT
2. LOCATION (Coordinates or Station): N 277,293 E 806,016
3. DRILLING AGENCY: MOBILE DISTRICT
4. HOLE NO. (As shown on drawing title): M-25-78
5. NAME OF DRILLER: B. PARKER
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 21.0'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (GS or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED ____ UNDISTURBED ____
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: DEPTH 10.5'
16. DATE HOLE: STARTED 12-5-78 COMPLETED 12-5-78
17. ELEVATION TOP OF HOLE: 305.3
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: F. KELLY

W/C %	DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	STANDARD PENETRATION (BLOWS PER FOOT) 0 20 40 60
21	1.5		BROWN-TAN INORG. SILT (ML) W/ LITTLE SAND & TR. ROOTS	
20	3.0		GRAY & BROWN LEAN CLAY (CL) W/ TR. SAND, LL=44, PL=22, PI=22	
22	4.5		BROWN & TAN CLAYEY INORG. SILT (ML) W/ TR. SAND	
25	6.0		BROWN SILTY LEAN CLAY (CL) W/ TR. SAND	
26	7.5		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND	
28	9.0		BROWN SILTY LEAN CLAY (CL) W/ TR. SAND	
	12.0			
	15.0		BROWN CLAYEY INORG. SILT (ML) W/ TR. SAND	
23	18.0			
	21.0		BROWN CLAYEY INORG. SILT (ML) W/ LITTLE SAND & TR. GRAVEL	
	24.0		BOTTOM OF HOLE	
	27.0			

ENG FORM 327 APR 74
J.C.

HOLE NO. M-25-78

Boring Location 7

APPENDIX C
HAZARDOUS WASTE PERMIT APPLICATION
AND DUMT CHEMICAL STOCKS

EPA — GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. GENERAL

I. EPA I.D. NUMBER

F | | | | | | | | | | | | ID

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI (except VI-B which must be completed regardless). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

Defense Depot Memphis
2163 Airways Blvd.
Memphis, TN 38114

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X	
B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		
D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X	
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	
J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 | SKIP | DEFENSE DEPOT MEMPHIS

IV. FACILITY CONTACT

	A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
2	HIXSON ROBERT MAJ FAC ENGR	901 744 5241

V. FACILITY MAILING ADDRESS

	A. STREET OR P.O. BOX	B. CITY OR TOWN	C. STATE	D. ZIP CODE
3	2163 AIRWAYS BLVD			
4		MEMPHIS	TN	38114

VI. FACILITY LOCATION

	A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER	B. COUNTY NAME	C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
5	2163 AIRWAYS BLVD	SHELBY				
6			MEMPHIS	TN	38114	

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

96 314

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
7699 See Block XII	(specify)
C. THIRD	**D. FOURTH**
(specify)	(specify)

VIII. OPERATOR INFORMATION

A. NAME

DEFENSE LOGISTICS AGENCY

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL M = PUBLIC (other than federal or state)
S = STATE O = OTHER (specify)
P = PRIVATE

F (specify)

D. PHONE (area code & no.) A 901 744 5241

E. STREET OR P.O. BOX

2163 AIRWAYS BLVD

F. CITY OR TOWN

MEMPHIS

G. STATE TN

H. ZIP CODE 38114

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)
9 N TN 0022322	8 P
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**
9 U	9 (specify)
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**
9 R	8 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

Receive, store, and ship goods for various military services and DoD. Goods handled by this Depot include the following major categories: clothing and textiles, construction materials, automotive parts, aircraft parts, metals, medical supplies, subsistance items, packaged petroleum products, pesticides, herbicides, chemicals, general supplies. The Memphis office of the Defense Property Disposal Service is a tenant organization and handles materials of all descriptions for resale. Goods are received and shipped by truck, rail, and air.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

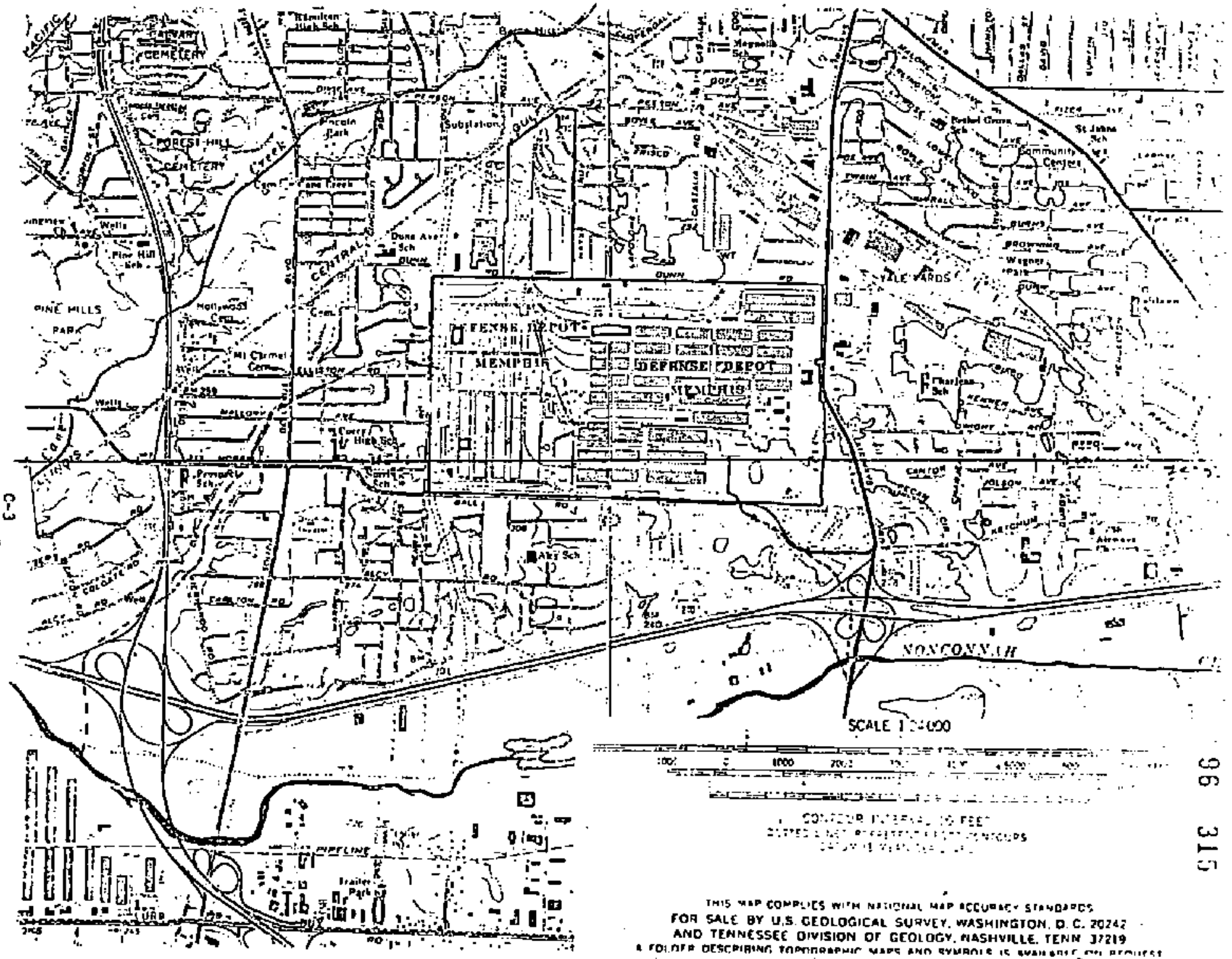
A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
RONALD N. BOWMAN, COL, USA Commander	Ronald N. Bowman	16 OCT 80

COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 3510-1 (6-80) REVERSE

* U.S. GOVERNMENT PRINTING OFFICE: 1980—323-829/6355



C-3

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242
AND TENNESSEE DIVISION OF GEOLOGY, NASHVILLE, TENN 37219
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

96 315

FORM 3 RCRA — EPA

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in item I above.

A. FIRST APPLICATION *(Place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)* (Date Construction Commenced): 8 | 41 | 07 | 11

[ ] 2. NEW FACILITY *(Complete item below.)*

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN: YR. | MO. | DAY

B. REVISED APPLICATION *(Place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES — CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.

1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR OR GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	O
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	S01	10,000	G		7				
2	S04				8				
3					9				
4					10				

I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY	
	W DUP	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	P122	With the exception		S01	Wastes are generated only when
2	P029	of DDT (EPA Hazard		S01	stock becomes unusable either
3	P013	No. U061), all		S01	through damage, overage, or stock
4	U056	items listed in		S01	items being banned (e.g. DDT).
5	U072	this part are		S01	Recoupment is used as much as
6	U121	generated intermit-		S01	possible to minimize losses to
7	U134	tently and in small		S01	waste and keep quantity of waste
8	U161	quantities. We		S01	to absolute minimum. Container
9	P022	have approximately		S01	sizes range up to 55 gal. drum.
10	U222	70 tons of DDT		S01	Wastes are stored only until they
11	U044	(U061) on hand		S01	can be disposed of by approved
12	P012	pending disposal		S01	methods by approved contractors
13	U108	at some future date.		S01	at approved disposal sites. We
14	U140			S01	anticipate very short (<90 days)
15	U193			S01	holding time for almost all items
16	U232			S01	prior to disposal once the RCRA
17	U080			S01	program is well established.
18	U228			S01	Items such as DDT for which no
19	U220			S01	authorized disposal method exists
20	U210			S01	will be an exception.
21	P037			S01	
22	U144			S01	
23	U159			S01	
24	U051			S01	
25	U057			S01	
26	U102			S01	

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CONTINUE ON REVERSE

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)
USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

F		T/A	C
			6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail)*.

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground-level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail)*.

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
35 05 15 N	090 00 00 W

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E DEPARTMENT OF THE ARMY	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F 20 MASSACHUSETTS AVE.	G WASHINGTON	DC	20314

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
RONALD N. BOWMAN, COL, USA Commander	Ronald N Bowman	16 Oct 80

EPA Form 3510-3 (6-80)

CONTINUE ON PAGE 5

W | DUP | 2 | DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	U122			S01	
2	U151			S01	
3	U196			S01	
4	U205			S01	
5	U043			S01	
6	U188			S01	
7	P065			S01	
8	U159			S01	
9	U154			S01	
10	U002			S01	
11	U117			S01	
12	P009			S01	
13	P105			S01	
14	U019			S01	
15	U211			S01	
16	P099			S01	
17	P073			S01	
18	P104			S01	
19	U054			S01	
20	U061			S01	
21	U112			S01	
22	U123			S01	
23	U160			S01	
24	P020			S01	
25	P098			S01	
26	U013			S01	

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CONTINUE ON REVERSE

Continued from page 2
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

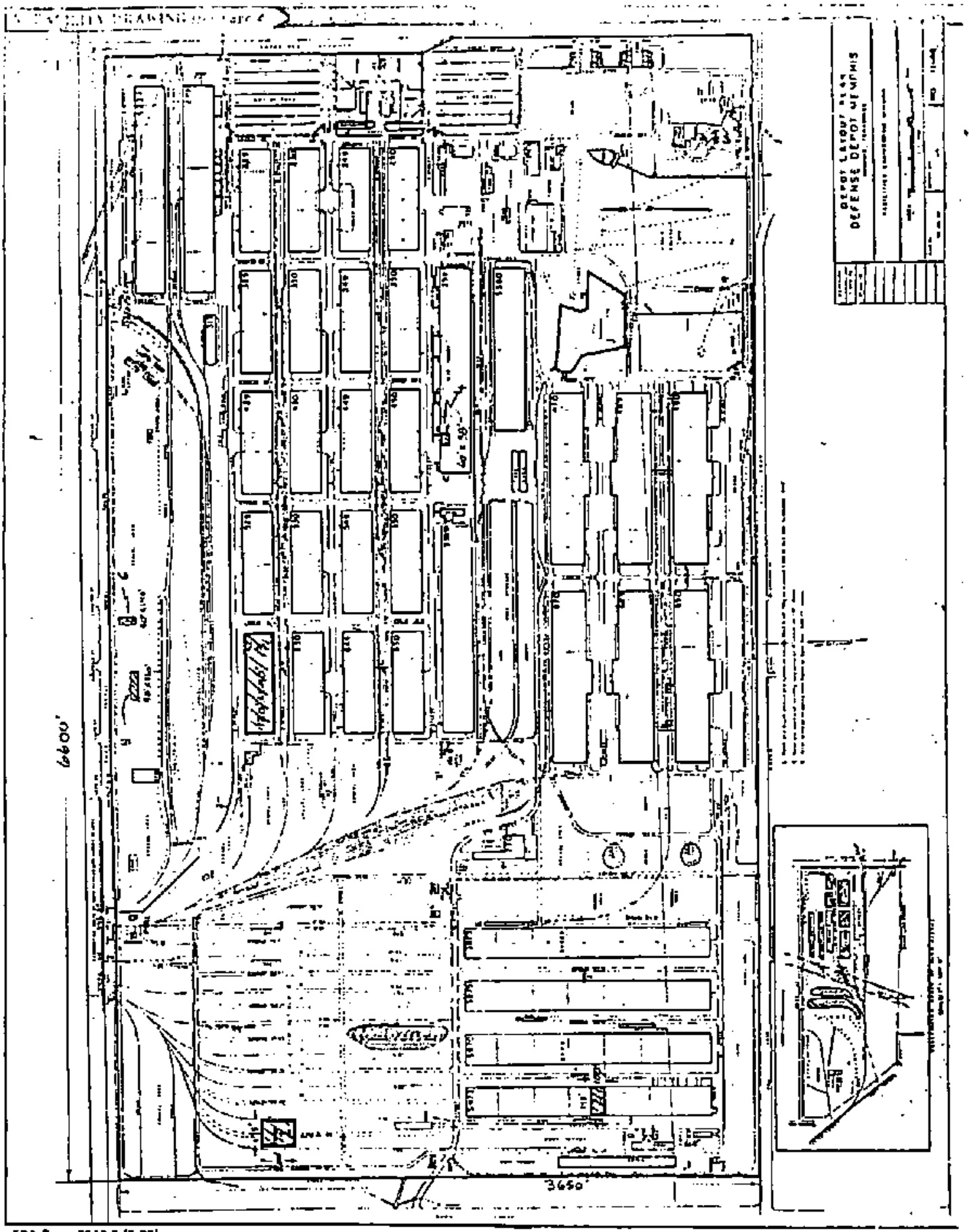
EPA I.D. NUMBER (enter from page 1)		FOR OFFICIAL USE ONLY	
W	1	W DUP	2 DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	P030	Intermittant Small Quantities		S01	
2	P005			S01	
3	U165			S01	
4	P070			S01	
5	P076			S01	
6	U239			S01	
7	U032			S01	
8	U229			S01	
9	U200			S01	
10	U226			S01	
11	P106			S01	
12	P021			S01	
13	D013			S01	
14	U036			S01	
15	F019			S01	
16	D001			S01	
17	D002			S01	
18	D003			S01	
19	D000			S01	
20					
21					
22					
23					
24					
25					
26					

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE


DEFENSE DEPOT MEMPHIS
6600'
3650'

NOTES FOR DEPOT LAYOUT PLAN

ITEM 1. Flammable Materials Storage, X-25 Area: Leaking flammable materials containers are stored here until material can be recouped. Facility consists of concrete pad with concrete curb around it to contain any leaks or spills.

