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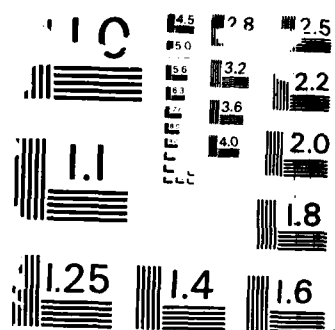
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This document has been prepared for the U.S. Army to support the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. This report includes the guidance and direction provided by a panel of experts knowledgeable in the safe transportation of hazardous materials. These experts were drawn from industry, academia, and members of the private consulting community. Sections 3.0 through 9.0 represent a transportation concept plan using the panel's guidance where applicable. The basis for this plan includes standing Army procedures and regulations regarding the handling and transport of chemical agents and munitions. It also includes results from previous studies conducted by the Army. (Key word)				
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**TRANSPORTATION OF CHEMICAL AGENTS AND MUNITIONS:
A CONCEPT PLAN**

Prepared for:
U.S. Army
Office of the Program Manager
for Chemical Munitions
Aberdeen Proving Ground, MD

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Prepared by:
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ABSTRACT

This document has been prepared for the U.S. Army to support the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. This report includes the guidance and direction provided by a panel of experts knowledgeable in the safe transportation of hazardous materials. These experts were drawn from industry, academia, and members of the private consulting community. Sections 3.0 through 9.0 represent a transportation concept plan using the panel's guidance where applicable. The basis for this plan includes standing Army procedures and regulations regarding the handling and transport of chemical agents and munitions. It also includes results from previous studies conducted by the Army.

Suggested Keywords: Chemical stockpile, Chemical munitions,
Transportation of chemical munitions

FOREWORD

The Transportation Panel was charged with developing criteria and requirements which would render the transportation of chemical agents and munitions as safe as possible should these munitions have to be moved. The panel was to accord safety as the primary consideration. Within this context, the panel was to provide guidance in the preparation of a transportation concept plan covering rail, air, marine, and on-site transportation.

The panel has reviewed this document. It finds that Section 2.0 and Appendix C of this document constitute a faithful summary of the panel's findings and recommendations. It also finds the body of the concept plan to be basically consistent with those recommendations.

The scope of the panel's charter was restricted to safety in transport for those disposal alternatives requiring transportation. The panel was not to make recommendations concerning the relative merits or risks of the alternatives. It has adhered to this mandate and has developed recommendations accordingly.

In view of this restricted charge, the panel has not considered the relative risks of all of the disposal alternatives, including on-site destruction. Unless transportation can be shown as the safest alternative, the panel prefers that the munitions not be moved off-site.

Michael S. Bronzini
Charles E. Dettmann
Charles O. Miller
Bruce J. Williams

Members, Transportation Panel

PREFACE

The U.S. Department of Defense is required by Public Law 99-145 to destroy the stockpile of lethal chemical agents and munitions stored at eight U.S. Army installations in the United States and at Johnston Island in the Pacific.

All but one of the disposal alternatives now under study by the U.S. Army for its Chemical Stockpile Disposal Program would require the off-site transport of chemical agents and munitions. All alternatives would require transport of the munitions within the boundaries of the eight installations. The principal purpose of this document is to address the nature of both kinds of transport in sufficient conceptual detail to support the preparation of the Final Programmatic Environmental Impact Statement for the program.

A clear concept of how such hazardous materials would be handled and transported is required to answer questions on safety, cost, and possible effects on the environment. This concept is sufficiently developed so that the important issues are identified and treated in a consistent framework. The concepts described in this document are of general applicability rather than site specific since an actual transportation operations plan, if the selected disposal alternative requires one, will necessarily reflect more detailed levels of program decision making.

This concept plan takes, as its point of departure, established Army procedures and Army-sponsored studies on safety and security practices and on the handling and transportation of chemical agents and munitions. A panel of four civilian sector transportation practitioners were invited to consider the particular difficulties of moving chemical munitions, to develop criteria and guidance, and generally, to give advice in the preparation of the concept plan. The concept plan is, therefore, a description of modal transportation options based on standard U.S. Army operating procedures and proposed actions that conform to the advice of the expert independent panel.

ACKNOWLEDGMENT

Many individuals and organizations have contributed to the preparation of this document. The MITRE team, the principals of which are Ms. Laura Skinner, Dr. Wade Smith, and Dr. Sherwood Chu, project leader, acknowledges their efforts.

Mr. Allan McKinney, project monitor for the U.S. Army, provided guidance and an abundance of resource material used in the development of the concept plan as described in Sections 3.0 through 9.0. Other substantial contributors to these sections from the Office of the Program Manager for Chemical Munitions were Mr. William Brankowitz, Mr. Thomas Kartachak, Ms. Peggy Thompson, Mr. Edward Meseke, and Ms. Barbara Kuryk. They provided valuable information in a variety of areas such as monitoring, security, leaker treatment, and safety procedures.

Other organizations also provided information and support. These included the Military Traffic Management Command; Military Airlift Command; Department of Defense Explosives Safety Board; U.S. Army Transportation Engineering Agency; H&R Associates; Oak Ridge National Laboratories--especially, Mr. William Hermes; Union Pacific Railroad; Thrall Car Manufacturing Company; Greenbrier Leasing; Simula Incorporated; and many other commercial organizations that supplied information necessary for successful completion of this study.

Other MITRE staff members have made substantial contributions to this effort: Mr. William Duff and Mr. John Perry for general expertise in Army chemical munition characteristics and safety practices, Ms. Ruby Davis for technical support, Ms. Judy Giselle Jackson for her patience and good humor in the production of this document, and Mr. Brian Price for his thorough review of and valuable comments on this report.

EXECUTIVE SUMMARY

INTRODUCTION

The U.S. Department of Defense is required by Congress (Public Law 99-145) to destroy the stockpile of lethal chemical munitions stored at eight U.S. Army installations in the continental United States (Figure ES-1) and at Johnston Island in the Pacific Ocean by the end of September 1994. The total Army stockpile at these sites is made up of rockets, mines, mortars, projectiles, cartridges, bombs, spray tanks, and bulk containers. These munitions contain the nerve agents GB and VX and the blistering agent mustard.

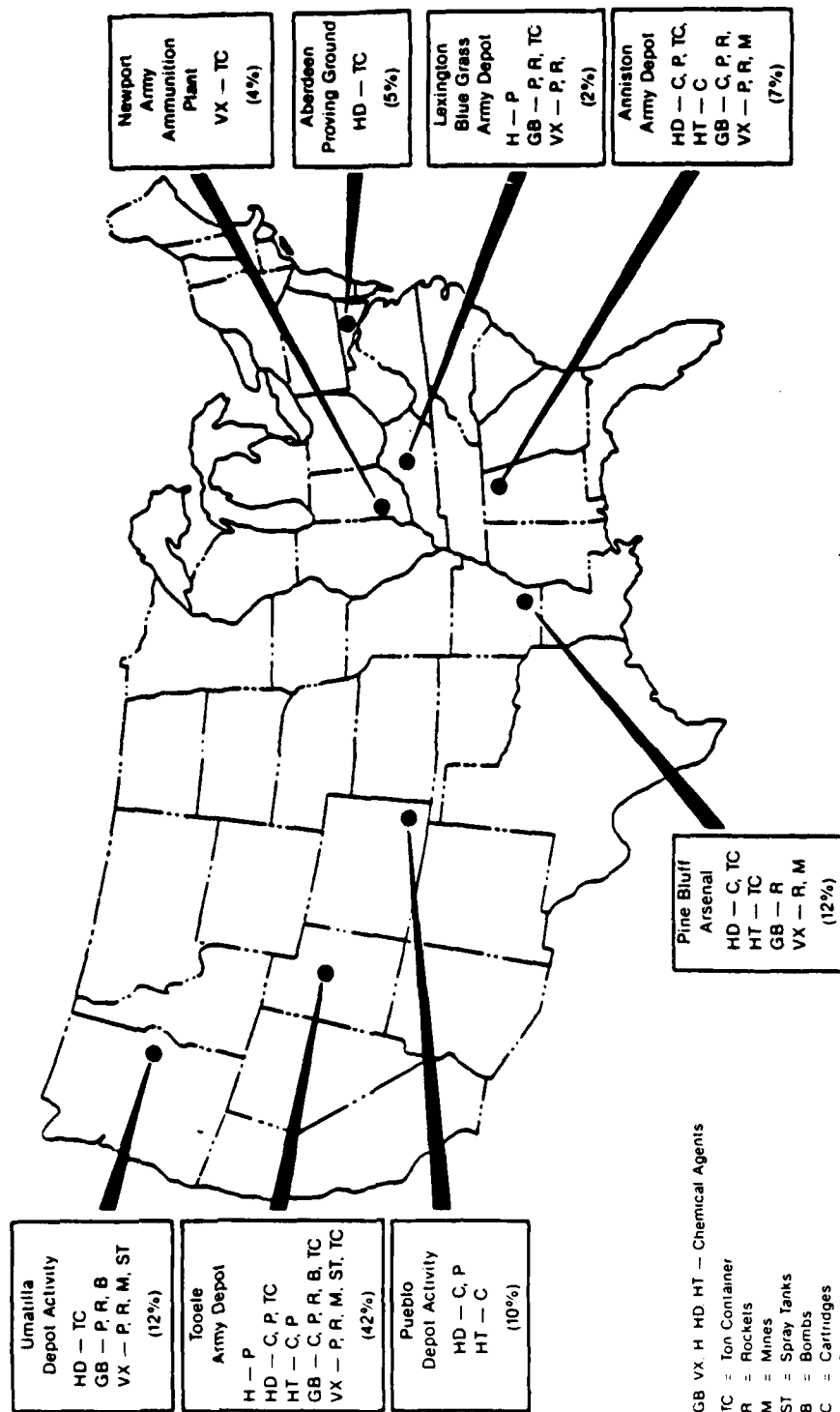
The Army has developed a plan for destruction of the chemical munition stockpile. This plan is set forth in the Army Chemical Stockpile Disposal Concept Plan submitted to Congress in March 1986 and supplemented in March 1987. In this plan, three disposal alternatives are described:

1. Destroy the agents and munitions at their current storage installations
2. Move the stockpile to regional destruction centers at Anniston Army Depot, Alabama, and Tooele Army Depot, Utah
3. Move the stockpile to a national destruction center at Tooele Army Depot, Utah

These three disposal alternatives were also described in a Draft Programmatic Environmental Impact Statement published by the Army in July 1986. As part of the public commentary on this document, requests were made of the Army to consider also the transport of the inventory from Aberdeen Proving Ground to Johnston Island by water or to Tooele Army Depot by air and from the Lexington-Blue Grass Army Depot to Tooele by air.

Presented in this report is a transportation concept plan for on-site and off-site movement of munitions. Off-site movement by rail, air, and water are discussed. The transportation concept plan conforms to the guidance provided to the Army by a panel of nongovernment experts, assembled to advise the Army on transportation methods and procedures.

This report consists of two parts. A summary record of panel guidance on transportation methods and procedures is given in Section 2.0 and Appendix C. The Army proposal for implementing a transportation program based on the guidance of the expert panel is contained in Sections 3.0 through 9.0.



GB VX H HD HT — Chemical Agents

TC = Ton Container
 R = Rockets
 M = Mines
 ST = Spray Tanks
 B = Bombs
 C = Cartridges
 P = Projectiles

Percentages shown are of total US Stockpile
 6% of stockpile is stored in Europe and at Johnston Atoll in the Pacific Ocean

**FIGURE ES-1
 LOCATION OF CHEMICAL AGENTS AND MUNITIONS
 IN THE UNITED STATES**

GUIDANCE OF THE TRANSPORTATION PANEL

The panel believes packaging to be the crucial component in the entire transportation system. Packaging, here, is meant in the system sense: it includes the outermost transport container; dunnage inside; inner containers, if any; and possibly the munition casings themselves. The most important role for the packaging system is the containment of the agent, both during normal transportation and during an accident. The containment criteria for packaging are: redundant protection against agent release during normal transport and prevention of agent release during an accident. Two additional packaging criteria are: compatibility with standard commercial handling and carrier equipment and the capability for automated monitoring of agent presence and temperature within the transport container.

For packaging design purposes, the panel described a number of accident scenarios which portray severe accidents that have occurred in hazardous materials transportation experience. The scenarios were defined for the rail, air, and marine modes separately and include hypothetical conditions of fire and crash. The panel also included the hypothetical accidents as defined by the Nuclear Regulatory Commission by means of a series of tests.

The panel made recommendations on transport operations by the rail, air, and marine modes. They pertain to operational elements such as preparation for transport, equipment, routing, and inspections. For preshipment preparation, the munitions should be placed in the transport container as early in the transport sequence as possible. For rail transport, equipment should be of current technology, routes should be chosen principally on the basis of track quality, and speeds be 10 miles per hour less than the designated limit, but never more than 50 miles per hour. For air transport, the airfield should be at least 200 feet wide and permit a straight-in approach of at least three miles, crew assignments be given with due consideration to the normal work/rest cycle, and emphasis be given to critical component maintenance problem areas. For marine transport, there should be an impact-attenuating space between the hull of the ship and the cargo. The panel also made recommendations on a number of program management functions addressing public involvement, packaging system testing, and a staff safety function with a central overview of the various safety elements within the transportation program.

PACKAGING

A study is underway to develop packaging concepts which will meet the panel's criteria. The conceptual packaging system will be designed to prevent agent release under the conditions of the accident scenarios described by the panel.

ON-SITE TRANSPORTATION AND ASSOCIATED OPERATIONS

Regardless of which disposal alternative is selected, there will be movement of the chemical munitions within the boundaries of the current storage locations. The operational procedures associated with on-site movement include the following:

- Activities necessary to prepare and move the munitions and ton containers from the site where they are currently stored to the loading area where off-site transport will begin
- Procedures for handling munitions or ton containers once they reach the destination site where destruction will occur
- Activities involved in preparing and moving munitions and ton containers from the current storage location to a nearby destruction facility on-site

The activities to be carried out will conform to established Army regulations and standing procedures on safety and security.

Preparations for movement at an origin site begin with monitoring and inspection of stockpile items to be moved from the storage location. Leaking munitions are identified and contained. For off-site transport, the munition and agents are then packed into the transport container and taken to a holding area where containers accumulate and await off-site transport. For on-site disposal, the munitions are also packed into a container and then trucked to the on-site disposal facility. At a destination site, a reverse sequence begins with the unloading of the containers from the transport vehicle and ends with the container's arrival at a storage facility to await disposal.

The details for movement on-site associated with rail and air transport and with on-site disposal are described in Section 4.0. The on-site activities associated with marine transport are described in Section 8.0.

PROGRAMMATIC CONSIDERATIONS COMMON TO THE RAIL, AIR, AND WATER TRANSPORTATION MODES

Several planning and coordination activities will have to be carried out before rail, air, or water transportation operations can begin. These activities include: site-specific documentation in accordance with the provisions of the National Environmental Policy Act, the preparation of a transportation operating plan, safety plan, vulnerability analysis, medical support plan, and emergency response plans; determination of personnel required to be in the Army Chemical Personnel Reliability Program and the implementation of the requirements of this program;

development and implementation of personnel training programs; establishment of command and control procedures and a central office; and selection of transportation routes. These activities are discussed generically in Section 5.0. These prerequisite tasks are distinct from certain safety assurance functions described in Section 9.0.

RAILROAD TRANSPORTATION

The transport of chemical munitions by railroad to a national or to regional destruction sites would be accomplished by loading sealed munition containers on a unit train dedicated to munitions carriage. For the national destruction site alternative, munitions would be shipped to Tooele Army Depot, Utah, from the seven other storage locations. For the regional destruction alternative, munitions would be shipped to:

(1) Tooele Army Depot, Utah from Umatilla Depot Activity, Oregon, and Pueblo Depot Activity, Colorado and (2) to Anniston Army Depot, Alabama, from Lexington-Blue Grass Army Depot, Kentucky, Pine Bluff Arsenal, Arkansas, Newport Army Ammunition Plant, Indiana, and Aberdeen Proving Ground, Maryland.

Munition containers would probably be carried on a type of rail car currently used in rail commerce built specifically for carrying stacked shipping containers of standardized dimensions. The advantages of using this type of rail car instead of an 89-foot flatcar are superior ride quality with respect to shock and vibration and greater container-carrying capacity for a train of any given length.

The containers may be carried stacked in two layers or in a single layer. Carrying two layers per rail car (double stacking) is desirable over a single layer because of the doubling of capacity of each munition train, reducing the number of trainloads needed. Fewer trains reduces the overall probability of a transport accident. Double stacking may reduce routing flexibility because of the height above rail of the stacked containers. Other factors such as security, emergency response, and cost may also affect the decision whether to double stack. This decision would be part of the development of a rail operating plan.

Shipments of munitions would consist of a munition train preceded by an escort train. Munition trains may carry several types of munitions, but they would contain only one type of chemical agent. The munition train carries the munition containers, support equipment, the convoy commander, security forces as required by Army Regulations 50-6 and 50-6-1, and some other support personnel. The escort train carries medical supplies and personnel, additional security forces, and other support personnel.

Munition trains would be a maximum of 8,000 feet long, a length chosen to be compatible with many mainline sidings. Trains may be shorter

than 8,000 feet for security, emergency response, or other operating reasons. The determination of train length and operating procedures will be part of the development of a rail operating plan if a decision to implement rail transport is made.

The number of trainloads required to transport the stockpile of chemical munitions depends on train length, the type of rail car used to carry munitions, and whether containers are double stacked. Use of trains of 8,000 feet and double-stacked containers results in the fewest trainloads. For these conditions, about 70 to 75 trainloads would be required for the national destruction center alternative. For the regional destruction center alternative, about 50 to 55 trainloads would be required.

Described in Section 6.0 are the activities and procedures for implementing a railroad transportation program for chemical munitions. Activities discussed in that section begin with loading of the containers onto the rail cars and end with unloading the containers from the train at the receiving installation.

AIR TRANSPORTATION

Transport of chemical munitions by aircraft would be accomplished by loading the sealed munitions containers onto U.S. Air Force C-141 or C-5 transport planes. The munitions containers would require no handling or opening during a flight. However, emergency landing sites would be designated along the route for handling containers if needed in an emergency. Special operating procedures would be developed for the airlift mission.

Two locations are currently under study for air shipment of munitions. These are Lexington-Blue Grass Army Depot, Kentucky, with about 2 percent of the stockpile by agent weight, and Aberdeen Proving Ground, Maryland, with 5 percent of the stockpile by agent weight. The destination would be Tooele Army Depot, South Area, Utah. The two origin sites are being considered for munition removal in response to comments received on the Draft Environmental Impact Statement on the Chemical Stockpile Disposal Program. The Army is considering Tooele Army Depot as the only receiving installation for all destruction alternatives because of the low population density in the vicinity of Tooele Army Depot and the difficulty of constructing an airfield at Anniston Army Depot.

The transport sequence, described in Section 7.0, begins with loading of containers onto the aircraft at the origin and ends with unloading of the containers at Tooele Army Depot.

WATER TRANSPORTATION

Movement of the inventory of ton containers of mustard agent from Aberdeen Proving Ground, Maryland, to Johnston Island would be accomplished using the LASH shipping system (Lighter Aboard Ship). In this system, barges (called lighters) are loaded with cargo at shore facilities and towed through shallow waters to a large, ocean-going LASH vessel anchored in deeper water nearby. The loaded lighters are lifted aboard the LASH vessel with a shipboard crane and stored in the hold. The LASH vessel then proceeds to the destination. At the destination the lighters are lifted from the hold and placed in the water using the LASH vessel crane, towed to a shore facility, and the cargo unloaded.

A LASH ship would be taken from the U.S. Navy Ready Reserve Fleet and prepared for the voyage to Johnston Island. A civilian Merchant Marine crew would operate the vessel under contract. The ton containers of mustard agent are placed in shipping containers, and the containers are then loaded onto the lighters at an Army facility constructed on Army property on the Bush River or Boone Creek. Loaded lighters are towed to the LASH vessel anchored off the shipping lane at the mouth of the Bush River, lifted aboard the vessel and stowed in the hold.

Upon completion of loading, the LASH vessel proceeds to Johnston Island. After leaving the Chesapeake Bay, the vessel would head southward in the Atlantic Ocean along the coast of South America. After rounding the southern tip of South America, the ship proceeds directly to Johnston Island. The Panama Canal would not be used because of the problem of maintaining adequate vessel security in the confined area of the canal. A Coast Guard vessel and two tugboats would accompany the munition ship in the Chesapeake Bay for security and safety.

The description of operations in Section 8.0 includes all activities beginning with preparing ton containers at Aberdeen Proving Ground for packing and ending with disposition of ton containers at Johnston Island.

SAFETY ASSURANCE FUNCTIONS WITHIN THE TRANSPORTATION PROGRAM

The safety program management function will be directed by the Safety and Surety Division of the Office of the Program Manager for Chemical Munitions. It is a centralized staff function to assure that safety in the diverse operational aspects of the transportation program are adequately addressed in the overall program plan and that safety responsibilities for the operational units are identified and properly assigned. A system safety program will be established applying the principles of MIL-STD-882B to the transportation program.

In addition to this safety function, which is aimed at activities internal to the Army, a safety promotion and outreach program will be established. This program will assist those states, located along the transport routes, in enhancing their emergency preparedness capabilities to respond to chemical munition transportation accidents should they occur. It will provide the states with an understanding of the nature of the hazards and what that implies in terms of preparedness components such as training, equipment, and medical treatment. The program will also provide for channels of communication between the Army and the states to resolve issues that may arise due to munitions transport. This program will be developed by the Public Affairs Office in the Office of the Program Manager for Chemical Munitions and coordinated with the affected states.

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1.0 INTRODUCTION

The U.S. Department of Defense is required by Congress (Public Law 99-145) to destroy the stockpile of lethal chemical agents and munitions stored at eight U.S. Army installations in the continental United States (Figure 1-1) and at Johnston Island in the Pacific Ocean by the end of fiscal year 1994. The inventory at these sites is made up of rockets, mines, mortars, projectiles, cartridges, bombs, spray tanks and bulk containers containing the nerve agents GB and VX and the blistering agent mustard.

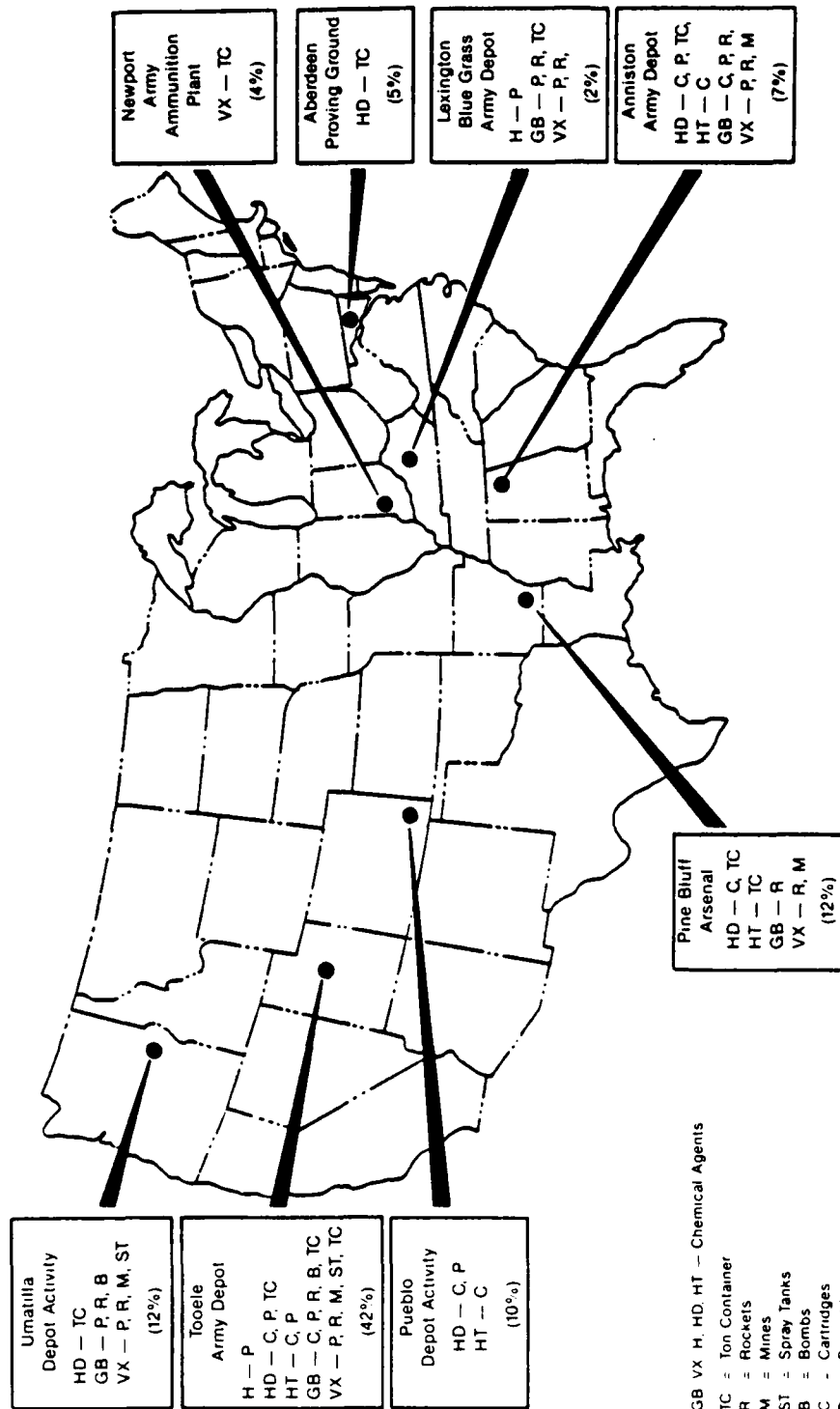
The Army has developed a plan for destruction of the chemical agent and munition stockpile. This plan is set forth in the Army Chemical Stockpile Disposal Concept Plan submitted to Congress in March 1986 and supplemented in March 1987. In this plan, three alternatives are described for the locations of the destruction facilities.

