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米軍基地による環境変化が与える自然および社会への影響に関する複合的研究

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DRAFT

Chemical Weapons Movement

History Compilation

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Aberdeen Proving Ground, Maryland 21010-5401

DRAFT

Chemical Weapons Movement History Compilation

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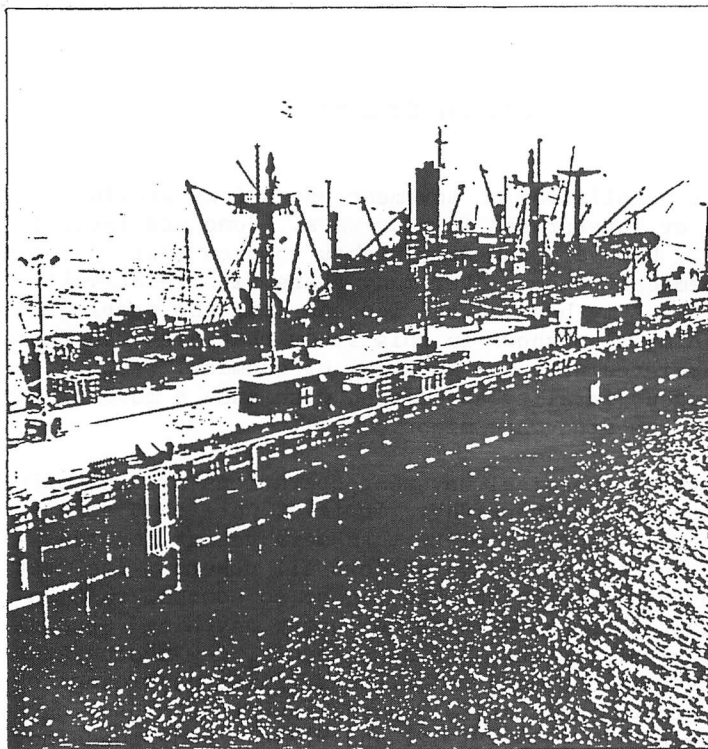
Executive Summary

The production of a compilation of movement operations provides a base of data which can be used or interpreted in many ways. Some are favorable to the Army, and some are not. However, the Army wishes to show that (1) it has moved large quantities of chemical weapons over many years with relatively few problems and that (2) the Army has learned lessons from the problems which it has encountered. The Army also shows in this study that although there have been some problems associated with the movement of chemical weapons, there has never been a chemical agent fatality associated with such a move. Most of the incidents catalogued in the study are minor.

That the Army records on chemical movement operations are incomplete is a theme frequently returned to in the study. It is of note that some of the earlier records are actually more complete than were recent records. There are many reasons for this, but one which overshadows all others. The fact is that by the 1950's these movement operations had become so common, that an attitude had become prevalent that these moves were no longer anything "special." They were regarded as a matter of routine, and as a result, few photographs were taken, and many records were disposed of as excess files according to then existing regulations. It was not until 1969 and 1970 that close control of movements under the new public laws (91-121 and 91-441) made these moves once again into something special or different which required better tracking of operations and preservation of records.

Lastly, it should be noted that the U.S. Army throughout all of these years has operated one unit to escort these munitions and to respond to emergencies. This unit, the U.S. Army Technical Escort Unit has existed since 1943 and has the responsibility for the moving of all chemical munitions. The vast majority of the information contained in this study comes either directly, or indirectly from their records. These records have been kept under the following organizational titles:

January 1943 - February 1944	Guard and Security Section, Camp Siebert, Alabama
February 1944 - January 1946	Guard and Security Section, Edgewood Arsenal, Maryland
January 1946 - March 1947	9710 Technical Service Unit, Guard and Security, Edgewood Arsenal, Maryland
March 1947 - September 1957	9710 Technical Service Unit, Technical Escort Detachment, Edgewood Arsenal, Maryland
September 1957 - Present	U.S. Army Technical Escort Unit, Edgewood Arsenal/Aberdeen Proving Ground, Maryland



**OPERATION RED HAT -
THE USNS FRANCIS X.
McGRAW AT TENGAN
PIER, OKINAWA -
OKC TO JA, 1970-1977,
PAGE 1.**



**OPERATION RED HAT -
PREPARING TO LOAD
M55 ROCKETS -
OKC TO JA, 1970-1977,
PAGE 1.**

How to Use the Compilation

Excluding the Executive Summary, the movement history compilation consists of five principal sections: (1) an introduction, (2) a location key, (3) a summarization of the known incidents associated with moves, (4) a compilation of the actual moves, and (5) recommendations and conclusions.

Introduction:

The Introduction is provided to explain the resources used to produce this report.

Location Key:

The Location Key provides a list of codes, usually three or four letters, which conveniently represent locations where chemical weapons were shipped to or from. The Location Key directly refers to the To and From columns in the section covering the compilation of moves.

Incident Summarization Sheets:

The section titled Incident Summarization Sheets contains, by reference number, a listing of incidents which occurred on movement operations. These were developed from existing trip reports, special project reports, depot records and, in some cases, personal interviews with former escort officers. This section is probably incomplete, owing to the condition of Army records, however it is felt that it documents all major incidents and shows most of the minor incidents. It is important to note that there has never been a chemical agent fatality on a chemical weapon movement operation.

The definition of an incident, for purposes of this report, is anything out of the ordinary which either resulted in, or might have resulted in, a spill or an injury. The term incident, as rigidly defined by AR 50-6 or AR 335-40, is not applicable in this report. For purposes of this report, a major incident is presumed to involve injuries from chemical warfare agent, or a large spill. A minor incident is defined as having no injuries, or a small/no spill.

Compilation of Moves:

The section covering the compilation of actual moves is the heart of the report. The section is divided into years from 1946 to 1986. During each year the pages are numbered, so that a move can be referred to by referring an entry on "1946, page 5," as an example. The section shows the following information:

1. From: The location from which the shipment originated. This is also sometimes an intermediate point where modes of transportation were changed such as From EA To ENJ, then From ENJ to Sea.

2. To: The location to which the shipment was sent. The destination of "sea" indicates a sea dumping of chemical weapons.

3. Date: Where two dates are given, the dates represent the date the shipment left, and the date that it arrived. Where one date is given, the date

represents only an arrival date or an approximate date of the move, due to poorer quality of historical records.

4. Type: Moves were categorized into movement types as follows:

S = sea shipment (either for transport or disposal)
R = rail shipment
M = tractor trailer truck shipment
A = air shipment

5. Cargo: The type of cargo requires some discussion of what was then, and is now, in the inventory, as well as the common abbreviations for chemicals used by the Army.

Rockets - includes the current M55 Rocket, as well as the no longer extant Honest John Rocket, 4.5" aircraft rocket and German rockets.

Drums - refers to the practice of storing chemicals in 55 gallon drums, generally discontinued in 1946.

Bulk or Cylinder - refers to one-ton containers or commercial gas cylinders.

Projectiles - refers to steel shelled artillery and mortar rounds, both U.S. and German, some of which are now obsolete (such as the 75mm), and some of which are currently stored (105mm, 155mm, 8 inch artillery and 4.2 inch mortar rounds).

Mines - refers to liquid filled land mines such as the current M23 VX filled land mine or the former British H or HT filled land mine.

Bombs - refers to both current and obsolete liquid filled aircraft bombs of several nations. All mustard filled bombs have long been disposed of other than periodic infrequent recoveries.

CAIS - an acronym referring to chemical agent identification sets. These items actually consisted of seven different configurations of training sets made over a period of almost 50 years by the Army and the Navy. They were sets intended for use by troops during training so that chemical agents could be properly identified and decontaminated in combat. Some sets contain little agent, while others contain as much as a large projectile.

CL - the abbreviation for chlorine gas, a World War I choking gas, identical to what is used for water purification today.