ITEM 2. Recoup Area, Bldg. 972, Section3: Area is covered shed where materials in damaged containers are repoured or overpacked for re-issue or stored for disposal.

ITEM 3. Hazardous Materials Warehouse, Bldg. 629: Storage area for acids, bases, corrosives, pesticides, herbicides and rodenticides. Damaged or overage items identified in this building are moved to Bldg. 972. These movements are entirely on the Depot property.

ITEM 4. Medical Warehouse, Bldg. 359: One room in this building is used to store all unserviceable medical items. The number and quantity of these items that are hazardous is extremely small. All medical wastes are held here until disposal.

ITEM 5. Flammable Storage Area for PDO: The Defense Property Disposal Office uses this area for short-term storage of flammable items for resale or possible disposal. Used motor oils are sold for re-refining or BTU recovery.

ITEM 6. Non-Flammable Storage Area for PDO: The Defense Property Disposal Office uses this area for short-term storage of non-flammable items for resale or possible disposal.

DDMT-HH (MAJ Hinson/(901)744-5241/mi)

SUBJECT: DDMT Application for RCRA Permit

U. S. Environmental Protection Agency, Region IV
ATTN: Mr. Andrew Ryan
345 Courtland St., N. E.
Atlanta, GA 30365

Dear Mr. Ryan:

Enclosed is the Defense Depot Memphis (DDMT) application for a Hazardous Waste Permit, EPA ID No. TN4210020570.

Please note on EPA Form 3510-3 page 4 that I have signed as owner/operator. This is a change to our original submission. After our first submission, we received guidance from Headquarters, Defense Logistics Agency (DLA) that Depot Commanders would sign as owner and operator. The property is legally owned by Department of the Army but DLA has total responsibility for activities on the property.

We have made every effort to complete Part IV of EPA Form 3510-3, Description of Hazardous Wastes, per your instructions. Since we have no processes that generate hazardous wastes on a regular basis, it is impossible to make an estimate of annual wastes generated. For this reason we have listed the quantities we have on hand at this time for items now awaiting disposal. All the other items listed either have been or may be generated in small quantities. If EPA needs a number for each item solely to fill a data field in a computerized information management system, we have no objection to 1 lb. being used as estimated annual quantity generated so long as you recognize that the number is used only to maintain the item in the listing of hazardous materials we may generate. Our annual reports will show amounts of each item generated in the reporting period.

This installation is a Defense Depot with a Defense Property Disposal Office (DPDO) as a tenant activity. The Depot activities generate hazardous wastes when stock becomes contaminated, exceeds age limitations, or its container is

PE	DL	WC	FP	[illegible]	[illegible]	DG	UT	
1	2							

DPDT-HH
Mr. Andrew Ryan
U. S. Environmental Protection Agency, Region IV

damaged. We then attempt to recoup the item and return it to stock. If it cannot be salvaged for reissue, it is reported to DPDO for disposition. The disposal office will attempt to sell the item for recycling, re-refining, or for use. Failing the sale of an item, the DPDO then will dispose of it through a contractor. In addition to the materials received from DPDT, the DPDO Memphis also may receive hazardous materials from several other DoD installations in the region.

We are determined to meet the RCRA requirements and are committing considerable resources toward that end. Should you have any questions on this application, please contact MAJ Robert A. Hixson at 901-744-5241.

Sincerely,

Signed

1 Encl

RONALD N. BOWMAN
Colonel, USA
Commander

EPA I.D. NUMBER: VTN421002057 0

FOR OFFICIAL USE ONLY: W DUP 2 DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	U002	20 160	G		See cover letter.
2	U013	See cover letter.			"
3	U019	"			"
4	U032	220 1760	G		"
5	U036	355 Lbs.			"
6	U041	See cover letter.			"
7	U043	"			"
8	U051	"			"
9	U054	17 136	G		"
10	U057	See cover letter.			"
11	U061	71+ Tons			"
12	U072	See cover letter.			"
13	U080	"			"
14	U102	"			"
15	U108	"			"
16	U112	"			"
17	U117	190 1520	G		"
18	U121	See cover letter.			"
19	U122	"			"
20	U123	"			"
21	U134	3764 30112	G		"
22	U139	See cover letter			"
23	U140	"			"
24	U144	"			"
25	U151	"			"
26	U154	"			"

EPA Form 3510-3 (6-80)

(enter "A", "B", "C", etc. behind the "F" to identify photocopied pages)

CONTINUE ON REVERSE

Excel 1

EPA I.D. NUMBER (enter from page 1): T X D 0 4 2 1 0 0 2 0 5 7 0 | W | DUP | 2 | DUP

FOR OFFICIAL USE ONLY

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	U159	115 920	G		See cover letter.
2	U160	See cover letter.			"
3	U161	"			"
4	U165	"			"
5	U188	"			"
6	U193	"			"
7	U196	"			"
8	U200	"			"
9	U205	60 Bottles			"
10	U210	See cover letter.			"
11	U211	"			"
12	U220	"			"
13	U226	"			"
14	U228	67 576	G		"
15	U229	See cover letter			"
16	U232	"			"
17	U239	"			"
18	P005	30 Lbs.			"
19	P009	See cover letter			"
20	P012	"			"
21	P013	"			"
22	P020	"			"
23	P021	40 Lbs.			"
24	P022	See cover letter			"
25	P029	"			"
26	P030	"			"

EPA Form 3510-3 (6-80)

(enter "A", "B", "C", etc. behind the "1" to identify photocopied pages)

CONTINUE ON REVERSE

EPA I.D. NUMBER (enter from page 1): T R 4 2 1 0 0 2 0 5 7 0

W DUP DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1	P037	60#			See cover letter.
2	P065	See cover letter			"
3	P070	"			"
4	P073	"			"
5	P076	"			"
6	P098	"			"
7	P099	"			"
8	P104	"			"
9	P105	"			"
10	P106	53 BT 166			"
11	P122	See cover letter			"
12	D001	< 1000 Pounds	G		"
13	D002	< 1000 Pounds	G		"
14	D003	< 1000 Pounds	G		"
15	D008	550 Lbs.			"
16	D013	30 Lbs.			"
17	D000	1000 Lbs.	G		"
18					

...TION OF HAZARDOUS WASTES (continued)

...USE THIS LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

F	T	N	4	2	1	0	0	2	0	5	7	0	3	6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail)*.

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground-level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail)*.

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)			LONGITUDE (degrees, minutes & seconds)		
34	05	15 N	09	06	08 W

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
RONALD N. BOWMAN, Colonel, USA Commander		

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
RONALD N. BOWMAN, Colonel, USA Commander		

WASTES ALREADY REPORTED TO EPA

EPA HW #	Name
U002	Acetone
U013	Asbestos
U019	Benzene
U032	Calcium Chromate
U036	Chlordane
U041	1 Chloro-2,3-epoxypropane
U043	Chloroethene
U051	Cresote
U054	Cresylic Acid
U056	Cyclohexane
U057	Cyclohexanon
U061	DDT
U072	1,4-Dichlorobenzene
U080	Dichloromethane
U102	Dimethyl Phthalate
U108	1,4-Dioxane
U112	Ethyl Acetate
U117	Ethyl Ether
U121	Fluorotrichloromethane
U122	Formaldahyde
U123	Formic Acid
U134	Hydrofluoric Acid
U139	Iron Dextran
U140	Isobutyl Alcohol
U144	Lead Acetate
U151	Mercury
U154	Methanol
U159	Methyl Ethyl Ketone
U160	Methyl Ethyl Ketone Peroxide
U161	Methyl Isobutyl Ketone
U165	Napthalene

WASTES ALREADY REPORTED TO EPA
(Continued, Page 2 of 3)

EPA HW #	Name
U188	Phenol
U193	1,3-Propane Sultone
U196	Pyridine
U200	Reserpine
U205	Selenium Sulfide
U210	Tetrachloroethene
U211	Tetrachloromethane
U220	Toluene
U226	1,1,1-Trichloroethane
U228	Trichloroethene
U229	Trichlorofluoromethane
U232	2,4,5-Trichlorophenoxyacetic Acid
U239	Xylene
D001	Ignitable wastes not listed
D002	Corrosive wastes not listed
D003	Reactive wastes not listed
D013	Lindane
P005	Allyl Alcohol
P009	Ammonium Picrate
P012	Arsenic Trioxide
P013	Barium Cyanide
P020	2-Sec-Butyl-4,6-Dinitrophenol
P021	Calcium Cyanide
P022	Carbon Disulfide
P029	Copper Cyanide
P030	Cyanides
P037	Dieldrin
P065	Mercury Fulminate
P070	2-Methyl-2-(Methylthio) Propionaldehyde-O-(Methylcarbonyl) Oxime

WASTES ALREADY REPORTED TO EPA
(Continued, Page 3 of 3)

EPA HW #	Name
P073	Nickel Carbonyl
P076	Nitric Oxide
P098	Potassium Cyanide
P099	Potassium Silver Cyanide
P104	Silver Cyanide
P105	Sodium Azide
P106	Sodium Cyanide
P122	Zinc Phosphide (R,T,)

THAMA-G.1/MEM/APPC.4
5/5/82

HAZARDOUS MATERIALS IN DPDO MEMPHIS INVENTORY
(Items Marked * Are Stored at DPDO, Others by DDMT-I)

NSN	Material	Location	Quantity	EPA HW #
810-00-184-4796	Acetone		4 CN (20 #)	U002
810-00-230-3938	Calcium Chromate		4 DR (200 G)	U032
810-00-281-2039	Sodium Cyanide, Tech		53 BT (165 #)	P106
810-00-280-2763	Methyl Ethyl Keytone	*	2 DR (100 G)	U-159
810-00-299-8501	Ethyl Ether, Anhydrous	*	2 PT	U-117
810-00-823-8005	Ethyl Ether, Anhydrous		38 CN	U-117
840-00-240-2540	Insecticide DDT	*	298 DR	U061
810-00-246-6432	Insecticide DDT		25 DR	U061
840-00-253-3892	Insecticide DDT	*	328 PL	U061
840-00-253-3892	Insecticide DDT		840 CN	U061
840-00-264-6692	Insecticide DDT		154 PL	U061
840-00-264-6692	Insecticide DDT	*	1 CN	U061
840-00-264-6692	Insecticide DDT		12 CN	U061
840-00-270-8262	Insecticide, Chlordane		69 CN	U036
840-00-270-8262	Insecticide, Chlordane		10 gal	U036
840-00-246-6436	Calcium Cyanide		40 #	P021
810-00-299-8508	Sodium Cyanide	*	1 BT	P106
810-00-678-4418	Trichloroethylene	*	12 gal	U228
810-00-812-9181	Trichloroethylene	*	4 DR	U228
810-00-264-9019	Cresylic Acid, Tech	*	17 gal	U054
810-00-753-4786	Hydrofluoric Acid		96 PT	U134

APPENDIX D

PESTICIDE STOCKS

ENTOMOLOGY DEPARTMENT
PESTICIDES ON HAND 2-1-81

NAME OF PESTICIDE	BLDG 267	BLDG 737	TOTAL
Avitrol EPA Reg # 11649-7 Avitrol Corp Tulsa, OK	38 lbs	0	38 lbs
Anti-Dione (PM) Rose Fungicide EPA Reg # 1023-11-AA Tuco-Div of the Upjohn Co. Kalamazoo, Mich 49001	6-3/4 lbs	0	6-3/4 lbs
D-Phenothrin, 2% Insecticide, Aerosol (12 oz) cans 6840-01-067-6674 EPA Reg #901-79 DLA 400-79-C-2928	39-3/4 lbs	0	39-3/4 lbs
Baygon (1.5%) liquid 6840-01-027-3865 EPA Reg # 3125-21A-ZA	3/4 gals	0	3/4 gals
Diuron 80 WP 6840-00-825-7790 EPA Reg # 2749-59-AA	4 lbs	0	4 lbs
Dursban 2-E 6840-00-T01-8670 EPA Reg # 464-343-ZA	7½ gals	10 gals	17½ gals
Fog & Mill Spray EPA Reg # 4887-29 Stephenson Chemical Co. 2444 West Point Dr. College Park, GA 30387	550 gals	0	550 gals
Hyvar-XL EPA Reg #532-346 E.I Dupont DeNemours & Co.	0	2 gals	2 gals
Baygon (Granula) 2% 6840-00-498-4057 EPA Reg # 3125-171-AA	42½ lbs	0	42½ lbs