<u>Destruction Location Alternative</u>	<u>Description</u>
On-site	Destroy agents and munitions at their current storage installations.
Regional	Move the stockpile to regional destruction centers at Anniston Army Depot, Alabama and Tooele Army Depot, Utah.
National	Move the stockpile to a national destruction center at Tooele Army Depot, Utah.

These three disposal alternatives were also described in a Draft Programmatic Environmental Impact Statement published by the Army in July 1986. As part of the public commentary on this document, requests were made of the Army to consider also the transport of the inventory from Aberdeen Proving Ground to Johnston Island by water or to Tooele Army Depot by air and from the Lexington-Blue Grass Army Depot to Tooele by air.

Presented in this report is a transportation concept for on- and off-site movement of munitions that will meet the requirement to destroy the stockpile by the end of September 1994. Off-site movement by rail, air and water are discussed. The transportation concept is based on guidance provided to the Army by a panel of nongovernment experts, assembled to advise the Army on transportation methods and procedures.

This report consists of two parts. A summary of panel guidance on transportation methods and procedures is given in Section 2.0 and Appendix C. The Army proposal for implementing a transportation program



GB VX H, HD, HT — Chemical Agents
 TC = Ton Container
 R = Rockets
 M = Mines
 ST = Spray Tanks
 B = Bombs
 C = Cartridges
 P = Projectiles

Percentages shown are of total US Stockpile
 6% of stockpile is stored in Europe and at Johnston Atoll in the Pacific Ocean

FIGURE 1-1
LOCATION OF CHEMICAL AGENTS AND MUNITIONS
IN THE UNITED STATES

conforming with the guidance of the expert panel is contained in Sections 3.0 through 9.0.

1.1 Purposes of This Report

The purposes of this report are as follows:

- Summarize guidance of the expert panel on transportation
- Describe feasible transportation concepts conforming with this guidance
- Provide information for the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program and for other studies in support of the munition destruction program

Various studies and data available to the Army, including the transportation concept plan, will provide information for determining whether an off-site transportation program for munitions should be implemented. If a decision is made to move all or part of the stockpile, the concept plan will serve as the basis for developing transportation-mode-specific operating plans and manuals.

1.2 Scope of This Report

The transportation concept plan presented in this report covers all elements of a transportation program that can be implemented for a destruction program that is to be completed in September 1994. These elements include program planning, test and evaluation, training, packaging, handling, transport operations, safety, security, and command and control. The details are sufficient to determine the feasibility of the transportation concepts and to provide information to other studies (see Section 1.6) supporting the planning of the destruction program. The concept plan incorporates the guidance of the expert panel on transportation, the regulations of the Department of Defense and other federal agencies (for example, the U.S. Department of Transportation; see Appendix B), standing operating procedures of the organizations that will transport or support the transport of the agents and munitions, and the results of studies undertaken by the Army.

The following transportation methods have been considered in developing the transportation concept plan:

Transportation
Mode

Scope of Transportation Plan

Rail	Covers all movements required to implement the national and regional destruction centers alternatives.
Air	Movement from Lexington-Blue Grass Army Depot and Aberdeen Proving Ground to Tooele Army Depot is described in response to comments on the Draft Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program.
Water	Movement from Aberdeen Proving Ground to Johnston Island is described in response to comments on the Draft Programmatic Environmental Impact Statement on the Chemical Stockpile Disposal Program. Movement of munitions by water is not feasible at some of the other storage locations. Movement from some storage locations is feasible but would also require land transportation segments.

1.3 Expert Panel on Transportation Methods and Procedures

To assist in an objective determination of appropriate transportation methods, the Army, through The MITRE Corporation, assembled a panel of experts from outside the Federal government who are knowledgeable about transportation methods and operations, transportation of hazardous material, and transportation safety. The charge to the panel was to develop system requirements and criteria for the safe transportation of chemical munitions, both within the boundaries of the installations at which the munitions are stored, and in off-site transportation by railroad, aircraft, and waterway. The panel was not asked to make recommendations as to which transport mode is preferable. The members of the panel and their areas of expertise are given in Table 1-1.

The panel met four times to develop transportation system requirements and criteria and to provide guidance for the preparation of the transportation concept report. A summary of the panel guidance is given in Section 2.0 and Appendix C.

Panel members relied on a variety of information sources in addition to their own expertise to develop the criteria and guidance. Some of these information sources included transportation studies prepared by the Army, a study of the destruction program by the National Academy of Sciences, the Draft Programmatic Environmental Impact Statement on the Chemical Stockpile Disposal Program, chemical agent and munitions data and studies, personnel of the Office of the Program Manager for Chemical

TABLE 1-1
MEMBERS OF THE EXPERT PANEL ON TRANSPORTATION CONCEPTS
FOR CHEMICAL MUNITIONS

Panelist and Title	Area of Expertise
Michael S. Bronzini Professor and Head Department of Civil Engineering Pennsylvania State University	Freight transportation with emphasis on marine transportation
Charles E. Dettmann Vice President, Transportation Union Pacific Railroad	Rail transportation of hazardous materials
Charles O. Miller President System Safety, Inc.	System safety with emphasis in aviation and human factors
Bruce J. Williams Manager, Land Transportation Dow Chemical Company	Shipping of hazardous materials

Munitions, the U.S. Military Traffic Management Command, consultants to the destruction program, personnel of the Department of Defense Explosives Safety Board, and U.S. Air Force personnel of the Military Airlift Command.

1.4 Overview of the U.S. Army Program for Destruction of Chemical Munitions

In Public Law 99-145, the U.S. Congress directed the Secretary of Defense to destroy the stockpile of unitary chemical agents and munitions by September 30, 1994. In carrying out the destruction program, the Army must provide maximum protection of the environment, the general public, and the personnel involved in the destruction program. The Army submitted the Chemical Stockpile Disposal Concept Plan to Congress in March 1986. Subsequently, Congress expressed concern that the 1994 deadline for completing the destruction of the stockpile may not allow for the development and use of the most cost-effective destruction methods. In Public Law 99-661, the Congress directed the Department of Defense to provide a report on alternative approaches to destruction of the chemical stockpile that would optimize safety considerations and cost-effectiveness without the constraints of the 1994 deadline. To address this issue, the Army submitted a Concept Plan Supplement to Congress in March 1987.

Both the Chemical Stockpile Disposal Concept Plan and the Supplement contain detailed schedules for destruction and for plant construction and operation. Under the 1994 deadline, construction of continental United States plants would begin in 1988 and operation would begin in 1991. There are other schedule options presented in the Supplement, with completion dates ranging from 1996 to as late as 2008.

1.4.1 Stockpile Characteristics

The stockpile of chemical munitions to be destroyed consists of rockets, land mines, cartridges, mortars, various types of projectiles, bombs, spray tanks, and bulk agent containers (called ton containers). Characteristics of the stockpile components are given in Table 1-2, and descriptions of the munitions and bulk containers are given in Appendix A. The types of munitions, the agents they contain, and the percentage of the total Army stockpile contained at each storage location are given in Figure 1-1.

1.4.2 Chemical Agent Characteristics

The chemical agents contained in the munitions or bulk containers are of three types:

- VX - persistent nerve agent
(O-ethyl S-[2-(diisopropylaminoethyl) methylphosphonothiolate])

TABLE 1-2
CHARACTERISTICS OF CHEMICAL AGENTS AND MUNITIONS

Munition	Chemical Agent	Agent Weight (lbs)	Dunnage Weight ^a (lbs)	Metal Weight (lbs)	Explosive	Explosive Weight (lbs)	Propellant	Propellant Weight (lbs)
Mine	M23	VX	10.5	21.2	27.4	Comp. B4	0.8	0.00
Rocket	M55	GB	10.8	27.8 ^b	23.8	Comp. B	3.2	19.30
Rocket	M55	VX	10.2	27.8 ^b	23.5	Comp. B	3.2	19.30
Mortar	M2A1	HD	6.0	10.0	18.2	Tetryl	0.1	0.4
105 Projectile	M360	GB	1.6	16.0	43.3	Tetrytol	1.1	2.8
105 Projectile	M60	HD	3.0	18.0	44.7	Tetrytol	0.3	2.8
155 Projectile	M121A1	GB	6.5	5.0	92.4	Comp. B	2.4	0.0
155 Projectile	M122	GB	6.5	5.6	92.4	Comp. B	2.4	0.0
155 Projectile	M220	HD	11.7	1.0	86.7	Tetrytol	0.4	0.0
155 Projectile	M104	HD	11.1	9.4	82.5	Tetrytol	0.4	0.0
155 Projectile	M121A1	VX	6.3	5.0	92.6	Comp. B	2.4	0.0
81N Projectile	M426	GB	14.5	21.0	185.5	Comp. B4	7.0	0.0
81N Projectile	M426	VX	14.5	22.0	185.5	Comp. B4	7.0	0.0
Bomb	MK94	GB	108	59.0	333	--	0.0	0.0
Bomb	MC1	GB	220	70.0	505	--	0.0	0.0
Bomb	MK116	GB	347	0.0	178	--	0.0	0.0
Spray Tank	TMU-28/B	VX	1356	0.0	567	--	0.0	0.0
Ton Container	TC	GB	1500	0.0	1400	--	0.0	0.0
Ton Container	TC	HD	1700	0.0	1400	--	0.0	0.0
Ton Container	TC	VX	1600	0.0	1400	--	0.0	0.0

^aaper round

^b14.07 lbs of wood; 9.30 lbs of resin; 4.43 lbs of glass fiber

- GB - nonpersistent nerve agent
(O-isopropyl methylphosphonofluoridate)
- H, HD, HT - persistent mustard (blistering) agents
(H, HD = 2,2'-dichlorodiethyl sulfide)
(HT = 2,2'-dichloroethylthiodiethyl ether)

VX is absorbed through the skin and respiratory system and by ingestion. GB acts in the same way as VX, but due to its higher vapor pressure, it acts primarily through the respiratory system. Nerve agents injure and kill by inhibiting the action of an enzyme (acetylcholinesterase) that is essential for the functioning of the nervous system. These nerve agents are liquids at room temperature. They are colorless, tasteless, and odorless, and cannot be detected without special equipment or until symptoms of exposure appear.

H, HD, and HT (mustard) are liquids that act by blistering the skin and respiratory system. Levinstein mustard, H, is a liquid which has a pungent odor and is detectable at low concentrations. HD is a distilled form of H. HT is a mixture of 60 percent HD, and 40 percent T by weight, where T is the compound Bis(2(2-chloroethylthio)ethyl) ether.

1.4.3 Types of Destruction Facilities

Two types of destruction plants are scheduled for construction: mixed plants and bulk plants. Mixed plants are capable of processing all types of munitions and ton containers. Bulk plants are designed to process ton containers and bombs. For the national alternative, three mixed plants and two bulk plants will be constructed at Tooele Army Depot, Utah. Under the regional alternative, two mixed plants and one bulk plant will be built at Tooele Army Depot, and one mixed and one bulk plant will be constructed at Anniston Army Depot, Alabama. For the on-site alternative, one mixed plant each will be constructed at Pueblo, Umatilla, Tooele, Anniston, and Lexington stockpile locations. Bulk plants will be constructed at Tooele, Newport, and Aberdeen. The existing plant constructed to destroy the incapacitating agent BZ at Pine Bluff, Arkansas, will be modified to a mixed plant to destroy chemical munitions.

1.4.4 Plant Operating Schedule

To meet the September 1994 date for completion of destruction of the stockpile, the plants must begin operation in March 1991. The plants will operate 5 days per week and 24 hours per day. Scheduled maintenance will be performed on weekends.

Schedules for munition processing necessary to meet the 1994 deadline at the national and regional locations are shown in Figure 1-2. These schedules have been optimized for efficient plant operation only. Transportation requirements or efficiencies have not been considered in

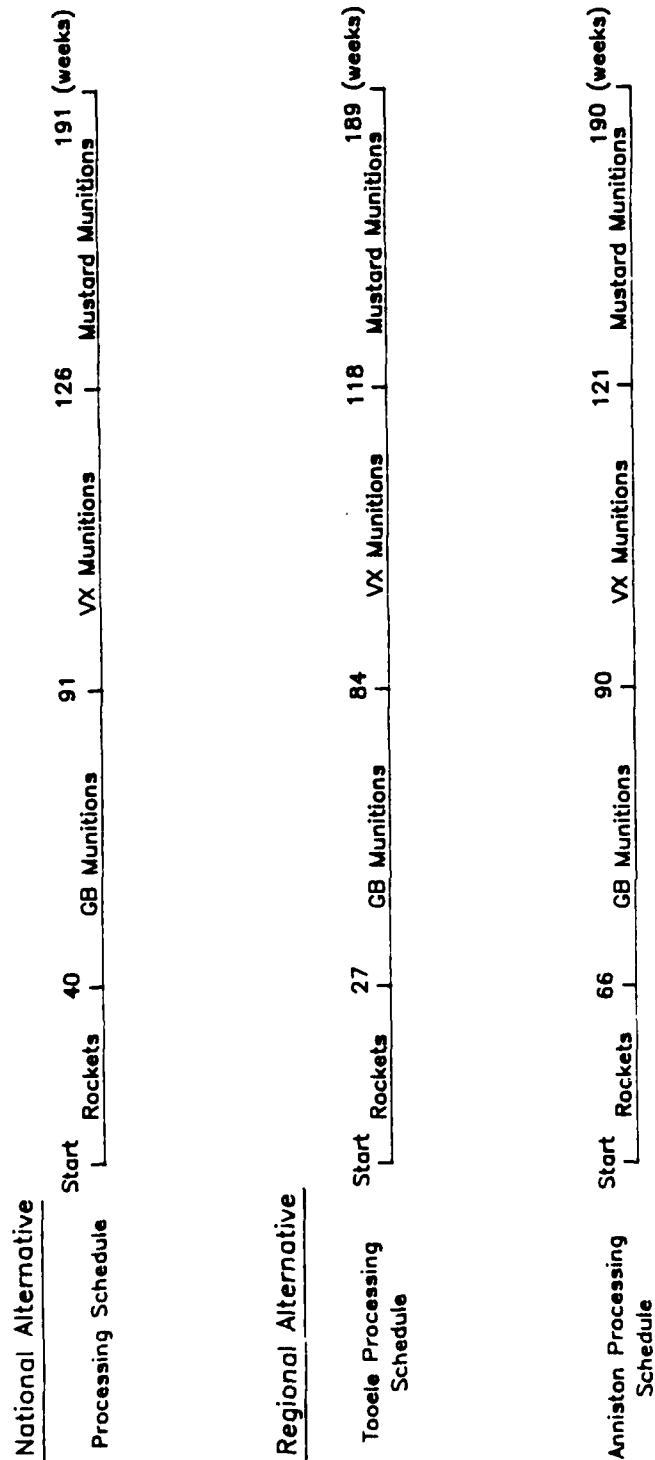


FIGURE 1-2
MUNITION AND AGENT PROCESSING SCHEDULES

developing these schedules. The durations of munition processing is a function of the number of plants, plant processing rates, and the munition inventory to be destroyed at each location.

1.5 Past Transportation of Chemical Munitions

Most of the lethal chemical munitions currently in the national stockpile were transported from manufacturing locations or other storage locations to their current storage site. Most of these movements were by truck, ship, or rail. Some munitions were moved by aircraft. Movement of items currently in the inventory began as early as 1942 and continued into the late 1960s. In addition to these movements were movements made for overseas deployment and return during and following World War II, movements involving captured German and Japanese munitions, movements involving test or experimental munitions and movements to ports for sea disposal. These early moves were usually conducted without incident, but during the period of the 1940s and 1950s, when requirements were less stringent, some chemical leaks and spills occurred. On several occasions in the late 1940s, some military and civilian personnel were injured in moves involving captured German mustard munitions.

Public Law 91-121 was passed in 1969 and amended by Public Law 91-441 in 1970. These laws limit the open-air testing, disposal, and movement of chemical weapons. They also mandate the stringent review of plans for any proposed movement. Some moves that occurred during the period since 1969 are described below. A detailed compilation for shipments dating from 1946 can be found in The Chemicals Weapons Movement History which the Army prepared in 1987.

Operation CHASE X. Obsolete M55 rockets were encased in solid concrete coffins and shipped by rail from Lexington-Blue Grass Army Depot and Anniston Army Depot to the Military Ocean Terminal at Sunny Point, North Carolina. This move was conducted in August 1970 without incident. The munitions were disposed of at sea in deep water without incident.

Operation Red Hat. The entire contents of Chibana Army Depot in Okinawa was loaded onto six ships and moved to Johnston Island in the Pacific Ocean. Mustard munitions were moved in January 1971 with the remaining items following in August and September 1971. During the loading of one vessel, a pallet of 15 M55 rockets was accidentally dropped from a crane approximately 40 feet into the hold of the vessel. Although subsequent examination showed that some of the rockets were severely damaged, no significant leak or spill occurred, and there was no harm to operators or the general public.

Operation FMA. A small number of mustard-filled ton containers, HD projectiles and GB projectiles were moved about 20 road miles by truck convoy, removing all chemical munitions remaining at Fort McClellan,

Alabama to Anniston Army Depot, Alabama. This operation was conducted in December 1976 without incident.

Operation TNS. Mustard-filled mortar cartridges were transported by rail approximately 25 miles from the North Area to the South Area of Tooele Army Depot. This operation was conducted in August 1977. Prior to Army inspection, and prior to arrival in the North area, one of two engines scheduled to pull the munitions train was involved in a collision when the brakes failed, allowing it to roll into another train. This engine was replaced, and the actual movement of munitions proceeded without incident.

Operation DTS. A variety of GB, VX, and phosgene munitions was moved by truck convoy from Dugway Proving Ground, Utah to the South Area of Tooele Army Depot, Utah (approximately 50 miles). This operation was conducted in August 1977 without incident.

Operation SETCON I. This operation involved the movement of about 10 percent of the inventory of Chemical Agent Identification Sets containing actual agents formerly used in chemical warfare training from several locations to Rocky Mountain Arsenal for incineration. The move was conducted by air and truck convoy in January 1978 without incident.

Operation SETCON II. This operation involved the movement of the remaining Chemical Agent Identification Sets to Rocky Mountain Arsenal for disposal. The move was conducted in May and June 1980 using air and truck convoys. During the movement operation, a helicopter transferring sets from Crane Army Ammunition Activity, Indiana, to Fort Campbell Army Airfield experienced engine failure and crashed. No agent was spilled. There were no other incidents.

Operation RMT. The stock of GB-filled Weteye bombs and three one-ton containers of GB at Rocky Mountain Arsenal, Colorado were moved to Dugway Proving Ground, Utah by military aircraft and subsequently to the South Area of Tooele Army Depot by truck convoy. This operation was conducted in July 1981 without incident.

1.6 Other Studies Related to Transportation

Various interdependent studies are currently underway by the Army to support the Chemical Stockpile Disposal Program. The Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program will integrate these various support studies, including the transportation concept plan set forth in Sections 3.0 through 9.0 of this report.

The transportation plan will be used as an input to studies on risk analysis, mitigation measures, and emergency response. The risk analysis effort is a comprehensive assessment of hazards of the entire disposal program. The mitigation study evaluates measures that will lessen

identified hazards and adverse impacts of the disposal program. The emergency response effort develops preparedness and response concepts for both on-site and off-site contingencies. There are also parallel studies on monitoring, packaging design concepts, and transportation of the agents and munitions at reduced temperatures.

1.7 Regulations Governing Transportation

Transportation of chemical agents and munitions is governed by regulations of the U.S. Department of Defense and other federal agencies. Federal agencies with oversight and/or enforcement roles in the transportation program include the U.S. Department of Transportation, the U.S. Department of Health and Human Services and the U.S. Environmental Protection Agency. An overview of these regulations is given in Appendix B.

In addition, states affected by transportation may have regulatory jurisdiction over certain aspects of the transportation program. These states, and any relevant regulations, would be determined if and after a decision to transport is made, and routes selected.

The transportation concept, presented in Sections 3.0 through 9.0, is consistent with the requirements of the Federal regulations discussed in Appendix B.

1.8 Organization of the Report

This report is made up of two independent parts. The first part, presented in Section 2.0, is the summary of the recommendations and guidance of the transportation panel. The second part, contained in Sections 3.0 through 9.0, is the concept plan for a munition transport program that has been developed by the U.S. Army and their consultants to comply with the 1994 deadline for destruction of the stockpile.

The concept plan presented in Sections 3.0 through 9.0 is based on the guidance of the transportation panel. The format of the concept plan is as follows:

- Section 3.0 contains information about the characteristics of the container that will be used for transport of the chemical munitions.
- Section 4.0 presents all activities that will take place on Army installations (i.e., transport for on-site destruction and on-site activities associated with off-site moves).
- Section 5.0 describes planning and management activities common to all off-site transport modes.

- Sections 6.0, 7.0 and 8.0 describe transportation concepts for off-site movement by railroad, aircraft and waterway, respectively.
- Section 9.0 presents safety assurance functions for the transportation program.

2.0 GUIDANCE OF THE TRANSPORTATION PANEL

The panel developed the generic criteria that the major elements of the overall transportation system must satisfy in order to ensure safety. Three distinct transportation elements were identified and addressed: packaging; cargo handling operations at the sites; and rail, air, and marine operational procedures. Also identified and addressed were program management functions crucial to the safety of the transport operations.

What follows is a summary record of the recommendations. To the extent feasible, this summary incorporates the panel's language. In some instances, the panel developed its recommendations with specificity (e.g., Appendix C). In most cases, however, the recommendations were of a broad nature. The details of how the various recommendations are to be implemented are described in the body of the concept plan, Sections 3.0 through 9.0.

2.1 Basic Considerations

In developing the criteria for the transportation system, the panel was motivated by a number of different basic considerations.

First, and foremost, is recognition that the selection of a disposal option which would require transportation would initiate a program with a highly specialized and singular mission. Due to the toxicity of the agents and the potential scale of the operations, the mission goes beyond the routine transportation of the most hazardous of materials in commerce. The mission, therefore, requires special attention and treatment. It needs a particularly strong safety emphasis in the overall program management.

Second, for munitions with both agent and explosives, the toxic hazard and the explosive hazard should be separated prior to shipment, whenever feasible.

Third, there should be redundancy in the protection against release of agent into the atmosphere during normal transport.

Fourth, the munitions should be packed into a transportation container at the origin site as early in the transport process as possible. Once containerized, subsequent direct handling of the munitions themselves would be eliminated and handling mishaps minimized.

Fifth, packaging is the crucial component in the entire transportation system. It provides containment of the hazard; it affects the extent and the manner of the handling of the munitions; and it has a significant influence on the choice of equipment used in transport. Packaging is to be considered in a system context, taking into account the

munition type, the bracing and dunnage, overpacking, human factors, and the vehicles.

Finally, recognition should be given to the obvious: as is true with almost any human activity, it is not possible to guarantee that chemical munition transportation can take place with zero risk.

2.2 Packaging Criteria for Off-site Transportation

A number of considerations have been taken into account in the development of criteria for packaging. Packaging, here, is meant in the system sense: it includes the outermost transport container; dunnage inside; inner containers, if any; and possibly the munition casings themselves. The most important role for the packaging system is the containment of the agent, both during normal transportation and during an accident. In an accident, the packaging provides the impact and thermal protection necessary to prevent agent release.

Packaging also plays a significant role in the way the cargo is handled throughout the transport process. Containerization early in the transportation sequence minimizes handling of the munitions themselves and reduces the potential for handling accidents. If the container is standardized, it enables intermodality, such as transferring a container from a truck to a train at the loading area, or removing a container from the scene of a derailment by truck.

Finally, a packaging system with demonstrable accident survivability enhances public confidence in the safety of the transport operations.

Motivated by the foregoing considerations, the panel arrived at the following four packaging system criteria:

1. The system should provide redundant protection against agent release during normal transport.
2. The system should prevent agent release into the environment in the event of an accident. For munitions with any explosives and/or propellants, the risk from release of agent due to detonation should be small compared to other accident scenarios.
3. The transportation container should be compatible with standard commercial handling and carrier equipment. This eliminates the need for specialized handling procedures and equipment, and enables the use of current equipment technology.
4. The transportation containers should be equipped with automated agent and temperature monitors and alarms. This enables the timely detection of possible leaks within the container.

For criterion 2, accident scenarios for packaging design purposes are described below. They portray severe accidents that have occurred in hazardous materials transportation experience. Prevention of agent release under these scenarios would provide a high degree of assurance that the packaging system would survive virtually all credible accidents. It is recognized that it is not possible to guarantee that the packaging could never fail under any conceivable accident circumstance.

2.2.1 Rail Accident Scenarios

In a railroad accident the packaging system can be subjected to fire, crush, impact and puncture.

Fire. The design fire to be protected against is a grade crossing accident involving the two diesel locomotives of the munition train striking a tank truck carrying a petroleum product such as liquified propane gas. The locomotives can carry 8,000 gallons of diesel fuel and the tank truck 6,000 gallons of liquified propane gas. The resulting pool fire along the tracks defines the fire intensity and duration.

Impact. The design impact accident is the munition container striking a bridge abutment at 50 miles per hour.

Crush and Puncture. This accident scenario is a train derailment at 50 miles per hour. Two locomotives, five buffer cars and the first munition car derail in an accordion-like manner. The following cars crush the first munition car dynamically; that is, the locomotives and cars are moving so that energy attenuation results from both the forward motion and the accordion-type derailling of the lead cars. The puncture probe is the coupler impinging on the first munition car.

2.2.2 Air Accident Scenarios

The design accident for aircraft containers is a crash on takeoff or landing, which is the most frequent type of aircraft crash accident. This scenario defines the impact forces and fire intensity and duration. The accident situation assumed is that the aircraft is essentially upright and under reasonable control upon impact. Speeds are characteristic of take-off and landing operations.

2.2.3 Marine Accident Scenarios

In a marine accident, the packaging system can be subject to fire, impact, and sinking.

Fire. The accident is assumed to be caused by burning of the ship's fuel. For a Lighter-Aboard-Ship (LASH) vessel, holding barges called lighters, the fuel tank is located directly beneath the hold. No

sustained fire is assumed for inland waterway barges, since they contain no fuel.