CG - the abbreviation for phosgene, another choking gas used in World War I and stockpiled extensively as a deterrent during World War II. Phosgene is used extensively by the chemical industry as a raw material for items such as plastics and fertilizers. The Army has periodically sold excess stocks of phosgene to private industry.

CK - the abbreviation for cyanogen chloride, a cyanide gas stockpiled extensively as a deterrent during World War II.

H - the abbreviation for mustard, manufactured by either the Levinstein or Thiodiglycol processes, a blister agent used in World War I, stockpiled during World War II and which remains stockpiled today. It is found filled in many different weapons, by many different nations. All of the belligerents during World War II stockpiled extensive quantities of mustard.

HD - the abbreviation for distilled mustard, chemically identical to H, but purified further so that it can be stored longer before polymerizing.

HT - the abbreviation for mustard mixed with T, which is Bis [2 (2-chloroethylthio) ethyl] ether, a compound used to depress the normal freezing point of mustard which is about 58°F.

L - the abbreviation for lewisite, an arsenical blister agent stockpiled extensively during World War II of which very little exists today.

GA - the abbreviation for Tabun, the first nerve agent developed secretly by Germany in 1936 (GA or German A-type). Stockpiled extensively by Germany during World War II.

GB - the abbreviation for Sarin, the standard non-persistent nerve agent stockpiled by the U.S. today.

VX - the abbreviation for the standard persistent nerve agent stockpiled by the U.S. today.

AC - the abbreviation for Hydrogen Cyanide, a cyanide gas stockpiled during World War II.

CN - the abbreviation for an early form of tear gas (such as today's riot control gas CS). CN, and its derivatives, CNS, CNB, etc., were relatively non-toxic.

PS - the abbreviation for chloropicrin a World War I tear gas which was relatively toxic when compared to CN or CS.

DM - the abbreviation for an arsenical riot control vomiting gas, no longer stockpiled.

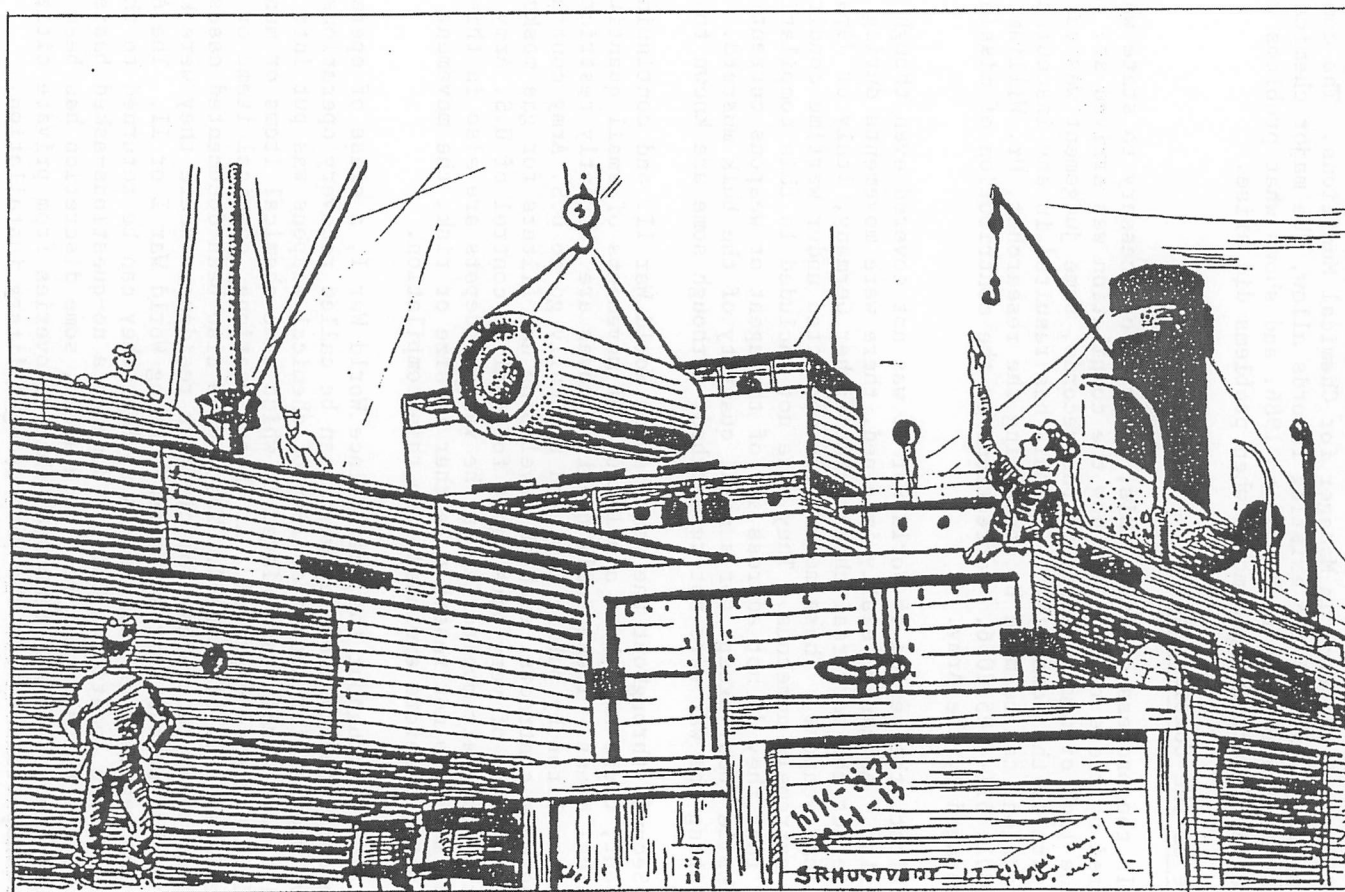
6. Quantity: Where it could be determined, this item shows the number of railcars, the number of aircraft, the number of trucks, and the name of the cargo ship. Where this information was unavailable, whatever information that was provided was used. It is emphasized that, due to the variety of records sources used, the description of quantity varies from the standards; for instance, instead of railcars of projectiles, the quantity may be found shown as pounds, tons or numbers each. Wherever possible, the quantity of railcars, aircraft, or trucks was used. Where railcars, aircraft or trucks are specified, the number reflects cargo carrying vehicles, without escort or security.

7. Incidents: Where an incident was identified, a number appears. This refers the reader to the section titled Incident Summarization Sheets. By looking at the corresponding number, the reader will find a summary describing the incident. Where "None" is stated, there is some documentation which

supports that no incident occurred. Where the column is left blank no information could be found. This almost certainly means that no incident occurred, however, no confirming documentation could be found to substantiate this conclusively.

Recommendations and Conclusions:

The section covering recommendations and conclusions deals with the problems discovered by researching past movement operations and what might be done to prevent them from being repeated. It is presented in the context of lessons learned.



PERIOD DRAWING OF DOCKSIDE OPERATIONS - 1946.

Introduction

The material that follows in this report is a compilation of Army Chemical Warfare Service Records which were located in November 1986 to April 1987 by the Office of the Program Manager for Chemical Munitions. The compilation documents, as far as the existing records allow, the major chemical warfare moves which were made from 1946 to 1986, and shows what problems were encountered during these moves when problems did arise.

Scope of the Compilation:

In the process of doing this, it is also necessary to state what is not covered by these records and how the compilation was arrived at. At times, due to the lack of completeness of the records, some judgement was called for on the part of the researcher. If this has resulted in any inaccuracy, corrections can be made by contacting the researcher, Mr. William Brankowitz, at (301) 671-4505/2056. Corrections or the contribution of missing material is encouraged by the Army.