NAME OF PESTICIDE	BLDG 267	BLDG 737	TOTAL
MSMA 6840-00-T030-1435 EPA Reg # 677-269-38228 Mallard Chemical Co. Pine Bluff, Ark	105 gals	0	105 gals
Monuron 80 WP EPA Reg # 2749-60-AA	0	100 lbs	100 lbs
Octagon Household Spray 6840-00-180-6069 EPA Reg # 904-149-6830	¼ gal	0	¼ gal
Paraquat CL (Ortho) 6840-00-T02-5480 EPA Reg #239-2186AA	7 gals	0	7 gals
Phostoxin (Aluminum Phosphide) 6840-00-442-5698 EPA Reg # 5857-Z-AA (in 2 lb. 3.28 oz cans)	0	34 lbs	34 lbs
Phostoxin (Aluminum Phosphide) 6840-00-145-0016 EPA Reg # 5857-1-AA (in 3 lb 2.79 oz cans)	0	48 lbs	48 lbs
Rat Pucks (Rodenticide Diphacin Paraffin) 6840-00-089-4664 EPA Reg # 9319-1	10 lbs		10 lbs
Sevin 80 WP 6840-00-932-7297 EPA Reg # 1016-43 Chemical Compound Corp Riverhead, N.Y. 11901	6 lbs	360 lbs	366 lbs

NAME OF PESTICIDE	BLDG 267	BLDG 737	TOTAL
Turf Fungicide EPA Reg # 10088-37-AA Weil Chemical Co. 219 Scott St. Memphis, TN 38112	8 lbs	0	8 lbs
ULD-V-500 5% Vapona Insecticide 6840-00-T00-6028 EPA Reg # 11540-8 Micro - Gen Equip Corp P.O. Box 32784 San Antonio, TX 78216	275 gals	0	275 gals
EDG-IT EPA Reg # 1325-70 Weil Chemical Co. 219 Scott St. Memphis, TN 38112	5 gals	0	5 gals
Rodenticide, Anticoagulant 2-Pivalyl-1, 3-Indandoine 6840-00-753-4972 EPA Reg # 6830-32 Octagon Process Inc. Edgewater, N.J. 07020	1 lb	0	1 lb
Calcium Cyanide (Cyanogas) EPA Reg # 241-232-AA 6840-00-246-6439 American Cyanamid Co. Agricultural Div Princeton, N.J. 08540	14 oz	0	14 oz

ENTOMOLOGY DEPARTMENT
EQUIPMENT ON HAND
(3/4/81)

1. 100-Gallon Sprayer (new)
2. 300-Gallon Sprayer (Bean) 70144
3. 200-Gallon Sprayer (Bean) 79696
4. 300-Gallon Sprayer (Bean) 76752
5. 300-Gallon Sprayer (John Blue) 79616
6. Micro Gen Sprayers (A) 76647, (B) 75767, (C), 77685, (D) 76645, (E) 76646, (F) 76644, (G) 77684, (H) 76642, (I) 76643
7. Fog Generator "Curtis" 66511
8. Calcium Cyanide Gas Duster - (1)
9. Hand Duster (Bulb) - (1)
10. Hand Duster (Bellow) - (1)
11. Drager - (1)
12. 2-Gallon Compressed Air Sprayers - (3)

THAMA-G.1/MEM/APPD.2
04/29/82

DPDO PESTICIDE STORAGE

Bldg. 1184

Calcium Cyanide	40 lbs
Chlordane	355 lbs
DDT (Liq. Base)	306 gals
DDT 75%	20 lbs
Diaz	475 lbs
Dieldrin	60 lbs
Lead Arsenate	125 gals
Lindane	30 lbs
Malathion 97%	55 gals
Malathion 95%	55 gals
Malathion 57%	90 gals
Methyl Bromide	124 lbs
Methyl Bromide Gas Bottles	1 large
Methyl Bromide Gas Bottles	4 small

Bldg. Shed 9308

DDT	approx. 29 55-gal drums

Bldg. 629

DDT	Over 50 55-gal drums Over 100 5-gal cans

Estimated DPDO holding 70+ tons of DDT total.

60

ATTACH 4 REP SAMPLE

PEST CONTROL REPORT

C.D. CODE | UIC | YR. | NO.

FROM (Installation) | COMMAND

PART I - PEST CONTROL OPERATIONS

PEST NAME (a)	PEST CODE (b)	OPERATION NAME (c)	OPERATION TOTAL UNITS TREATED (d)	OPERATION UNIT (e)	OPERATION BLDG/TERRAIN TREATED (f)	PESTICIDE NAME (g)	PESTICIDE FORM (h)	APPLICATION AMOUNT (i)	APPLICATION UNIT (j)	PESTICIDE FINAL CONC. % (k)	RATE (Per Area Unit) 1ST RATE LBS (l)	1ST RATE % (m)	2ND RATE LBS (n)	2ND RATE % (o)	ENTER S, M, OR C (p)	MAN-HOURS (q)	PART II SHOP RECORD: DATE OF OPERATION (a)	PART II SHOP RECORD: BUILDING/TERRAIN IDENTIFICATION (b)
12 - 15	16	17 - 19	20 - 24	25 - 27	28 - 30	31 - 33	34 - 36	37 - 41	42 - 43	44 - 48	50 - 53	54 - 57	58 - 61	62 - 65	66	67 - 71		
FOOD PESTS	AA1	MEDDINSSUR			WHS											184		
FOOD PESTS	A	RESIDTR	666	MSF	WHS	MALATHION	EML	500	GA	5						23		
FOOD PESTS	AA1	ATMOSFUN	50	MCF	RRC	ALUMPHOS	SFU	11	LB	.219						35		
FOOD PESTS	AA1	ATMOSFUN	6	MCF	WHS	ALUMPHOS	SFU	.5	LB	.219						8		
FOOD PESTS	A	SPCTR	32070	MCF	WHS	ULD30052	SLN	234	GA	.5						90		
FLY FAB PST	A	SPCTR	24809	MCF	WHS	PYRETHINS	SLN	329	GA	.3						73		
ROACHES	A	RESIDTR	5	MSF	OFF	DURSBAN	EML	2	GA	.5						1		
ROACHES	A	RESIDTR	200	SF	WHS	BAYGON	EML	2	GA	1.5						1		
MITES	A	SPAIR	3	MCF	OFF	PYRETHINS	AER	4	LB	.6						4		
MITES	A	SPAIR	2	MCF	OFF	D-PHENOTHRIN	AER	3	LB	2						1		
ALL VEG		SPRDEQ	3	AO	OPO	OPH ROUND UP	EML	350	GA	.009						3		
MX GRASS/WD		SPRDEQ	79	AO	OPO	OPH MSMA	EML	2950	GA	.006						32		
ALL VEG		sppdeq	1	AO	OPO	OPH DIVAR	EML	200	GA	.006						6		
MICE	A	RESIDTR	2	MSF	OFF	BAYGIN	EML	4	GA	1.5						3		
SPIDERS	A	RESIDTR	70	MSF	OFF	BAYGON	EML	2	GA	1.5						1		
LEAF CHEWER	A	SPRDEQ	13	AO	OPO	CARBARYL	SUS	300	GA	.009						4		

96 339

APPENDIX E

NPDES PERMIT

Permit No.: TN0022322

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Defense Logistics Agency

is authorized to discharge from a facility located at

Defense Depot Memphis
2163 Airways Boulevard
Memphis, Shelby County, Tennessee

to receiving waters named

Nonconnah Creek

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof. The permit consists of this cover sheet, Part I 5 pages(s), Part II 12 page(s) and Part III 0 page(s).

This permit shall become effective on March 12, 1982.

This permit and the authorization to discharge shall expire at midnight, March 11, 1987.

FEB 0 9 1982

Date Signed

Paul J. Traina, Director
Water Management Division

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 001, 002, 003 - non-contact cooling water.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day (lbs/day)		Discharge Limitations Other Units (Specify)		Monitoring Requirements Measurement Frequency	Monitoring Requirements Sample Type
	Daily Avg	Daily Max	Daily Avg	Daily Max		
Flow--m^3/Day (MGD)	-	-	-	-	during discharge	----
Temperature $^{o}C(^{o}F)$	-	-	35(95)	38(100)	semi-annual	grab
*Chromium, Total	-	-	1.0 mg/l	1.0 mg/l	semi-annual	grab
*Zinc, Total	-	-	0.5 mg/l	1.0 mg/l	semi-annual	grab
*Chlorine, Residual	-	-	0.2 mg/l	0.2 mg/l	semi-annual	grab
*Copper, Total	-	-	0.5 mg/l	1.0 mg/l	semi-annual	grab

*Parameter to be monitored only if it is contained in substances or compounds added to the water by the permittee.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored semi-annually by a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 004 - surface runoff from firefighter training areas.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	1/quarter	N/A
Biochemical Oxygen Demand, 5 day	-	-	-	45 mg/l	1/quarter	grab
Oil and Grease	-	-	-	15 mg/l	1/quarter	grab
Total Suspended Solids	-	-	-	50 mg/l	1/quarter	grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per quarter by a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

The effluent shall not cause a visible sheen on the receiving waters.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 005 and 006 – Surface runoff from petroleum storage areas.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow–m^3/Day (MGD)	–	–	–	–	1/quarter	N/A
Oil and Grease				15 mg/l	1/quarter	grab
Total Suspended Solids	–	–	–	50 mg/l	1/quarter	grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored quarterly by a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

The effluent shall not cause a visible sheen on the receiving waters.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 007 and 008 - surface water runoff.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)	-	-	-	-	1/quarter	N/A
Oil and Grease	-	-	-	15 mg/l	1/quarter	Grab
Total Suspended Solids	-	-	-	50 mg/l	1/quarter	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per quarter by a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

The effluent shall not cause a visible sheen on the receiving waters.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   a. Permittee shall comply with the effluent limitations by the effective date of the permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

A. MANAGEMENT REQUIREMENTS

1. Discharge Violations

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than, or at a level in excess of, that identified and authorized by this permit constitutes a violation of the terms and conditions of this permit. Such a violation may result in the imposition of civil and/or criminal penalties as provided in Section 309 of the Act.

2. Change in Discharge

Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

3. Noncompliance Notification

a. Instances of noncompliance involving toxic or hazardous pollutants should be reported as outlined in Condition 3c. All other instances of noncompliance should be reported as described in Condition 3b.

b. If for any reason, the permittee does not comply with or will be unable to comply with any discharge limitation specified in the permit, the permittee shall provide the Permit Issuing Authority with the following information at the time when the next Discharge Monitoring Report is submitted.

(1) A description of the discharge and cause of noncompliance;
(2) The period of noncompliance, including exact dates and times and/or anticipated time when the discharge will return to compliance; and
(3) Steps taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

c. Toxic or hazardous discharges as defined below shall be reported by telephone within 24 hours after permittee becomes aware of the circumstances and followed up with information in writing as set forth in Condition 3b. within 5 days, unless this requirement is otherwise waived by the Permit Issuing Authority:

(1) Noncomplying discharges subject to any applicable toxic pollutant effluent standard under Section 307(a) of the Act;
(2) Discharges which could constitute a threat to human health, welfare or the environment. These include unusual or extraordinary discharges such as those which could result from bypasses, treatment failure or objectionable substances passing through the treatment plant. These include Section 311 pollutants or pollutants which could cause a threat to public drinking water supplies.

d. Nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

4. Facilities Operation

All waste collection and treatment facilities shall be operated in a manner consistent with the following:

a. The facilities shall at all times be maintained in a good working order and operated as efficiently as possible. This includes but is not limited to effective performance based on design facility removals, adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls (including appropriate quality assurance procedures); and

b. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during noncritical water quality periods and carried out in a manner approved by the Permit Issuing Authority.

c. The permittee, in order to maintain compliance with this permit shall control production and all discharges upon reduction, loss, or failure of the treatment facility until the facility is restored or an alternative method of treatment is provided.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to waters of the United States resulting from

noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature of the noncomplying discharge.

6. Bypassing

"Bypassing" means the intentional diversion of untreated or partially treated wastes to waters of the United States from any portion of a treatment facility. Bypassing of wastewaters is prohibited unless all of the following conditions are met:

a. The bypass is unavoidable-i.e. required to prevent loss of life, personal injury or severe property damage;

b. There are no feasible alternatives such as use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment down time;

c. The permittee reports (via telephone) to the Permit Issuing Authority any unanticipated bypass within 24 hours after becoming aware of it and follows up with written notification in 5 days. Where the necessity of a bypass is known (or should be known) in advance, prior notification shall be submitted to the Permit Issuing Authority for approval at least 10 days beforehand, if possible. All written notifications shall contain information as required in Part II (A)(3)(b); and

d. The bypass is allowed under conditions determined to be necessary by the Permit Issuing Authority to minimize any adverse effects. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration to the extent feasible.

This requirement is waived where infiltration/inflow analyses are scheduled to be performed as part of an Environmental Protection Agency facilities planning project.

7. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering waters of the United States.