Impact. Two different accidents are postulated. One is hitting the narrow edge of a bridge pier. Another is being struck in the side by the bow of another ship.

In both accident scenarios, it is assumed that there is space between the ship hull and the outermost lighter for impact absorption.

Sinking. Containers used in ocean-going shipments should survive a depth of 600 feet in ocean waters. Containers transported by barges on the Inland Waterway system should survive a depth of 100 feet.

2.2.4 Hypothetical Accidents Defined by Tests

A series of drop, puncture, fire and water immersion tests, as surrogates for severe transportation accidents, are required of certain high-level nuclear material transportation packages (10 CFR 71.73) by the Nuclear Regulatory Commission. Accident survival should be tested against either the transportation scenarios above or these nuclear standards, whichever are more stringent.

2.3 On-site Operations

Preparation of munitions for off-site transport should be as close to the storage igloc as possible in order to minimize handling mishaps. Recommendations for preparations for transportation are contained in Appendix C for each munition type.

Munitions should be placed in the transportation container as early in the transport sequence as possible.

The panel recommended that the Army investigate automated material handling capabilities for on-site operations to reduce human involvement, but with due regard for the results of the hazard analysis required for robotics or other automated systems.

For all on-site movements, the agents should be provided with one proven and assured layer of protection against release, either by overpacking or by the casings of some of the munitions themselves (see Appendix C).

2.4 Rail Transportation

Some of the important parameters in train operations are shaped by the requirements imposed on packaging. The packaging system satisfying the criteria above would provide a very high level of physical protection;

it would be able to take advantage of the most current technology in containerized rail freight transportation; and it would provide automated monitoring.

2.4.1 Equipment

The munition containers can be carried in either of two types of rail car. One is the standard 89-foot flatcar used for carrying truck trailers or containers. Each rail car can carry two 40-foot containers. The other type is the double-stack car which is of recent design. Each car consists of a "well" capable of holding standard containers up to 45 feet in length and in two tiers--one stacked on top of the other. Because the well provides the securing, no tie-down chains are required. The cars are configured in five-car sets with articulated linkages between cars. These linkages do not have slack. These cars provide ride quality superior to that of the standard flatcar.

The containers can be loaded into either type of car using standard hoisting equipment, such as gantry cranes, stacking cranes, or wheeled trucks. In commercial freight service, a train of 140 double-stack cars can be loaded in as little as four hours.

The buffer cars, which are required to be placed on the munitions train by Army regulations, should remain an integral part of the train and not be returned to the carrier at the end of each trip.

The Army should investigate means of obtaining more timely information on overheated bearings for the munitions train. Currently, infrared sensors, which detect overheated bearings, are placed alongside the tracks at 20 to 30 mile intervals. A bearing may overheat and freeze a wheel between sensors. More up-to-date detection, possibly in real-time, would reduce the chances for derailment. One possibility is to place electronic sensors on the cars themselves.

2.4.2 Routing

The routing criteria have evolved from the following considerations:

First, adequate packaging is the best and principal means of reducing risk to the public.

Second, direct routing minimizes travel time and, therefore, the probability of an accident.

Third, high track quality minimizes the potential for track-caused accidents. For the existing rail network, routes with the highest quality track are generally coincident with the most direct routes and also frequently pass through metropolitan areas.

These considerations led to the rail routing criterion: Use the highest quality track (Federal Railroad Administration's Class 3 or better) consistent with minimizing population exposure along the route. Class 4 or higher quality track should be used to the maximum extent possible. Similar quality should be used for on-post and connecting trackage, as well.

2.4.3 Train Operation Procedures

Recommendations on train operations address crew, train speed, inspections, and en route operations.

Crew. A standard train crew can be used to operate the train. The crew should receive training from the Army on self-protection in case of emergencies.

There should be a railroad officer on board at all times to serve as crew leader and as liaison with the Army commander. The rail officer should receive training from the Army on appropriate contingency procedures.

Train Speed. Train speed should be commensurate with ambient conditions according to the crew leader's judgment. The train should not exceed 50 miles per hour at any time. Train speed should always be at least 10 miles per hour less than the maximum permitted by the Federal Railroad Administration for the track class in use.

Predeparture Inspection. The carrier should conduct a full inspection of the empty train prior to loading. This inspection should be directed by a railroad maintenance officer.

En route Operations. There will be a pilot train preceding the munitions train to ensure integrity of the track structure and to provide emergency response support for the munitions train. The pilot train will also serve to warn of visibly identifiable hazards along the right of way.

The regular crew change locations should be modified--if necessary--to locations with smaller populations.

Inspections would occur at regular intervals (approximately every 1,000 miles) as required by the Power Brake Law of 1958, as amended, and by 49 CFR 232.

2.5 Air Transportation

Air transport would be provided by the Military Airlift Command. It would be a highly specialized mission needing special attention. The panel recommended that the Army work closely with Military Airlift Command

to examine every facet of the operation, and to identify and implement modifications to Military Airlift Command standard procedures which could yield an extra margin of safety.

2.5.1 Airfields

The runways at the origin, destination, and en route safe haven airfields should be at least 200 feet wide. The runway's surrounding environment should allow a straight-in approach for at least three miles with no significant obstructions. There should be overrun barriers, or other devices, for runways for additional safety.

At the origin, destination, and en route emergency safe havens, there should be in place emergency response procedures and capabilities, specifically prepared for this mission.

2.5.2 Aircraft

The specific aircraft selected for the mission should not have had a history of recurrent problems, especially with respect to critical and/or well-known maintenance problem areas. The aircraft should not have been recently out of a major check, during which components are removed from the aircraft for inspection and then reassembled. Particular attention should be given to critical component maintenance problems areas, such as tires, brakes, wheels and flight control equipment.

The panel also recommended that the Army and Military Airlift Command consider upgraded avionics in areas such as collision avoidance and wind shear detection.

2.5.3 Loading and Unloading

Standard Air Force equipment, such as roller pallets and container carriers, should be used.

2.5.4 Routing

Consistent with the locations of safe havens, routes should be chosen so as to avoid direct overflights of densely populated areas.

2.5.5 Crew

The normal Military Airlift Command crew should be augmented by a senior officer to serve as mission commander and liaison with the Army on-board commander. This officer will not fly the airplane but should be an experienced pilot.

The duty cycle for the crew should be limited to 12 hours including flying time and time on the ground. Due consideration should also be

given to immediate past work/rest cycles of the crew to preclude fatigue from excessive disruption of their circadian rhythm patterns.

2.5.6 Flight Operations

Taxiing. All other aircraft and ground vehicles in the vicinity of the loaded munition aircraft should cease movement during taxiing and take-off roll.

Take-off Roll. There should be an acceleration check in time to abort, if necessary, without exceeding the overrun capacity of the runway.

Departure, Climb, Descent, and Approach. Departure, climb, descent and approach should be under positive radar control.

Crew Safety. The crew should wear protective suits. Masks and gloves should be donned only if monitors indicate possible problems within the transportation container. The air in the interior of the aircraft should be monitored continuously.

Restricted Airspace Envelope. There should be coordination with the Federal Aviation Administration to create a restricted airspace envelope during take-off, flight and landing on loaded operations.

2.6 Marine Transportation

The panel considered the specific transport operation from Aberdeen Proving Ground to Johnston Island in the Pacific. It also considered inland waterway barge transport in general and developed a number of generic requirements.

2.6.1 Ocean Transportation from Aberdeen Proving Ground

The panel was requested to consider specifically the transportation of mustard in ton containers from Aberdeen Proving Ground to Johnston Island using barges known as lighters and a ship which holds the lighters, known as a Lighter-Aboard-Ship (LASH) vessel. Depending on where the lighters are to be loaded, this concept may require the clearing of a channel in the Bush River to the Chesapeake Bay. The channel clearing would also require the removal of unexploded ordnance from the river bottom. The LASH ship would move down the Chesapeake Bay into the open sea.

Bush River Channel. The Army should ensure that the extent of the removal of the unexploded ordnance from the Bush River will minimize public risk during transport of the mustard agent.

Loading and Unloading. Loading and unloading should take place during daylight hours only. The LASH vessel should be loaded in such a

way as to leave an impact-attenuating space between its hull and the outermost lighter.

Crew. The crew should receive training from the Army on self-protection in case of emergencies. The crew commander and crew should receive training on appropriate contingency procedures.

Predeparture Inspection. Prior to departure, the lighters, the towboat, and the LASH vessel should be thoroughly inspected. All hulls should be checked for leaks. The engines, the electrical system, the communication equipment, and the firefighting gear on both the towboat and the LASH ship should be inspected. The on-board crane of the LASH vessel should be thoroughly inspected.

En route Operations. There should be an escort ship to assist the LASH vessel during emergencies.

Traffic on the Chesapeake Bay Bridge should be stopped while the LASH vessel passes.

In the Chesapeake Bay, Coast Guard escorts should provide an unimpeded passageway for the LASH ship.

2.6.2 Inland Waterway Transport

The generic requirements for transportation on the Inland Waterway system pertain to equipment, loading and unloading, crew, inspections, and operational controls.

Operational Controls. All vessels and crew should be dedicated for the duration of the trip; that is, the same vessels and crew are used for the entire trip.

There should be an escort boat accompanying the barges.

Equipment. Barges should be the "jumbo" type: 195 feet by 35 feet, double-hulled, open hopper with special floor for tie-downs.

The towboats should have at least 2,500 horsepower.

The tows should consist of six barges arranged in a 2 by 3 array to obviate the need for the disassembly of the array during passage through locks.

The packagings used should have built-in attachments for hoisting equipment so that they can be retrieved from the river bottom in the event of sinking.

The regular marine radio communication system should be supplemented by a military system or a satellite communication system.

Loading and Unloading. Munition containers should be loaded only one layer deep. Loading and unloading should take place during daylight hours only.

Crew. There should be a company officer on the towboat serving as crew leader and as liaison with the Army commander in the escort boat.

Predeparture Inspections. Prior to loading, the empty barges and the towboat should be fully inspected. The inspection should include the engines, the electrical system, the communication equipment, and the firefighting gear on the towboat. All wires, winches, ratchets and tie-downs should be checked. The hulls should be checked for leaks.

2.7 Program Management Functions

There are a number of functions which the panel believes to be important and which should be incorporated into the transportation program prior to actual transport operations.

2.7.1 Public Participation

If a disposal alternative which requires transportation is selected, the potentially affected public should be involved. There should be a public information and education program on the disposal program.

The Army should develop jointly with the states along the routes emergency preparedness plans and programs for the states to respond to potential transportation accidents.

2.7.2 Testing and Evaluation of Packagings

The packaging systems selected and designed for use in transportation should be subjected to thorough testing and evaluation. The test program should include tests which simulate real-life accident environments.

2.7.3 Integration of Safety Functions

In addition to the safety responsibilities resident in the individual operating units, there should also be a centralized and integrative safety function within program management. This function ensures that the individual safety functions form a whole and are coordinated.

Mode- and munition-specific hazard analyses should be conducted to identify and evaluate potential problem areas in order to develop controls to assure hardware integrity and to develop plans and techniques for

controlling human error. Prior to transport operations, mode-specific simulation exercises should be conducted to test the soundness of these plans so that corrections can be put into place in a timely fashion.

Incident and accident investigation and documentation procedures should be developed prior to operations. Analyses of incidents and ongoing operations should be conducted to modify operational procedures, where appropriate.

2.7.4 Planning for En route Contingencies

The Army should incorporate plans to deal with en route contingencies as part of its standing operating procedures. These plans should address such subjects as: conditions under which diversion to a safe haven is necessary, potential impairment to vehicle operation, and accidents. These plans should provide for definite assignment of responsibilities during emergencies.

2.7.5 Weather

The Army should work closely with operating experts of the several modes to establish weather criteria for conducting transport operations. These criteria relate to, for example, heavy rains and conditions during which wind shear is more likely to occur.

2.7.6 Vulnerability Assessment

The Army should conduct an assessment to determine the vulnerability of chemical munitions to terrorist activities during transport. Such an assessment should take into consideration the elements of transport operations and the variety of threat potentials.

3.0 PACKAGING SYSTEM FOR TRANSPORT

Packaging is the crucial component in the entire transportation system. It provides protection against agent release, affects the manner of handling the agents and munitions, and influences the choice of equipment used in transport.

The Army is currently conducting a packaging study to determine the engineering design parameters and to develop conceptual packaging designs which will meet the panel's criteria. As many as three conceptual designs may have to be developed: one for the transport of all munition types and ton containers by rail, air and marine, one specifically for the transport of the mustard ton containers from Aberdeen by water, and one for the on-site transport of munitions for disposal on site. Since the transport of the mustard ton containers by barge and ship is such a specialized mission, it may be more efficient to design a container specifically for this application. The multimodal container may also be used for the on-site disposal movements. There may be a separate design specially tailored to this application. Because this study is still in its initial stages, no definitive concepts for transport containers can be described.

3.1 Packaging Criteria for Off-site Transport

The panel set forth four criteria (see Section 2.0) that the packaging systems should be designed to meet:

1. Redundant protection against agent release during normal transport
2. Prevention of agent release in most transportation accidents
3. Compatibility with standard cargo handling and transport equipment
4. Capability for automated agent and temperature monitoring within the transport container

Criterion 1 will be met by designing into the packaging at least two layers of agent containment.

The packaging system will be designed to prevent agent release during an accident to satisfy criterion 2. Accident scenarios for design purposes were developed by the panel and are described in Section 2.2.

In addition to these transportation accident scenarios, the panel also referred to the Nuclear Regulatory Commission's requirements for package survivability in transportation accidents. The Nuclear Regulatory Commission defines the hypothetical transportation accidents by means of replicable engineering tests, rather than actual transportation scenarios.

scenarios. These test requirements are imposed on packages of certain types of radioactive materials such as spent nuclear fuel. The test requirements, as contained in 10 CFR 71.73, are as follows:

- Drop Test - A 30-foot drop onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage is expected.
- Puncture Test - A 40-inch drop onto the upper end of a 6-inch diameter solid cylindrical mild steel bar mounted on an essentially unyielding, horizontal surface.
- Thermal Test - A 30-minute duration all-engulfing fire at 1475°F.
- Water Immersion - An 8-hour (or more) submersion under 15 feet of water.

As specified by the panel, the packaging system will be designed to prevent agent release under either the type of accident described in the panel's scenarios or the Nuclear Regulatory Commission's accident descriptions above, whichever are more stringent.

To satisfy criterion 3, the packaging will be designed with standard exterior dimensions (most likely 8' x 8' x 20') and equipped with standardized corners for handling by standard hoisting machinery.

Criterion 4 has two parts: temperature and agent monitoring. Temperature monitoring is intended to detect unusual elevation of temperature within a container carrying munitions which are energetic (e.g., rockets with propellants). The transport packaging system will be designed with an automatic temperature monitoring capability.

The purpose for automatic agent monitoring is the timely detection of agent presence within the walls of the transport container. The automatic monitors currently available can detect only relatively high levels of agent presence. More importantly, there is a question as to their reliability with respect to giving false positive or false negative signals. This is a serious consideration for rail transport because of the large quantity of containers involved.

How the in-transit monitoring requirement is to be met is being examined in the monitoring study referred to in Section 1.6. That study will address the manner by which monitoring will be performed and the frequency with which it will be conducted.

3.2 Packaging for Marine Transport

The water transport of mustard ton containers from Aberdeen is a specialized mission. If a packaging system is specifically designed for this single application, it will not be used for movement by the other modes.

One possible concept is that the transport container for barge transport will probably be a single ton container overpack that will be designed to meet the accident criteria set forth by the panel in Section 2.2. The ton container overpack will also meet criteria presented in Section 3.1. Due to space limitations on the marine transport vehicles, however, the overpack containers will be only slightly larger than the ton containers.

3.3 Packaging for On-site Transport

The panel's only criterion for on-site transportation to an on-site destruction facility was that one proven layer of protection against agent release should be provided. The Army is developing, in addition, a set of accident survival criteria for on-site movement analogous to the off-site transport accident scenarios described by the transportation panel in Section 2.2. A possible configuration for an on-site transport container specifically designed for this application is as follows. It will provide protection against agent release in the event of an on-site transport accident, and in case a leak develops during movement. It will have capability to be monitored upon reaching the storage or destruction facility, so that it may be opened and unpacked by properly protected workers in case a leak has developed. These containers will be designed to be decontaminated easily and/or recycled for use.

3.4 Effect of Packaging Configuration on Operations

Except for exterior dimensions and weight, the precise configuration and composition of the package do not affect the handling and transport operations. Therefore, the on-site and off-site transport concepts described in the subsequent sections remain valid regardless of how the final packaging design is configured.

The package configuration does have a significant effect on munition transportation throughput rate. How much cargo the transport container can hold determines the number of containers required, the size of the fleet, the number of trips, the number of handling personnel, and other quantities needed to meet a given delivery schedule. This set of numbers, in turn, significantly affect the total cost of the transportation program. Costs will be addressed in a separate report when the packaging study provides a concept with sufficient information on composition and cargo capacity.

3.5 Some Assumed Packaging Parameter Values

While the packaging configuration and construction do not affect the handling and transport sequences described in Sections 4.0, 6.0, and 7.0, some of the operational concepts are illustrated with packages of assumed size, weight, and payload.

For illustrative purposes, therefore, assumed values for certain parameters for an off-site transportation packaging system are stated here. The weights and payload numbers are based on preliminary analyses of feasible concepts.

- Exterior Dimensions: 8'x 8'x 20'
- Empty Weight: 28,000 lbs.
- Payload and Gross Weight : See Table 3-1

3.6 Package Testing

If a disposal option that will require transportation is chosen, a testing program will be initiated to ensure that the packaging system meets required performance criteria. The test program will be coordinated with appropriate oversight agencies, such as the Department of Transportation, the Environmental Protection Agency, and the Department of Health and Human Services. The goal of this interagency cooperation will be to define a munition packaging test program which will be effective and which will meet the shipping schedule selected for the disposal option.

TABLE 3-1
ASSUMED PACKAGE PAYLOAD AND WEIGHT

Item	Number of Pallets	Payload Weight (lb)	Gross Weight (lb) ^a
M55 Rocket Pallet	4	5,400	33,400
M23 Mine Pallet	3	4,011	32,011
4.2-inch Mortar Pallet	8	5,200	33,200
155mm Projectile Pallet	16	12,800	40,800
105mm Projectile Pallet	18	17,622	45,622
8-inch Projectile Pallet	12	15,036	43,036
MK 94 Bomb Pallet	6	6,132	34,132
MC-1 Bomb Pallet	6	9,540	37,540
Ton Container	2	6,600	34,600
TMU-28/B Spray Tank	3	5,805	33,805

^aTare Weight 28,000 lbs.

4.0 ON-SITE TRANSPORTATION AND ASSOCIATED OPERATIONS

The Chemical Stockpile Disposal Program will require movement of the chemical munitions and/or agent in ton containers within the boundaries of the site at which they are currently stored; and if a colocation alternative is selected, at the regional or national destruction center.

This section sets forth, in detail, steps and procedures necessary to prepare the stockpile for transportation. Transportation and associated operations at the current storage site as well as at the destination site are described. On-site transportation and associated activities are addressed for the on-site destruction alternative as well. Under this alternative, munitions and/or bulk agent are moved from the current storage location to a nearby demilitarization facility. Figure 4-1 presents a general schematic of operations discussed.

Descriptions of en route transportation activities and unique preparation procedures are contained in Sections 6.0, 7.0 and 8.0, which apply to rail, air and waterway transport, respectively.

The following sections address on-site activities for alternatives involving rail and air transport (on-site operations differ for the barge transport alternative and will be discussed in Section 8.0.) and for the on-site disposal alternative:

- Section 4.1 addresses preparatory procedures for certain munitions prior to the beginning of transport.
- Section 4.2 describes all activities occurring at the current storage location prior to beginning movement. Activities include monitoring, inspection, and handling.
- Section 4.3 describes loading the munitions or ton containers into transportation containers.
- Section 4.4 describes activities at the holding/loading area where loaded containers await shipment.
- Section 4.5 describes operations and transportation which occur at the destination upon arrival of the train or aircraft.
- Section 4.6 addresses preparation and movement of the stockpile from the current storage location to a nearby on-site facility for demilitarization.
- Section 4.7 presents implementation of administrative controls necessary to ensure safety and accountability of the stockpile during transport.

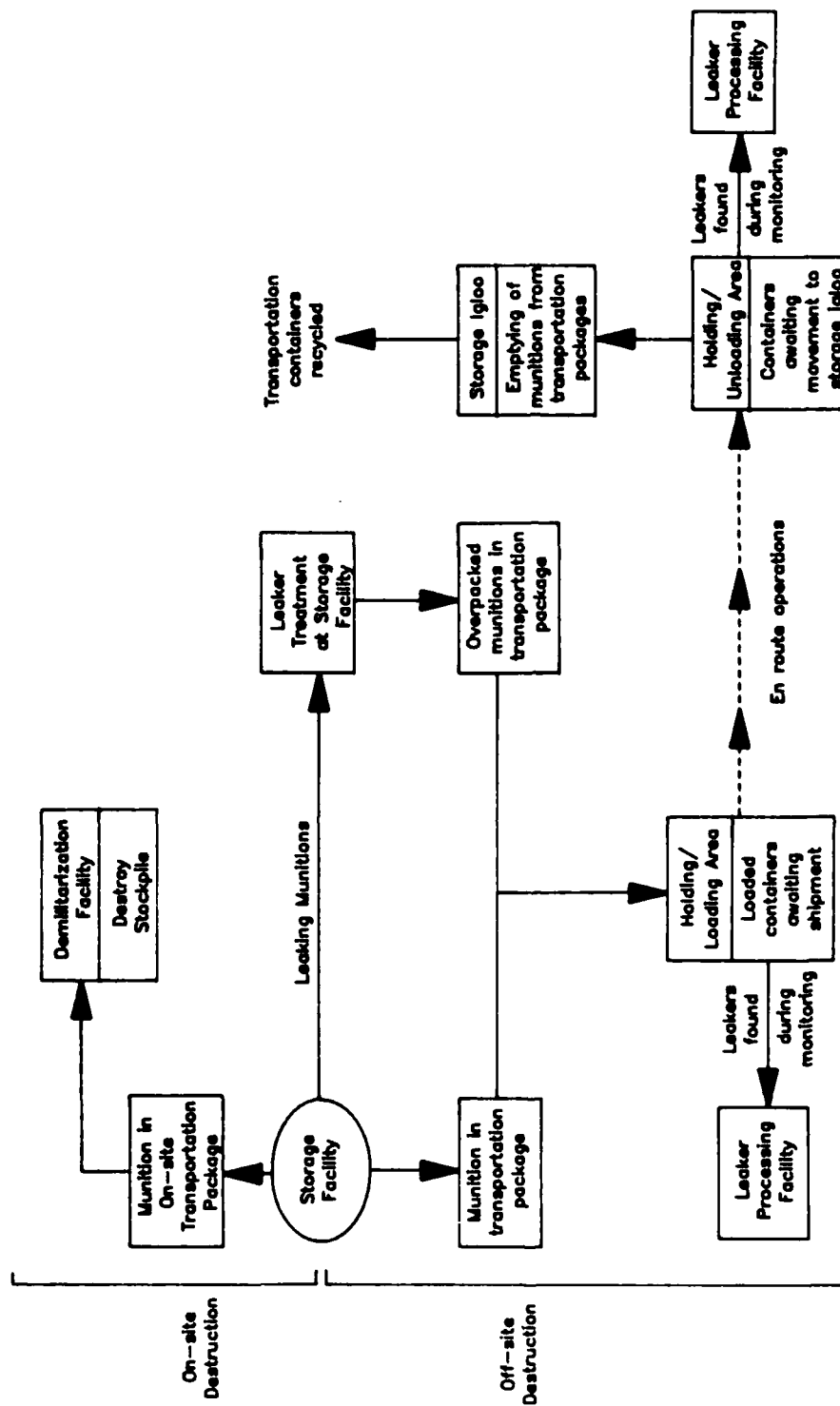


FIGURE 4-1
ON-SITE MOVEMENT AND ASSOCIATED OPERATIONS
AT ORIGIN AND DESTINATION SITES

4.1 Preparatory Treatment of Munitions and Ton Containers Prior to Transport

As part of regular maintenance at current storage locations, two kinds of action will have been undertaken prior to the initiation of transport operations.

Ton containers will have been tested ultrasonically to determine susceptibility to leak development in the plug and valve area. If those ultrasonic tests indicate potential leak development, plugs and valves will have been replaced.

In addition, two munition types, currently stored with their propellant, will have been processed prior to the beginning of transportation. The 4.2-inch mortar and 105mm cartridges will have had their propellant removed as part of regular maintenance at an on-site maintenance facility at installations where they are currently stored.

4.2 Munition Preparation at the Storage Location

The chemical munition stockpile is currently stored in secure areas in one of three configurations:

- In an igloo: an earth-covered magazine of either concrete or corrugated steel construction, covered with a minimum of 2 feet of earth.
- In an above-ground magazine: a warehouse-like facility in which only munitions which do not contain explosive components are stored.
- In an open-storage yard: an area where only mustard ton containers are stored on dunnage.

Although differences exist among these storage facilities, the term "igloo" will be used in describing common operations. Where the operations are distinctly different, such differences will be identified. The area outside the door of the igloo, a concrete pad at which some activities will be carried out, is referred to as the igloo apron.

Figure 4-2 presents the on-site munition handling steps which occur prior to off-site transportation. This flow diagram contains:

- Location where particular steps will occur.
- Specific sequence of steps which occur.
- Treatment of munitions or ton containers found to be leaking.