First, the period of World War II was not covered even though these records do exist. As can be easily imagined, there were movements during the war to counteract the very real threat that either Germany, Italy or Japan would use chemical weapons. These moves were conducted under wartime conditions, and were extremely numerous. They were not included in this compilation due to the fact that they do not address any of the agent or weapons currently in the stockpile today except for a small quantity of the bulk mustard. Records predating the war were not researched, although some are known to exist.

Second, throughout the years since World War II, and continuing to the present, there have been a multitude of movements of small quantities of chemical agent. These small quantity moves are currently restricted to less than one liter by public law, and typically go to U.S. Army contractors for use in defense contracts, such as developing new filters for gas masks. Moves of small amounts of very pure agent for quality control of U.S. Army laboratories that perform air monitoring on the various depots are also in this category. These moves do not resemble, either in size or risk, the movement of munitions, and were therefore excluded from this compilation.

Also, throughout the years since World War I, a class of operations has been conducted by the Army which can be called recovery operations. Prior to 1969, when strict accountability of chemical weapons was put into effect by public law, conditions existed in which some chemical items or munitions were used in training or fired. At these locations, chemical items or munitions are sometimes still discovered. There have also been documented cases of chemical weapons being recovered from civilian residences where they were kept after being obtained as "war souvenirs" during World War I or II. The Army provides for the recovery of these items so that they can be returned to the nearest safe storage location. This is done on a no-questions-asked basis to encourage such items to be turned in. Once again, some discretion has been used in the documenting of these items such that recoveries from private citizens are shown as transportation from the recovering military installation.

Lastly, during the period covered by this report, a small number of classified chemical moves have been made. These movement operations remain classified for national security reasons. On one of these moves there were two truck accidents in an area of mountainous terrain. Although neither accident resulted in a chemical release, a guard riding in one of the trucks was fatally injured when the truck struck a ditch and overturned. There were no injuries associated with the other accident. There have been no spills or injuries during other classified moves.

Purpose of the Compilation:

The purposes for constructing the compilation were to document, insofar as existing records allowed, the movements of chemical weapons:

- (1) To show how often chemical munitions were moved by the Army without problems,
- (2) To describe what kinds of problems were encountered when chemical weapons were moved and things did go wrong, and
- (3) To benefit from the lessons learned based on past movement problems by providing this information to other Army and contractor personnel working on studies for the Chemical Stockpile Disposal Program.

Although current movement concepts involve packaging, air monitoring and security measures far more stringent than those used previously, some lessons can still be learned from the earlier successes and particularly the earlier mistakes. These are summarized in the section entitled "Recommendations and Conclusions."

In addition, a section of this introduction is devoted to a description of monitoring for chemical agents and how this has changed through the years. This may assist the reader in putting into context the fact that the air monitoring devices available to the Army today are far more sophisticated than those of the previous periods, and that leaking weapons can be detected and dealt with today far more rapidly than in the past.

Construction of the Compilation:

The compilation was constructed principally by researching the records of chemical depots (past and present) and records retained by the Army which deal with the U.S. Army Technical Escort Unit. The Technical Escort Unit (located at the Edgewood Area of Aberdeen Proving Ground, Maryland) has been the responsible unit for the movement of chemical weapons since World War II, and is specifically trained for this purpose. Under previous names it was known as the Guard and Security Section, the 9710th Technical Service Unit, and the U.S. Army Technical Escort Unit, Edgewood Arsenal.

After each move, officers of this unit were required to write a trip report. These trip reports were detailed and included point of origin, point of destination, makeup of the team, makeup of the cargo, and specific details of the operation. They were frequently classified Confidential or Secret at

the time. In addition, at the end of each year, until the late 1950's, a historical summary of the unit was constructed. Unfortunately, since this was required to be an unclassified document, it usually lacked details other than origin and destination of a move, and typically listed the cargo as "classified toxic gases" or some similar phrase. Details of the operation itself, unless considered extraordinary, were not included.

Lastly, for large operations involving high public visibility such as some of the sea dumps, specific historical documents were assembled, complete with reports, messages, and photographs. These volumes were extremely useful for operations such as CHASE VIII and the 1958 sea dumps.

The above, had all of it been preserved, would have made for a complete record of all operations. Unfortunately, this was apparently not the case.

The proper course for documents to be turned in from the U.S. Army Technical Escort Unit is, and was, twofold. Documents, if believed to be of sufficient historical value, could be turned in to the Edgewood Arsenal Historical Office. If not so judged, these records could be turned in to the post Records Retention Center. Records would be held here for about a year. They would then be sent to the Modern Military Records Retention Center at Suitland, Maryland, where the National Archives and Records Administration (NARA) maintains them for the Army for a number of years. The records are periodically reviewed by the Army and are then turned over to the complete custody of the Archives.

From 1942 to 1950, this system was observed well, and all of the records from this period have survived intact. From 1951 to 1954, only the Historical Summaries appear to have survived. These documents are in the custody of NARA and may be viewed in the research room in Suitland, Maryland.

From 1955 and 1956 no Technical Escort Unit records at all have been found. Fortunately, this could be supplemented with some records from other depots which survived as part of their depot surveillance records.

In searching the files at the U.S. Technical Escort Unit, the complete trip reports for 1957 and half of 1958 were discovered. These were preserved by the unit historian.

For 1959, a summary document was discovered, at the same location, which described air movements; however, little information on other moves has been found.

From 1960 to the first half of 1964, only limited information has been discovered. This information came from a variety of sources including the special Historical volumes mentioned above, the AMCCOM Transportation Office, chemical depot records, and the personal remembrances of some former escort officers.

From the last half of 1964 through 1969, a summary of movement operations was fortunately preserved by the unit historian at the U.S. Army Technical Escort Unit. This summary was apparently constructed during the early 1970's by COL Phillip Blackwell who used the original trip reports. It includes all

information except a description of any unusual incident which occurred on the move. Information on incidents, where possible, was obtained from personal remembrances and depot records. The trip reports from which the summary was constructed, with a few minor exceptions, have been misplaced in the Army records system or have been disposed of. The few that survived did, apparently, because they were unclassified and were kept separate from the rest.

In addition to the "Blackwell summary", depot records have been found which significantly supplement the data for 1968 and 1969. This is significant in that the "Blackwell summary" appears to be very complete for 1964 to 1967, but is missing many moves from 1968 and 1969.

For the reasons above, the information provided in the compilation is not complete. Wherever possible, the Army will continue to seek missing records, and will update the compilation as any new information becomes available.

Additional Historical Background:

Over the years, the Army has adopted some names or expressions for specific moves, or groups of moves, which are not completely clear to someone reading the movement tables. This section is provided to add more background as an aid to the reader.

Most early moves of chemical weapons were simply isolated events. Those that were big enough not to be, such as the return of the stocks from Europe, took on no specific name, but might sometimes be referred to by the name of the ship they came "home" on. However, incidents which were noteworthy to the technical escort personnel frequently were given names either by those personnel or by the news media. Early incidents which typify this were as follows:

(1) The Francis L. Lee incident - frequently used to describe all of the problems involved with handling the leaking cargo of captured German war stocks aboard the ship, the Francis L. Lee from 1 May 1946 when it left Antwerp until December of 1946 when "mothballing" of the vessel was finally completed. See incident 19.

(2) The Leaking Nazi War Gas Train - refers to the series of events at Panola, Alabama, Amory, Mississippi, and Memphis, Tennessee caused by a trainload of munitions being moved from the Francis L. Lee to Pine Bluff Arsenal, Arkansas in July 1946. See incident 18.

In late 1948, the Army made the decision to sea dump the majority of its remaining stock of Lewisite. Sea dumping had been accomplished previously, but before this time munitions were generally loose dumped from barges. In this case the Army decided to fill a World War II merchant hulk, the S.S. Joshua Alexander, with the bulk Lewisite to be sea dumped. The hulk was then towed to sea and scuttled (see 1948, page 2). This work was assigned a code name, Operation Geranium (Lewisite has an odor like Geraniums). This was a method of operations and a naming convention not used again for some time; but eventually the Army returned to it.