8. Power Failures

The permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures either by means of alternate power sources, standby generators or retention of inadequately treated effluent. Should the treatment works not include the above capabilities at time of permit issuance, the permittee must furnish within six months to the Permit Issuing Authority, for approval, an implementation schedule for their installation, or documentation demonstrating that such measures are not necessary to prevent discharge of untreated or inadequately treated wastes. Such documentation shall include frequency and duration of power failures and an estimate of retention capacity of untreated effluent.

9. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any waters of the United States.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Permit Issuing Authority and/or authorized representatives (upon presentation of credentials and such other documents as may be required by law) to:

a. Enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit;

c. Inspect at reasonable times any monitoring equipment or monitoring method required in this permit;

d. Inspect at reasonable times any collection, treatment, pollution management or discharge facilities required under the permit; or

e. Sample at reasonable times any discharge of pollutants.

2. Transfer of Ownership or Control

A permit may be transferred to another party under the following conditions:

a. The permittee notifies the Permit Issuing Authority of the proposed transfer;

b. A written agreement is submitted to the Permit Issuing Authority containing the specific transfer date and acknowledgement that the existing permittee is responsible for violations up to that date and the new permittee liable thereafter.

Transfers are not effective if, within 30 days of receipt of proposal, the Permit Issuing Authority disagrees and notifies the current permitttee and the new permittee of the intent to modify, revoke and reissue, or terminate the permit and to require that a new application be filed.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act, (33 U.S.C. 1318) all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Permit Issuing Authority. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act (33 U.S.C. 1319).

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, terminated or revoked for cause (as described in 40 CFR 122.15 et seq) including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. A change in any condition that requires either temporary interruption or elimination of the permitted discharge; or

d. Information newly acquired by the Agency indicating the discharge poses a threat to human health or welfare.

If the permittee believes that any past or planned activity would be cause for modification or revocation and reissuance under 40 CFR 122.15 et seq, the permittee must report such information to the Permit Issuing Authority. The submission of a new application may be required of the permittee.

5. Toxic Pollutants

a. Notwithstanding Part II (B)(4) above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revoked and reissued or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

b. An effluent standard established for a pollutant which is injurious to human health is effective and enforceable by the time set forth in the promulgated standard, even though this permit has not as yet been modified as outlined in Condition 5a.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing", Part II (A) (6), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act (33 U.S.C. 1321).

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

11. Permit Continuation

A new application shall be submitted at least 180 days before the expiration date of this permit. Where EPA is the Permit Issuing Authority, the terms and conditions of this permit are automatically continued in accordance with 40 CFR 122.5, provided that the permittee has submitted a timely and sufficient application for a renewal permit and the Permit Issuing Authority is unable through no fault of the permittee to issue a new permit before the expiration date.

C. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during each calendar month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1). Forms shall be submitted at the end of each calendar quarter and shall be postmarked no later than the 28th day of the month following the end of the quarter. The first report is due by the 28th day of the month following the first full quarter after the effective date of this permit.

Signed copies of these, and all other reports required herein, shall be submitted to the Permit Issuing Authority at the following address(es):

Compliance Section
Water Permits Branch
EPA - Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Division of Water Quality Control
Tennessee Department of Public Health
621 Cordell Hull Building
Nashville, Tennessee 37219

3. Test Procedures

Test procedures for the analysis of pollutants shall conform to all regulations published pursuant to Section 304(h) of the Clean Water Act, as amended (40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants").

4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The person(s) who obtained the samples or measurements;

c. The dates the analyses were performed;

d. The person(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of all required analyses.

5. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

6. Records Retention

The permittee shall maintain records of all monitoring including: sampling dates and times, sampling methods used, persons obtaining samples or measurements, analyses dates and times, persons performing analyses, and results of analyses and measurements Records shall be maintained for three years or longer if there is unresolved litigation or if requested by the Permit Issuing Authority.

D. DEFINITIONS

1. Permit Issuing Authority

The Regional Administrator of EPA Region IV or designee.

2. Act

"Act" means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) Public Law 92-500, as amended by Public Law 95-217 and Public Law 95-576, 33 U.S.C. 1251 et seq.

3. Mass/Day Measurements

a. The "average monthly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month. It is, therefore, an arithmetic mean found by adding the weights of the pollutant found each day of the month and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Daily Average" or "Monthly Average" in Part I of the permit and the average monthly discharge value is reported in the "Average" column under "Quantity" on the Discharge Monitoring Report (DMR).

b. The "average weekly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and/or measured divided by the number of daily discharges sampled and/or measured during such week. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the week and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Weekly Average" in Part I of the permit and the average weekly discharge value is reported in the "Maximum" column under "Quantity" on the DMR.

c. The "maximum daily discharge" is the total mass (weight) of a pollutant discharged during a calendar day. If only one sample is taken during any calendar day the weight of pollutant

calculated from it is the "maximum daily discharge". This limitation is identified as "Daily Maximum," in Part I of the permit and the highest such value recorded during the reporting period is reported in the "Maximum" column under "Quantity" on the DMR.

4. Concentration Measurements

a. The "average monthly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average monthly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar month. This limitation is identified as "Monthly Average" or "Daily Average" under "Other Limits" in Part I of the permit and the average monthly concentration value is reported under the "Average" column under "Quality" on the DMR.

b. The "average weekly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such week (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all samples collected during that calendar day. The average weekly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar week. This limitation is identified as "Weekly Average" under "Other Limits" in Part I of the permit and the average weekly concentration value is reported under the "Maximum" column under "Quality" on the DMR.

c. The "maximum daily concentration" is the concentration of a pollutant discharged during a calendar day. It is identified as "Daily Maximum" under "Other Limits" in Part I of the permit and the highest such value recorded during the reporting period is reported under the "Maximum" column under "Quality" on the DMR.

5. Other Measurements

a. The effluent flow expressed as M^3/day (MGD) is the 24 hour average flow averaged monthly. It is the arithmetic mean of the total daily flows recorded during the calendar month. Where monitoring requirements for flow are specified in Part I of the permit the flow rate values are reported in the "Average" column under "Quantity" on the DMR.

b. Where monitoring requirements for pH, dissolved oxygen or fecal coliform are specified in Part I of the permit the values are generally reported in the "Quality or Concentration" column on the DMR.

6. Types of Samples

a. Composite Sample - A "composite sample" is any of the following:

(1) Not less than four influent or effluent portions collected at regular intervals over a period of 8 hours and composited in proportion to flow.

(2) Not less than four equal volume influent or effluent portions collected over a period of 8 hours at intervals proportional to the flow.

(3) An influent or effluent portion collected continuously over a period of 24 hours at a rate proportional to the flow.

b. Grab Sample: A "grab sample" is a single influent or effluent portion which is not a composite sample. The sample(s) shall be collected at the period(s) most representative of the total discharge.

7. Calculation of Means

a. Arithmetic Mean: The arithmetic mean of any set of values is the summation of the individual values divided by the number of individual values.

b. Geometric Mean: The geometric mean of any set of values is the N^{th} root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

c. Weighted by Flow Value: Weighted by flow value means the summation of each concentration times its respective flow divided by the summation of the respective flows.

8. Calendar Day

a. A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

APPENDIX F

LANDFILL USE AGREEMENT

CHECKED BOX APPLIES: XX ORDER FOR SUPPLIES OR SERVICES

☐ REQUEST FOR QUOTATIONS NO.

(THIS IS NOT AN ORDER. See DD Form 1155r)

PAGE 1 OF 1

1. CONTRACT/PURCH ORDER NO.: DLA-004-81-M-0510

3. DATE OF ORDER: 81 Feb 02

4. REQUISITION/PURCH REQUEST NO.: PG-SV-15-81

6. ISSUED BY: Base Procurement Branch
Defense Depot Memphis
Memphis, TN 38114
Mavis C. Nash/pw
(901) 744-5651

7. ADMINISTERED BY (if other than 6)

8. DELIVERY FOR: ☒ DEST ☐ OTHER (See Schedule if other)

9. CONTRACTOR/QUOTER — NAME AND ADDRESS:
City of Memphis Sanitation Service
Room 301 City Hall
125 N. Main St.
Memphis, TN 38103

10. DELIVER TO FOB POINT BY: Jan thru Mar 81

11. CHECK IF: ☐ SMALL BUSINESS ☐ MINORITY BUSINESS

12. DISCOUNT TERMS: Net

13. MAIL INVOICES TO: (Orig & 3 copies) See block 15

14. SHIP TO: N/A

15. PAYMENT WILL BE MADE BY:
ACCOUNTING & FINANCE DIV.
DEFENSE DEPOT MEMPHIS
MEMPHIS, TN 38114

MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER

16. TYPE OF ORDER: DELIVERY / PURCHASE X

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE:
9710100.5135 01 P937-35.9 S40110 937.410000 01W002 — $4,500.00

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICES	20. QUANTITY ORDERED/ACCEPTED	21. UNIT	22. UNIT PRICE	23. AMOUNT
0001	Furnish necessary refuse disposal site at City of Memphis Sanitary Landfill during period January, February and March 1981, 2nd. Quarter FY 1981, for Defense Depot Memphis, Airways Blvd., Memphis, TN 38114.	1	JOB	4,500.00	4,500000

The rate to be paid shall be as specified under Chapter 19 for the Code of Ordinance 2835 effective 1 May 1979 @ $.80 per cu. yd of refuse per attached ordinance.

"THE ATTACHED GENERAL PROVISIONS ARE INCORPORATED BY REFERENCE AND MADE A PART OF THIS ORDER."

24. UNITED STATES OF AMERICA
BY: L. B. BRANHAM (signature: LB Branham)
CONTRACTING/ORDERING OFFICER

25. TOTAL: 4,500.00

26. QUANTITY IN COLUMN 20 HAS BEEN: ☐ INSPECTED ☐ RECEIVED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

DATE — SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

36. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT.

DATE — SIGNATURE AND TITLE OF CERTIFYING OFFICER

EQUAL OPPORTUNITY ... QUOTATIONS SUBMITTED

... This request does not commit the Government to pay any costs incurred in preparation or the submission of this quotation or ...

GENERAL PROVISIONS

1. **INSPECTION AND ACCEPTANCE** Inspection and acceptance will be at destination, unless otherwise provided. Until delivery and acceptance, and after any rejection, risk of loss will be on the Contractor unless loss results from negligence of the United States Government. Notwithstanding the requirements for any Government inspection and test contained in specifications applicable to this contract, except where specialized inspections or tests are specified for performance solely by the Government, the Contractor shall perform or have performed the inspections and tests required to substantiate that the supplies and services provided under the contract conform to the drawings, specifications and contract requirements listed herein, including if applicable the technical requirements for the manufacturers' part numbers specified herein.

2. **VARIATION IN QUANTITY** – No variation in the quantity of any item called for by this contract will be accepted unless such variation has been caused by conditions of loading, shipping, or packing, or allowances in manufacturing processes, and then only to the extent, if any, specified elsewhere in this contract.

3. **PAYMENTS** – Invoices shall be submitted in quadruplicate (one copy shall be marked "Original") unless otherwise specified, and shall contain the following information: Contract or Order number, Item number, contract description of supplies or services, sizes, quantities, unit prices and extended totals. Bill of lading number and weight of shipment will be shown for shipments on Government Bills of Lading. Unless otherwise specified, payment will be made on partial deliveries accepted by the Government when the amount due on such deliveries so warrants.

4. **DISCOUNTS** – In connection with any discount offered, time will be computed from date of delivery of the supplies to carrier when acceptance is at the point of origin, or from date of delivery at destination or port of embarkation when delivery and acceptance are at either of those points, or from the date the correct invoice or voucher is received in the office specified by the Government, if the latter is later than date of delivery. Payment is deemed to be made for the purpose of earning the discount on the date of mailing of the Government check.

5. **DISPUTES** – (a) Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall mail or otherwise furnish a copy thereof to the Contractor. This decision shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the Secretary. The decision of the Secretary or his duly authorized representative for the determination of such appeals shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence. The Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision. (b) This "Disputes" clause does not preclude consideration of law questions in connection with decisions provided for in (a) above, provided, that nothing in this contract shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

6. **FOREIGN SUPPLIES** – This contract is subject to the Buy American Act (41 U.S.C. 10a-d) as implemented by Executive Order 10582 of December 17, 1954, and any restrictions in appropriation acts on the procurement of foreign supplies.

7. **CONVICT LABOR** – In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, September 10, 1965 (18 U.S.C. 4082(c)(2)) and Executive Order 11755, December 29, 1973.

8. **OFFICIALS NOT TO BENEFIT** – No member of or Delegate to Congress or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

9. **CONVENANT AGAINST CONTINGENT FEES** – The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration or otherwise recover, the full amount of such commission, percentage, brokerage or contingent fee.

10. **GRATUITIES** – (a) The Government may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this contract if it is found after notice and hearing, by the Secretary or his duly authorized representative, that gratuities (in the form of entertainment, gifts or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the Government with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such contract, provided, that the existence of the facts upon which the Secretary or his duly authorized representative make such findings shall be in issue and may be reviewed in any competent court. (b) In the event this contract is terminated as provided in paragraph (a) hereof the Government shall be entitled (i) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the contract by the Contractor and (ii) as a penalty in addition to any other damages to which it may be entitled by law to exemplary damages in an amount (as determined by the Secretary or his duly authorized representative) which shall be not less than three nor more than ten times the costs incurred by the Contractor in providing any such gratuities to any such officer or employee. (c) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

11. **RENEGOTIATION** – This contract, and any subcontract hereunder, is subject to the Renegotiation Act of 1951, as amended (50 U.S.C. App. 1211 et seq.) and shall be deemed to contain all the provisions required by Section 104 thereof, and is subject to any subsequent act of Congress providing for the renegotiation of contracts.