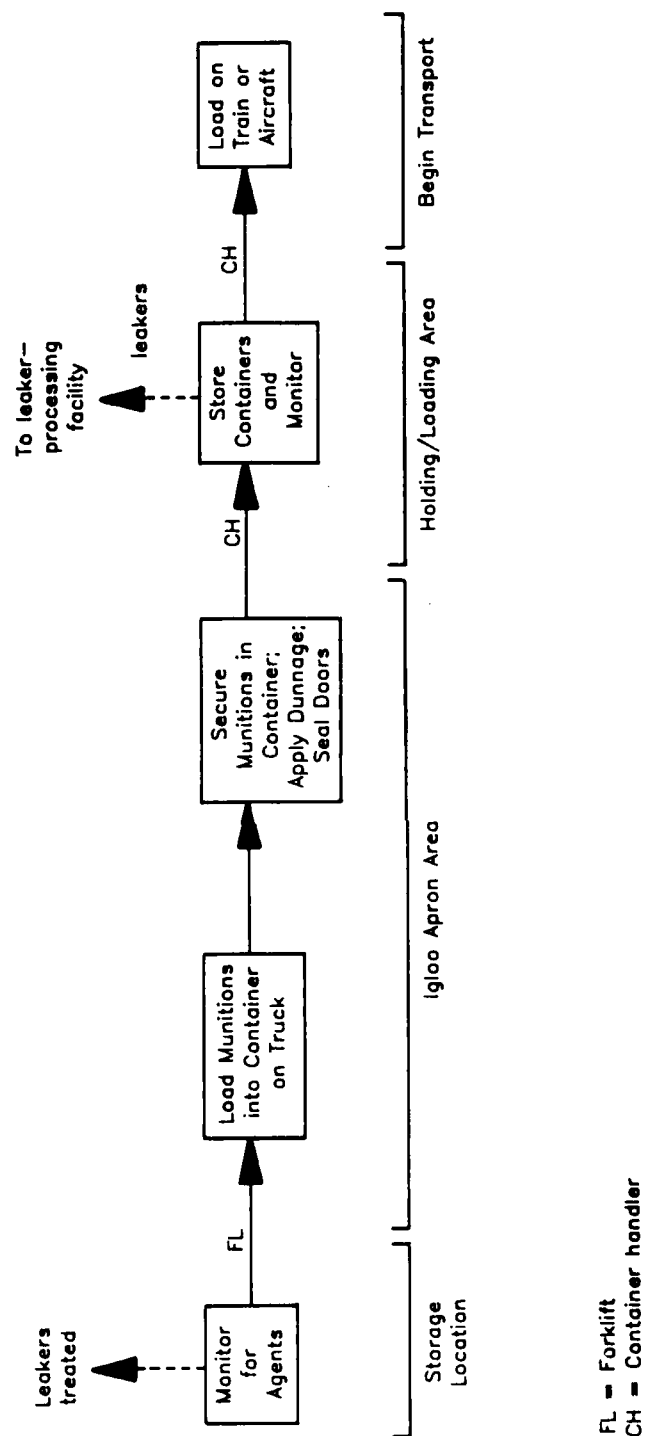


FIGURE 4-2
MUNITIONS HANDLING STEPS AT THE ORIGIN SITE
FOR RAIL AND AIR TRANSPORT

Reference to this flow diagram will be useful to the reader in understanding procedures described throughout the following sections.

Preparatory procedures to be accomplished as part of transportation activities include monitoring, inspection, leaking munition treatment and movement of all munitions from the storage igloo or location. Army Materiel Command Regulations 385-102 and 385-31 set forth detailed procedures for performing these activities. Included are standards for monitoring methods and equipment, standards for protective clothing, standards for safety, standards for decontamination, and accident response procedures.

4.2.1 Igloo Monitoring and Inspection

Various methods of monitoring and types of monitoring equipment are currently in use for detecting the presence of agent. Devices which are sensitive to presence of low levels (i.e., down to permissible exposure limits) are referred to as low-level monitors; those which only detect high levels (i.e., down to immediately dangerous to life and health) are referred to as high-level monitors.

Prior to opening an igloo, the air inside will be sampled and analyzed for the presence of agent. Agent-specific sampling equipment will be used to detect low levels of agent in the igloo. This procedure, is referred to as "pre-entry monitoring". After the samples are withdrawn, they will be transported to an on-site laboratory for immediate analysis. The samples will be analyzed by a gas chromatographic technique, for presence of the specific agent stored in the igloo. Igloos found to contain leaking munitions during monitoring will be opened last. Nonleaking munitions in those igloos will be prepared and shipped (Section 4.2.3). Leaking munitions will be prepared and shipped together after all nonleaking items. Treatment procedures for leaking munitions are described in Section 4.2.2.

Once pre-entry monitoring is complete and verified, a visual inspection for munition and container damage and/or leakage will be conducted by personnel wearing 'Level A' protective clothing. The Level A classification provides maximum protection to personnel who could become exposed to agent upon entering the igloo. In inspecting the igloos, personnel will perform visual inspection of its contents to ensure that the pallets are safely stacked and that there are no visible signs of munition damage or corrosion or agent leakage. Special attention will be given to any wet or damp areas and painted surfaces, since agent may cause blistering or peeling and discoloration of painted surfaces. All suspect liquids will be tested by an additional reliable monitoring method which is agent-specific for determination.

Throughout the entire inspection operation, high-level alarm air monitors will be functional inside the igloo, one monitor each to be located at the front and back of the igloo.

Total monitoring time at the igloo (including pre-entry, first entry visual inspection and analysis of samples) could require more than 5 hours per igloo. The sequence of monitoring activities is shown in Table 4-1.

4.2.2 Processing of Leaking Munitions and/or Ton Containers

Munitions and/or ton containers found to be leaking during storage location monitoring and inspection will be treated before further movement. The process of treating these leaking munitions and ton containers occurs at the storage location and is discussed in the following sections.

4.2.2.1 Treatment of Leaking Munitions. Procedures for treating leaking munitions are depicted in Figure 4-3 and listed below:

1. Identify the leaking munition
2. Access the pallet containing the munition (if applicable)
3. Remove the munition from the pallet on which it is stored (if applicable)
4. Decontaminate simultaneously, if possible:
 - a. The individual munition
 - b. Adjacent munitions
 - c. Any other contaminated area
5. Place the individual munition in a protective plastic wrap
6. Replace the decontaminated adjacent munitions onto a pallet
7. Place the wrapped leaking munition into an overpack (discussed in the following section)
8. Decontaminate exterior of overpack and move to a temporary storage location for future processing

Once the leaking munition has been found and isolated, it is placed into a barrier bag (a plastic wrap) which provides immediate vapor containment of the leaking munition, per current Army procedures. The wrapped munition is then placed into a munition-specific heavy-walled steel overpack, designed to provide a high level of assurance of agent

TABLE 4-1
SCHEDULE AND TIME CONSTRAINTS FOR IGLOO MONITORING

Activities	Time
Arrival of monitoring crew and setting sampler	30 minutes
Sample collection	120 minutes
Collection of sampler results, log in at lab and preparation for analysis	30 minutes
Analysis performed	120 minutes
Bubbler results received and igloo entrance (Level A) ^a	Negligible
Set up of high-level alarms	15 minutes
Visual inspection ^b	30 minutes

^aCrews enter in highest level protective clothing, referred to as 'Level A'.

^bOverlaps with alarm setup.

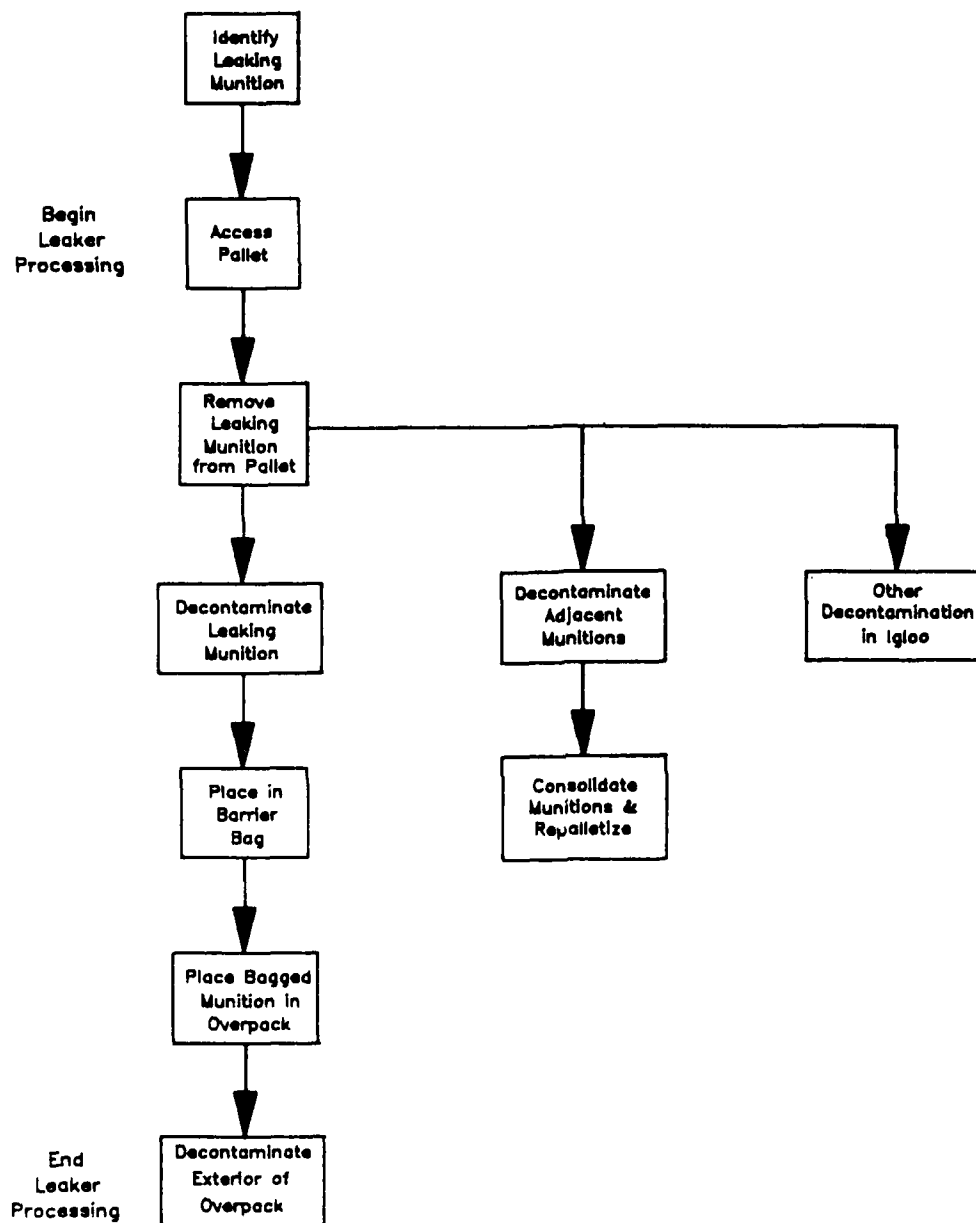


FIGURE 4-3
LEAKER MUNITION HANDLING AT THE STORAGE LOCATION

vapor and liquid containment, even if the munition continues to leak. These types of overpacks are currently in use for leaker (or potential leaker) containment. The Army is pursuing the development of improved individual leaking munition packaging, in order to provide the same level of containment as offered by the body of a newly manufactured munition. The overpacked munition is then moved to a temporary storage location for future transport.

For transportation activities, these overpacked leaking munitions will be palletized and placed into the shipping container with other munitions of the same type and with the same agent. Subsequent steps are the same as those described in Sections 4.3 through 4.5 for nonleaking munitions. All overpacked leaking munitions will be shipped together in the last trips (i.e., shipments) of the transportation program. Due to the increased weight and volume of the overpacks within the shipping container, the number of munitions may vary for a "leaker" trip.

4.2.2.2 Treatment of Leaking Ton Containers. Agent-filled ton containers will be identified and moved using a forklift outside the igloo door onto the igloo apron (if applicable) and treated there. If ton containers are currently stored in storage yards, treatment of leakers will occur at the yard.

This treatment consists of plug and valve replacement. This procedure will be accomplished using a negative pressure glove box device that exhausts through a carbon filter. Versions of this portable device, which also functions as a handling device, are in current use in treating leaking ton containers at the storage location. The apparatus provides complete vapor containment during the plug and valve replacement process. After replacement procedures are complete, the exterior of the ton container will be decontaminated. No leaker overpacks will be used for ton containers, as they are for munitions. However, subsequent steps for transportation after treatment are the same as those discussed in Section 4.2.2.1 for leaking munitions.

4.2.3 Preparation of Nonleaking Munitions

Munitions which have been verified as not leaking after monitoring and inspection of the storage location will be moved from the storage location on pallets, by forklift directly into the transportation container.

4.3 Loading the Transportation Container

Pallets or containers of munitions and ton containers will be placed into a transport container meeting the criteria and specifications set forth in Section 3.0. The final configuration of the package will be determined by the Army's packaging study currently underway. For purposes

of this discussion, the container is assumed to be of standard cargo dimensions (8'x 8'x 20'). The container is also assumed to have two doors at one end for loading. The two doors provide seals for redundant protection against vapor leakage.

Typical operations of loading munitions into the container are depicted in Figure 4-4. This schematic assumes storage in an igloo. Similar operations would occur at above-ground magazines or open-storage yards.

4.3.1 Preparation of Shipping Container

Empty shipping containers will be stored at the origin site at a predetermined location. This location may be the holding/loading area near the rail or air terminal (see Figure 4-4).

One empty shipping container will be loaded using standard cargo handling equipment, onto a flatbed truck. Once loaded, this container will be secured onto the truck for safe movement on-site. The truck will be driven to the storage igloo and parked as indicated in Figure 4-4, adjacent to the igloo apron.

4.3.2 Loading Munitions into the Shipping Container

Forklifts are used to move pallets, one at a time, out of the igloo, along the igloo apron and into the container which has been loaded on a flatbed truck.

Two to eighteen pallets of munitions, depending on munition type, as shown in Table 4-2, will be loaded into the shipping container. Once loaded the pallets will be secured inside the container, and packing material (i.e., "dunnage") applied. The inner and outer doors of the container will then be sealed and locked and seals verified. This process of packaging munitions into the shipping container (including closing and sealing) will depend on munition type and will take between one and four hours per container, and require between 3 to 15 four-person crews. Precise crew numbers and schedules will be developed as part of the operational plan when the transport mode and schedule for destruction of the stockpile have been determined, and if a disposal alternative requiring interstate transport is selected.

The sealed container on the truck will then be driven to the holding/loading area, probably in convoys of five vehicles: 1 munition truck, 2 security trucks, an emergency vehicle and a decontamination truck (see Section 4.7, Administrative Controls). All vehicles will adhere to a 20 mph maximum speed limit for this trip, which will be about one mile.

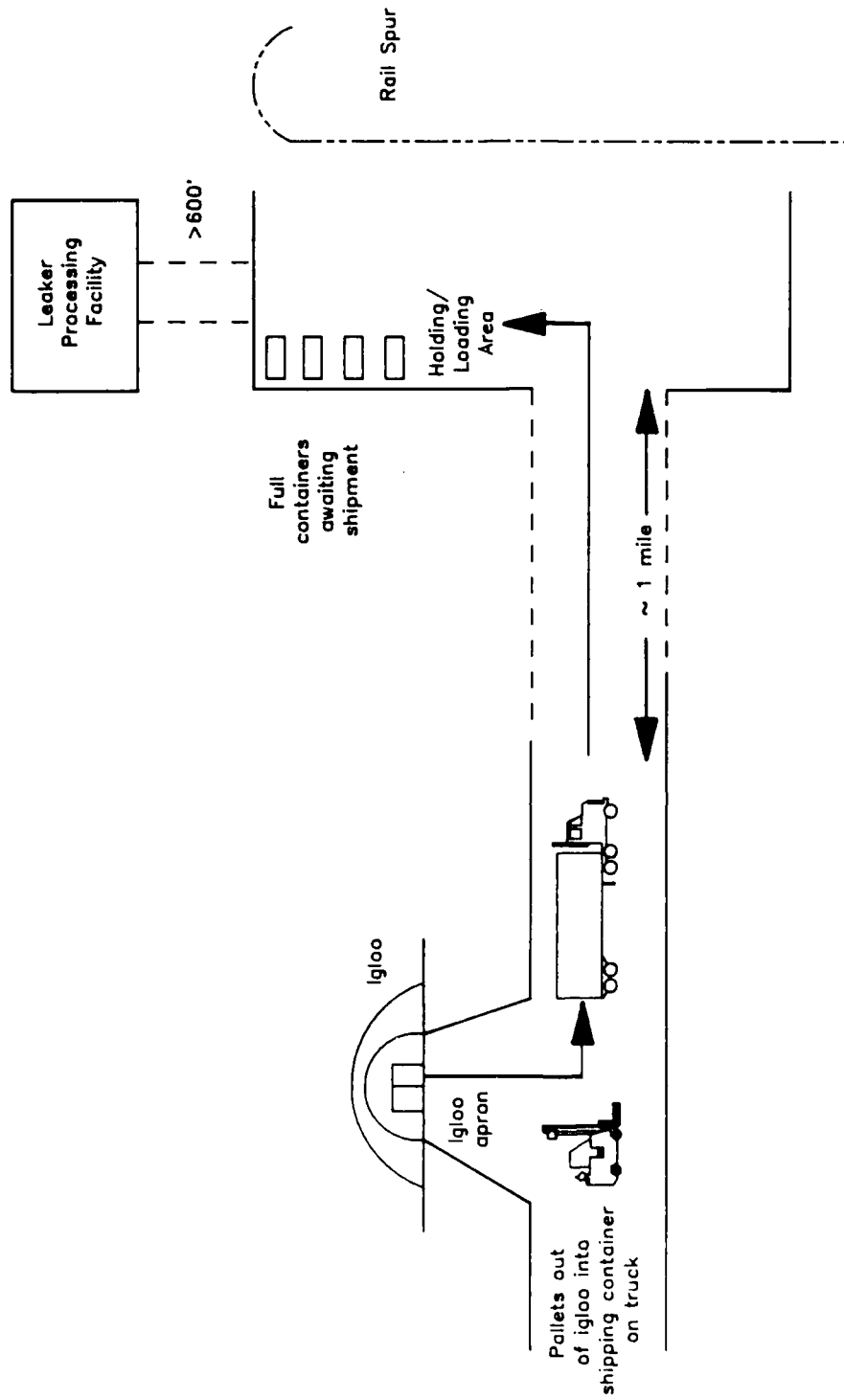


FIGURE 4-4
SCHEMATIC OF MUNITIONS LOADING OPERATIONS

TABLE 4-2
CHEMICAL AGENT AND MUNITION PACKAGING

Item	Number of Items per Shipping Container
M55 Rocket Pallet	4
M23 Mine Pallet	3
4.2-inch Mortar Pallet	8
155mm Projectile Pallet	16
105mm Projectile Pallet	18
8-inch Projectile Pallet	12
MK 94 Bomb Pallet	6
MC-1 Bomb Pallet	6
Ton Container	2
TMU-28/B Spray Tank	3

4.4 Operations at Loading Facility

Shipping containers on the flatbed truck will be brought to a loading facility. The schematic presented in Figure 4-4 depicts the train loading facility (holding/loading area and leaker processing facility) for the transportation program. Site-specific considerations will determine the exact location of each of the areas.

Siting of facilities are governed by Army Materiel Command Regulations 385-100, 385-102 and 385-31, which protect areas outside of installation boundaries in the event of chemical release onpost. A loading facility for air transport will have the same components and same general layout. Differences would be in the size of the holding area, which would require considerably less space to load containers for transport by aircraft.

This loading facility will be located entirely within an Army exclusion area of the originating site, which will permit application of security standards currently followed in the exclusion area. The transport vehicle will be brought into the exclusion area for loading, if possible, i.e., construction of a rail spur to the protected holding area will probably be most cost-effective in light of the additional security afforded. In the case of air transport, however, it may not be feasible for the airfield to be constructed in the exclusion area. This plan will assume, for the purpose of consistency, that a new loading facility will be built at each location. Discussed below are activities at each of the two major components of the loading facility: the holding/loading area, and the leaker processing facility.

4.4.1 Holding/Loading Area Activities

Storage of shipping containers awaiting shipment will be at the holding/loading area located adjacent to the transport conveyance terminal (see Figure 4-4). The holding area is a concrete pad constructed to support equipment used for loading or shipping containers onto a train or aircraft.

Shipping containers will be unloaded at the holding/loading area from the trucks used to transport them from the storage location. These unloading operations will be accomplished using standard cargo loading devices (see Appendix D). As they arrive, shipping containers will be placed in a single layer, in a row, onto the holding area alongside the edge furthest from the rail siding. This configuration will meet safety requirements of distance separation of munitions and rail, and facilitates loading onto the train.

For illustrative purposes, a typical train load which could accommodate 140 shipping containers would necessitate approximately one

week to prepare and containerize munitions for a one-train trip. Thus, a loaded shipping container could be stored in the holding/loading area for at least six days.

In the case of aircraft transportation, the holding/loading area will be considerably smaller due to the carrying capacity of the C-141 or C-5A or C-5B aircraft. Depending on munition type, a C-141 will accommodate one or two loaded shipping containers, and a C-5A or a C-5B can accommodate between four and six. Thus, depending on schedules and number and type of aircraft, one to thirty shipping containers may be in a holding area for one or two days.

During storage, security standards applicable to exclusion areas will be in force. Guards will patrol the holding area round-the-clock to ensure security of the cargo.

Low-level monitoring will be performed during storage. If monitoring results indicate agent inside the shipping container, that shipping container will be loaded on a truck using the standard cargo loading equipment, and transported to the leaker processing facility for treatment.

4.4.2 Activities at the Leaker Processing Facility

The leaker processing facility will be a building equipped to handle leaking munitions in shipping containers. Shipping containers found during periodic monitoring to contain leaking munitions will be brought to the leaker processing facility. Containers will be unlocked and opened and the leaking munition actually identified. The leaking munition will be removed from its pallet, overwrapped, decontaminated and repacked into a shipping container by Level-A protected personnel. The shipping container will then be ready for shipment.

All munitions that have been found to be leaking, and treated in the leaker processing facility will be shipped with other munitions of the same agent type; these items may be consolidated within a shipping container with previously treated leakers as described in Section 4.2.2.1, but not with any nonleaking items.

4.4.3 Loading the Transport Vehicle

When the holding/loading area is full (i.e., enough shipping containers to load the transport conveyance), and the train or aircraft arrives, loading operations will begin. Standard cargo loading equipment devices will be used to move and load the shipping containers from the holding/loading area onto the train or aircraft. Detailed loading procedures are described in Sections 6.0, 7.0 and 8.0 for each transport mode.

4.5 Activities at the Destination Site

Sections 6.0 and 7.0 describe en route activities for the rail and air transport alternatives. This section describes activities at the destination for these moves. The destination sites are either Tooele Army Depot or Anniston Army Depot, depending on whether the national or regional alternative is selected. Activities at the destination are depicted in Figure 4-5. Activities at Johnston Island incident to marine transport of the Aberdeen Proving Ground stockpile are described in Section 8.0.

Upon reaching the destination, the train or aircraft will be unloaded at the unloading/holding area. The configuration of the unloading/holding facility is similar to the loading facility shown at Figure 4-4. The shipping container will be removed from the train or aircraft and placed in the unloading/holding area using standard container handling equipment. The shipping containers will be monitored using low-level monitors while they await further processing.

Any suspect shipping container will be transferred to the leaker processing facility, for unpacking, overpacking leaking munitions and isolation as an identified leaker for subsequent destruction. Unpacking of the suspect container will be performed by properly protected (i.e., Level A protection) personnel within an agent-containment area (see Section 4.4.2). Empty shipping containers will be chemically decontaminated as necessary and returned to the holding/loading area for future use.

Shipping containers in which no agent leaks are detected after low-level monitoring at the holding area will be loaded onto a truck and moved from the holding area to an unpacking area at a temporary storage location. At this location, the shipping container will again be monitored to ensure that no leaks have developed during movement, then unlocked and opened and the pallets of munitions removed by forklift and placed into storage buildings. The munitions will remain at this storage facility awaiting destruction. Empty shipping containers will be returned to the holding area and reused.

4.6 Operations for On-site Destruction

In the on-site destruction alternative, transportation is necessary from the storage location to the demilitarization facility. Figure 4-6 presents a schematic of transportation and associated activities necessary for this on-site movement.