During the 1950's, the only major operation referred to by name was the Ralston sea dump. This operation was carried out in the spring of 1958, and consisted of the sea dumping of the remaining stocks of M70 bombs and some remaining Lewisite. The operation took its name from the name of the merchant hulk to be filled with the bombs, the S.S. William Ralston. The operation consisted of rail moves from Deseret Chemical Warfare Depot (now the south area of Tooele Army Depot) and Navajo Army Depot to the naval weapons station at Concord, California. From there, the Ralston and, later, a barge of one ton containers, were moved to sea for scuttling/dumping.

In the early 1960's, the system of using code names came back into use. This system has continued to the present day. Some notable examples which are sometimes referred to in the text of this report are as follows:

(1) Operation YBA - The first movement of chemical weapons to Okinawa from the Continental United States (see 1963, page 1). This includes the accompanying rail moves to Concord Naval Weapons Station, the port of departure.

(2) Operation YBB - The second movement of chemical weapons to Okinawa (see 1963, page 1).

(3) Operation YBF - The third and final movement of chemical weapons to Okinawa in April 1965 (see 1965, page 2).

(4) Operation CHASE 8 - The first of the four CHASE sea dumps of chemical weapons. CHASE was a U.S. Navy acronym for "Cut Holes and Sink Em." The Navy had been sea dumping conventional high explosive ammunition at sea using former merchant hulks which were scuttled for years. One series of these dumps were the CHASE dumps. Many people, even within the Army, erroneously assume that all CHASE dumps were chemical weapon dumps. In fact, the vast majority were not. CHASE 8, the first chemical weapons CHASE dump, was made in May-June 1967 (see 1967, pages 1 and 2). The material dumped was bulk mustard ton containers and GB filled M55 rockets. The rockets were placed into steel vaults which were then filled with concrete. All of the cargo was placed aboard a merchant hulk (the S.S. Corporal Eric Gibson) and was then sunk in deep water off the continental shelf.

(5) Operation YZU - The movement of the current chemical weapons stocks to Europe in June 1967. Most aspects of this movement remain classified.

(6) Operation CHASE XI - The second CHASE operation (see 1968, page 1) held in May-June 1968. This operation was conducted similarly to the previous CHASE operation.

(7) Operation CHASE XII - The third CHASE operation (see 1968, page 1) held in June 1968. The cargo in this case was mustard contaminated one ton containers filled with water.

(8) Operation CHASE X - The fourth and final CHASE operation (see 1970-1977, page 1) conducted in August 1970. Why CHASE X followed XI and XII is unclear, although it was probably planned earlier and executed later. The cargo consisted of solid concrete vaults of GB filled M55 rockets.

(9) Operation Red Hat - The movement of all chemical munitions on Okinawa to Johnston Atoll in January - September 1971 (see 1970-1977, page 1). This operation involved the last major movement of M55 rockets.

(10) Operation TNS - The movement of mustard filled mortar projectiles from the north area of Tooele Army Depot to the south area of Tooele Army Depot by train in August 1977 (see 1970-1977, page 1).

(11) Operation DTS - The movement of various chemical munitions from Dugway Proving Ground to the south area of Tooele Army Depot in August 1977 by truck convoy (see 1970-1977, page 1).

(12) Operation SETCON I - The movement (see consolidation, or SETCON) of small stocks of Chemical Agent Identification Sets (CAIS) to Rocky Mountain Arsenal from worldwide sites for incineration during the pilot test of a facility at Rocky Mountain Arsenal in January and February 1978.

(13) Operation SETCON II - Following the successful pilot incineration program, the movement of all remaining stocks of CAIS to Rocky Mountain Arsenal in May-June 1980 (with an earlier Navy move in 1978 to facilitate the airlift).

(14) Operation RMT - The airlift of the GB filled Weteye bombs at Rocky Mountain Arsenal to Dugway Proving Ground, and the associated truck convoys from Dugway Proving Ground to Tooele Army Depot in August 1981 (see 1981-1986, page 1).

Description of Monitoring:

The monitoring of the air and of suspect liquids for chemical agent has developed tremendously over the last 40 years. It is important to keep in context while reading this report exactly what monitoring was available during transportation to the U.S. Army over the years.

a. Mustard and Lewisite: Detection of a mustard or lewisite leak during the late 1940's and early 1950's consisted of visual inspections and odor. Using sense of smell to detect a mustard or lewisite leak is less hazardous than might be normally suspected, as both compounds have very characteristic odors which can be detected by smell at very low concentrations. Mustard has an odor described as that of garlic, while lewisite has an odor similar to geraniums.

During the same period, the Army had a detector crayon for localizing mustard or lewisite leaks. This crayon would turn color in the presence of the chemical agents and was useful for verifying, for instance, if a wet spot under a one-ton container plug might be chemical agent seepage or merely water condensation.

Later, in the mid-1950's, the Army developed detector tubes. These tubes were thin glass tubes with a chemical substance inside. The substance was wetted with a second reactive chemical, then an aspiration bulb was connected to the glass tube. The tube was aimed at the desired sample area and the aspiration bulb was used to pump air through the glass tube. If mustard or lewisite was present, the primary substance in the tube would turn color. This

system is still in use today for spot checks, and is similar to the industrially used Draeger-style tubes available for many compounds.

At the same time as the detector tubes were developed, an impregnated paper was also developed to replace the detector crayon. This detector paper, referred to as M8 paper, is still in use today.

Recently the Army has begun limited use of the British manufactured Chemical Agent Monitor, or CAM, which can perform similar spot checks for mustard by using an ionization principal similar to home smoke alarms. However, this new device has not been previously used in monitoring a move.

Other very sensitive devices the U.S. Army uses to monitor for mustard, principally the use of bubblers and the gas chromatographic based Automatic Chemical Agent Monitoring System (ACAMS), are also available. However, neither of these systems is easily portable and they have never been used in a move. Their principal application has been at fixed storage or disposal sites. Monitoring for lewisite has become relatively unimportant as most remaining stocks were destroyed at Rocky Mountain Arsenal in 1981 and 1982. Only small quantities remain at Tooele Army Depot.

b. Nerve Agents (GA, GB, and VX): Detection of nerve agents was a matter of great concern thrust upon the U.S. Army upon discovery of Germany's secret stocks of Tabun (GA) in 1945. As all of the nerve agents are essentially odorless and are deadly at low concentrations, a quick and accurate method was required.

The method selected was biological monitoring. Rabbits, which were found to be very susceptible to the nerve agents, were placed in the vicinity of the weapons. Usually four rabbits in small cages would be placed in a railcar. This method continued in use during transportation until 1969, and at some storage installations into the early 1980's.

In the mid-1950's, as with mustard, a detector tube was developed for nerve agent. The detector tube has continued into use today, but is supplemented by a newer wafer like paper held in a plastic matrix that can be similarly aspirated and changes color in the presence of nerve agent.

In the late 1960's, a chemical reaction based alarm, the M8, was developed which detected nerve agent at the level immediately dangerous to life and health. This alarm was used extensively in later moves, such as Operation RMT in 1981, although it was not as rugged as was desirable and would false alarm with reasonable frequency.

Since that time, the Army has fielded the M8A1 alarm, which is an ionization alarm for GB and VX. This alarm is considerably more rugged and false alarms with less frequency. It is highly suitable for movement operations, as is a similar alarm, the British CAM, and either of these alarms would replace older methods.

As with mustard, the Army has other techniques for the monitoring of nerve agent (bubblers and ACAMS) which are excellent, but are designed for fixed storage or disposal facilities. These methods are not easily portable and have not been used during transportation.

Description of Packaging.