12. **CONDITION FOR ASSIGNMENT** – This Purchase Order may not be assigned pursuant to the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), unless or until the supplier has been requested and has accepted this order by executing the Acceptance hereon.

13. **COMMERCIAL WARRANTY** – The Contractor agrees that the supplies or services furnished under this contract shall be covered by the most favorable commercial warranties the Contractor gives to any customer for such supplies or services and that the rights and remedies provided herein are in addition to and do not limit any rights afforded to the Government by any other clause of this contract.

14. ... RIGHTS, WITHHOLDING AND ADJUSTMENTS ... (Applicable ... 1976 ...)

15. **FAST PAYMENT PROCEDURE**

(a) General. This is a fast payment order. Invoices will be paid on the basis of the Contractor's delivery to a post office, common carrier, or, if shipped by other means, to the point of first receipt by the Government.

(b) Responsibility for Supplies. Title to the supplies shall vest in the Government upon delivery to a post office or common carrier for shipment to the specified destination. If shipment is by means other than post office or common carrier, title to the supplies shall vest in the Government upon delivery to the point of first receipt by the Government. Notwithstanding any other provision of the purchase order, the Contractor shall assume all responsibility and risk of loss for supplies (i) not received at destination, (ii) damaged in transit, or (iii) not conforming to purchase requirements. The Contractor shall either replace, repair, or correct such supplies promptly at his expense, provided instructions to do so are furnished by the Contracting Officer within ninety (90) days from the date title to the supplies vests in the Government.

(c) Preparation of Invoice.

(1) Upon delivery of supplies to a post office, common carrier, or in shipments by other means, the point of first receipt by the Government, the Contractor shall prepare an invoice in accordance with Clause 3 of the General Provisions of Purchase Order, except that invoices under a blanket purchase agreement shall be prepared in accordance with the provisions of the agreement. In shipments by either post office or common carrier, the Contractor shall either (A) cite on the invoice the date of shipment, name and address of carrier, bill of lading number or other shipment document number, or (B) attach copies of such documents to his invoice as evidence of shipment. In addition the invoice shall be prominently marked "Fast Pay." In case of delivery by other than post office or common carrier, a receipted copy of the Contractor's delivery document shall be attached to the invoice as evidence of delivery.

(2) If the purchase price excludes the cost of transportation, the Contractor shall enter the prepaid shipping cost on the invoice as a separate item. The cost of parcel post insurance will not be paid by the Government. If transportation charges are separately stated on the invoice, the Contractor agrees to retain related paid freight bills or other transportation billings paid separately for a period of three years and to furnish such bills to the Government when requested for audit purposes.

(3) In the event this order requires the preparation of a Material Inspection and Receiving Report (DD Form 250), the contractor has the option of either preparing the DD Form 250 or including the following information on the invoice, in addition to that required in (c)(1) above: (A) a statement in prominent letters "NO DD 250 PREPARED"; (B) shipment number; (C) mode of shipment; and (D) at line item level, (i) National Stock Number and/or Manufacturer's part number, (ii) unit of measure, (iii) Ship-To-Point, (iv) Mark-For-Point if in contract, and (v) MILSTRIP document number if in contract.

(d) Certification of Invoice. The Contractor agrees that the submission of an invoice to the Government for payment is a certification that the supplies for which the Government is being billed have been shipped or delivered in accordance with shipping instructions issued by the ordering officer, in the quantities shown on the invoice, and that such supplies are in the quantity and of the quality designated by the cited purchase order.

OUTER SHIPPING CONTAINERS SHALL BE MARKED "FAST PAY"

16. (This clause applies if the contract is for services and is not exempted by applicable regulations of the Department of Labor.)

SERVICE CONTRACT ACT OF 1965 – Except to the extent that an exemption, variation or tolerance would apply pursuant to 29 CFR 4.6 if this were a contract in excess of $2,500, the Contractor and any subcontractor hereunder shall pay all of his employees engaged in performing work on the contract not less than the minimum wage specified under section 6(a)(1) of the Fair Labor Standards Act of 1938, as amended (current minimum wage). However, in cases where section 6(e)(2) of the Fair Labor Standards Act of 1938 is applicable, the rates specified therein will apply. All regulations and interpretations of the Service Contract Act of 1965 expressed in 29 CFR Part 4 are hereby incorporated by reference in this contract.

ADDITIONAL GENERAL PROVISIONS

17. **CHANGES** – The Contracting Officer may at any time, by a written order, and without notice to the sureties, make changes, within the general scope of this contract, in (i) drawings, designs, or specifications, where the supplies to be furnished are to be specially manufactured for the Government in accordance therewith; (ii) method of shipment or packing and (iii) place of delivery. If any such change causes an increase or decrease in the cost of, or the time required for performance of this contract, whether changed or not changed by any such order, an equitable adjustment shall be made by written modification of this contract. Any claim by the Contractor for adjustment under this clause must be asserted within 30 days from the date of receipt by the Contractor of the notification of change provided that the Contracting Officer, if he decides that the facts justify such action, may receive and act upon any such claim if asserted prior to final payment, under this contract. Failure to agree to any adjustment shall be a dispute concerning a question of fact within the meaning of the clause of this contract entitled "Disputes." However, nothing in this clause shall excuse the Contractor from proceeding with the contract as changed.

18. **TERMINATION FOR DEFAULT** – The Contracting Officer, by written notice, may terminate this contract, in whole or in part, for failure of the Contractor to perform any of the provisions hereof. In such event, the Contractor shall be liable for damages, including the excess cost of reprocuring similar supplies or services, provided that, if (i) it is determined for any reason that the Contractor was not in default or (ii) the Contractor's failure to perform is without his and his subcontractor's control, fault or negligence, the termination shall be deemed to be a termination for convenience under paragraph 19. As used in this provision the term "subcontractor" and "subcontractors" means subcontractor(s) at any tier.

19. **TERMINATION FOR CONVENIENCE** – The Contracting Officer, by written notice, may terminate this contract, in whole or in part, when it is in the best interest of the Government. If this contract is for supplies and is so terminated, the Contractor shall be compensated in accordance with Section VIII of the Armed Services Procurement Regulation, in effect on this contract's date. To the extent that this contract is for services and is so terminated, the Government shall be liable only for payment in accordance with the payment provisions of this contract for services rendered prior to the effective date of termination.

20. **ASSIGNMENT OF CLAIMS** – Claims for monies due or to become due under this contract shall be assigned only pursuant to the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15). However, payment to an assignee of monies under this contract shall not, to the extent provided in said Act, as amended, be subject to reduction or set-off (See Clause 12).

ACCEPTANCE

The Contractor hereby accepts the offer represented by the numbered purchase order as it may previously have been or is now modified, subject to all of the terms and conditions set forth, and agrees to perform the same.

NAME OF CONTRACTOR	SIGNATURE	TYPED NAME AND TITLE	DATE SIGNED

DD FORM 1155r ... REPLACES EDITION OF ... WHICH IS OBSOLETE

STANDARD FORM 33, JULY 1986 GENERAL SERVICES ADMINISTRATION FED PROC REG (41 CFR) 1-16.101	CONTINUATION SHEET	REFERENCE NO. OF DOCUMENT BEING CONTINUED	PAGE
		DLA-004 81-M-0510	3

NAME OF OFFEROR OR CONTRACTOR

CITY OF MEMPHIS SANITATION SERVICE

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT

GENERAL PROVISION NO. 11 (RENEGOTIATION) ON DD FORM 1155r IS DELETED.

GENERAL PROVISION NO. 5 (DISPUTES) ON DD FORM 1155r IS DELETED AND THE FOLLOWING CLAUSE IS INCORPORATED BY REFERENCE IN LIEU THEREOF:

DAR 7-103.12(a) DISPUTES 1980 JUN.

DLA-004-84-M-0510

INCORPORATION OF CONTRACT CLAUSES BY REFERENCE IN PURCHASE ORDERS

1. THE FOLLOWING DEFENSE ACQUISITION REGULATION (DAR) (FORMERLY ASPR), 1976 EDITION, CLAUSES WHICH ARE CHECKED IN THE BLOCK TO THE LEFT OF THE DAR REFERENCE ARE HEREBY INCORPORATED BY REFERENCE IN THIS SOLICITATION/ CONTRACT WITH THE SAME FORCE AND EFFECT AS IF SET FORTH IN FULL:

A. CLAUSES FOR ORDERS OVER $2,500

	DAR	CLAUSE TITLE	CLAUSE DATE
X	7-103.16(a)	CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION	1971 NOV
X	7-103.28	AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS	1976 MAY
X	7-104.32	DUTY FREE ENTRY-CANADIAN SUPPLIES	1977 APR
___	7-1903.41(a)	SERVICE CONTRACT ACT OF 1965 (AS AMENDED) (NOTE: THIS CLAUSE SUPPLANTS GENERAL PROVISION 16 OF DD FORM 1155r)	1979 SEP
X	7 103.12	DISPUTES	1980 JUN

B. OTHER CLAUSES

	DAR	CLAUSE TITLE	CLAUSE DATE
___	7-104.24(a)	GOVERNMENT PROPERTY (FIXED PRICE)	1968 SEP
___	7-104.24(a)&(c)	GOVERNMENT PROPERTY (FIXED PRICE)	1978 SEP
___	7-104.24 (f)	GOVERNMENT PROPERTY (SHORT FORM)	1964 NOV
___	7-104.45(a)	LIMITATION OF LIABILITY	1974 APR
___	7-1912	LIMITATION OF LIABILITY SERVICE CONTRACT	1974 APR

2. AVAILABILITY OF TEXT OF CLAUSES. THE COMPLETE TEXT OF ANY OR ALL OF THE ABOVE CLAUSES IS AVAILABLE FROM CONTRACTING OFFICER, DEFENSE DEPOT MEMPHIS, 2163 AIRWAYS BLVD., MEMPHIS, TN 38114 AND WILL BE FURNISHED UPON REQUEST.

APPENDIX D

INTERVIEWS

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 28 Sep 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION: Burial of Chemical Warfare Materials at Memphis Defense Depot.		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Murrell	ADDRESS	PHONE NUMBER AND EXTENSION (314) 331-8787
PERSON CALLED Paul J. Traut	OFFICE	PHONE NUMBER AND EXTENSION (901) 458-0893

SUMMARY OF CONVERSATION: Mr. Traut worked at the Depot during the early years of WWII was then Drafted into the Army for three years (spent two years in New Guinea) and was rehired into the Chemical Warfare Section immediately after the war's end. He was present during the destruction of the German Bombs and worked for MAJ Spahn and 1LT Pittinger. On the German Bomb destruction he recalled the following:

The military handled all of the destruction except the digging of the pits by the Facility Engineers. The train was placed on the tracks in front of the two magazines (to the east) and the entire area was roped off. If the train was moved it was only moved on that particular siding. All destruction was done at Dunn Field by military personnel, civilians were not allowed into that area. So he has no knowledge of the actual locations of the pits. The area where the boxcars were parked was tested every month (for a year) by his personnel with negative results.

He stated that after the war, MP's would come to the Depot about once a month with Ordnance which had been confiscated from returning service members. He would destroy the materials in pits at Dunn Field either by demolition (explosive) or by chemical reaction. The pits were later covered up with bauxite storage.

He apparently got into an argument with MAJ Spahn over some bombs which were stored in NC1 section 1. Maj Spahn thought the bombs were empty and he thought they were filled 500lb bombs. He took one bomb out to an old large tree on Dunn Field and disassembled it in front of MAJ Spahn. The bomb then dispersed incendiary components over the area. He said all kinds of people then got involved in getting the bombs shipped out to another location. He said in all there were probably around two hundred of these bombs stored in section 1.

I asked about the burial of impregnite on the east side of Dunn Field along the trees and fence line. He stated the reason was due to the large number of burials already performed in other locations of Dunn Field.

He did say that all burials were accurately recorded and given to the Facility Engineers. He believed that the Quartermaster Corps would be the keeper of these records. He had no knowledge of any burials ever being done on the main depot.

He also tested flame throwers. He said it was always done with No 2 Diesel and then recharged and put back into the system.

He also stated that he knew that items had been buried out at Millington TN, north of Memphis. The site is used by the Navy and an ammunition plant. As a Property Disposal Officer (PDO) he sent chemicals there to be buried. He also believes ordnance may be buried there.

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 26 Oct 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION: Burial of Chemical Warfare Materials at Memphis Defense Depot.		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Morrell	ADDRESS	PHONE NUMBER AND EXTENSION (314) 331-8787
PERSON CALLED Paul J. Traut Interviewed at his home in Memphis.	OFFICE	PHONE NUMBER AND EXTENSION (901) 458-0893

SUMMARY OF CONVERSATION: Mr. Traut identified the siding where the German Bombs were unloaded and then reloaded. This siding was east of the pond next two the two Chemical Warfare Service igloos. He knew the bombs were taken to Dunn Field but not the location of the pits.

He personally tested Flame Throwers against the middle of the northwest side of the curved loading dock in Dunn Field. He used #2 diesel and then recharged the unit and placed it back into stockage. As far as he knew he was the only person who tested the flame throwers.

He said the burial of the 86,000 pounds of CC-2 Impregnite was done first. The burial of the 3000,000 pounds of XX-CC-3 Impregnite was done later, probably in 1947. He identified the area for the XX-CC-3 as being along the east fence of Dunn Field in the northeast corner.

The area where he destroyed conventional ordnance for the MPs was in the southwest corner of Dunn Field. He kept the caps and explosives in the two above ground magazines (Bldgs SF2 & SG2).

Mr. Traut stated that he only used a blasting cap to crack open the case of the incendiary cluster bomb and that the phosphorus inside each individual incendiary did not ignite.