As described in Section 4.2.1, operations at the storage location begin with pre-entry monitoring and a subsequent visual inspection of munitions. In this alternative, munitions and or bulk containers found to

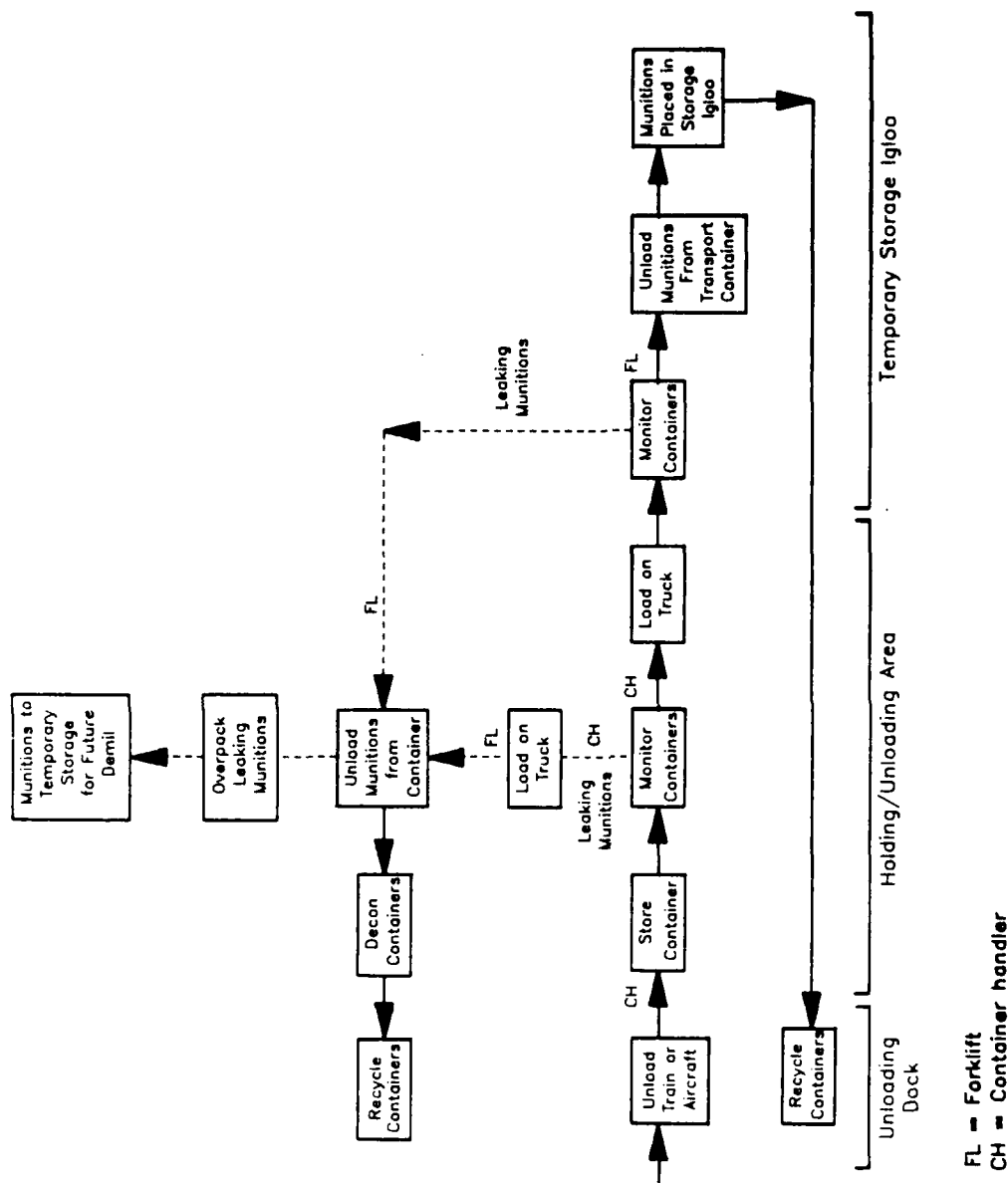


FIGURE 4-5
MUNITIONS HANDLING STEPS AT DESTINATION SITE

be leaking will have been treated at the storage location (as described in Section 4.2.2) before transportation activities to the demilitarization facility begin.

When monitoring and inspection results indicate the absence of any agent leakage, munitions in pallets (where relevant) will be moved out of the storage location by forklift, onto the igloo apron and into an on-site transportation container.

For the on-site destruction alternative, all munitions will be moved using on-site transportation containers. Pallets of munitions and ton containers will be loaded into the container at the igloo apron. Munition-filled containers, closed and sealed, will be loaded by forklift onto a truck, secured, and driven to the destruction facility. Trucks will adhere to a 20 mph maximum speed limit and administrative controls followed (see Section 4.7). The distance from any storage location to the destruction facility will be approximately one mile, except in the case of Pine Bluff Arsenal, where the distance is approximately three miles.

4.7 Administrative Controls

Administrative controls will be in place during all aspects of on-site transportation. On-site transport of munitions from the storage location to a loading area or to an on-site destruction facility will take place entirely within the Army installation boundaries. Army personnel, experienced and knowledgeable in the transport of chemical munitions, will handle the transport from the storage location or facility. Standardized procedures will be followed and accident response teams will be standing by during all aspects of the movement.

Convoys will be used for the munition movement. The configuration of this convoy, varies from installation to installation. A typical convoy would be comprised of five vehicles, as follows: a security escort, the munition-carrying truck, a decontamination vehicle, an emergency vehicle, and a following security escort vehicle.

Prior to movement, road surfaces to be used to transport munitions will be checked to ensure smooth movement of the vehicles used; low speed limits will be adhered to.

During both on-site and off-site transportation, there will be an unbroken chain of custody of the munitions. A munitions manifest will be prepared at the originating installation. This munitions manifest will assure custodial responsibility during all phases of transportation.

Use of the manifest will begin when munitions are placed into the transportation container by munitions storage personnel. These personnel will be responsible for preparing an inventory in the form of the munitions manifest. Signatures of the convoy commander accompanying a

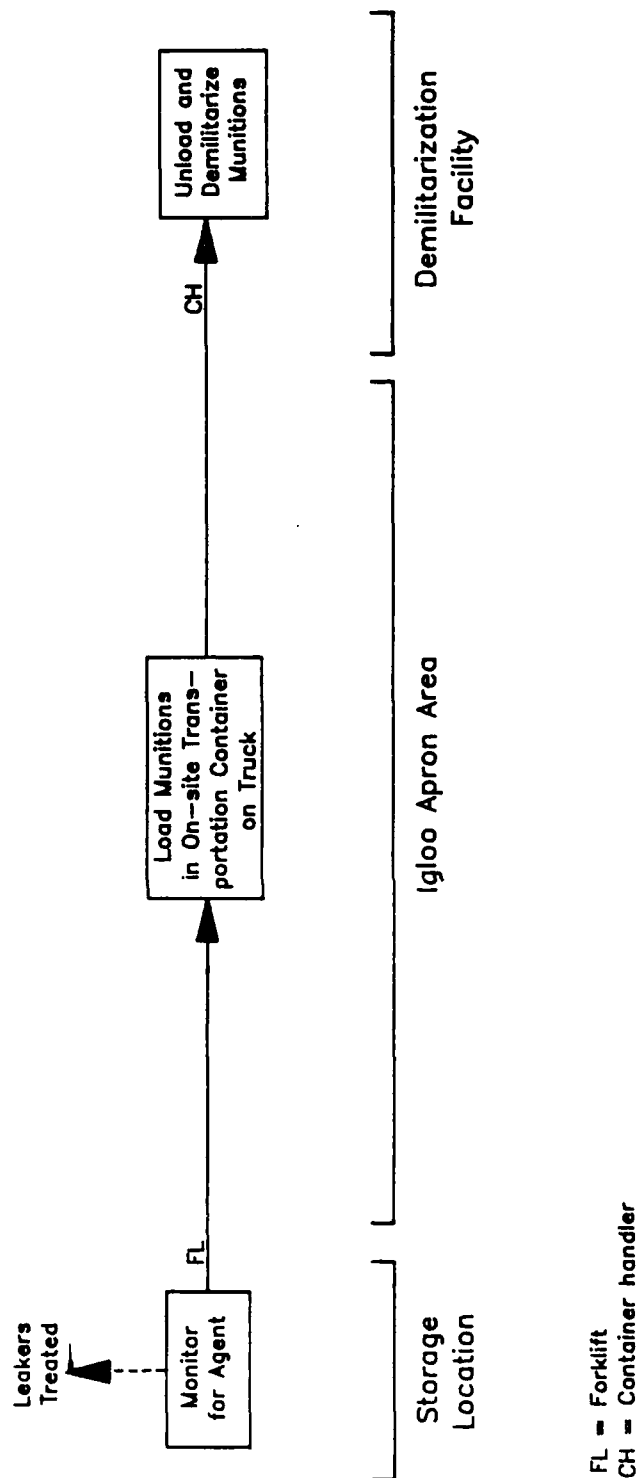


FIGURE 4-6
MUNITIONS HANDLING FOR ON-SITE DESTRUCTION OF STOCKPILE

shipment will be required at each point that munitions "change hands." The manifest will accompany the shipment through receipt by storage personnel at the destination site. This process will assure accountability of munitions during transport.

5.0 PROGRAMMATIC CONSIDERATIONS COMMON TO THE RAIL, AIR, AND WATER TRANSPORTATION MODES

The Army will carry out several planning and coordination activities before a rail, air, or water transportation program is begun. These activities include: the preparation of a transportation operating plan, safety plan, vulnerability analysis, medical support plan, and emergency response plans; determination of personnel required to be in the Army Chemical Personnel Reliability Program and the implementation of the requirements of this program; development and implementation of personnel training programs; establishment of command and control procedures and a central office; and selection of transportation routes. These activities are discussed below. Details of some of these activities that are specific to a transportation mode are given in the section on that mode.

5.1 Transportation Operating Plan

An operating plan based on the proposed transportation concept will be prepared for use by program personnel before a transportation program is begun. The operating plan will include detailed procedures on operations, security, and safety. Some of the elements of this plan will be the following:

- Materiel to be transported
- Schedules
- Location of scheduled stops, if any
- Delineation of authority and responsibilities
- Training requirements for personnel
- Security procedures
- Safety and emergency response procedures and responsibilities
- Special operating requirements
- Munition monitoring procedures

5.2 Safety Submissions and Site Plans

Safety submissions and site plans will be prepared for new facilities located within the boundaries of the Army installations as required by Army Materiel Command Regulations 385-100 and 385-31. These documents specify distances, methods and procedures for safe operation of facilities. Some elements of these plans are as follows:

- Hazard zone calculations
- Munition container handling requirements
- Inspection and testing requirements
- Emergency equipment and protective clothing requirements
- Contamination control requirements
- Monitoring requirements
- Special operating procedures

Site-specific plans will include hazards analyses, which are specific to the site terrain and prevailing weather. The safety submission will be prepared by the individual installations and coordinated subsequently with U.S. Depot System Command; U.S. Army Armament, Munitions and Chemical Command; U.S. Army Test and Evaluation Command; Army Materiel Command Field Safety Activity, and the Department of Defense Explosives Safety Board. The Department of Health and Human Services will also review the plans. These reviews are conducted to ensure that no unsafe operations are implemented, and that all possible measures are taken to avoid accidents or injury to operating personnel or to the surrounding community. All approvals must be obtained before construction of facilities can begin.

5.3 Preoperational Survey

Prior to beginning transportation operations, a preoperational survey will be conducted. The preoperational survey will involve simulating operations beginning at the storage site where activities begin. Inert materials will be used in place of munitions. The purpose of the survey is to identify and eliminate potential safety problems and to ensure effective operations. The preoperational survey will be conducted by an independent team that will observe all aspects of the operations.

A detailed description of the preoperational survey is an important element of the safety management program. As discussed in Section 9.2, the Army will establish procedures for cooperating with local communities. Involvement with local emergency response personnel will be necessary during the simulated transportation activities. Lessons learned from the preoperational survey and subsequent simulation of the operational activities will help identify problems and help develop program changes to eliminate these problems. These procedures will be integrated into the emergency response plan.

5.4 Vulnerability Analysis

A sabotage vulnerability assessment will be carried out in order to determine the vulnerability of chemical munitions to terrorist activities during transport. This assessment will take into consideration the elements of transport operations and the variety of threat potentials. It will assess the vulnerability of the operational elements and identify measures that can be taken to reduce that vulnerability.

5.5 Medical Support Plan

A medical support plan for transportation program personnel will be developed for approval by the U.S. Army Health Services Command, and for review and approval by the Department of Health and Human Services. This plan will describe the medical procedures, personnel, facilities and equipment to be used in supporting the transport of chemical munitions. Medical response to a chemical accident during loading, transport, and unloading will be developed as part of the emergency response plans (see below).

5.6 Emergency Response Plans

A generic Emergency Response Concept Plan has been prepared by the Army. If a disposal alternative requiring transportation is selected, specific emergency response plans will be prepared for shipping and receiving installations and for the transportation routes. These plans will be specific for each installation, mode of transport, and transportation route. State and local authorities will participate, as necessary, in the development of these plans. The nature of these plans will be determined by the characteristics of credible accidents identified in a risk analysis for the munition inventory to be shipped from each location.

5.7 Public Affairs Plans

Prior to implementation of a transportation program, the Public Affairs Office of the Program Manager for Chemical Munitions will prepare public affairs plans for the originating and destination installations. A generic public affairs plan will be prepared for communities along the transportation routes that could be affected.

5.8 Chemical Personnel Reliability Program

The Army Chemical Personnel Reliability Program is used to identify chemical surety duty positions and to manage the personnel assigned to the

positions. Features of the program (Army Regulation 50-6) include the following:

- Identification and designation of chemical surety positions
- Selection, screening and evaluation of Chemical Personnel Reliability Program candidates on the basis of the following:
 - favorable current personnel security investigation
 - screening of local personnel records
 - evaluation of medical history and physical condition
- Certification of acceptability for the Chemical Personnel Reliability Program by the certifying official
- Personal interview and briefing conducted by the certifying official
- Certification of training and proficiency by the certifying official
- Continuing evaluation by the certifying official and co-workers
- Disqualification of personnel who no longer meet applicable personnel reliability standards
- Administrative termination of Chemical Personnel Reliability Program personnel no longer assigned to chemical duties

Personnel with responsibility for chemical munitions and agents must comply with the requirements of the Chemical Personnel Reliability Program. At a minimum, these will be personnel having access to or controlling chemical surety materiel. Personnel who must be in the Chemical Personnel Reliability Program will be determined and a pool of qualified personnel will be established before a transportation program begins.

5.9 Personnel Training Programs

Personnel must be well trained and certified in accordance with Army Materiel Command Regulation 350-9 for the tasks involved in the transportation program to assure the safety of the operations and the security of the material. Personnel to be trained may include loading and unloading crews; operating crews; convoy command, safety and security personnel; other convoy support personnel such as medical teams; and en route civilians that might be involved in emergency response activities and transportation security. Additional information specific to each transportation mode is given in the appropriate section.

5.10 Command and Control

A central command and control office will also be established to provide a centralized point of contact for the munition movement operation. All communications to the munition convoy will originate from this office upon approval by the officer in charge of the Command and Control Unit. The duties of the central Command and Control Office will be as follows:

- Functioning as the primary communication link during movement of munitions
- Receiving communication checks and status reports on movements of chemical munitions
- Relaying reports and information to participating and supporting organizations
- Providing current information on status of normal and emergency operations to supporting and participating organizations

5.11 Route Selection

For rail and air transportation, typical routes will be depicted in the Final Programmatic Environmental Impact Statement. A possible route for shipment of the bulk agent inventory at Aberdeen Proving Ground, Maryland to Johnston Island is proposed in Section 8.0. Should a disposal alternative requiring transportation be selected, the Army will seek the advice of and coordinate with the appropriate federal agencies, affected commercial carriers, and the states to be traversed in selecting specific routes.

6.0 RAILROAD TRANSPORTATION

The transport of chemical munitions by railroad to a national site or to regional destruction sites will be accomplished by loading sealed munition containers on a unit train dedicated to munitions carriage. For the national destruction site alternative, munitions will be shipped to Tooele Army Depot, Utah, from the seven other storage locations. For the regional destruction alternative, munitions will be shipped to Tooele Army Depot from Umatilla Depot Activity, Oregon, and Pueblo Depot Activity, Colorado, and to Anniston Army Depot, Alabama, from Lexington-Blue Grass Army Depot, Kentucky, Pine Bluff Arsenal, Arkansas and, Newport Army Ammunition Plant, Indiana, and Aberdeen Proving Ground, Maryland.

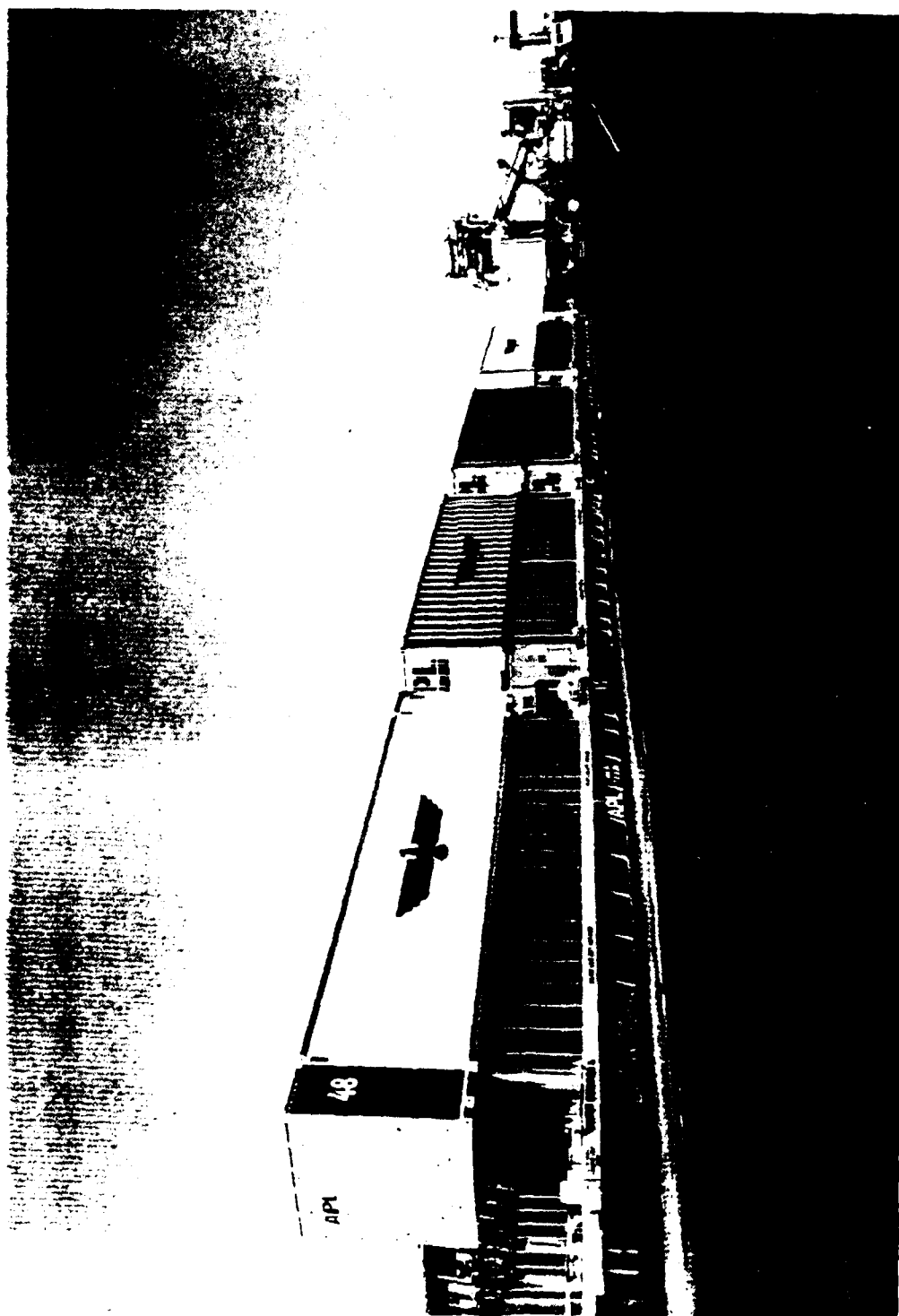
Munition containers will probably be carried on a type of rail car currently used in rail commerce built specifically for carrying stacked shipping containers of standardized dimensions (Figure 6-1). The advantages of using this type of rail car instead of an 89-foot flatcar are superior ride quality and capacity to carry more munition containers on a train of any given length.

The containers may be carried stacked in two layers (as shown in Figure 6-1) or in a single layer. Carrying two layers per rail car (double stacking) is desirable over a single layer because of the doubling of capacity of each munition train, reducing the number of trainloads needed. Double stacking, however, may reduce routing flexibility because of the height above rail of the stacked containers. Other factors such as security, emergency response, and cost may also affect the decision whether to double stack. This decision will be part of the development of a rail operating plan.

Shipments of munitions will consist of a munition train preceded by an escort train. Munition trains may carry several types of munitions, but they will contain only one type of chemical agent. The munition train will carry the munition containers, support equipment, the convoy commander, security forces as required by Army Regulation 50-6 and Army Regulation 50-6-1, and some other support personnel. The escort train will carry medical supplies and personnel, additional security forces, and other support personnel.

Munition trains will be a maximum of 8,000 feet long, a length chosen to be compatible with many mainline sidings. Trains may be shorter than 8,000 feet for security, emergency response, or other operating reasons. The determination of train length and operating procedures will be part of the development of a rail operating plan if a decision to implement rail transport is made.

The number of trainloads required to transport the stockpile of chemical munitions will depend on train length, the type of rail car used to carry munitions, and whether containers are double stacked. Using



Courtesy of Thrall Car Manufacturing Company

FIGURE 6-1
EXAMPLES OF DOUBLE-STACK RAIL CARS
FOR STANDARD-DIMENSION TRANSPORTATION CONTAINERS

trains of 8,000 feet and double-stacked containers will result in the fewest trainloads. For these conditions, about 70 to 75 trainloads will be required for the national destruction center alternative. For the regional destruction center alternative, about 50 to 55 trainloads will be required.

Described in this section are the activities and procedures for implementing a railroad transportation program for chemical munitions. These include the following:

- Programmatic considerations
- Rail equipment
- Loading operations and facilities
- Predeparture activities
- En route activities
- Unloading operations
- Return of munition and escort trains

Activities discussed in this section begin with loading of the rail cars and end with unloading the train at the receiving installation. Packing of the munition containers, transport of the container to the holding area near the rail car loading location, and on-post transport of the container at the receiving installation are described in Section 4.0. A discussion of the munition shipping container is given in Section 3.0.

6.1 Programmatic Considerations

The Army will undertake several planning and coordination activities before a railroad transportation program is implemented (see Section 5.0). Discussed below are the details of some of these activities that are specific to railroad transportation. Additional discussion of safety assurance functions is in Section 9.0.

6.1.1 Personnel Training

A training program will be developed and implemented for personnel involved in the rail transportation program. Training will be required for the following personnel.

6.1.1.1 Container Handling Crews. Container handling crews will be trained on the container handling equipment to be used for loading and unloading operations (see Section 6.3). The training program will include

practice in train loading and unloading operations and procedures using containers of weight similar to loaded munition containers.

All personnel will be trained in chemical agent self-protection procedures. This training includes the fitting and use of personal protective equipment, familiarization with toxic chemical agents and their characteristics, operation of agent alarms, and actions to take in the event an alarm sounds. Training also includes agent exposure symptoms, self-aid and first aid for agent exposure, and evacuation plans in the event agent is released.

6.1.1.2 Train Operating Crew. All train crew members will be given chemical agent self-protection training by the Army. This training is described above in Section 6.1.1.1. In addition to self-protection training, the train crew leader (a railroad management official, see Section 6.5.1) will also receive training from the Army in safety and emergency response procedures.

6.1.1.3 Other Railroad Personnel. Other railroad personnel associated with munition train operations will be informed of the hazardous nature of the cargo and of their role in en route emergency response.

6.1.1.4 Escort Personnel. All Army personnel escorting munition trains will receive refresher training in their assigned area of responsibility. All Army personnel will be trained in all aspects of emergency response and handling of chemical agents. This includes use of protective clothing, surety and safety procedures, emergency procedures, chemical detection, first aid, and use of decontaminants. Security guards and Technical Escort Unit personnel will be trained in the appropriate use of force.

6.1.1.5 State and Local Personnel. Medical personnel along the rail corridor will be trained to treat agent casualties. State and local officials will be briefed on emergency response and security plans. State and local personnel will be trained as required.

6.1.2 Emergency Response Plans

Emergency response plans for shipping and receiving installations and for the rail route will be developed and approved before railroad movement of munitions is begun. Emergency response considerations for the rail transportation of chemical munitions are substantial and varied. Since the area affected includes the entire rail transport corridors selected for the regional or national disposal center options, there will be a substantial number of organizations, agencies, and personnel involved in emergency response planning. Implementation approaches may include local area and regional response team concepts, or a mobile emergency response capability in escort for each shipment. Substantial coordination through

a public outreach program with state and local authorities will be essential to an effective emergency response program. Details of the emergency response concept are given in the Emergency Response Concept Plan.

6.1.3 Route Selection

Routes for shipment must be selected. A discussion of criteria to be used in selecting the routes is given in Section 2.4.2. One criterion is that Federal Railroad Administration track Class 4 or better should be used as much as possible. Some track Class 3 can be used in rail terminal areas to connect to Class 4 or better segments. The other criterion is that population exposed along the route should be minimized and high population densities avoided to the extent possible consistent with the track class criterion.

The Federal Railroad Administration promulgates regulations regarding track standards to assure safety of railroad operations. Six track classifications have been established based on roadbed, track geometry, track structure and required track inspection frequency (Code of Federal Regulations, Title 49, Part 213 - Track Safety Standards). Standards become more stringent as track class increases from Class 1 to Class 6. Allowable speed limits also increase with track class. The routes selected for rail transportation will be on track Class 4 or better to the maximum extent possible consistent with minimizing population exposure. Track Class 3 will not be used for lengthy segments. Consideration will be given to upgrading track of Class 3 or less to obtain a routing that would reduce population exposure. The Army will seek the advice of the Federal Railroad Administration and the railroads involved when selecting routes.

Another consideration in route selection will be accommodation of the 19-foot height of the munition rail cars if the munition containers are double stacked on the rail cars.

6.1.4 Maintenance of Railroad Equipment

Particular attention will be given to maintenance of the munition train rail cars. The U.S. Army will control the munition-carrying rail cars either through lease, purchase, or contractual requirements with the providing carrier, and will develop a special program regarding equipment maintenance before a rail transportation program is begun. If the rail equipment is leased by the Army, a maintenance program will be negotiated as part of the lease. If the rail equipment is Army-owned, a maintenance contract will be negotiated with a railroad having appropriate facilities. If rail equipment is provided by the carrier, maintenance requirements will be specified in the contract with the carrier. A maintenance program will include preventive maintenance elements.

6.1.5 Command and Control

An 11-member Command and Control Team will travel with each rail convoy and will be present during loading and unloading operations. The Command and Control Team will consist of the following personnel:

- | | |
|-----------------------|-----------------------------|
| 1 Commanding Officer | 2 Technical Escort Officers |
| 2 Operations Officers | 2 Medical Officers |
| 2 Security Officers | 2 Laboratory Supervisors |

The commander of the team will be the custodian of the munitions during transit and will be the military commander of the convoy. Team members will be on duty full time during railroad movement of munitions with personnel working in shifts. The team will maintain contact with the central Command and Control Office (see Section 5.0).

6.1.6 Procedural Tests and Evaluations

All procedures and activities of the rail transportation program will be practiced and tested before the transport of munitions and chemical agents begins. Loading and unloading of munition cars will be practiced with munition containers of loaded weight similar to containers loaded with munitions or chemical agents. Emergency response activities of convoy personnel will also be practiced. Results of all tests will be evaluated and changes implemented that will improve program performance.