Past packaging and shipment of chemical munitions was not considered with the scrutiny currently being given this issue. This particularly relates to the issue of overpacking munitions in a vapor tight container. Packaging, prior to Operation RMT in 1981 (the movement of Weteye bombs from Rocky Mountain Arsenal to Tooele Army Depot - see the next section and 1981-1986, page 1), concentrated on adequate blocking and bracing of the munitions. Some excellent photographs of this, taken during Operation Red Hat, are provided in the section for moves from 1970-1977. Other than blocking and bracing, the munitions were shipped in their storage configuration. This configuration generally had the munitions stored on sturdy wooden pallets, which were not overpacked in any fashion. The number of munitions per pallet varied with the size of the munition.

The only exception to the palletized configuration were the Navy bombs (MK94 and Weteye), the spray tanks and the one ton containers. The Navy bombs have their own specially designed overpack to protect them from salt spray and other contaminated effects, as well as to protect the crew from a leaking bomb. The spray tanks used by the Air Force also come in a specially designed overpack. One ton containers have previously been shipped "as is".

Typically, on early moves, weapons were shipped in closed box cars and were stacked as efficiently as possible. During the incidents mentioned in this report, several disadvantages of doing this became apparent:

- (1) If an item on the top leaked, it contaminated everything underneath it,
- (2) If an item on the bottom leaked, everything above it had to be moved to reach it, and
- (3) Such cramped conditions made emergency response more hazardous to the technical escort team coping with the problem.

In the 1950's, a modified approach using less dense packing was adopted. This was later formalized in rail and air packaging drawings published in the 1960's. Generally speaking, rockets, mines, and projectiles were still moved in boxcars, although they were not stacked as high or packaged as densely as before. One ton containers and bombs were moved in gondola cars (there are some excellent photographs of this in the section for 1958 on the Ralston sea dump). Spray tanks were moved on flat cars.

During Operation RMT in 1981, packaging was given some additional attention for the first time. Several Weteye bombs had been discovered leaking throughout the years prior to the move, and their contents had been drained into one ton containers. These one ton containers were overpacked for the air

move in a special steel container. The Weteye bombs, as previously mentioned, are already overpacked and were shipped as stored. Prior to Operation RMT, overpacking was accomplished only for munitions found to be leaking just prior to or during a move.

Reconciling the Records:

For anyone reading the history compilation pages, there is a tendency to want to reconcile all movements. That is, if VX projectiles went into Dugway, and are no longer stored there, the reader might wish to search for an outgoing shipment to show what happened to these items.

In some instances this can be done. In many instances, however, this attempt would be doomed to failure. Failure to reconcile the records could occur for several reasons as follows:

(1) For many years, the Army fired chemical weapons during tests at many of the locations shown. Some locations which extensively fired chemical weapons were Pine Bluff Arsenal, Edgewood Arsenal, and Dugway Proving Ground.

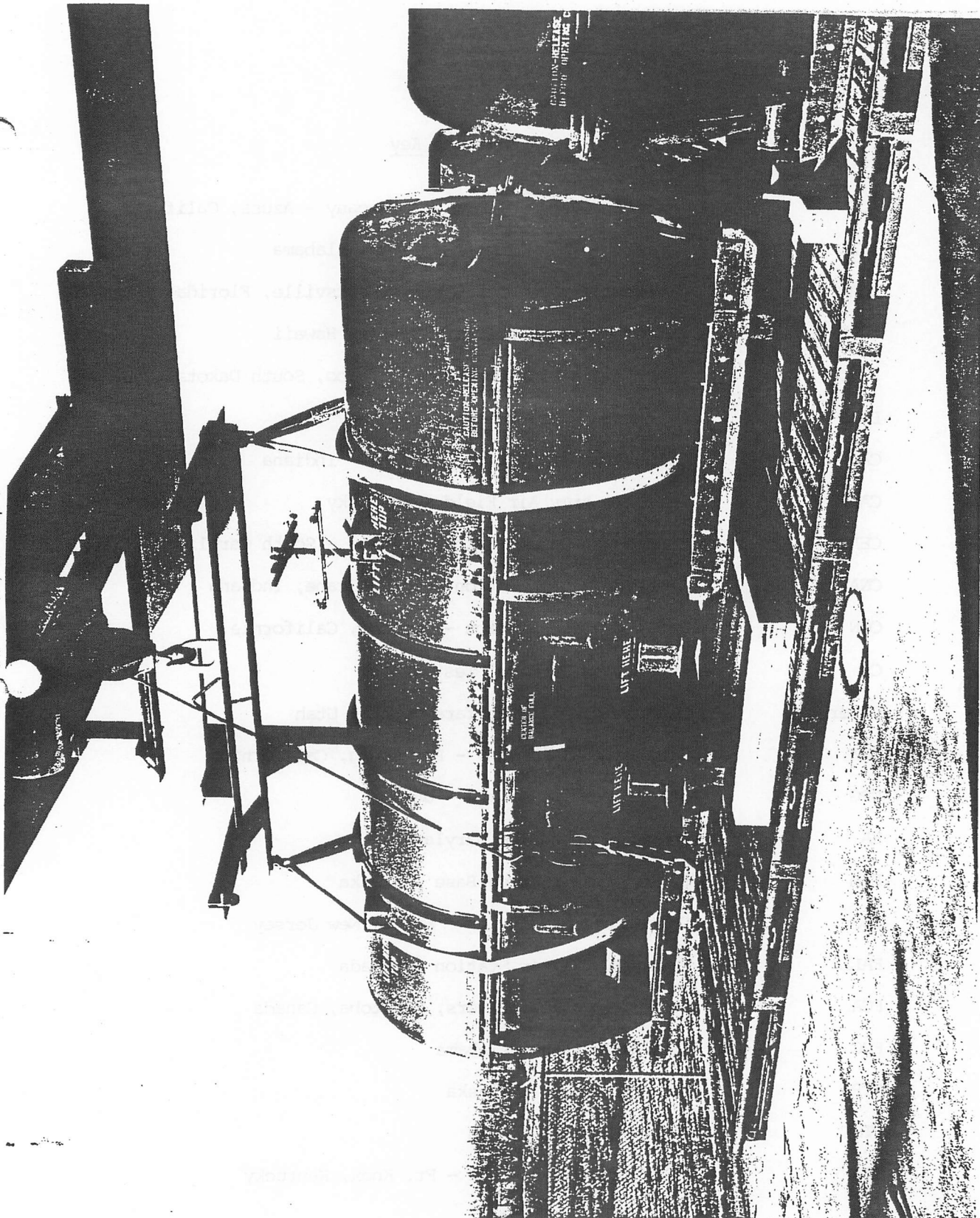
(2) The Army has transferred agent from certain munitions into other containers or munitions. For instance, at Pine Bluff Arsenal, captured German stocks and British stocks were transferred from bombs and land mines into one ton containers. At Rocky Mountain Arsenal, phosgene from bombs and projectiles was transferred into one ton containers. The containers were later sold by the government to private industry. The phosgene was then used as a raw material for fertilizers, plastics, etc.

(3) The Army has run many major disposal programs. For instance, all GB and HD stocks remaining at Rocky Mountain Arsenal in 1970 were incinerated or neutralized in controlled industrial facilities. At earlier dates, many installations destroyed chemical munitions by open pit burning.

(4) Finally, as referred to earlier, the records are not complete for all years. There are some moves, for instance the specific date of movement of GB rockets from Rocky Mountain Arsenal to east coast depots (accomplished some time in 1961-1963), which are simply missing.

For whatever admitted flaws in records completeness that exist, the records do give a picture of the magnitude of moves made over the years, and the success, and sometimes the problems, which the Army has encountered during this time. For further discussion of this issue, the reader is referred to the section on "Recommendations and Conclusions."