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 28 Sep 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION: Burial of Chemical Warfare Materials at Memphis Defense Depot.		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED:	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Murrell	ADDRESS Corps of Engineers, St. Louis MO.	PHONE NUMBER AND EXTENSION (901) 331-8787
PERSON CALLED Charles E. Anderson, Memphis TN.	OFFICE	PHONE NUMBER AND EXTENSION (901) 363-6249

SUMMARY OF CONVERSATION: Mr. Anderson recalled the burying of Chemical Agent Identification Sets (CAIS) in Dunn Field. At first they tired to send the bad CAIS to Pine Bluff, AK, but were told to destroy the sets in Memphis. He said that this was done five or six times with a few defective sets each time. He also knew of the burial of the impregnite at Dunn field. He did not recall exactly were in Dunn Field the burials took place. He did not recall any burials being done on the hill (picnic area). He had no knowledge of any burials ever being done on the main depot. He recommended talking to Paul Traut, who he believed was still alive.

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 27 Oct 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION: Burial of Chemical Warfare Materials at Memphis Defense Depot.		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED:	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Murrell	ADDRESS Corps of Engineers, St. Louis MO.	PHONE NUMBER AND EXTENSION (901) 331-8787
PERSON CALLED Charles E. Anderson, Memphis TN. Interviewed at his home in Memphis.	OFFICE	PHONE NUMBER AND EXTENSION (901) 363-6249

SUMMARY OF CONVERSATION: Mr. Anderson recalled the burying of Chemical Agent Identification Sets (CAIS) in Dunn Field. He identified an area just west of the main track into the Depot, about halfway between the north fence and the TVA lines. He said that they were buried intact but that the contents were only simulated agents for the training of soldiers. He was unsure as to how many sets were buried this way.

He also recalled the burying of XX-CC-3 Impregnite in the same general area, either in 1955 or 1956. He said that shortly after the burial the ground started giving off a smoke due to the decomposition of the Impregnite. He also indicated that DANC, Chlorinated Lime and RH195 were also probably buried in the same area.

The same area was used to test engineer heavy equipment (dozers, scrapers, etc.) after it was repaired by the Depot's heavy equipment shop. He said that the surface soil has probably been moved around at least a hundred times.

More recently the area was used to store vehicles from a Memphis reserve unit while their armory was undergoing repairs. On weekends, mechanics would come in and work on the vehicles.

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 10 Nov 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION Memphis Defense Depot		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Murrell	ADDRESS COE, St. Louis District	PHONE NUMBER AND EXTENSION (314) 331-8787
PERSON CALLED John F. Carpenter (Fred) Interview at his home at Lineville, AL.	OFFICE Retired	PHONE NUMBER AND EXTENSION (205) 396-6245

SUMMARY OF CONVERSATION:

Mr. Carpenter was part of the detail unloading the boxcars on the rail siding. He was part of the detail from Edgewood Arsenal and did not know much about the depot. On the second day, he was burned by Mustard due to a hole in his pant leg. He spent the rest of the time in Memphis at the 4th Ferry Command Hospital at the Memphis Airport.

He did recall that there was a small pond beside the siding. He said the bombs that were leaking were placed on a truck and taken to anther area, which he thought was close by and on the Depot. He said that if he was at the siding and looking towards the pond, the truck disappeared to his right.

TELEPHONE OR VERBAL CONVERSATION RECORD

DATE 21 Nov 94

For use of this form, see AR340-15; the proponent agency is the Adjutant General's Office.

SUBJECT OF CONVERSATION Memphis Defense Depot, 1946		
INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
OUTGOING CALL		
PERSON CALLING Thomas Murrell	ADDRESS Corps of Engineers St. Louis, MO	PHONE NUMBER AND EXTENSION (314) 331-8787
PERSON CALLED Edwin C. Pittenger	OFFICE 6501 Lake Washington Blvd.NE, Apt 204 Kirkland, WA 98033 787 W. Bella Vista Dr. Green Valley, AZ 81614	PHONE NUMBER AND EXTENSION (206) 822-5960 (602) 625-3235

SUMMARY OF CONVERSATION:

Mr. Pittenger was a CWS Officer assigned to Memphis Depot during 1945 and 1946. His primary duty was to check on other posts, camps and activities which the Memphis Depot supported. He spent most of his time traveling and would check stockage levels and rates of usage, then make recommendations.

He was at the Depot when the train cars were first brought onto the depot. He was part of the initial inspection and unloading. When the Army Personnel from Edgewood Arsenal arrived and took over the operation, he returned to his normal duties. He was checked for Mustard burns, but does not remember actually being burned. He did not recall that any of the bombs had been buried and did not recall any other burials.

He did mention that to his knowledge all the Army Air Fields that he knew of did Chemical Training with the Chemical Agent Identification Sets (CAIS). He also stated that he had met a CWS Officer that had been stationed at Shemya, Alaska and had used CAIS shipping containers to ship booze to another CWS Officer.

PERSONNEL INTERVIEW

Person(s) Interviewed: Mr. Leonard Broyden

Address: 41448 Rollingshill Dr.
Memphis TN

Telephone: (901) 357-2609

Date: 21 Feb 80 Time:

Method: Telephone: X Personal:

Interviewed By: Lt Col David R. Lee, AFLC/DEPV, 74920

Place of Interview: Memphis TN

Others Present:

Relationship to Mallory AFS: Heavy equipment operator at Memphis General Depot

Summary of Interview: (Continue on back)

See Attachment

Suggested Follow-Up:

Evaluation of data obtained:

This is an interview conducted by telephone at approximately 1400 hours, 21 Feb 80, with a Mr. Leonard Broyden. Other information pertaining to Mr. Broyden is contained on the personnel contact form. The interview was conducted as the result of obtaining Mr. Broyden's name from Hal Morris in the Shelby County Health Department. I called Mr. Broyden at his home to discuss the alleged dumping by Mallory. Mr. Broyden worked at Mallory for a short time before going to work at Memphis General Depot on Airway Road. He was a troubleshooter for the Memphis General Depot, and he also was an equipment operator. He indicated that perhaps a Mr. Bill Williams who was in maintenance at Warner Robins could provide some further information. Broyden used to be at Mallory in 1945; however, in 1946 he went to Memphis General. He didn't know anything of any chemical dumping. He indicated that he used to dig trenches for some of the residue material which was buried. He indicated that they put the perishables and the like, perhaps old food and things of that nature which exceeded the life date, into the Dunn fill site across from the Memphis General Depot on Dunn Road. However, this location has been covered up with bauxite ore. He indicated that he was very familiar with the Frayser area in the 1950's and he had lived out there. He used to hunt birds and he knows of no dumps out in the area. He indicated that the Steele Road was a little gravel road at that time, and it was relatively inpassible in the winter time. He also indicated that no trucks were allowed to cross over the old Watkins Street bridge. He indicated that there were notices posted on the bridge which said 5 tons limit and no trucks allowed. He indicated that it would have been very difficult to get a semi-trailer down Steele Street. He indicated that any drums and the like use to go out to the Hollywood dump. He indicated that the Commander was very concerned on the digging of the trenches to make sure things were properly buried, particularly at the Dunn fill site. He indicated that the Hollywood dump was a city operated activity, and there was a black man at the gate who used to control the entry. He remembers they had two D-7 dozers on site, and they were operated by city operators. He also indicated that Mallory did not have any bulldozers. Memphis General had dozers and provided heavy equipment support of that nature to Mallory. Mr. Broyden said that he had lived out in the Frayser for some 26 years. He also said that only within the last 20 years had the bridge across the Wolf Creek had been a good bridge. Prior to that it was a two lane steel-wooden bridge with some asphalt scattered on it. This terminates the interview comments.

APPENDIX E

NEWSPAPER ARTICLES

Commercial Appeal, Sunday 14 July 1946 P6-1

96 375

NAZI WAR GAS SEEPS INTO AMORY DISTRICT

Commercial Appeal 7-14-46

Bombs Leak, Poison Fumes Are Freed At Rail Siding

Special to The Commercial Appeal

AMORY, Miss., July 13.—A carload of captured German mustard gas bombs, which began leaking on a Frisco Railroad siding near the heart of town Saturday, gave Amory a scare.

The captured bombs, en route to an Army proving ground in this country for testing, were in a boxcar that was cut from a freight train arriving in Amory Friday night.

Early Saturday railroad employes smelled mustard fumes, and discovered that some of the bombs were leaking. The car was quickly shunted to a remote sidetrack at Bigbee, two miles from Amory, and headquarters of the Army's Third Service Command at Atlanta notified.

Pending arrival of experts from the Chemical Warfare Service, soldiers equipped with gas masks took over, to guard the car and keep spectators at a safe distance. One soldier was overcome and several railroad men reported their eyes were smarting and that they were suffering from headaches.

The gas, in liquid form, dripped to form a small pool under the car, and from this the fumes arose.

Capt. Ralph Saem of the Military Police Detachment at Memphis dispatched a detail of 17 men equipped with gas masks to guard the leaking car until a decontamination squad from the Chemical Warfare Service arrived by plane from Edgewood, Md., to take charge of the situation.

Sergt. Abraham Steinberg, the soldier overcome at Amory, was flown to the Fourth Ferrying Group's hospital at Memphis after receiving preliminary treatment by Dr. John Murphy, returned Army physician of Amory. Hospital officials said Sergeant Steinberg's condition was not serious.

Press-Scimitar, Monday 15 July 1946

GERMAN GAS ESCAPES HERE

Front Page

In Missouri Pacific And Frisco Railroad Yards

Memphis General Depot Chemical Warfare officers were performing their third day of emergency gas duty today combatting liquid German mustard gas which leaked from 500 pound bombs in the Frisco and Missouri Pacific yards Saturday.

The bombs, loaded in eight freight cars, were en route to the Pine Bluff, Ark., arsenal from New Orleans, where they had arrived from Europe.

The Depot was notified that three of the cars were leaking on Saturday morning, Col. H. S. Evans, Depot commander, said.

All eight cars were moved to the Depot, where train crews wearing gas masks switched them to an isolated area.

The cars were moved under guard. Maj. Otto J. Spahn, depot chemical warfare officer, and his assistant, 1st Lt. E. C. Pittenger, decontaminated the Missouri Pacific yards, where the gas leak was heaviest, both Saturday and Sunday with hand decontaminators. They have been working night and day.

This afternoon three depot decontamination trucks were spraying all tracks over which the cars had passed.

Capt. James Whittenberger, medical officer who flew from Edgewood Arsenal, Md., last night, and Major Spahn were checking Memphis hospitals today for possible casualties.

So far, the only reported gas casualty in Memphis is Sgt. Abraham Steinberg, who was overcome in Amory, Miss., Saturday in a mustard gas leakage from another train. He is in Fourth Ferrying Group Hospital.

(See Page 3 for story about Amory, Miss., gas leakage.)

Press-Scimitar, Monday 15 July 1946

96 377

NAZI GAS BOMB LEAKS, BURNS EIGHT AT AMORY

Amory, Miss., a city of about 5000 in Monroe County, 125 miles southeast of Memphis, had a taste of what "might have been" if the Nazis had been in a position to bomb the United States.

A leaking Nazi airplane mustard gas bomb in a freight car caused eight casualties and considerable excitement in the community over the week-end.

The bomb was one of a carload of captured bombs, brought into New Orleans by ship and being sent by rail to an Eastern Army proving ground.

The car was shunted onto a railroad siding in the yards at Amory and one of the bombs began leaking Saturday.

Seven railroad men working with the car and a soldier suffered burns, according to Dr. John Murphy, former Army doctor.

Dr. Murphy said if "atmospheric conditions had been right," the mustard gas fumes might have caused considerable suffering in Amory. As it was, only those who approached the leaking gas suffered burns.

Guy Rorie, 48, Amory, Frisco conductor on the train which was to have brought the bomb car from Amory to Memphis, is at St. Joseph's Hospital suffering from burns on the right leg and arm and back. His eyes were inflamed by the fumes.

Mr. Rorie said the train had left Amory for Memphis when the trouble was discovered. The car was taken to Amory, and later moved to an isolated siding at Bigbee, three miles toward Memphis from Amory.

Mr. Rorie said he had climbed on top of the car and apparently did not get any of the liquid gas on him, but was burned by fumes.

Paul Wright, Amory, brakeman on another train, also suffered burns severe enough to send him to a hospital in Columbus, Miss.

Sgt. Abraham Steinberg, who apparently helped guard the car before a detachment of 17 Military Police from Memphis arrived in Amory Saturday night, suffered burns and his eyes were reported affected. He was flown to the Fourth Ferrying Group hospital at Municipal Airport.

It was reported at the hospital that Sgt. Steinberg will "have a hard time for a couple of weeks" in the hospital, but that he will not lose his sight.