6.2 Railroad Equipment

Railroad equipment required includes locomotives, the munition container cars, and passenger and other standard rail cars for escort personnel and support equipment (Table 6-1). The makeup of the munition and escort trains is described below.

6.2.1 Munition Train

The munition train is likely to consist of rail cars carrying as many as 280 munition containers, passenger and/or other type of cars carrying security and support personnel, and freight cars to buffer the personnel cars from the munition cars (Table 6-1). The buffer cars will be used to carry support equipment or will be filled with an inert material. All rail cars used for explosives will be certified for Class A explosive material (Army Materiel Command Regulations 385-31 and 385-102). The munition train will carry sufficient equipment and personnel to provide security for the cargo, to control accidental agent release, provide medical first-aid treatment for on-board personnel, and allow quick emergency response until personnel from the escort train can arrive at the scene.

TABLE 6-1
ILLUSTRATIVE MAKEUP OF THE MUNITION AND
ESCORT TRAIN IN A RAIL CONVOY

Type of Rail Car	Escort Train (Numbers of Cars)	Munition Train (Numbers of Cars)
Munition (loaded)	0	70
Munition (empty)	5	0
Container overpack ^e	2	0
Buffer	0	33 ^a
Tank ^f	1	1 ^b
Decontamination ^g	2	2 ^b
Passenger	3	0
Guard	0	7 ^c
Support equipment	4	d
Radio support	1	2
Laboratory	1	1
Medical	1	0
Command	0	1
TOTALS	20	117

^aFive cars between the command car engines and the first munition car.
Two cars between cars carrying Army personnel and munition cars.

^bWill be used as buffer cars. Included in buffer car count.

^cGuard cars will be interspersed among the munition cars. They are likely to be modified passenger cars.

^dWill be carried on buffer cars.

^eOverpack containers will be carried on 89-foot flatcars.

^fWater for decontamination compound.

^gDecontamination compound and supplies.

A double-stack container rail car will be used to carry munition containers (Figure 6-1). This type of rail car is proposed because more containers can be carried on a train of any given length than if 89-foot-long flatcars are used. A double-stack container car can carry two 20-foot containers as a single layer or four containers double stacked as two layers. In the double-stacked configuration, the top containers are secured to the bottom containers at the corners and to each other at the adjoining ends. Total rail car height above the rails if double stacked may be as high as 19 feet.

The operational configuration of the munition train can be determined only during the detailed planning that would be carried out in developing a rail transport operating plan if a decision to implement a rail shipment program is made.

Several factors will affect the decision whether to double stack the munition containers. These include container accessibility, security requirements, agent monitoring ability, routing, and rail shipping costs. The number of munition cars, the arrangement of cars in the munition train, train length, and whether to double stack containers must be determined when a rail plan is developed.

For conceptual planning purposes, a likely train configuration is described here that meets the requirements of Army Regulation 50-6 and Army Materiel Command Regulations 385-100 and 385-31 related to transportation of chemical surety material and that remains within the maximum train length of 8,000 feet.

The munition train will have a command car as the first car behind the engines, followed by five buffer cars. The rest of the train will be seven repeating units, each containing 15 cars:

- 10 munition cars (2 five-car units, if permanently coupled)
- 2 buffer cars
- 1 guard car
- 2 buffer cars

Buffer cars will be standard freight cars carrying convoy-support equipment or loaded with an inert material. Guard cars will probably be standard-length passenger cars.

6.2.2 Escort Train

The escort train will carry support and emergency response equipment and personnel (Table 6-1). At least one car will have a wheel loading greater than any on the munition train to guard against track sabotage.

There will also be a car as wide, low, and tall as cars on the munition train. Standard passenger and freight cars will be used.

6.3 Rail Car Loading Operations and Train Preparation

Loading of munition containers onto rail cars will take place within a chemical exclusion area inside the boundary of the shipping installation. Container loading and train preparation must be supervised by Technical Escort Unit personnel and security guards using the two-person concept. This rule requires the presence of two people for loading operations, each knowledgeable and trained in the task to be performed. Loading operations and safety and security procedures are described below.

6.3.1 Loading of Munition Containers on Rail Cars

Sealed munition containers will be loaded onto rail cars at a container holding and loading facility to be constructed at each shipping installation. This facility will consist of a concrete pad adjacent to the train holding track, which may be a loop. Containers ready for loading will be stored on the concrete pad.

The containers will be loaded onto the train using commercially available equipment designed for handling shipping containers of standardized dimensions (see Appendix D for pictures of typical equipment). Figure 6-1 shows a container handler lifting a container onto a double-stack rail car. Several of the container handlers will operate at once to load the train in 10 hours or less.

Train movement and the loading scenario may vary depending on the particular facilities at the shipping installation. A likely scenario is as follows. The munition train will enter the loop track with the cars arranged in the order for transit (see Section 6.2.1). The first part of the train will be stationed along the loading area. After the cars are loaded, the train will move forward to position the next set of empty cars along the loading area. This will be repeated until all cars have been loaded. At some shipping locations, it is possible that the train will be broken apart for loading and reassembled into the en route configuration after loading is completed. If during loading any part of the train is outside of the exclusion area, proper security will be provided.

6.3.2 Escort Train Preparation

The escort train equipment and personnel will be assembled in time to be ready to depart with the munition train. Guards and other support personnel will arrive 48 hours prior to departure. Command and Control Unit, Technical Escort Unit and medical personnel will be on post 48 hours prior to commencing munition train loading operations. Time prior to loading and departure will be used to prepare for the convoy and to support the loading operation.

6.3.3 Safety and Medical Support

Munition containers will be loaded on rail cars within the chemical exclusion area during daylight hours only. Standard Army chemical agent monitors and alarms will be operational in the loading and holding area during loading operations. All workers associated with loading operations will wear work gloves and protective boots and will carry a gas mask for protection against agent vapor. The two-man rule will be used for loading operations (Army Regulation 50-6). This rule requires the presence of two people for all operations, each knowledgeable and trained in the task to be performed.

The medical support team that will accompany the munition train will be on duty during loading of the train. They will work in coordination with the medical treatment facility at the installation. The medical support plan for the transportation program will state responsibilities of all parties in coordination with the current emergency response plan for the installation. Backup medical support will be provided by other military medical centers in the area as outlined in the emergency response plan.

6.3.4 Security

Security during train loading and while awaiting train departure will be provided by the installation security forces. These forces will be augmented by the guards that will accompany the convoy when they are present on post.

The Command and Control Unit that will accompany the convoy will be on duty during train loading operations and remain on duty until the train is unloaded at the destination. The unit will be in contact with the central Command and Control Office (see Section 5.0).

6.3.5 Munitions Manifest

A manifest of munitions will accompany the munitions train as part of the Army chain of custody procedure. This manifest will be prepared by the Army commander of the loading operation. The manifest will contain the following information:

- List of all munitions per container and car
- Munition lot numbers and identification numbers
- Munitions packaging details

For rockets, which have been declared obsolete by the Army and are classified as a hazardous waste, the manifest must also comply with the documentation requirements of the Resource Conservation and Recovery Act

To maintain the chain of custody of the munitions, the manifest will be given to the commander of the Command and Control Team accompanying the train, who will be the custodian of the munitions en route.

6.4 Predeparture Inspections

Prior to departure of the munition and support trains, equipment will be inspected as described below.

6.4.1 Munition Container Cars

Empty munition rail cars will receive a full inspection prior to loading. This inspection will be supervised by a member of railroad management familiar with rail equipment inspection. At a minimum, tests and inspections to be carried out are as follows:

Brake systems--Test operating system. Inspect brakes on each car. Inspect hoses visually.

Trucks, wheels, and bearings--Inspect wheels for cracks and flat spots. Inspect bearings for wear.

Couplers--Inspect visually for wear, cracks, and deterioration.

Communication systems--Test system for proper functioning, both within and among trains and with dispatching personnel.

Engine and train safety systems--Test systems for proper functioning.

The actual inspections will be determined and clearly defined prior to commencing a rail transportation program.

6.4.2 Trains

The engines and equipment used for the munition and escort trains will be inspected and tested by the train crew prior to departure under the supervision of the railroad management representative familiar with rail equipment inspection and testing. These tests and inspections will consist of standard railroad operating procedures normally used prior to departure from a terminal.

6.5 En route Operations and Support Personnel

Once underway the munition and escort trains will be operated under procedures as described below. The likely makeup of the trains is given in Table 6-1. Support personnel are given in Table 6-2.

On board the trains will be a Command and Control Team, Technical Escort Unit, laboratory personnel, medical support unit, security forces,

TABLE 6-2
ARMY PERSONNEL ACCOMPANYING EACH RAIL MUNITION CONVOY

Type of Personnel	Escort Train	Munition Train
Guards	27	155 ^a
Medical	13	0
Laboratory	5	5
Technical Escort Unit	16	10
Command and Control Team	3	8
Other Support Personnel	16	26
	—	—
TOTALS	80	204

^aTwo guards for each munition car (140) and 15 additional guards, as required by Army Regulations 50-6. Guards will work 12-hour shifts. Guards will ride in guard cars along the length of the train.

and other support personnel (Table 6-2). The commander of the Command and Control Team will be the convoy commander. The functions of the escort personnel include the following:

- Maintain continuous security and surveillance of the cargo
- Perform safety inspections and monitoring
- Prevent unauthorized personnel from tampering with the train or cargo
- Provide immediate capability to respond to accidents and protect the public
- Maintain communications with the central Army Command and Control Office
- Provide immediate medical, technical and security capability

6.5.1 Munition and Escort Train Operation

Train operation will be 24 hours a day. The only planned stops will be for railroad operating crew changes and for normal train inspection required under the Power Brake Law (49 CFR 232) at intervals of not more than 1,000 miles. All stops will be at locations selected to minimize population exposure.

The munition train will be operated with a standard crew provided by the carrier railroads. In addition, an officer of the railroad, representing company management, will ride in the lead engine of the munition train as the train crew leader.

The munition train will be preceded by an escort train with no intervening train activity. The munition and escort trains will have priority over all other traffic. This will be specified in the contract with the rail carrier.

Train speed will be commensurate with weather, track and operating conditions, or 10 mph less than maximum for the Federal Railroad Administration track class, but never greater than 50 mph.

On dual track lines, oncoming trains will maintain a speed of 35 mph or less while passing the munition train. On single track lines, oncoming trains will be stopped on a siding while the munition and escort trains pass.

Radio communications will be maintained among all munition train crew members, Command and Control Team, Technical Escort Unit personnel, security force, escort trains, dispatching personnel and the central Army

command and control office. Radio checks will be made among all personnel routinely during transport.

The commander of the Command and Control Team will be the convoy commander. The train crew leader and the commander of the Command and Control Team will work closely together. The train crew leader will have authority over how train operations are carried out. The commander of the Command and Control Team will be the custodian of the munitions and will have authority over all matters related to the munitions in consultation with the Technical Escort Unit.

6.5.2 Security

Train security will be provided by guards and the Command and Control Team.

6.5.2.1 Guards. Current Army regulations require sufficient guards to accompany the munition train so that there are two guards for each munition car plus 15 additional guards. For a train with 70 munition cars, there would be 155 guards. There will also be 27 guards on the escort train.

It is likely that 182 guards are more than are necessary for adequate train security and that a waiver from the requirements of the current Army regulation may be granted. The guard requirement will be determined as part of the development of a rail transportation operating plan if a decision to ship munitions by rail is made. For purposes of preparing this transportation concept plan, the requirement of the current Army regulation is followed.

The guard unit commander will ride in the Command and Control car at the front of the train. Guard personnel will ride in the guard cars dispersed among the munition cars (see Section 6.2.1) with 20 guards per car and one guard car per 10 munition cars. Guards will work 12-hour shifts.

The munition cars will be under surveillance of the guards at all times during transit. When the munitions train is stopped for crew changes and for required train inspections, an exclusion zone will be established around the train, and a walking guard will be maintained on each side of the munition cars with two guards per car. The guards will also visually inspect the munition containers for damage while maintaining the guard. Details of unclassified Army security procedures are given in Appendix E. Additional classified procedures will also be employed.

6.5.2.2 Command and Control Team. The 11-member Command and Control Team will be divided between the munition train and the escort train (Table 6-2). The team commander will ride in the command car of the

munition train. The rest of the personnel on the munition train will be dispersed among the guard cars. Team members will be on duty full time, working in shifts. The Command and Control Team will be in radio contact with all members of the transport convoy and with the central Command and Control Office.

6.5.3 Safety and Medical Support

Safety while in transit will be maintained by the presence of medical and other support personnel with the convoy to respond to emergencies should they occur. Approximate numbers of personnel and their rail car assignment have been shown on Table 6-2. Most emergency response personnel will be carried on the escort train to prevent their being incapacitated in a munition-train accident. Response personnel on the munition train will only include the number required to provide immediate first aid to munition train personnel and to respond to any agent monitoring alarm.

6.5.3.1 Technical Escort Unit. The Army Technical Escort Unit will consist of 26 soldiers who are on duty 24 hours per day, working in shifts. There will be 10 members on the munition train and 16 on the escort train. Those on the munition train will be dispersed among the guard cars of the munition train. The unit commander will ride in the command car of the munition train. The functions of the unit are to contain chemical agent and handle munitions in an emergency, monitor the chemical agent and temperature container monitoring control panels, and provide limited medical attention of a first-aid nature until medical personnel from the escort train reach the scene of an accident or incident.

6.5.3.2 Medical Support. A medical team of approximately 13 people will be carried on the escort train. The primary function of the medical team is to provide medical care to on-board personnel in an emergency. Emergency medical response activities are described in Section 6.5.5. The medical team will consist of the following personnel:

- 6 medical specialists
- 2 nurses
- 1 inhalation therapist
- 1 biomedical equipment repair technician
- 1 physician
- 1 administrator
- 1 physician's assistant

An all-terrain ambulance and support equipment will be carried on the escort train. Two backup medical teams will also be on call for emergencies. These teams will be brought to the train location rapidly from their permanent station. It is also possible that a mobile emergency response team may accompany the convoy. Details are provided in the Emergency Response Concept Plan.

6.5.3.3 Other Support Personnel. Other support personnel accompanying the train will include laboratory and instrument repair technicians, drivers for support vehicles, vehicle mechanics, and food service and other personnel necessary to support the convoy forces. Approximately 16 support personnel will ride on the escort train and 26 support personnel on the munition train.

6.5.3.4 Support Equipment. Sufficient support equipment will be carried on the munition and escort trains to deal with emergencies, container handling requirements, and equipment malfunction while en route.

Decontamination capability will be carried on three rail cars for the one type of chemical agent carried on the train. A tank car will contain water for preparing decontamination solution. Another car will carry a 2 1/2-ton all-wheel drive truck with an M12 decontamination apparatus. Another car will carry decontamination equipment consisting of an Army all-terrain utility vehicle (HUM-VEE), a decontamination pumping/heating apparatus, decontamination supplies, water tank trailer, protective clothing and other necessary gear.

One container handler for lifting containers and several container chassis and tractors or flatbed trucks for transporting containers will be carried on each train. A ramp car will be used to get those vehicles to the ground.

Ten small commercially available all-terrain vehicles will be carried on each train for rapid movement of personnel along the length of the trains.

Medical, radio, and laboratory support equipment have been discussed above.

6.5.3.5 Personnel Safety. Members of the guard units, Technical Escort Units, Command and Control Teams, and medical units must be in the Army Chemical Personnel Reliability Program (see Section 5.0). The train crew and other support personnel will not be in the Chemical Personnel Reliability Program but will have their blood cholinesterase baseline level measured so that exposure to nerve agent can be determined if an accidental agent release occurs. This blood baseline is not required for transport of mustard.

6.5.4 Munition Container Monitoring

Munition containers will be monitored for the leakage of chemical agent and for temperature. Monitoring methods and procedures are still under development by the Army and will be published in a monitoring report when development is completed. Given below is an overview of the likely procedures.

6.5.4.1 Chemical Agent Monitoring. The outermost airspace of the munition containers will be monitored periodically for the presence of chemical agent that had leaked through the inner agent barrier. This monitoring may be carried out in an automated continuous manner if a feasible method can be developed, or periodically using manual sampling. Described below is the manual method.

Manual monitoring will take place when the train is stopped for train inspections required under the Power Brake Law (see Section 6.5.1). Monitoring activities will require two to four hours to complete. If the customary inspection site is in a rail terminal located in a populated area, the site will be changed to an area with less population. New trackage will be constructed, if necessary, to hold the munition and escort trains in order not to disrupt regular rail traffic while the monitoring is carried out.

A laboratory for processing monitoring samples will be carried on the escort and munition trains. Five laboratory and equipment repair technicians will travel with each laboratory car. Additional laboratory personnel and equipment may also be located at the monitoring sites.

6.5.4.2 Temperature Monitoring. Monitoring of the munition container for temperature will be continuous. Temperature data will be transmitted by telemetry or a hard-wired system to a panel in the nearest guard car. The panel will be observed at all times by a member of the Technical Escort Unit.

6.5.5 Response to Detection of Leaking Chemical Agent

If chemical agent is detected during container monitoring, the presence of agent will be verified with another sample. If the presence of agent is verified, the container will be removed from the car using a container handler stored at the monitoring location and placed in a vapor-tight overpack carried on flatcars on the escort train. The overpack will be closed and the integrity of the seals verified using a tracer gas as described in Section 4.0. The flatcar will be coupled to the munition train, and the convoy will continue the trip. This overpack will be monitored periodically for the duration of the trip on the same schedule as the other munition containers.

6.5.6 Response to High Temperature in a Container

The purpose of temperature monitoring is to provide an early warning of abnormal events inside the container. Proper response to such an event will depend on the type of munition and agent present. Response procedures will be developed by the Army prior to implementing a transportation program.

6.5.7 Emergency Response to Accidental Agent Release

In the event of an accidental agent release en route with the potential to result in casualties to citizens near the accident site, the emergency response plan procedures will be implemented (see Sections 6.1.2 and 5.5). Details of the proposed Army emergency response are contained in the Emergency Response Concept Plan.

The primary source of emergency medical care at the accident site will be from the medical team on board the escort train; should the emergency include contamination beyond the immediate accident site and involve a local community, then the surrounding medical community will respond with Army support as outlined in the emergency response plan. Backup Army medical teams will be brought in as required. An Army chemical on-scene commander and the response team will be transported to the site of the accident as specified in the emergency response plan by the fastest means available. Telephone and/or radio communications will be available at all times with state or local emergency authorities including medical authorities capable of responding to emergency medical requirements.

The medical support rail car will be equipped with positive pressure capability to preclude agent contaminants being introduced into the car interior. All chemical agent casualties will be decontaminated at the accident site prior to being brought inside the medical support rail car or transported elsewhere to other medical treatment facilities.

An appropriate all-terrain ambulance with support equipment will be carried on the escort train. Air ambulance support will be coordinated in advance with military and civilian aviation assistance along the rail convoy route for emergency air evacuation, if required, as part of the emergency response plan.

Procedures for recovery and cleanup of an accident site will be developed as part of the development of a rail transportation operating plan.

6.5.8 Response to Malfunctioning Rail Equipment

If a rail equipment malfunction that could affect safety occurs on the munition or escort train, both trains will stop and the malfunction will be remedied before proceeding. The decision where to stop will be made by the railroad officer, who is the train operating crew leader, in consultation with the Army convoy commander. Procedures for remedying malfunctioning equipment will be described in the rail operating plan. Five spare double-stack rail cars will be included in the escort train to replace malfunctioning munition rail cars.

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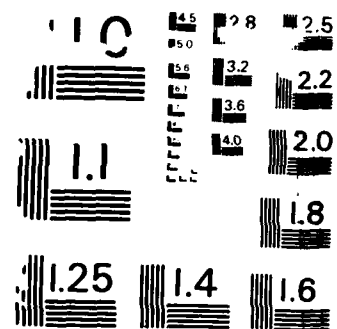
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6.6 Train Unloading at the Destination Installation

Upon arrival at Anniston Army Depot, Alabama or Tooele Army Depot, Utah, the command of the munitions train and the munitions manifest will be transferred from the Command and Control Team commander to the commander of the receiving and unloading operations.

The container unloading process will take place in a chemical exclusion area. The munition train will enter the loop track of the unloading area in the en route configuration of cars. The securing devices holding the container corners will be removed and a container handler will lift the containers off the rail car and place them in the adjacent holding area. Security will be provided as described for the loading operation. Unloading will generally be accomplished in less than 8 hours. Disposition of containers after unloading is described in Section 4.0.

If a leaking container in a container overpack is brought into the unloading area on the train, the overpacked container will be unloaded first and taken immediately to the leaker processing facility, where it will be handled as described in Section 4.0.

6.7 Return of Munition and Escort Trains

Empty munition shipping containers and rail cars that are verified free of chemical agent contamination will be loaded onto empty double-stack rail cars. Munition and escort train cars may be moved together as one train to the next shipping location. The movement would be as regular freight operations for a unit train.

7.0 AIRCRAFT TRANSPORTATION

Transport of chemical munitions by aircraft will be accomplished by loading the sealed munitions containers onto U.S. Air Force C-141 or C-5 transport planes (see Figures 7-1 and 7-2). The munitions containers will require no handling or opening during a flight. However, emergency landing sites will be designated along the route for handling containers if needed in an emergency. Special operating procedures will be developed for the airlift mission.

Two locations are currently under study for air shipment of munitions. These are Lexington-Blue Grass Army Depot, Kentucky, with about 2 percent of the stockpile by agent weight, and Aberdeen Proving Ground, Maryland, with 5 percent of the stockpile by agent weight. The destination will be Tooele Army Depot, South Area, Utah. The two origin sites are being considered for munition removal in response to comments received on the Draft Environmental Impact Statement on the Chemical Stockpile Disposal Program. The Army is considering Tooele Army Depot as the only receiving installation for all destruction alternatives because of the low population density in the vicinity of Tooele Army Depot and the difficulty of constructing an airfield at Anniston Army Depot.

Discussions of the air alternative contained in this section are generic in nature. If either of the two site-specific air alternatives is chosen, operational details will then be developed. Details will be provided at the time such an option is chosen, in comprehensive site-specific environmental documentation. Included in this documentation will be a detailed design of an air transport container.

Activities discussed in this section begin with the loading of the munition container into the aircraft and end with the unloading of the munition container from the aircraft. Packing of the munition containers, transport of the munition containers to a holding area, and on-post transport of the containers at Tooele Army Depot are described in Section 4.0.

7.1 Programmatic Considerations

The Army will undertake several planning and coordination activities before an aircraft transportation program is implemented (see Section 5.0). Discussed below are the details of some of these activities that are specific to air transportation. Additional description of safety assurance functions is given in Section 9.0.