AP2-426.2/AMC-67



Special Task Group - Add on to Plot as a Hoop & Barrel Assembly Plant

Location Key

ACY	American Cyanamid Chemical Company - Azusa, California
ANAD	Anniston Army Depot - Anniston, Alabama
BAAB	Brooksville Army Air Base - Brooksville, Florida
BARB	Barbers Point Naval Air Station, Hawaii
BHOD	Black Hills Ordnance Depot - Igloo, South Dakota
BRAG	Ft. Bragg - North Carolina
CAAA	Crane Army Ammunition Activity - Indiana
CAAF	Campbell Army Air Field - Kentucky
CHAS	Charleston Naval Weapons Station - South Carolina
CNAD	Crane Naval Ammunition Depot - Crane, Indiana
CON	Naval Weapons Station - Concord, California
CZ	Canal Zone Tropical Test Areas
Deseret	Deseret Chemical Warfare Depot - Utah
DOW	Dow Chemical Company - Pittsburg, California
DPG	Dugway Proving Ground - Utah
EA	Edgewood Arsenal - Maryland
ELM	Elmendorf Air Force Base - Alaska
ENJ	Colts Neck Naval Pier - Earle, New Jersey
FALL	Fallon Naval Air Station - Nevada
FCA	Fort Churchill - Rivers, Manitoba, Canada
FMC	Fort McClellan - Alabama
FTR	Ft. Richardson - Alaska
FTST	Ft. Stewart - Georgia
GAAF	Godman Army Air Field - Ft. Knox, Kentucky
GAK	Ft. Greely - Alaska

Location Key (Continued)

GCWD	Gulf Chemical Warfare Depot - Huntsville, Alabama
GUAM	Anderson Air Force Base - Guam
HAAP	Hawthorne Army Ammunition Plant - Nevada
JA	Johnston Atoll
KEY	Keyport Naval Torpedo Station - Washington
LALM	Los Alamitos Naval Air Station - California
LBDA	Lexington-Blue Grass Depot Activity
LEJ	Camp Lejeune - North Carolina
ILL	Lualualei Naval Magazine - Hawaii
LOD	Letterkenny Ordnance Depot - Pennsylvania
LRAFB	Little Rock Air Force Base - Arkansas
MAAB	MacDill Army Air Base - Tampa, Florida
MAAP	McAlester Army Ammunition Plant - Oklahoma
MAFB	Maquire Air Force Base - New Jersey
MAP	Mukilteo Ammunition Pier - Mukilteo, Washington
MCMA	Mineral County Municipal Airport - Nevada
MMA	McAlester Municipal Airport - Oklahoma
NAAP	Newport Army Ammunition Plant - Newport, Indiana
NAVG	Naval Magazine - Guam
NAZ	Navajo Army Depot - Arizona
NMD	Naval Mine Depot - Yorktown, Virginia
NOPE	New Orleans Port of Entry - Braithwaite, Louisiana
NRAF	New River Marine Corps Air Field - North Carolina
OKC	Chibana Army Depot - Chibana, Okinawa

Location Key (Continued)

PAAF	Phillips Army Air Field - Aberdeen Proving Ground, Maryland
PAFB	Pope Air Force Base - North Carolina
PBA	Pine Bluff Arsenal - Arkansas
PNMA	Pendleton Municipal Airport - Washington
PUDA	Pueblo Depot Activity - Pueblo, Colorado
QUAN	Quantico Marine Corps Air Field - Virginia
RAH	Rahway Arsenal - Rahway, NJ
RMA	Rocky Mountain Arsenal - Colorado
SBSB	Small Boat Wet Storage Basin - Charleston, South Carolina
SBCA	Seal Beach Naval Weapons Station - California
SJOD	San Jacinto Ordnance Depot - Houston, Texas
SUF	Suffield Test Center - Ralston, Alberta, Canada
SUN	Sunny Point Naval Pier - Sunny Point, North Carolina
SVOD	Savanna Ordnance Depot - Savanna, Illinois
TAFB	Travis Air Force Base - California
TEAD	Tooele Army Depot - Tooele, Utah
TNM	Theodore Naval Magazine - Mobile, Alabama
TORO	El Toro Marine Corps Air Station - California
TUL	Tulalip Backup Storage Depot - Tulalip, Washington
UKMR	Upper Kipapa Military Reservation - Hawaii
UMDA	Umatilla Depot Activity - Hermiston, Oregon
WAAF	Wainwright Army Air Field - Ft. Wainwright, Alaska
WHID	Whidbey Island Naval Air Station - Washington
WRAF	Wright Army Air Field - Georgia
YTS	Yuma Test Station - Yuma, Arizona

Incident Summarization Sheets

1. (Date: Jul/Aug 47, Ref: 1947, page 1) One 4.2 inch phosgene (CG) filled mortar cartridge was discovered leaking while unloading on the dock. Item was destroyed. There were no injuries.
2. (Date: Mar 48, Ref: 1948, page 2) Minor valve leaks were discovered during the movement on two bulk containers of mustard (H). The leaks were sealed and decontaminated. There were no injuries.
3. (Date: Feb 48, Ref: 1948, page 2) A switching accident at Pine Bluff Arsenal resulted in two railcars filled with HT ton containers derailing and overturning. No leakers occurred and there were no injuries.
4. (Date: Jul 47/Jan 48, Ref: 1947, page 1) One minor road accident. No injuries and no leakers.
5. (Date: Aug/Sep 49, Ref: 1949, page 1) Truck 3 of the convoy was involved in a slow-speed collision with a civilian automobile near Jefferson City, Missouri. No leaks, spills or injuries were involved.
6. (Date: Nov 49, Ref: 1949, page 1) Truck 9 of the convoy was involved in a serious (20 mph) accident with a civilian truck when the police escort in St. Josephs City, Missouri failed to block off an intersection. There were no spills or leaks. Personnel on the truck were injured by the collision (injured neck and back, bruised knee, bruised side, etc.).
7. (Date: Oct 49, Ref: 1949, page 1) During unloading of the trucks, the fact that one 75mm projectile had rolled out of its pallet went unnoticed. The projectile was found later in the day still in the truck at the Ringsby Transportation Company Garage, Denver, Colorado. The projectile was reported to the Army and removed to Rocky Mountain Arsenal without further incident.
8. (Date: Oct 49, Ref: 1949, page 1) The air brakes on truck 8 of the convoy failed causing it to rear-end truck 7 near Bennett, Colorado. A vehicle fire started as the collision was serious, but was quickly extinguished by the escort personnel. There was no leak or spill, but there were some collision oriented injuries.
- 9 (A). (Date: Nov/Dec 48, Ref: 1948, page 2) During placement of the ton containers in the hold of the vessel prior to sea dump, a valve was accidentally sheared off. A vapor leak occurred but was sealed and decontaminated. There were no injuries.
- 9 (B). (Date: Nov/Dec 48, Ref: 1948, page 2) During the sea dump, the scuttling crew reported donning masks due to vapor in the hold of the vessel. It is probable that a ton container leaked during movement to the dump site. There were no injuries.
10. (Date: Jun 50, Ref: 1950, page 2) Truck 303 of the convoy was involved in a collision in Red Bird, Wyoming on 8 June 1950. No further details regarding this accident exist in the historical files.