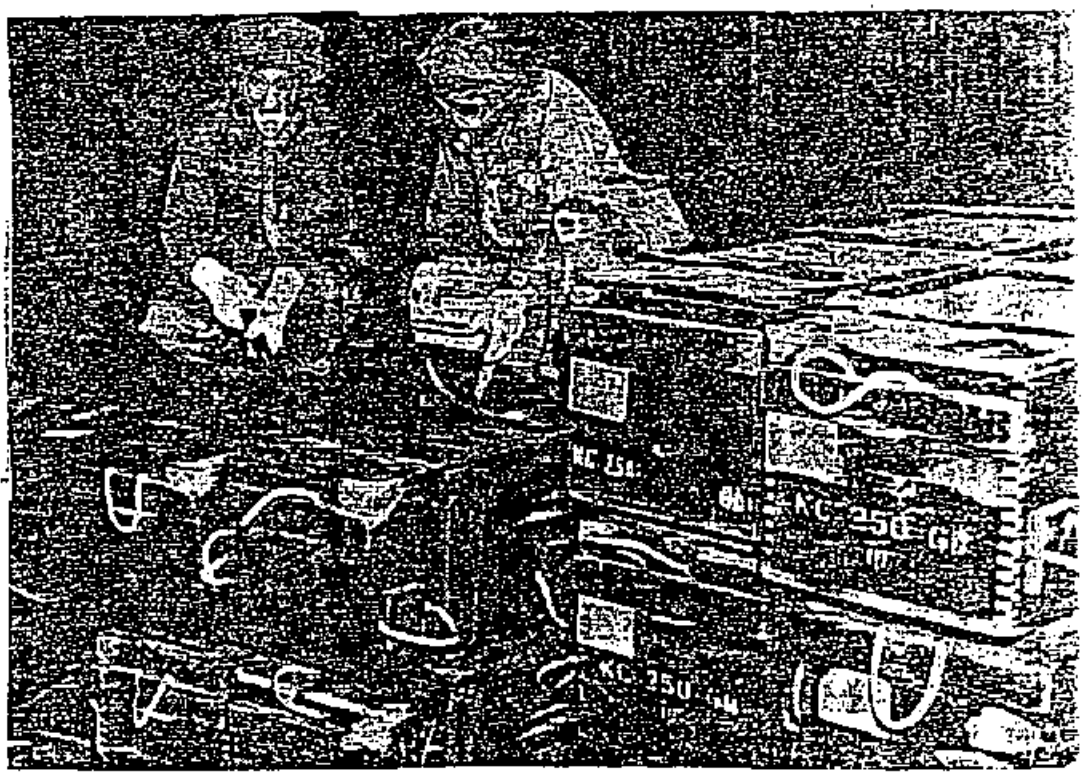
Dr. Murphy said the other five casualties, all railroad men, were painfully but not severely burned by fumes, and were treated in Amory by an Army doctor who is a specialist in gas burns and was flown to Amory from Washington. He said a secret Army treatment was administered the victims.

"The gas scare caused quite a bit of disturbance in Amory, tho most of the population didn't know what it was all about," Dr. Murphy said.

Capt. Ralph Saenz of the Memphis Military Police detachment dispatched 17 MPs, with Lt. William Koon in charge, to Amory. Their job is to keep the curious from becoming casualties.

"Six men from Edgewood Arsenal flew in Saturday night," Lt. Koon said. "They decontaminated the place in Amory where gas dripped.

Commercial Appeal, Tuesday 16 July 1946



TEST FOR GAS — Two soldiers of Army Chemical Warfare Service test for vaporized gas on German poison gas containers in a freighter hold at Theodore, Ala. Naval Ammunition Depot, after other containers began leaking in a freight car near Amory, Mi Jobs of unloading gas are going begging—$40.95 a night—after many workers suffer burns. —Associated Press Ph

(Story on Page Four)

BOMB SQUADS AT WORK ON GAS LEAKS: NINE CASUALTIES

Decontamination squads continued to work on Nazi liquid mustard gas bomb leaks in Memphis and near Amory, Miss., today, as one more casualty was added to the list, making a total of nine.

Seven of the men who suffered mustard gas burns were railroad men and two were soldiers. None is regarded as in serious condition, tho four remain hospitalized.

Two decontamination squads from Edgewood Arsenal, Md., are working on the decontamination of leaking 500-pound bombs in three of eight boxcar loads in Memphis, while another squad from Edgewood is at work on a car with a single leaking bomb at Bixbee, on the Frisco near Amory, Miss.

Eight Cars in Memphis

The gas is all part of one big shipment from the Gulf Coast. Some of the cars were diverted. The eight cars that are in Memphis were consigned to the Pine Bluff, Ark., arsenal from New Orleans. Others, including the single car at Bixbee, are consigned to an eastern arsenal.

The Army wants to study the Nazi mustard gas airplane bombs.

The situation is reported under control. The eight cars in Memphis were sent to the Memphis General Depot for decontamination.

The first Edgewood squad flew into Memphis Saturday night, and a second squad was flown in last night. They are working under the direction of Lt. Charles A. Meyer, chemical warfare officer of Edgewood Arsenal, and will remain on the job with their decontamination truck until the gas is completely neutralized. The cars are in a large restricted area at the depot, and there have been no casualties in Memphis, tho three of the victims from elsewhere are in Memphis hospitals.

His Leg Burned

Set. Stanley Woronowicz, who was riding as a guard on a gas train, suffered burns on the leg in Alabama, but did not realize they amounted to anything until he arrived in Memphis. He is now at Kennedy Veterans Hospital, where his condition is reported "not serious."

Sgt. Abraham Steinberg, another train guard, is reported "resting easier" today at Fourth Ferrying Group Hospital. His eyes were affected by gas fumes at Amory Saturday, but his condition is not serious, the hospital reports.

Guy Rorie, Frisco conductor from Amory, is at St. Joseph's Hospital, where his condition is reported good, and Paul Wright, a Frisco brakeman, is recovering in a hospital at Columbus, Miss. The other trainmen who suffered minor burns were not hospitalized.

Expert Arrives

Capt. James Whittenberger, medical officer who is an expert in treating gas casualties, was flown to Memphis from Edgewood and is checking on all of the victims.

Cause of the leaking bombs is being investigated by technicians from Washington, who are working with Maj. Otto J. Spahn, Memphis General Depot chemical warfare officer.

It is believed that the extremely high temperature in the boxcars of bombs caused some expansion of the gas which resulted in the leaks.

Commercial Appeal, Wednesday 17 July 1946

GAS CREW IS STILL BUSY

Decontamination Work Continues Along Track

Decontamination work in connection with the leaking German mustard gas bombs which caused several injuries at Amory, Miss., and between Memphis and Amory, continued yesterday, Col. H. S. Evans, commander the Memphis General Depot, reported.

Colonel Evans reported there were no new developments, and the truck was continuing the job of decontaminating the tracks over which the bombs moved.

Seven railroad men were treated for mustard gas burns by an Amory physician. Frisco Conductor Guy Rorie was treated at St. Joseph Hospital, and Sergt. Abraham Steinberg was treated at Fourth Ferrying Group Hospital and Sergt. Stanley Waronowicz was treated at Kennedy General Hospital.

None was reported in serious condition.

Commercial Appeal, Tuesday 16 July 1946 PG-9

GERMAN GAS CLAIMS TWO MORE CASUALTIES

Soldier Guard, Conductor Are Latest Victims

SITUATION IN HAND HERE

Two more casualties were added yesterday to the long string of injuries growing out of the shipping of a quantity of leaking captured German mustard gas bombs from New Orleans to the Pine Bluff, Ark., Arsenal.

First burned were 74 longshoremen who unloaded the bombs from the S. S. Frances Lee at Theodore, near Mobile, Ala. Placed on trains, at least eight cars of bombs developed leaks and burned a number of railroad men and soldier guards before being isolated and put under special guard at Memphis General Depot where they are being decontaminated.

Two Burned At Amory

Maj. Otto J. Spahn, depot chemical warfare officer and Capt. James Whittenberger, medical officer who flew from Edgewood Arsenal, Md., reported the last two casualties are Sergt. Stanley Woronowicz, a guard on a train who was taken to Kennedy Veterans Hospital, and Guy Rorie of Amory, Miss., Frisco conductor, who was taken to St. Joseph Hospital.

Flown to the Fourth Ferrying Group Hospital from Amory where a leaking car was sidetracked Saturday was Sergt. Abraham Steinberg.

Dr. John Murphy of Amory, reported he treated seven railroad men in Amory for burns. Paul Wright, a brakeman of Amory, was sent to a Columbus, Miss., hospital for treatment.

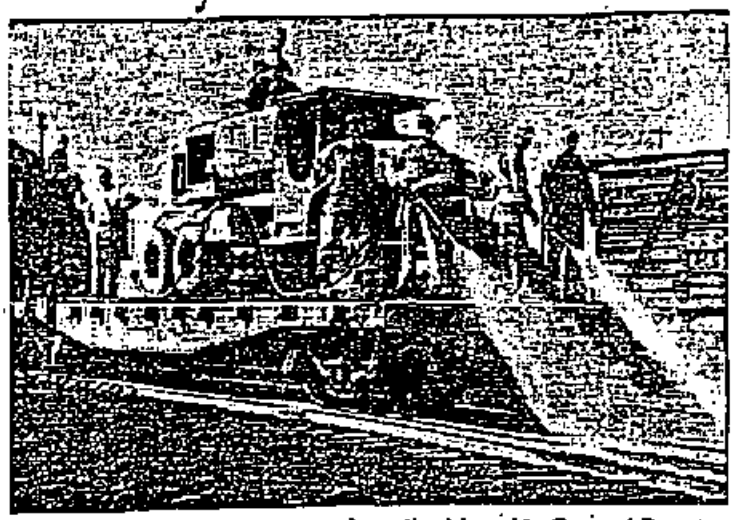
Railroads Decontaminated

Chemical warfare officers of the depot, headed by Lieut. Charles A. Meyer, chemical warfare officer of Edgewood Arsenal yesterday continued decontaminating all tracks of the Frisco and Missouri Pacific railroads here where the cars passed on their way to the depot for isolation.

Cause of the leaks is being investigated by technicians from Washington, who are working with Major Spahn in handling the situation, which they reported "well in hand."

No injuries have occurred here.

Deadly Fumes Neutralized



Decontamination crews from the Memphis General Depot yesterday continued the process of neutralizing German mustard gas which leaked from captured bombs and burned nearly 100 men between Mobile, Ala., and Amory, Miss., before being isolated at the depot. They were en route to the Pine Bluff, Ark., Arsenal. —Staff Photo

(Additional Picture on Page 22)

APPENDIX F

PRESENT SITE PHOTOGRAPHS

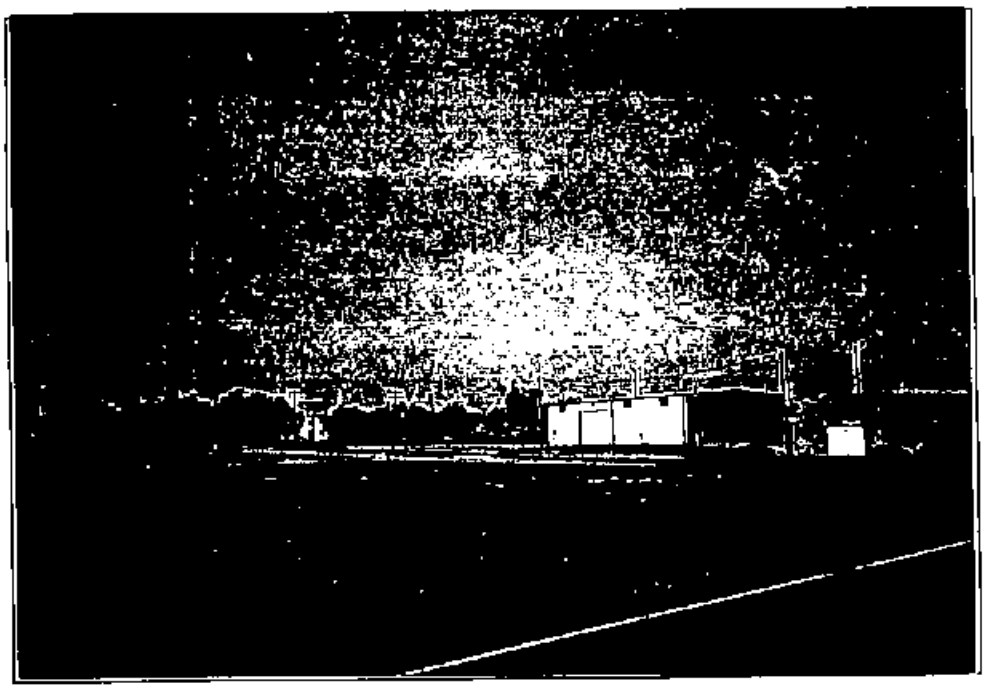


Figure # 1
Igloo Area on the main depot - looking soutwest.

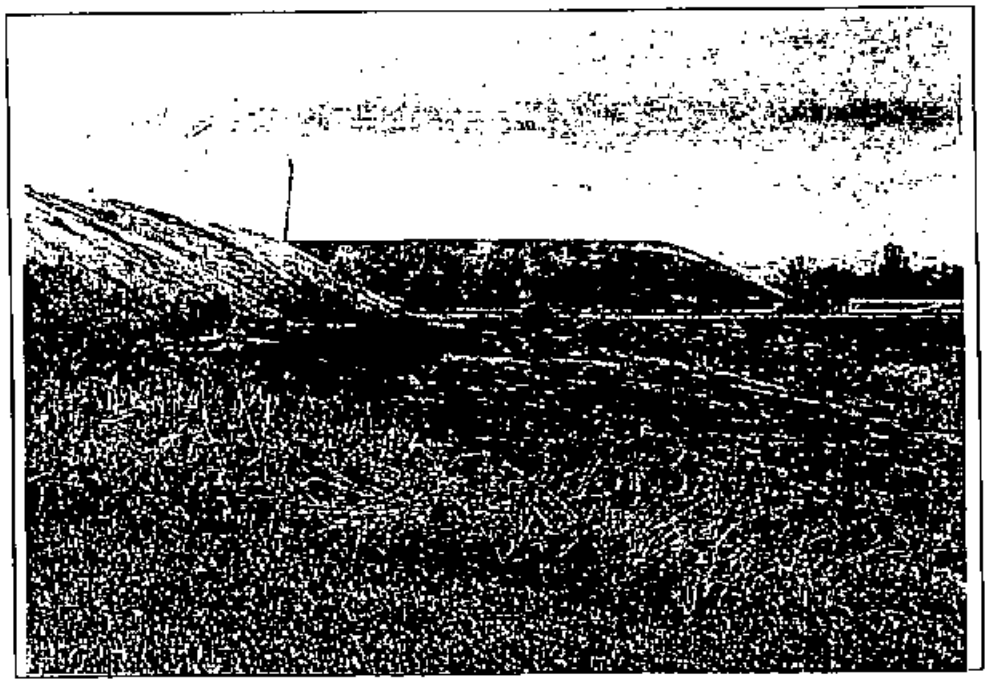


Figure # 2
General area of Dunn Avenue Area where German Mustard Bombs may have been destroyed.