7.1.1 Special Assignment Airlift Mission Request

The airlift of the chemical munitions, if undertaken, will be carried out by the U.S. Air Force Military Airlift Command. The request from the Army for airlift will be handled as a Special Assignment Airlift Mission

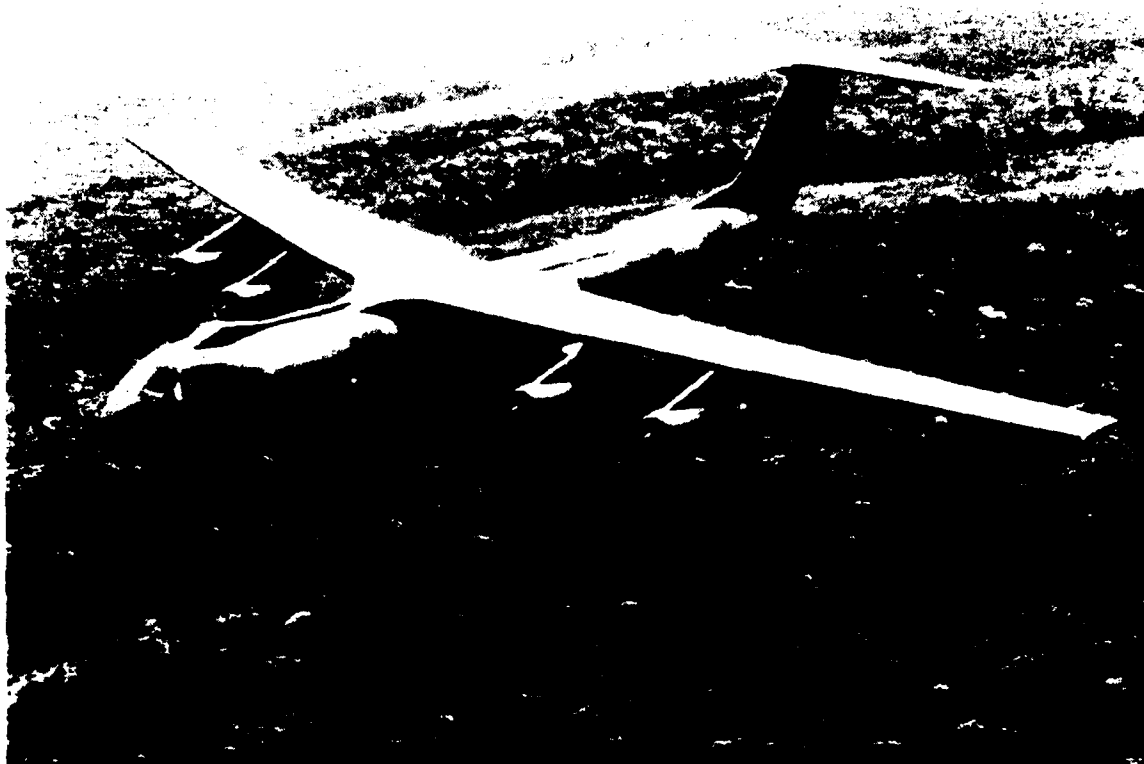


FIGURE 7-1
U.S. AIR FORCE C-141 AIRCRAFT

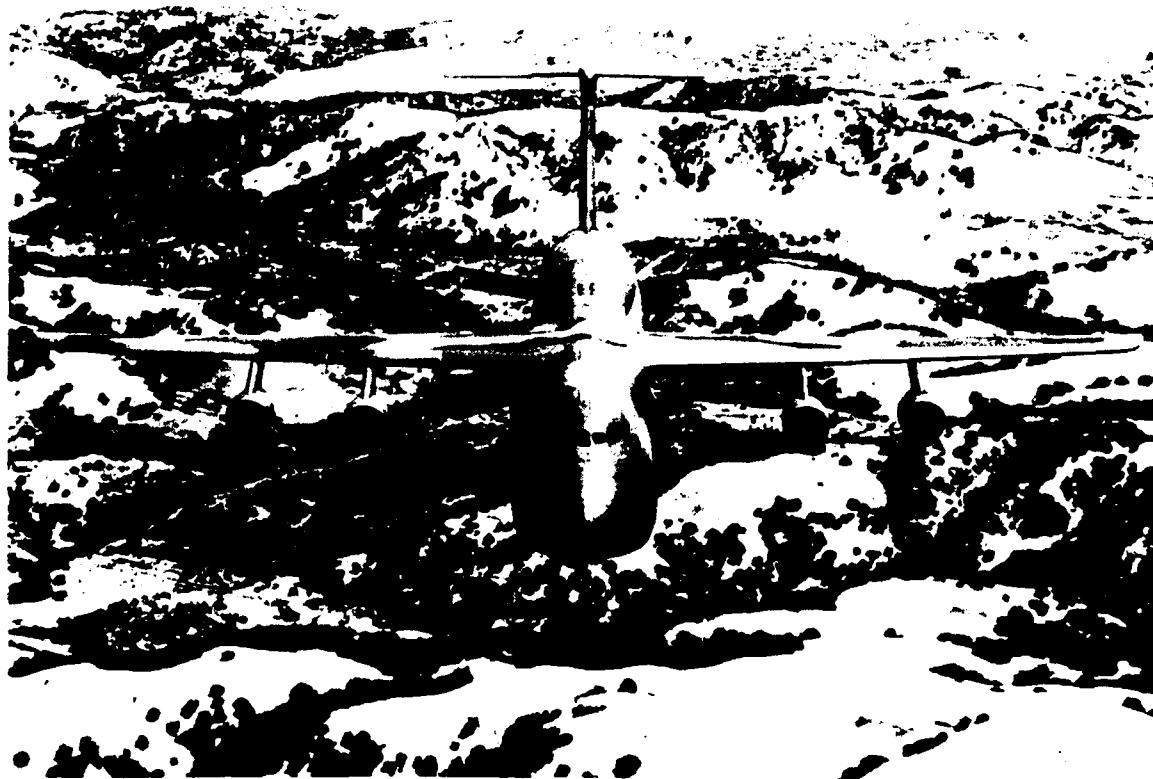


FIGURE 7-2
U.S. AIR FORCE C-5 AIRCRAFT

(Air Force Regulation 76-38). As part of the documentation of the Mission requirements, the Army and the Air Force will develop a Mission Operating Directive delineating the operating requirements and procedures to be followed in the airlift operation. Because of the hazard of the cargo, these operating requirements and procedures will be more stringent than standard airlift operating procedures of the Military Airlift Command. Procedures developed for airlift of nuclear cargo (Military Airlift Command Regulation 55-18, Nuclear Airlift Operations) will be used as a model for development of the Directive. Elements of Air Force and Military Airlift Command regulations concerning transport of hazardous materials (e.g., Air Force Regulation 71-4, Military Airlift Command Regulation 55-14) will also be incorporated as needed. The Mission Operating Directive will include the following:

- Taxiing--All other aircraft and ground vehicles on or near the apron, taxiways, and runways will cease movement while the munitions aircraft is taxiing or on its takeoff and landing roll.
- Take-off roll--There will be an acceleration check in time to abort takeoff, if necessary, without exceeding the overrun capability of the runway.
- Departure, climb, descent and approach--Will be under positive radar control.
- Communications--Radio communications will be maintained with the Army central Command and Control Office, the Command and Control Team at the origin and destination, and the emergency landing sites en route. Radio checks will occur no less frequently than once every 30 minutes.

7.1.2 Route Selection

Specific flight routes will be selected before an aircraft transportation program is implemented. Routes will be as direct as possible, but aircraft will not fly directly over densely populated areas.

7.1.3 Emergency Response Plans

Emergency response plans for shipping and receiving installations will be developed and approved before aircraft movement of munitions is begun. Emergency response planning for the air transportation option involves, initially, expanded site planning at the origin and destination sites for transportation of chemical munitions by air. This will be necessary because of the extended risk posed by takeoff and landing operations at these sites--the principal effect of this being an extension of the site emergency response programs that will otherwise be required for those sites if air transportation were not being used. Additional

response capabilities associated with emergency landing sites along the air transport routes will be established. Details of the emergency response concept are given in the Emergency Response Concept Plan.

7.1.4 Selection of Emergency Landing Sites

Government-controlled facilities for landing the munitions aircraft will be needed along the route should an emergency arise in flight. The airfields and facilities will meet Air Force standards for the type of aircraft used. In addition, the airfields will meet the following requirements to the extent possible:

- Low population density around the site
- U.S. Air Force installation (preferable) or other federal property
- Straight-in approach for at least three miles with no significant obstructions
- Runways at least 150 feet wide
- Planned crash rescue, medical, security, and emergency response procedures
- Medical support facilities and trained medical personnel on-site or nearby
- Container handling and decontamination equipment on-site
- Direct communications with the central Army Command and Control Office

7.1.5 Operation Order for In-flight Emergencies

The Army and Air Force will develop procedures for response to in-flight aircraft malfunctions and chemical agent leaks. These procedures will be published by the Air Force as an Operation Order for use by flight crews of munitions aircraft. For aircraft malfunctions, the order will augment the standard Air Force procedures to be followed. For leaking chemical agent, the order will delineate air crew procedures to be followed if a munition is leaking but no agent is leaking into the aircraft cabin from the shipping container, or if agent is leaking into the cabin.

7.1.6 Aircraft Selection and Maintenance

Aircraft to be used for munition transport will be selected carefully, will meet the highest standards of reliability, and will not have an uncorrected history of recurring malfunctions. An aircraft

selection procedure will be developed for the chemical munition transport mission that is similar to that used for selecting and maintaining aircraft for transportation of nuclear weapons (Military Airlift Command Regulation 55-18). These procedures address specific critical aircraft components and are more stringent than standard Military Airlift Command procedures. Particular attention will be given to recurrent, critical, and well-known aircraft maintenance problems, such as tires, wheels, and brakes.

7.1.7 Command and Control

A Command and Control Team will be stationed at each shipping and receiving installation. The team will be in telephonic contact with the central Command and Control Office during loading or unloading of munition aircraft.

7.1.8 Personnel Training

A training program will be developed and implemented for personnel involved in the air transportation program. Training will be required for the following personnel.

7.1.8.1 Container Handling Crews. Army and Air Force container handling crews will be trained on the container handling equipment to be used for loading and unloading operations (see Section 7.3). The program will include practice in aircraft loading and unloading operations and procedures using containers without munitions but having a loaded weight similar to loaded munition containers.

Loading personnel will be trained in chemical agent self-protection procedures. This protection includes the fitting and use of personal protective equipment, familiarization with toxic chemical agents and their characteristics, operation of agent monitors and alarms, and actions to take in the event an alarm sounds. Training also includes agent exposure symptoms, self-aid and first aid for agent exposure, and evacuation plans in the event agent is accidentally released.

7.1.8.2 Air Crew. Air crews will be given refresher training in the use of in-flight protective garments. The Army will provide chemical agent self-protection training. In addition, the air crew leader will also receive training from the Army in safety and emergency response procedures.

7.1.8.3 Air Traffic Control Personnel. Air traffic control personnel responsible for directing munition aircraft flights will be briefed on any special operating procedures and the controller's role in emergency procedures.

7.1.8.4 Escort Personnel. Members of the Technical Escort Unit will be trained in all aspects of emergency response and handling of chemical agents. This includes use of protective clothing, surety and safety procedures, in-flight emergency procedures, chemical detection, first aid, and use of decontaminants. Technical Escort Unit personnel will also receive training in security procedures. Guards will be trained in the appropriate use of force to respond to overt and covert actions.

7.1.8.5 En Route Civilian Personnel. State and local officials will be briefed on emergency response and security operations and personnel trained as required.

7.1.9 Preoperational Tests and Evaluations

Procedures and activities of the aircraft transportation program will be practiced without munitions prior to transport. Loading and unloading of the aircraft will be practiced with munition containers of loaded weight similar to containers loaded with munitions. Results will be evaluated and necessary changes implemented that will improve program performance.

7.2 Construction of Origin and Destination Airfields

Airfields would have to be constructed at Lexington-Blue Grass Army Depot, Aberdeen Proving Ground, and Tooele Army Depot for an air transportation program. New airfields constructed must meet Air Force standards as specified in Air Force Regulation 86-14. These new airfields will have runways 200 feet wide. A precision approach will be used, which requires a 5-mile straight-in approach path.

There is a requirement for a clear zone and two accident potential zones at the end of each runway (Figure 7-3). As defined in Air Force Regulation 86-14, the Accident Potential Zone I is the area that possesses a significant potential for accidents, and the Accident Potential Zone II is the area that has a measurable potential for accidents. Land use in these zones immediately at the end of the runway is restricted as specified in Air Force Regulation 19-9. The clear zone must also meet minimum grading and clearance requirements (Air Force Regulation 86-14). It is desirable that the accident potential zones be government owned so that land use can be completely controlled.

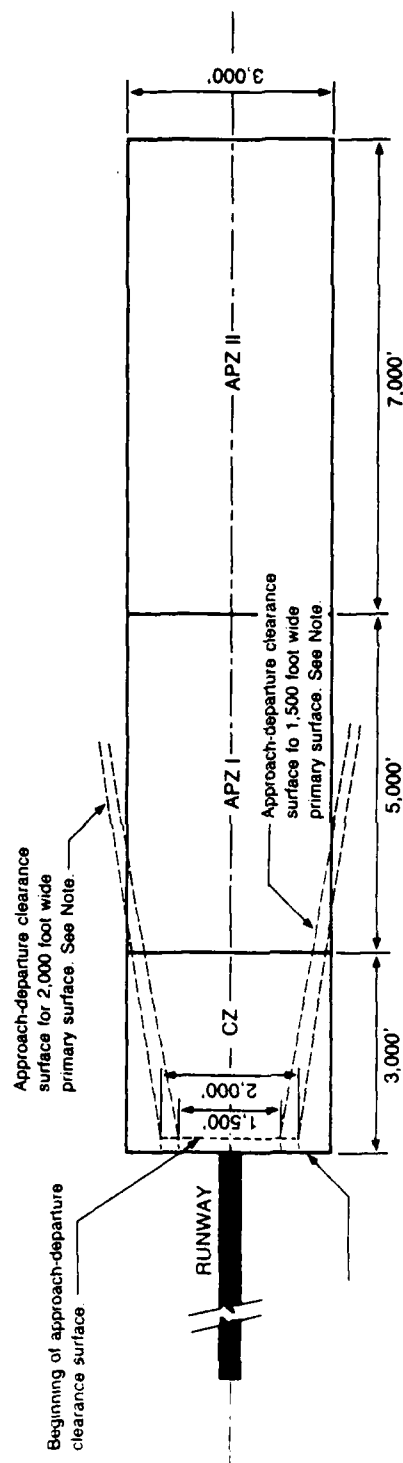
An approach-departure clearance zone also is required. This zone extends 50,000 feet from the end of the runway. Heights of structures within this zone are restricted.

7.2.1 Airfield at Tooele Army Depot

Delivery of munitions by aircraft directly to Tooele Army Depot, Utah, will require the construction of an airfield in the South Area.

LEGEND

- CZ CLEAR ZONE
- APZ I ACCIDENT POTENTIAL ZONE I
- APZ II ACCIDENT POTENTIAL ZONE II



NOTE

The width and configuration of an approach-departure clearance surface are based on the width of the primary surface-not the width of the clear zone.

CLASS B RUNWAY

NOT TO SCALE

Source: Air Force Regulation 86-14

FIGURE 7-3
DIMENSIONS OF AIRFIELD CLEAR ZONE AND ACCIDENT POTENTIAL ZONE

There are two potential sites for an airfield in the South Area (Figure 7-4). The most convenient one is on the west side of the South Area.

The clear zones can be located within the installation boundary. Because of the siting flexibility, a site will be selected so that all of the Accident Potential Zone I at both ends of the runway will be within the installation boundary. A portion of the Accident Potential Zone II at both ends of the runway will be on privately owned property. Land use compatibility within the accident potential zones has not yet been determined. It also has not yet been determined if there will be any obstacles within the approach-departure clearance zone. Easements for the accident potential zones and approach-departure clearance zones may need to be acquired if the airfield is constructed.

7.2.2 Airfield at Lexington-Blue Grass Army Depot

The only feasible location for a C-141-capable airfield at Lexington-Blue Grass Army Depot is on the east side of the installation, north of the Block D magazine (Figure 7-5). The runway and clear zones will be located within the installation boundaries. The accident potential zones will extend outside the installation boundary. Low-density residential areas and farms are located within the accident potential zones off post. At the west end of the runway, Accident Potential Zone I will be on installation property, but a small part of Accident Potential Zone II will be outside the boundary. Part of the installation administration area and shop and maintenance areas will be within this zone but will not affect airfield operations. At the east end of the runway, approximately 40 percent of the Accident Potential Zone I and all of Accident Potential Zone II will be on private property. No major compatibility problems were identified during a ground and aerial survey. Off-installation easements for the required 50 to 1 approach-departure slope on both ends of the runway may be required depending on the final runway design.

The only known approach zone interference off post is a possible conflict with the airspace of other privately owned airfields and the airspace of a low-level military air route. The west approach zone will pass the Madison County Airport about 7.5 miles from the end of the proposed runway and will intersect the approach zone of another small grass strip airport approximately 3.5 miles away. A low-level military air route (IR 75) will also be affected by aircraft operation. If these problems can be mitigated, a 5-mile straight-in approach will be available.

There are obstacles in the approach-departure clearance zone at the west end that will need to be removed. There are approximately 35 earth-covered explosives storage magazines within the west Accident Potential Zone boundary. Explosives and munitions will be removed from these magazines, but the empty magazines will not have to be removed.

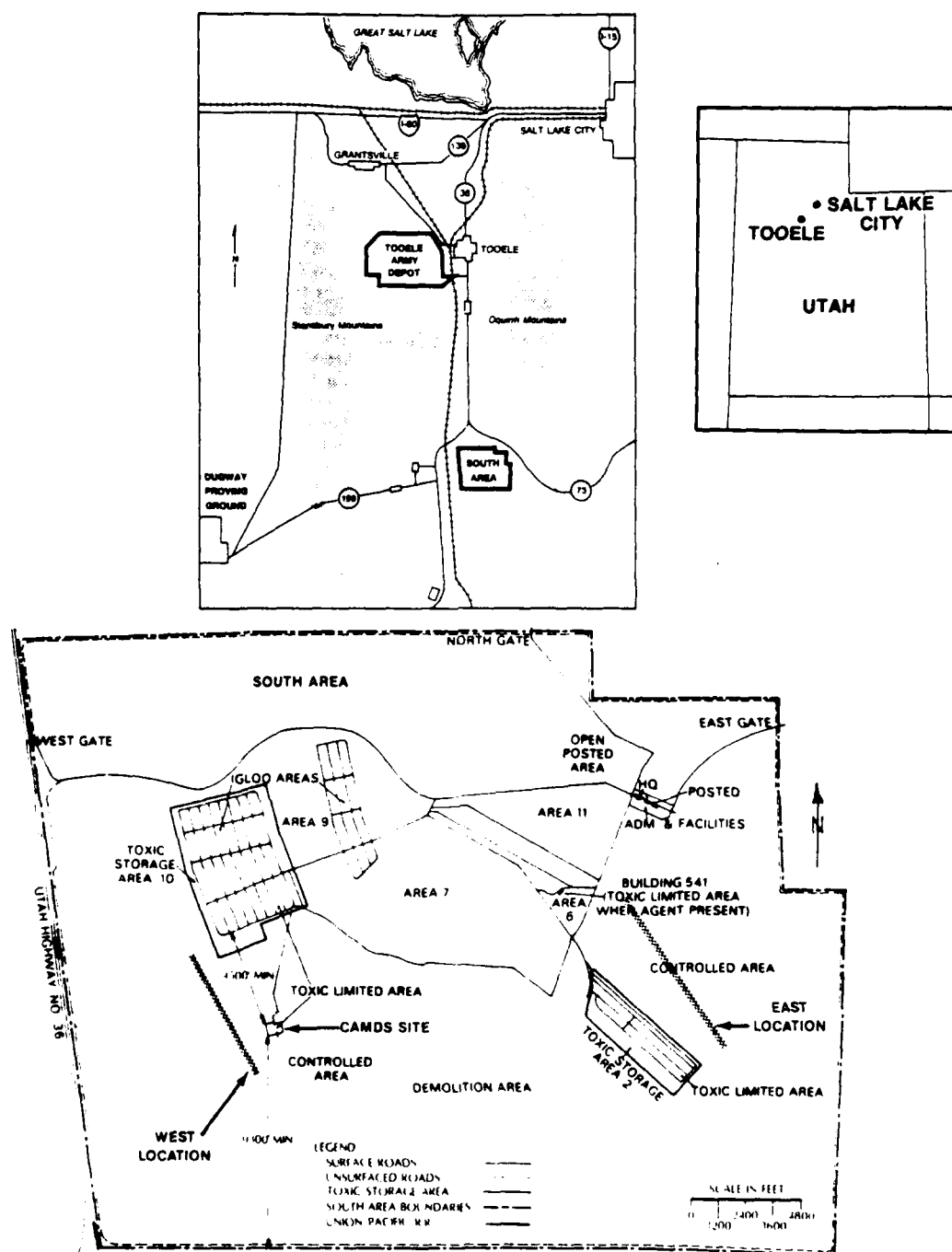


FIGURE 7-4
PROPOSED ALTERNATIVE LOCATIONS OF THE AIRFIELD
TO BE CONSTRUCTED AT TOOELE ARMY DEPOT, UTAH

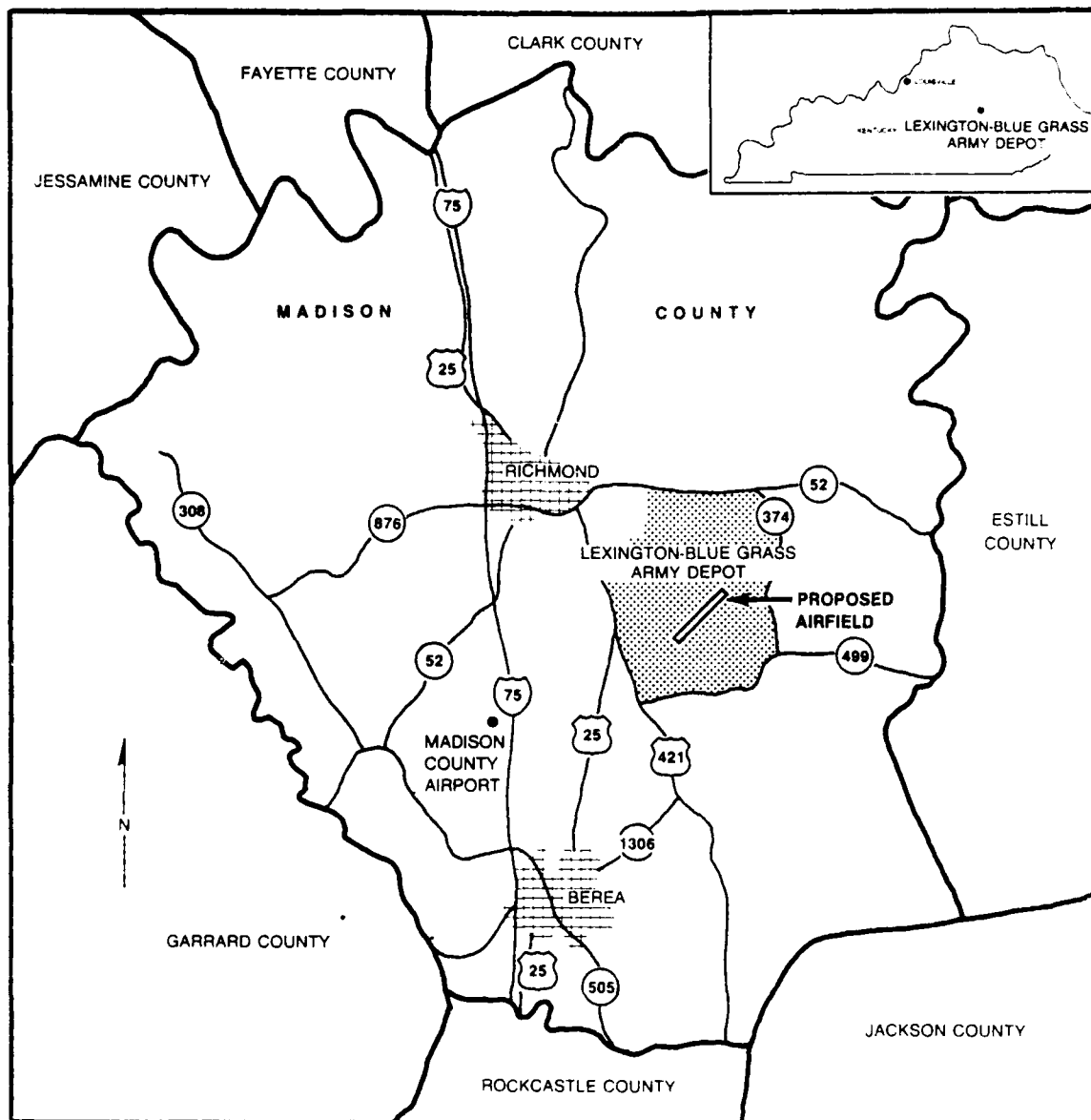


FIGURE 7-5
 PROPOSED LOCATION OF THE AIRFIELD TO BE CONSTRUCTED
 AT LEXINGTON-BLUE GRASS ARMY DEPOT, KENTUCKY

7.2.3 Airfield at Aberdeen Proving Ground

Feasibility studies have been completed for two potential airfield sites at Aberdeen Proving Ground. These sites are the existing Weide Field airstrip and Gunpowder Neck. Only the Gunpowder Neck site appears feasible. The required extension of the Weide Field airstrip would necessitate the removal of many on-post buildings. Cost to rebuild the buildings elsewhere on post makes this alternative economically infeasible.

The Gunpowder Neck area is situated between Gunpowder River and Bush River and extends into Chesapeake Bay (Figure 7-6). The proposed airfield site is located near the southern tip of Gunpowder Neck with the conceived centerline of the proposed runway extending from Fords Point to Watson Creek and oriented at an angle of approximately N 20° 00'W. This orientation is favorable for prevailing wind conditions. This site is mostly wooded and surrounded by extensive marshy areas created by numerous inland creeks. The existing terrain along the proposed runway centerline varies in elevation from 5 to 35 feet with the north and south ends of the runway at the lower elevation.

A 5-mile straight-in approach is available from the south. Two towers must be removed for a 5-mile straight-in approach from the north. Additionally, the south end of the existing Weide Field runway is approximately 16,500 feet from the north end of the proposed runway. The operation of a runway on Gunpowder Neck will require close coordination with the operation of Weide Field.

An existing moving target track is located approximately 7,000 feet to the east of the proposed runway. There are several tank firing positions between this track and the proposed runway with one 3,000-meter firing position situated west of the proposed runway. The proposed runway will severely limit, and possibly prohibit, the use of this firing range during the period of munition shipment.

Ammunition is currently stored on the west side of the proposed runway. Quantity-distance arcs extend into the primary surface and clear zone area of the proposed runway. This ammunition may have to be relocated if the runway is built. Additionally, this part of the Gunpowder Neck site has been an ammunition impact area and will possibly contain unexploded ordnance, which must be located and removed. Seven buildings and some other structures will have to be removed to construct the airfield.

7.3 Aircraft Loading

Loaded munition containers will be brought from the holding area to the aircraft. Special equipment may be required for placing the container onto the aircraft because some loaded containers will exceed the weight capacity of standard Air Force loaders.