11. (Date: Jun/Jul 50, Ref: 1950, page 2) Upon starting from a dead stop, a tractor and trailer uncoupled causing the trailer to fall forward onto the ground. There was no damage to the load. There were no spills, leaks or injuries.
12. (Date: Sep 46, Ref: 1946, page 8) Three leaking lewisite bombs were discovered during movement from the train to the barge. These were sealed and decontaminated, and then overpacked. There were no injuries.
13. (Date: Aug 46, Ref: 1946, page 10) Mustard bombs were discovered leaking during the unloading of the barge. One Non-Commissioned Officer was injured. Hospitalization was not required.
14. (Date: Aug 46, Ref: 1946, page 9) Leaking chemical munitions were found during the unloading of the S.S. Richardson. They were segregated onto special barges after being sealed and decontaminated. The leakers included 2 German GA bombs, 2 British H land mines, 46 CG bombs and 154 German H bombs. During the handling of these items "three civilian employees of this station received mustard gas injuries in handling contaminated lines to barges containing leaking munitions. None were hospitalized. Eight enlisted personnel received injuries from mustard gas in miscellaneous operations handling leakers. None were hospitalized." The barges were being used to remove unserviceable munitions found on the S.S. Richardson to a sea dumping area.
15. (Date: May/Jun 46, Ref: 1946, page 9) "Hold Number 2 had a considerable concentration of CG from leaking bombs." The hold was ventilated using large fans. The leakers were sealed. The cargo was unloaded by 18 June 1946. There were no injuries.
16. (Date: May/Jun 46, Ref: 1946, page 9) When unloading of the vessel began, personnel were not in protective clothing and leakers were soon encountered resulting in injuries. Both civilian stevedores and military personnel were then put into full rubber protective clothing. Eventually a total of 2 leaking GA bombs and 154 leaking mustard munitions were discovered. The leakers were sealed, decontaminated and overpacked. They were then segregated on the dock for sea dump. "Fifty-two civilians of the Charleston Stevedoring Company were treated for gas injuries, and 10 of them were hospitalized. Nine civilian employees of the Basin were treated for gas injuries and 3 were hospitalized. Eight Army personnel were injured, and 3 of them were hospitalized." All injuries were mustard burns.
17. (Date: Jul 46, Ref: 1946, page 9) Leaking mustard bombs from the cargo hold of the S.S. Francis Lee were taken by barge to Horn Island, Mississippi, and were open air burned. "All working personnel received vapor burns in the wrist area...some men also had slight burns on the neck." These injuries were incurred by the military group which off-loaded and burned the bombs.

18. (Date: Jul 46, Ref: 1946, page 9) The famous "Leaking Nazi War Gas Train." Soon after leaving Theodore Naval Magazine (12 July 1946) leaking German H bombs were discovered in one railcar. This car was detached from the train at Panola, Alabama, the leaks sealed and the car was returned to TNM for inspection and later shipment.

At Amory, Mississippi, a second car was discovered to be leaking seriously (13 July 1946). It was detached and moved to a siding in Bigbee, Mississippi and was left under guard. In spite of this, several railroad employees of the Amory yard ventured too close to the car and received vapor burns. A military escort team from Edgewood Arsenal arrived and by 17 July 1946, had isolated the leaker, decontaminated the area and destroyed the munition. The railcar then was forwarded to Pine Bluff Arsenal without further incident on 21 July 1946.

Meanwhile, the train with the remaining 8 cars had continued on toward Pine Bluff Arsenal. Arriving at the yard in Memphis, Tennessee (late on 13 July 1946), it was discovered that 3 more cars had leakers on board, and that one was very serious. The train had, in fact, contaminated 10 miles of track leading to the yard. Another special escort team from Edgewood Arsenal was sent to Memphis. The tracks were decontaminated, the leaking railcars were separated and decontaminated, and the leaking munitions were isolated and destroyed. These 3 railcars eventually reached Pine Bluff Arsenal on 30 July 1946.

During the Amory and Memphis operations, at least 21 civilian railyard workers received vapor burns from mustard and 2 were hospitalized. At least twenty-five military personnel received both vapor and liquid burns and at least 4 were hospitalized. The final medical report on these incidents lists 60 total gas exposures - 28 at Amory and 32 at Memphis. The injuries were mainly due to the high summer temperatures, poor availability of proper protective clothing and a lack of understanding and cooperation by local military authorities. This incident resulted in the virtual rewriting of chemical movement procedures used at that time.

19A. (Date: May-Jul 46, Ref: 1946, page 8) This ship, the S.S. Francis Lee, like others carrying captured German stocks, was found to contain leakers; however, this ship contained far more leakers than any of the others. These were segregated on the pier after decontamination and were placed on a barge for disposal (see Incident 17). During the unloading of the vessel 375 people were injured by exposure to mustard, and at least 22 people were hospitalized, making this the worst chemical incident the Army has ever incurred during transportation (excluding combat action during World War II). All of the injured were military personnel, or civilian contract personnel to the Army, principally stevedores.

19B. (Date: Jul-Aug 46, Ref: 1946, page 9) Upon opening the last hold of the Francis Lee, the situation was determined to be beyond handling with the resources at TNM. Consequently, the hold was sealed and the ship was moved to Edgewood, Maryland. Here, technical teams off-loaded the last 300 bombs, destroyed them and completely decontaminated the ship. There were 52 cases of

minor vapor burns during this operation, and some personnel were briefly hospitalized. The ship was subsequently moved to Baltimore for "moth balling" prior to being placed in long-term storage. During the moth-balling process, three civilians were injured and hospitalized due to contamination which had gone undiscovered in a remote portion of the bilge. This area was decontaminated by teams from Edgewood. The ship was checked periodically at its naval reserve mooring for the next 3 years, and no further contamination was found.

20. (Date: May/Jun 46, Ref: 1946, page 7) This ship, the S.S. Isaac Wise, contained some leakers. These were destroyed at San Jacinto Ordnance Depot. Five men received mustard vapor burns during the unloading operation - one ship's crewman, three stevedores, and one military escort person.

21. (Date: Jun/Jul 46, Ref: 1946, page 6) A serious mustard leaker was discovered as the train approached Chattanooga, Tennessee. The car was isolated at Tinner, Tennessee. The leaking bomb was sealed and decontaminated, and mustard which had spilled onto the siding was also decontaminated.

22. (Date: Jun/Jul 46, Ref: 1946, page 6) A leaking railcar was discovered upon entering the Georgia Railroad Yard at the corner of Delta and DeKalb Streets, Atlanta, Georgia. The car was isolated and a military escort team from Edgewood Arsenal was sent to decontaminate the area. The siding was decontaminated and the bomb was isolated and destroyed. Some military personnel on the escort team received minor vapor burns, and one air force enlisted man was briefly hospitalized with vapor burns.

23. (Date: Jun 46, Ref: 1946, page 5) One railcar was found to contain leaking drums of mustard upon arrival at Gulf Chemical Warfare Depot. There were no injuries.

24. (Date: Apr 46, Ref: 1946, page 4) On 8 April 1946, while at sea, a ton container of chlorine began leaking through a faulty fusible plug. After unsuccessful efforts to plug the leak, the ton container was thrown overboard. There were no injuries.

25. (Date: Mar 46, Ref: 1946, page 4) On 6 March 1946, while at sea, a 150 pound cylinder of chlorine was found to be leaking. After unsuccessful efforts to plug the leak it was thrown overboard. There were no injuries.

26. (Date: Apr/May 46, Ref: 1946, page 7) Eight 1,000 pound phosgene (CG) bombs and six 500 pound phosgene (CG) bombs were discovered leaking during unloading of the S.S. Park Benjamin. Twelve were repaired and two were destroyed (see Incident 39). There were no injuries.

27. (Date: Mar 46, Ref: 1946, page 2) Two mustard bombs were found to be leaking upon arrival. These were placed on a barge and dumped at sea. There were no injuries.

28. (Date: Feb 46, Ref: 1946, page 1) A gasoline line broke causing the truck to catch fire near Little Rock, Arkansas. The crew quickly extinguished the fire. There were no spills, leaks or injuries.

29. (Date: Jun 46, Ref: 1946, page 5) A railcar was discovered leaking mustard near Manchester, Georgia. Military escort teams were sent from Edgewood Arsenal, Maryland, to decontaminate the spill and arrived on 25 June 1946. The teams located a leaking bomb on 26 June 1946 and decontaminated it. The railcar was then forwarded to Gulf Chemical Warfare Depot (GCWD) without further incident. During the decontamination operations at Manchester, approximately 6 civilian employees of GCWD received mustard vapor burns. Approximately 14 members of the military escort teams also received vapor burns, and 7 men were hospitalized for approximately 2 weeks.