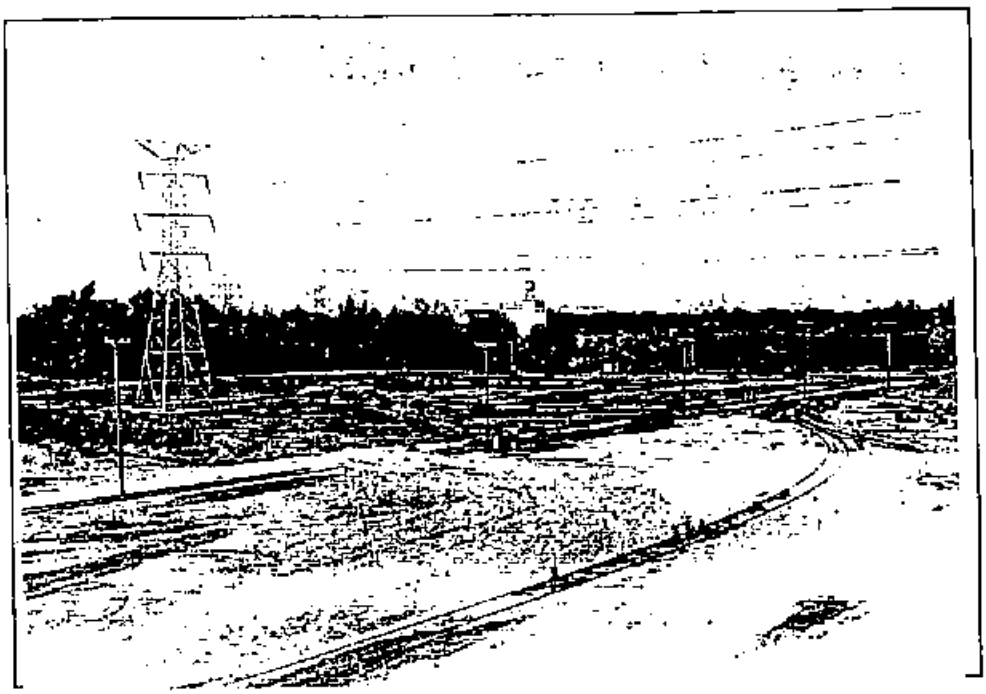


Figure # 3
Dunn Field Area of Dunn Avenue Area - looking northwest.

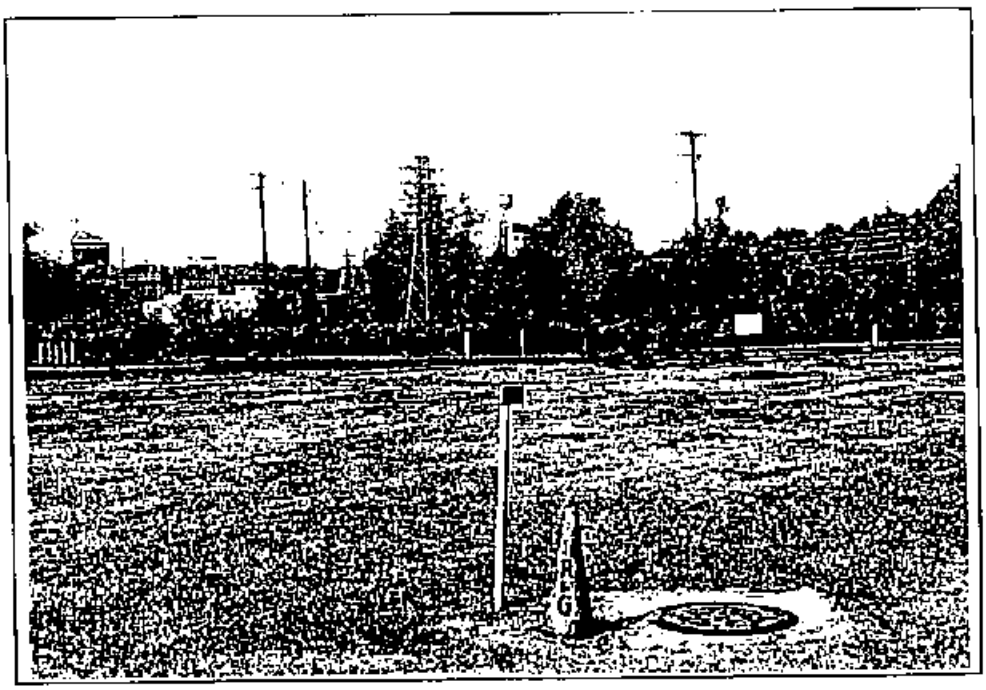


Figure # 4
Closer view of the Dunn Field Area of Dunn Avenue Area
- looking northwest.

Figure # 5
Curved Loading Dock, Dunn Avenue Area - looking South.

Figure # 6
Closer view of the Curved Loading Dock, Dunn Avenue Area - looking South.

APPENDIX G

RAC WORKSHEETS

18 Apr 94
Previous editions obsolete

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

Site Name MEMPHIS DEFENSE DEPOT
Site Location MEMPHIS TN
DERP Project # – DUNN AVE. AREA
Date Completed 11 JAN 95

Rater's Name THOMAS MURRELL
Phone No. (314) 331-8787
Organization CELMS-PM-M (OEW)
RAC Score 2

OEW RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882C and AR 385-10. The RAC score will be used by CEHND to prioritize the remedial action at Formerly Used Defense Sites. 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	VALUE
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)	10

What evidence do you have regarding conventional OEW? DISPOSAL ACTIVITES BY MR. TRAUT.

B. Pyrotechnics (For munitions not described above.)

	VALUE
Munition (Container) Containing White Phosphorus (WP) 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, Screening Smokes (other than WP)	(4)
Pyrotechnics (Select the largest single value)	4

What evidence do you have regarding pyrotechnics? BASE INTERVIEW INDICATED SMOKE MUNITIONS MAY HAVE BEEN DISPOSED.

C. Bulk High Explosives (Not an integral part of conventional ordnance; uncontainerized.)

	VALUE
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)	Ø

What evidence do you have regarding bulk explosives? _____

D. Bulk Propellants (Not an integral part of rockets, guided missiles, or other conventional ordnance; uncontainerized)

	VALUE
Solid or Liquid Propellants	6
Propellants	Ø

What evidence do you have regarding bulk propellants? _____

E. Chemical Warfare Materiel and Radiological Weapons

	VALUE
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	(25)
War Gas Identification Sets	(20)
Radiological	15
Riot Control Agents (Vomiting, Tear)	5
Chemical and Radiological (Select the largest single value)	25

What evidence do you have of chemical/radiological OEW? SEE REPORT

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39

TOTAL HAZARD SEVERITY VALUE
(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	Hazard Severity Value	
CATASTROPHIC	(I)	21 and greater	39
CRITICAL	II	10 to 20	
MARGINAL	III	5 to 9	
NEGLIGIBLE	IV	1 to 4	
**NONE		0	

* Apply Hazard Severity Category to Table 3.

**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

	VALUE
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) 2

What evidence do you have regarding location of OEW? KNOWN BURIALS

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

	VALUE
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) 5

What are the nearest inhabited structures? RESIDENTIAL HOMES

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

	VALUE
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) 5

Narrative _____

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

	VALUE
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) 5

Describe types of buildings in the area. _____

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

BARRIER	VALUE
No barrier or security system	5
Barrier is incomplete (e.g., 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) 1

Describe the site accessibility. FENCED AREA WITH CONTROLLED ACCESS

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 inhabitated areas or otherwise increase accessability.

	VALUE
Expected	5
None Anticipated	(0)

Site Dynamics (Select largest value) 0

Describe the site dynamics. DIGGING IS CURRENTLY NOT EXPECTED

TOTAL HAZARD PROBABILITY VALUE
(Sum of Largest Values for A through F--Maximum of 30) ___
Apply this value to Hazard Probability Table 2 to determine Hazard Probability Level.

TABLE 2

HAZARD PROBABILITY

Description	Level	Hazard Probability Value
FREQUENT	A	27 or greater
PROBABLE	B	21 to 26
OCCASIONAL	(C)	15 (17) to 20
REMOTE	D	8 to 14
IMPROBABLE	E	less than 8

* Apply Hazard Probability Level to Table 3.

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 Expedite INPR, recommending further action by CEHND - 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 Usually indicates that no further action (NOFA) is necessary. 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.

AGREE WITH RAC 2 SCORE, THE AREA IS CONTROLLED ACCESS AND ALL HAZARDS ARE BURIED.

18 Apr 94
Previous editions obsolete

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

Site Name MEMPHIS DEFENSE DEPOT
Site Location MEMPHIS TN
DERP Project # MAIN DEPOT
Date Completed 11 JAN 95

Rater's Name THOMAS MURRELL
Phone No. (314) 331-8787
Organization CELMS-PM-M (OEW)
RAC Score 4

OEW RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882C and AR 385-10. The RAC score will be used by CEHND to prioritize the remedial action at Formerly Used Defense Sites. 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	VALUE
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)	1

What evidence do you have regarding conventional OEW? REMOVAL OF PISTOL RANGE

B. Pyrotechnics (For munitions not described above.)

	VALUE
Munition (Container) Containing White Phosphorus (WP) 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, Screening Smokes (other than WP)	4
Pyrotechnics (Select the largest single value)	Ø

What evidence do you have regarding pyrotechnics? _____

C. Bulk High Explosives (Not an integral part of conventional ordnance; uncontainerized.)

	VALUE
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)	Ø

What evidence do you have regarding bulk explosives? _____

D. Bulk Propellants (Not an integral part of rockets, guided missiles, or other conventional ordnance; uncontainerized)

	VALUE
Solid or Liquid Propellants	6
Propellants	Ø

What evidence do you have regarding bulk propellants? _____

E. Chemical Warfare Materiel and Radiological Weapons

	VALUE
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25
War Gas Identification Sets	20
Radiological	15
Riot Control Agents (Vomiting, Tear)	5
Chemical and Radiological (Select the largest single value)	Ø

What evidence do you have of chemical/radiological OEW? ALL SPILLS WERE IMMEDIATLY CLEANED UP.

TOTAL HAZARD SEVERITY VALUE 1
(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	Hazard Severity Value
CATASTROPHIC	I	21 and greater
CRITICAL	II	10 to 20
MARGINAL	III	5 to 9
NEGLIGIBLE	IV	(1) to 4
**NONE		0

* Apply Hazard Severity Category to Table 3.

**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

	VALUE
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) 2

What evidence do you have regarding location of OEW? LOCATION OF PISTOL RANGE PRIOR TO REMOVAL

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

	VALUE
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) 5

What are the nearest inhabited structures? BLDG 270

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

	VALUE
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) 5

Narrative _____

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

	VALUE
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) 5

Describe types of buildings in the area. _____

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

BARRIER	VALUE
No barrier or security system	(5)
Barrier is incomplete (e.g., 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) 5

Describe the site accessibility. _____

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 inhabitated areas or otherwise increase accessability.

	VALUE
Expected	5
None Anticipated	(0)

Site Dynamics (Select largest value) 0

Describe the site dynamics. AREA IS NOW PART OF GOLF COURSE

TOTAL HAZARD PROBABILITY VALUE
(Sum of Largest Values for A through F--Maximum of 30)
Apply this value to Hazard Probability Table 2 to determine Hazard Probability Level. ___

TABLE 2

HAZARD PROBABILITY

Description	Level	Hazard Probability Value
FREQUENT	A	27 or greater
PROBABLE	B	22 to 26
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IMPROBABLE	E	less than 8

* Apply Hazard Probability Level to Table 3.

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 Expedite INPR, recommending further action by CEHND - 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 Usually indicates that no further action (NOFA) is necessary. 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 FORM INDICATES A RAC 4 SCORE. GIVEN THE FACT THAT EXPLOSIVE ORDNANCE WAS PROBABLY NEVER USED ON THE PISTOL RANGE AND THAT THE RANGE WAS LATER REMOVED — RECOMMEND A RAC SCORE OF 5 BE ASSIGNED AND THAT NO FURTHER ACTION IS NECESSARY.

APPENDIX H

REPORT DISTRIBUTION LIST

MEMPHIS DEFENSE DEPOT

REPORT DISTRIBUTION LIST

Addressee	Copies
Commander, Memphis Defense Depot Environmental Office 2163 Airways Blvd. Memphis, Tennessee 38114-5000	4
Commander, U.S. Army Engineer Division Huntsville, ATTN: CEHND-PM-ED P.O. Box 1600 Huntsville, Alabama 35807-4301	2
Commander, U.S.Army Chemical Materiel Destruction Agency Attn: SFIL-NSM , Bldg. E4585 Aberdeen Proving Ground, MD 21010	1
Commander, U.S. Army Chemical & Biological Defense Command Attn: AMSCB-CIH, Bldg. E5183 Aberdeen Proving Ground, MD 21010-5423	1
U.S. Army Technical Center for Explosives Safety Attn: SMCAC-ESM Savanna, IL 61074-9639	1

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

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ADMINISTRATIVE RECORD

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