30. (Date: May 68, Ref: 1968, page 1) During the movement of this train from ANAD to Earle, New Jersey, the train was required to be repositioned while in the Potomac River Railroad Yard, Alexandria, Virginia. During this time two carloads of rockets were uncoupled from the train, and upon departure, were inadvertently left in the yard. When this was discovered, a military team was sent to secure them, and they were subsequently moved to the sea dump area without incident. The rockets in the carloads were completely encased in concrete for the sea dump, and at no time leaked or caused injuries.

31. (Date: Mar 58, Ref: 1958, page 1) Leakers developed during the move as follows: 7 discovered in Elko, Nevada, 23 discovered in Portola, California, 34 discovered in Sacramento, California, and 59 discovered upon arrival in Concord. This resulted in 7 of the 15 gondola cars being contaminated. Load was decontaminated enroute and on arrival. No injuries.

32. (Date: Mar/Apr 58, Ref: 1958, page 1) Leakers developed during the move as follows: several minor leaks discovered in Portola, California, major leaks were apparent by the time the train arrived in Sacramento, California. During off-loading in Concord, about 150 leakers were found in 22 of 30 gondolas. Prompt decontamination and temperatures dipping into the 30's at night prevented a major spill. Spills were confined to the gondolas and were decontaminated. There were no injuries.

33. (Date: Apr 58, Ref: 1958, page 1) Leakers developed during the move. During off-loading, leakers were found in 29 of 30 cars. Prompt decontamination prevented a major spill and spills were confined to the gondolas. Leakers were segregated and rapidly overpacked in propellant charge cans during the off-loading at Concord, and all rail cars were decontaminated. There were no injuries.

34. (Date: Sep 65, Ref: 1965, page 4) The VX spray tank being returned was almost, but not quite, empty. During the movement, the spray tank nozzle leaked a small amount of VX. The military escort team used a powdered and spray decontaminant to clean the spill, and the chemical reaction caused a small on-board fire on the aircraft. The fire was quickly extinguished and there were no injuries.

35. (Date: May 65, Ref: 1965, page 2) During Operation YBF as the USNS McGraw was moving out of San Francisco harbor, another ship turned across its bow resulting in a near collision. The ships cleared each other by approximately 600 feet.

36. (Date: Oct 68, Ref: 1968, page 3) Upon preparing to unload one railcar at Umatilla, the rabbits were found dead. Further inspection disclosed a small leak in an MC-1 bomb (GB) at the edge of the center suspension lug. The bomb was immediately taped to stop the leak and was then overpacked. The area was then decontaminated. There were no injuries.

37. (Date: Sep 68, Ref: 1968, page 2) During unloading of one railcar at Umatilla, a leaking MC-1 bomb (GB) was detected. The leaker was taped and overpacked. The area was then decontaminated. There were no injuries.

38. (Date: Aug 64, Ref: 1964, page 1) During the movement to sea, a ton container of mustard leaked at the valve assembly. The lip of the ton container had filled with mustard and the ton container below was contaminated as well. The team evacuated the barge, suited up in protective clothing and returned to the barge. They then dumped both ton containers over the side and decontaminated the spill on the barge deck. There were no injuries and the rest of the material was sea dumped without further incident.

39. (Date: May 46, Ref: 1946, page 7) Three leaking German phosgene bombs were disposed of by taking them offshore and dumping them in deep water. There were no injuries.

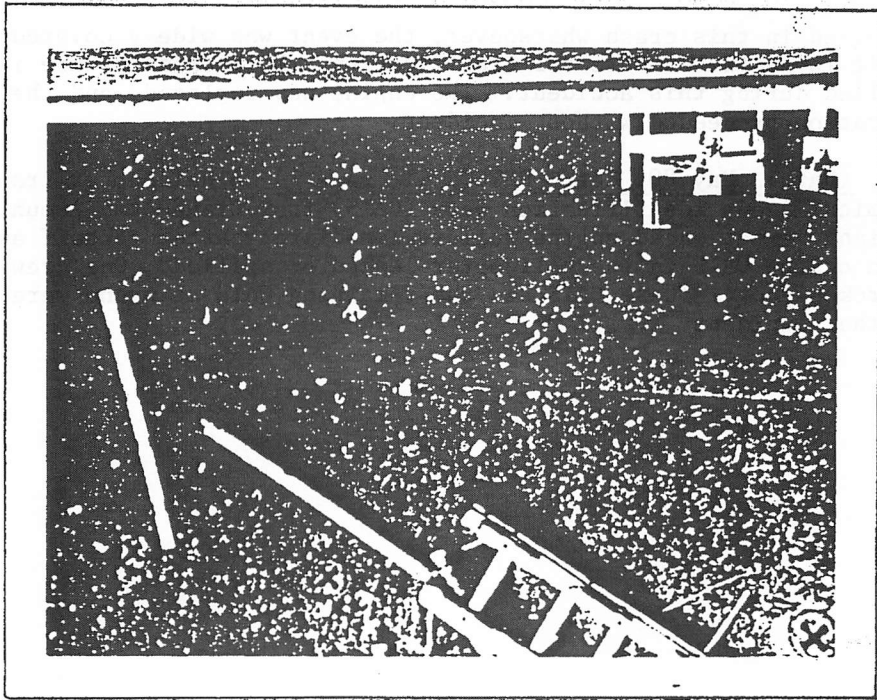
40. (Date: Jul 46, Ref: 1946, page 9) During unloading of the Francis Lee, 33 leaking German bombs were set aside on a barge for sea disposal. These were dumped on 13 Jul 46 20 miles off the coast. While dumping the bombs, a forklift pierced one bomb accidentally, contaminating the barge and allowing the mustard to partially drain. Since the personnel conducting the dump were in protective clothing, there were no serious injuries and the barge was decontaminated. However, the partially drained bomb floated away rather than sinking. It subsequently washed ashore (20 Jul 46) where local residents retrieved it as a war souvenir. The Army recovered the item on 23 Jul 46. Fortunately, the mustard had been flushed from the bomb, broken up by wave action, and had reacted with the seawater. The bomb was completely clean of mustard. There were no injuries to the civilians who retrieved the bomb.

41. (Date: Aug 71, Ref: 1970-1977, page 1) During the loading of the USNS Sealift, one pallet of 15 M55 rockets was accidentally dropped approximately 40 feet into the hold of the vessel from a crane. Although subsequent examination showed that some of the rockets had been severely damaged, no spill occurred, and there was no harm to operators or the general public.

42. (Date: Aug 77, Ref: 1970-1977, page 1) Prior to Army inspection, and prior to arrival in the North Area of Tooele Army Depot, one of two engines scheduled to pull the munitions train was involved in a collision when its brakes failed allowing it to roll into another train. Although no weapons were

involved in this crash whatsoever, the event was widely covered by the media, so it is mentioned here for clarification. No chemicals were involved in or spilled during this accident. The engine was replaced, and the actual movement operation proceeded without incident.

43. (Date: May 80, Ref: SETCON II, page 1) A helicopter transferring Chemical Agent Identification Sets (CAIS) from Crane Army Ammunition Activity, Indiana, experienced engine failure immediately after takeoff and crashed. None of the CAIS in the helicopter leaked or spilled. One crew member suffered a broken foot. These CAIS and the remaining CAIS at Crane were removed without further incident.



OPERATION RED HAT - M55 ROCKETS LIE IN THE HOLD OF
USNS SEALIFT AFTER ACCIDENTAL DROPPING -OKC TO JA,
1970-1977, PAGE 1.