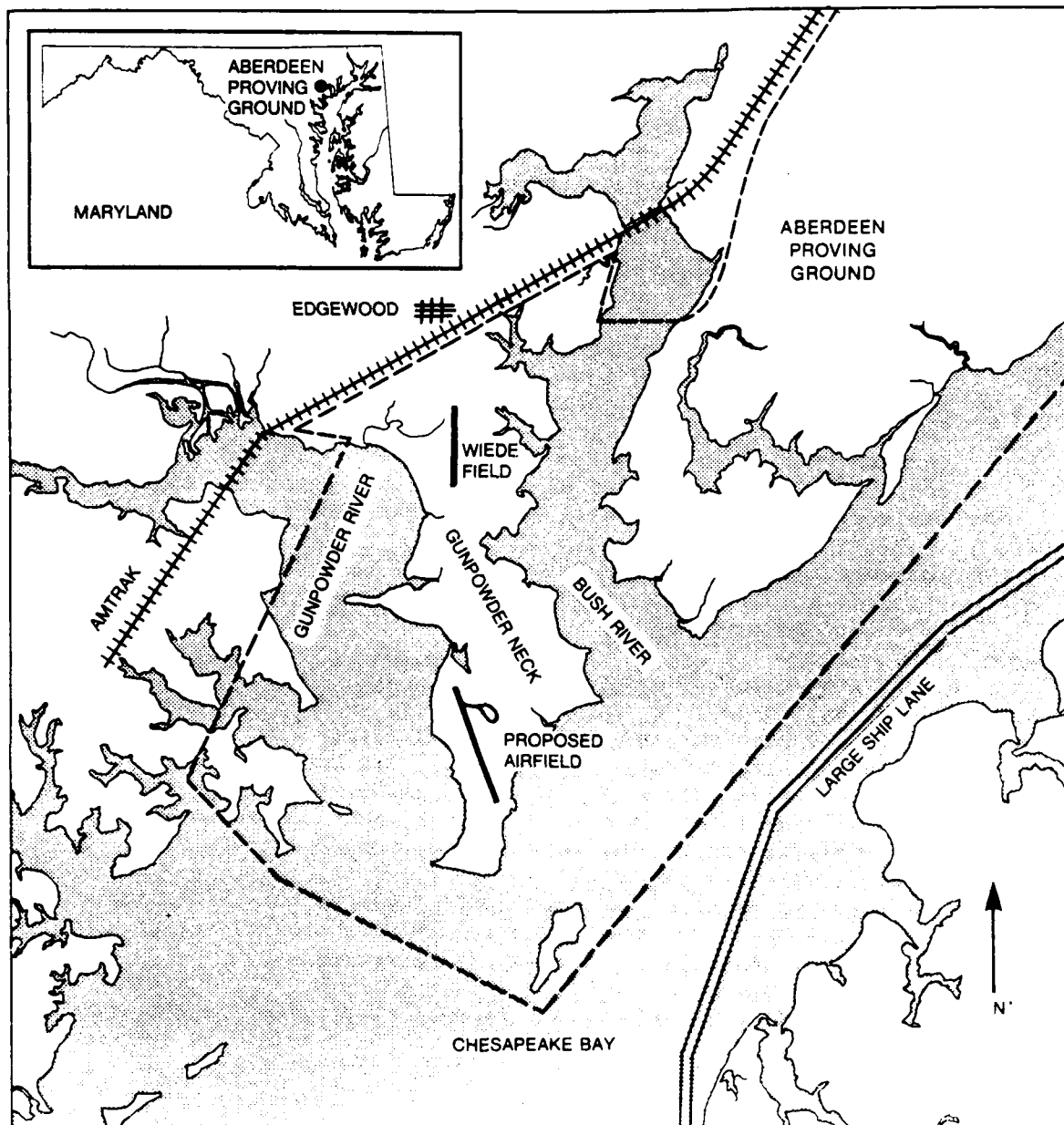


FIGURE 7-6
PROPOSED LOCATION OF THE AIRFIELD TO BE CONSTRUCTED
AT ABERDEEN PROVING GROUND, MARYLAND

7.3.1 Loading Operations

An aircraft is loaded as follows:

- Munition containers ready for loading on the aircraft will be stored in a temporary storage area near the aircraft loading area (see Section 4.0).
- A container handler will be used in the holding area to place a container on a container chassis or a flatbed truck.
- The container will be brought to the aircraft on the container chassis as a tractor-trailer unit or on a flatbed truck.
- A container handler will place the container onto standard Air Force pallets. The pallets will be on a standard Air Force loader (Figure 7-7) if the weight does not exceed 40,000 pounds. Heavier containers will be handled on a stand constructed for that purpose. The container will be secured to the pallets.
- The container and pallets will be rolled into the cargo bay of the aircraft and will be secured in accordance with Military Airlift Command requirements.

7.3.2 Safety and Medical Support

Standard Army chemical agent monitors and alarms will be in place around the aircraft loading and holding area. All workers associated with loading operations will wear work gloves and protective boots, and will carry a protective mask for protection against agent contact. All personnel will be trained in evacuation procedures.

The two-man rule will be used for loading operations. This rule requires the presence of two people for all loading operations, each knowledgeable and trained in the task to be performed.

Medical support for the loading site will be provided by the post medical personnel. Backup medical support will be provided by the supporting regional/area Army or other military medical centers as outlined in the emergency response plan.

Members of the Technical Escort Unit, Command and Control Team, guards, air crew leader, and other personnel with responsibilities for chemical surety material will be in compliance with the Army Chemical Personnel Reliability Program. Members of container handling and loading crews will not be in the Chemical Personnel Reliability Program. The Army will analyze blood samples from work crew members assigned to work with VX and GB agents in order to establish a baseline level of cholinesterase for

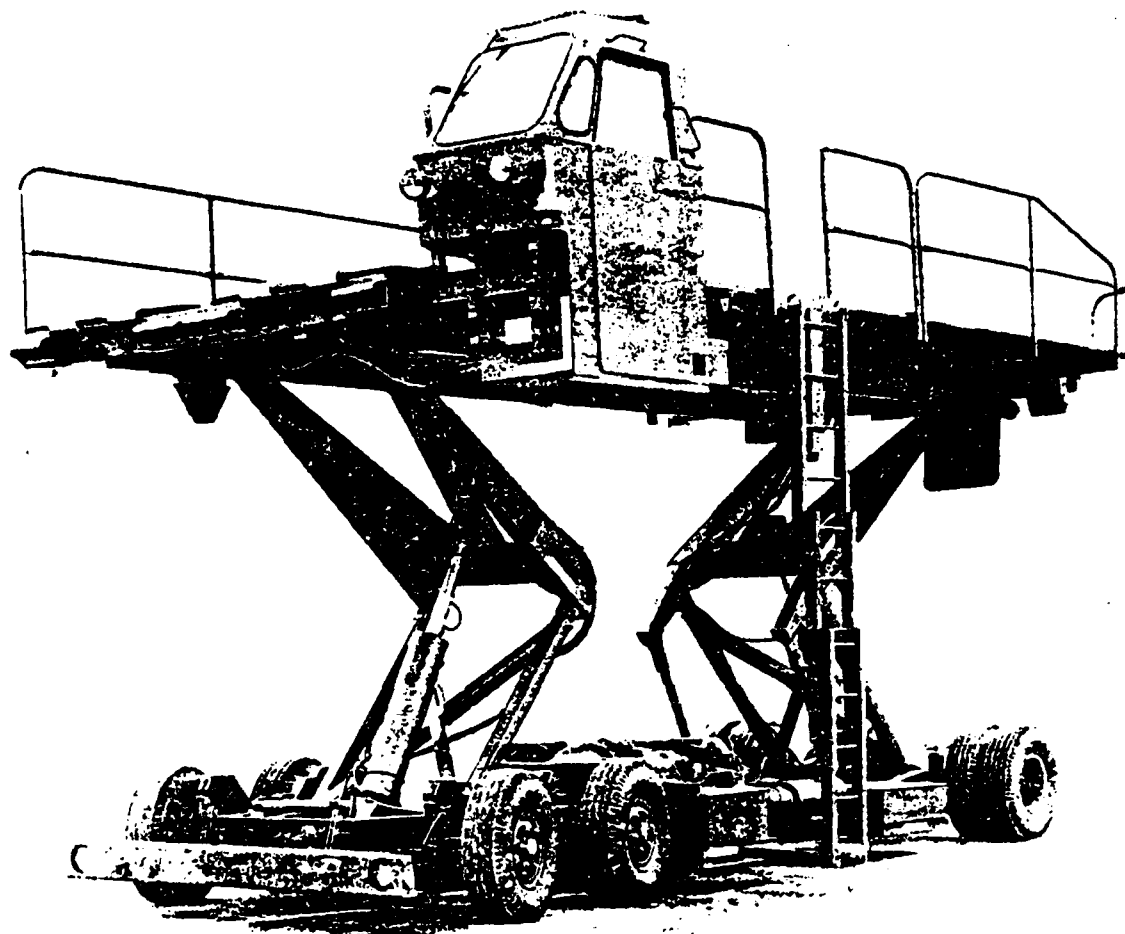


FIGURE 7-7
TYPICAL AIR FORCE LOADER

these workers. If an agent release occurs, this baseline can then be used to determine whether these workers have been exposed to nerve agent. Baseline sampling will be done in accordance with Department of the Army Pamphlet 40-B.

Low-level monitoring for agent leakage into the exterior container (see Section 3.0) will be done shortly before moving the container from the holding area. If agent is detected, the container will be taken to the leaker processing facility for repacking of the munitions and decontamination of the container.

The automatic temperature monitoring system on the container (see Section 3.0) will be checked prior to loading the container on the aircraft. No container will be loaded with a malfunctioning monitoring system.

7.3.3 Security

A temporary exclusion area will be maintained around the aircraft loading area using armed guards in accordance with Army regulations. General security will be provided by the installation security force. An armed member of the Technical Escort Unit will accompany the vehicle carrying each container to the aircraft loading site.

A 10-member Command and Control Team will be stationed at the origin installation and will be on duty during aircraft loading operations. The team will be in communication with the central Command and Control Office.

7.3.4 Munitions Manifest

A munitions manifest will accompany each shipment as part of the chain of custody procedure. This manifest will be prepared by the Army commander responsible for the loading operation. The manifest will contain the following information:

- List of munitions in each container
- Munition lot numbers and identification numbers
- Munition packaging details

For rockets, which have been declared obsolete by the Army and are classified as a hazardous waste, the manifest must comply with the documentation requirements of the Resource Conservation and Recovery Act. To maintain the munition chain of custody, the manifest will be given to the commander of the Army Command and Control Team, who will be the custodian of the munitions during transportation.

7.4 Predeparture Inspections

Prior to departure of the loaded aircraft, equipment will be inspected and tested as described below.

7.4.1 Munition Container

Munition containers will be inspected visually for damage prior to loading. Securing systems for the Air Force pallets and tie-downs will be inspected for damage and proper attachment prior to takeoff. Any container that fails inspection will be returned to the chemical exclusion area for reloading of munitions into a new container and shipment at another time.

7.4.2 Chemical Agent Monitoring System for Aircraft Cargo Hold

All agent monitoring devices will be tested prior to takeoff. The aircraft will not depart unless the chemical agent monitoring system for the aircraft cargo hold is functioning properly.

7.4.3 Container Temperature Monitor

The temperature monitoring system for each container will be tested prior to takeoff. The aircraft will not depart unless the system is functioning properly.

7.4.4 Aircraft

The aircraft will be inspected prior to departure according to normal Air Force requirements. This inspection will be supervised by the qualified aircraft commander (see Section 7.5.1).

7.5 In-flight Operations and Activities

Flight operations will be conducted in accordance with the procedures given in the Mission Operating Directive (see Section 7.1.1). Flight personnel will consist of an augmented Air Force mission crew, four Army Technical Escort Unit personnel, and four Army guards.

7.5.1 Aircraft Operation

Flight operations will follow standard Air Force procedures and the Mission Operating Directive.

An additional senior officer, who is a qualified aircraft commander, will be added to the flight crew as mission commander on the flight deck. The mission commander will not pilot the plane, but will be responsible for aircraft operation in coordination with the commander of the Army

Technical Escort Unit in the event of an in-flight emergency involving chemical agent.

Flight operations will be closely coordinated with the Federal Aviation Administration in the air traffic control system. The filed flight plan will use the words "dangerous cargo" and the pilot will use those words when communicating with air traffic controllers. The controllers will provide special handling for the aircraft as described in the Controllers Handbook, Section 3, Special Operations, 8-20 Aircraft Carrying Dangerous Cargo. This handling involves rules about changing the route of the aircraft and use of special routings, if any are specified.

Altitude reservation may be used. This involves the exclusion of all other aircraft from the altitude along the flight line of the munitions aircraft for a specified period of time ahead of the passage of the aircraft. A decision as to whether altitude reservation should be used will be made in consultation with the Air Force and the Federal Aviation Administration if the decision is made to transport by air.

Flight conditions will be monitored to reduce the chance of encountering turbulent conditions. This will be accomplished through frequent radio contact with aircraft in the vicinity about en route conditions.

7.5.2 Safety

Safety within the aircraft will be assured by monitoring air in the cargo hold for chemical agent, monitoring the munition container for temperature, having Army Technical Escort Unit personnel on board who are trained in agent handling procedures, and wearing of protective clothing during the flight. Response to an in-flight emergency is described in Section 7.5.4. Flight operations contributing to flight safety are described in Section 7.5.1.

7.5.2.1 Monitoring of Aircraft Cargo Hold Air. The air of the aircraft cargo hold will also be monitored continuously for chemical agent using an Army monitor.

7.5.2.2 Monitoring of Container Temperature. The container will be monitored continuously for temperature. This will serve as an early warning of a major problem developing with the munitions inside the container.

7.5.2.3 Aircraft Crew Safety. Flight crews and escort personnel on board the aircraft will wear protective clothing designed by the Air Force for flying in chemical battlefield environments. Under normal flight conditions, only the protective suit will be worn so that the head and hands are unencumbered for flight activities. The protective mask and

gloves will be put on only under circumstances described in Section 7.5.5 for an in-flight emergency.

7.5.3 Security

Four armed guards will accompany each flight. The four Technical Escort Unit members will also be armed and trained in security procedures. These personnel would provide primary security only if the aircraft must land in an emergency at an airfield not designated as an emergency landing site. At designated emergency landing sites, Army personnel aboard the aircraft personnel will augment the primary security force provided by on-site personnel.

7.5.4 Response to Aircraft Equipment Malfunction

Procedures to be implemented if aircraft equipment malfunctions in flight will be specified in the Mission Operating Directive. If there is an equipment malfunction that could affect the safety of the flight, the flight will divert to the nearest designated emergency landing site, where repairs can be made. The flight will not continue until the Air Force aircraft commander, in consultation with the Army Technical Escort Unit commander, is satisfied that safety will not be compromised. If necessary another aircraft will be brought in to continue the flight.

If the aircraft commander determines that an aircraft malfunction is an immediate threat to the safety of the flight, the aircraft will divert to the nearest available landing site. The nearest emergency response team will proceed immediately to this site to provide security and medical support, if needed.

7.5.5 Response to a Monitoring Alarm

If the chemical agent monitor indicates the presence of agent in the air of the cargo hold, or an increase in temperature within the container, all aircraft personnel will immediately don full protective gear. The monitor alarm will then be confirmed using the backup monitoring system. If the alarm is verified, the aircraft commander will notify the nearest designated emergency landing site (which may also be the origin or destination), proceed to the site and land immediately. The aircraft will taxi to a designated area, the container will be removed and remedial actions implemented. Base security forces will be deployed to guard the aircraft, and the emergency response team will be alerted.

Before the container is removed from the aircraft, the downwind hazard distance will be established based on the approximate amount of agent that can be exposed to the atmosphere. This calculation will be made by the Technical Escort Unit utilizing a downwind hazard area calculation. Meteorological data from on-site equipment will be used in the calculation.

Downwind hazard monitoring teams will be dispatched to conduct both high- and low-level monitoring during the time that agent contamination is present at the site. People both on-and-off base will be evacuated as necessary.

The container with the leaking munitions will be removed from the aircraft using a container handling system as described for aircraft loading. The container will then be placed into an overpack container and stored at the landing site. This overpack container will be closed and the integrity of the seals verified. The aircraft and any contaminated ground area will be decontaminated. After reloading the overpack container onto the aircraft, the aircraft will continue to the destination after alerting the central Command and Control Office. Technical Escort Unit personnel will carry out the above operations wearing full chemical agent protective clothing.

7.6 Unloading Operations at Tooele Army Depot

Procedures and equipment for unloading of containers from the aircraft will be similar to those for loading operations. On-site distribution of containers is described in Section 4.0.

A temporary exclusion area will be maintained around the aircraft by armed guards during unloading. Personnel associated with unloading activities will be in compliance with the Chemical Personnel Reliability Program or have a baseline blood cholinesterase level established.

7.7 Return of Containers

After the containers have been unloaded, they will be tested for the presence of chemical agent and decontaminated if necessary. The aircraft will also be certified free of agent contamination. Containers will be returned to the origin installation by aircraft or other means.

8.0 WATER TRANSPORTATION

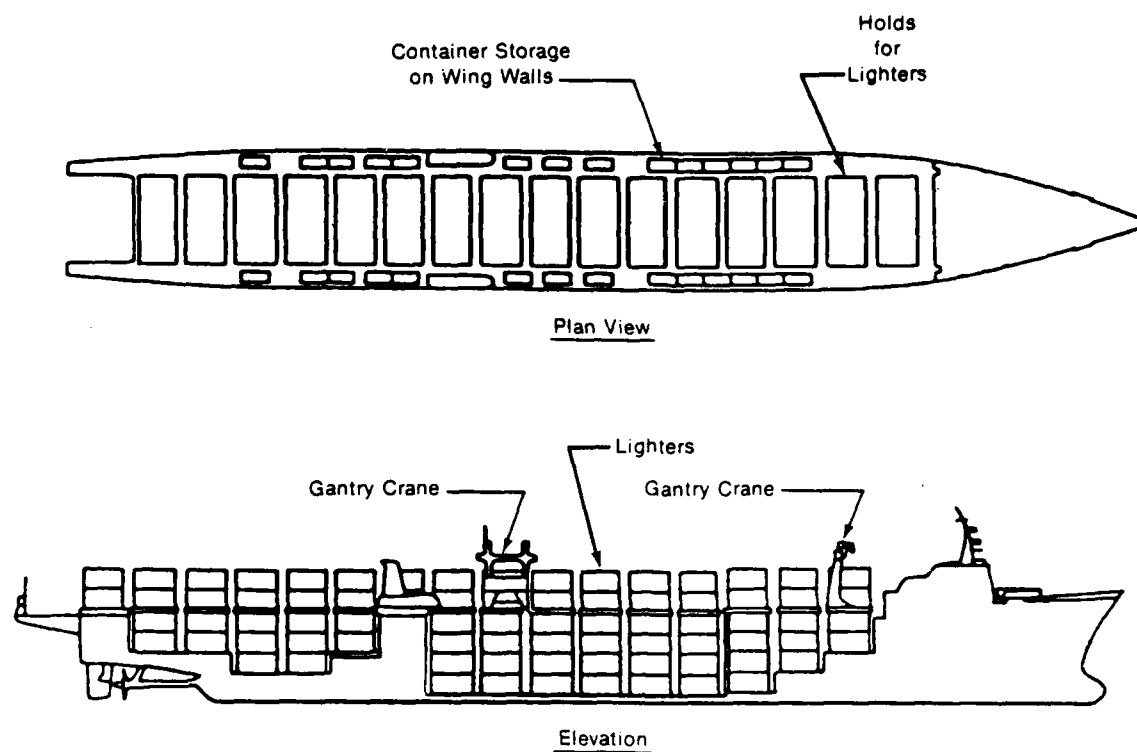
Shipment of the mustard agent inventory in ton containers at Aberdeen Proving Ground, Maryland, to Johnston Island in the Pacific Ocean is discussed in this section. This shipping program has been chosen for analysis because of comments received on the Draft Programmatic Environmental Impact Statement on the Chemical Stockpile Disposal Program and because of comments made at the impact statement scoping meetings and comments on the Draft Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program.

Discussions presented in this section are conceptual in nature. If this site-specific alternative is chosen, detailed operational plans will be developed at that time. Details will be presented in comprehensive site-specific environmental documentation, which will include design of a marine transport container.

Movement of the inventory of ton containers of mustard agent from Aberdeen Proving Ground, Maryland, to Johnston Island will be accomplished using the LASH shipping system (Lighter Aboard Ship). In this system, barges (called lighters) are loaded with cargo at shore facilities and towed through shallow waters to a large, ocean-going LASH vessel anchored in deeper water nearby. The loaded lighters are lifted aboard the LASH vessel with a shipboard crane and stored in the hold. The LASH vessel then proceeds to the destination. At the destination the lighters are lifted from the hold and placed in the water using the LASH vessel crane, towed to a shore facility, and the cargo unloaded. A LASH ship is depicted in Figure 8-1 and a typical lighter in Figure 8-2.

A LASH ship will be taken from the U.S. Navy Ready Reserve Fleet and prepared for the voyage to Johnston Island. A civilian Merchant Marine crew will be hired to operate the vessel. The ton containers of mustard agent will be placed in shipping containers (see Section 3.0), and the shipping containers will be loaded onto the lighters at an Army facility constructed on Army property on the Bush River. Two loading sites are under consideration (Figure 8-3). Dredging of an 8-foot deep channel will be necessary in the vicinity of either of the piers selected. Loaded lighters will be towed to the LASH vessel anchored off the shipping lane at the mouth of the Bush River (Figure 8-3), lifted aboard the vessel and stowed in the hold.

Upon completion of loading, the LASH vessel will proceed to Johnston Island along the route shown in Figure 8-4. The Panama Canal will not be used because of the problem of maintaining adequate vessel security in the confined area of the canal. A Coast Guard vessel will accompany the convoy in the Chesapeake Bay for security and safety. The U.S. Navy will be responsible for security for the ocean part of the voyage beginning at the mouth of the Chesapeake Bay. The method for providing this security



Note: No Lighters Containing Munitions Will be Carried Above Deck

FIGURE 8-1
PLAN AND PROFILE OF A LIGHTER-ABOARD-SHIP (LASH) VESSEL

Principal Characteristics of LASH Barges	
Length	61'6"
Width	31'2"
Height Overall	14'0"
Hatch Opening	44' by 26'
Draft of Empty Barge	1'6"
Draft, Maximum	8'8"
Weight of Empty Barge	80 Long Tons
Cargo Capacity	368 Long Tons
Bale Capacity	19,600 Cu. Ft.
Grain Capacity	20,100 Cu. Ft.

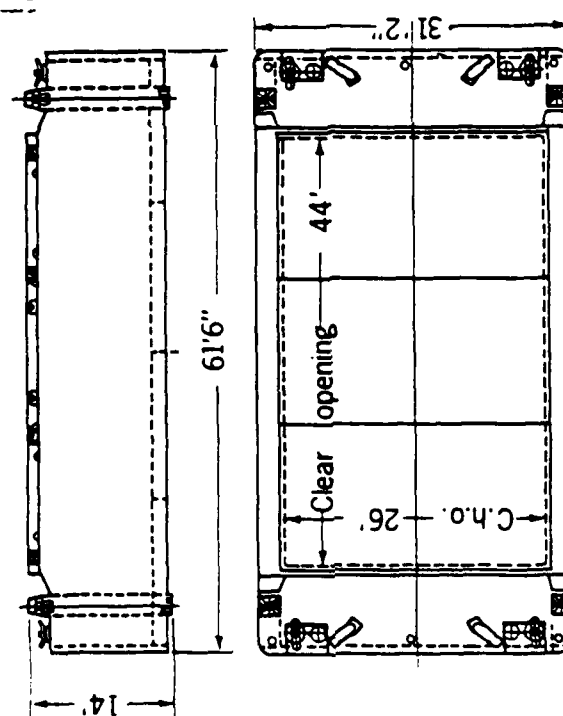


FIGURE 8-2
TYPICAL LIGHTER FOR USE WITH LIGHTER-ABOARD-SHIP SYSTEM

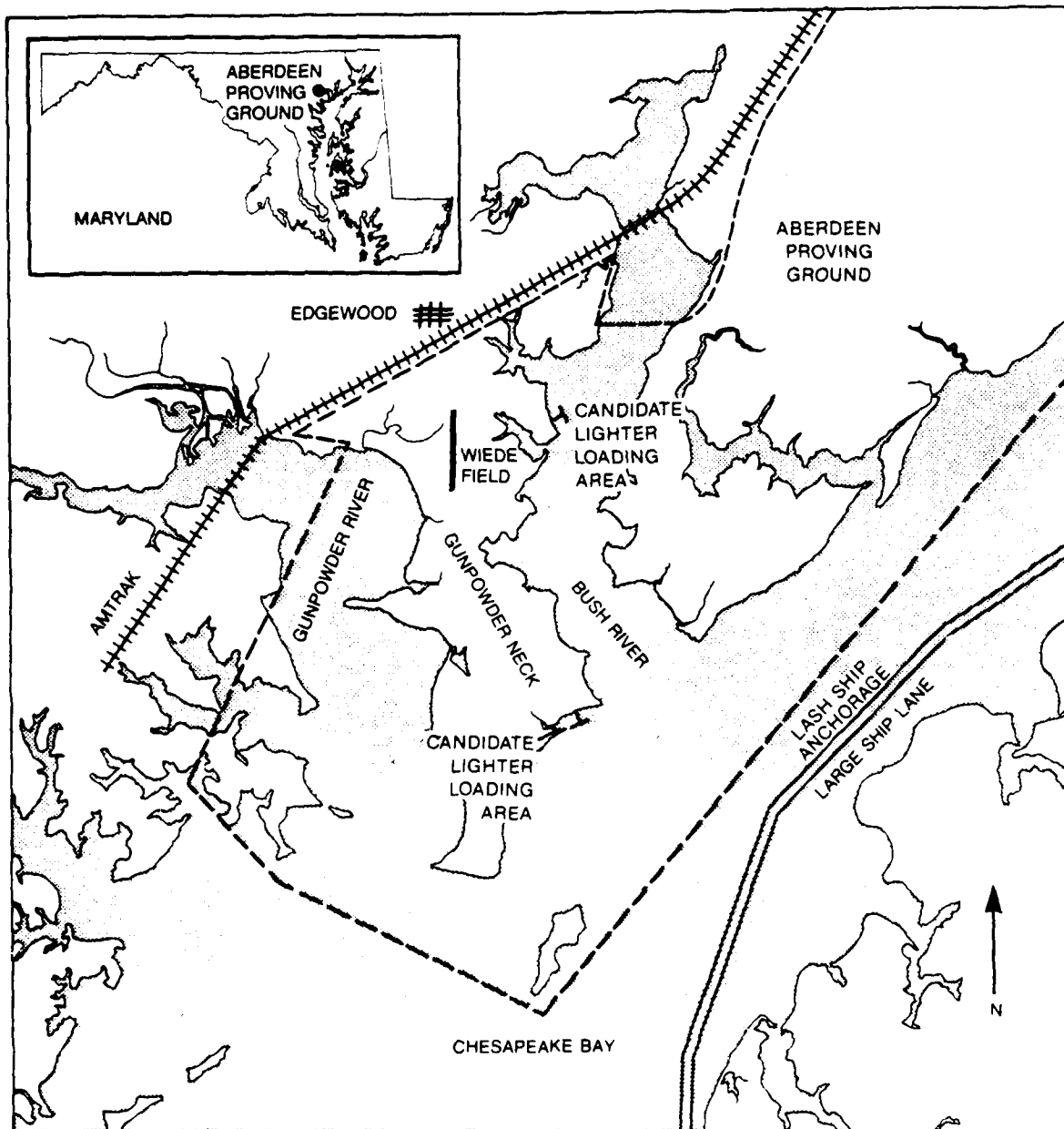


FIGURE 8-3
PROPOSED ALTERNATIVE LOCATIONS OF LIGHTER LOADING AREA
AT ABERDEEN PROVING GROUND, MARYLAND

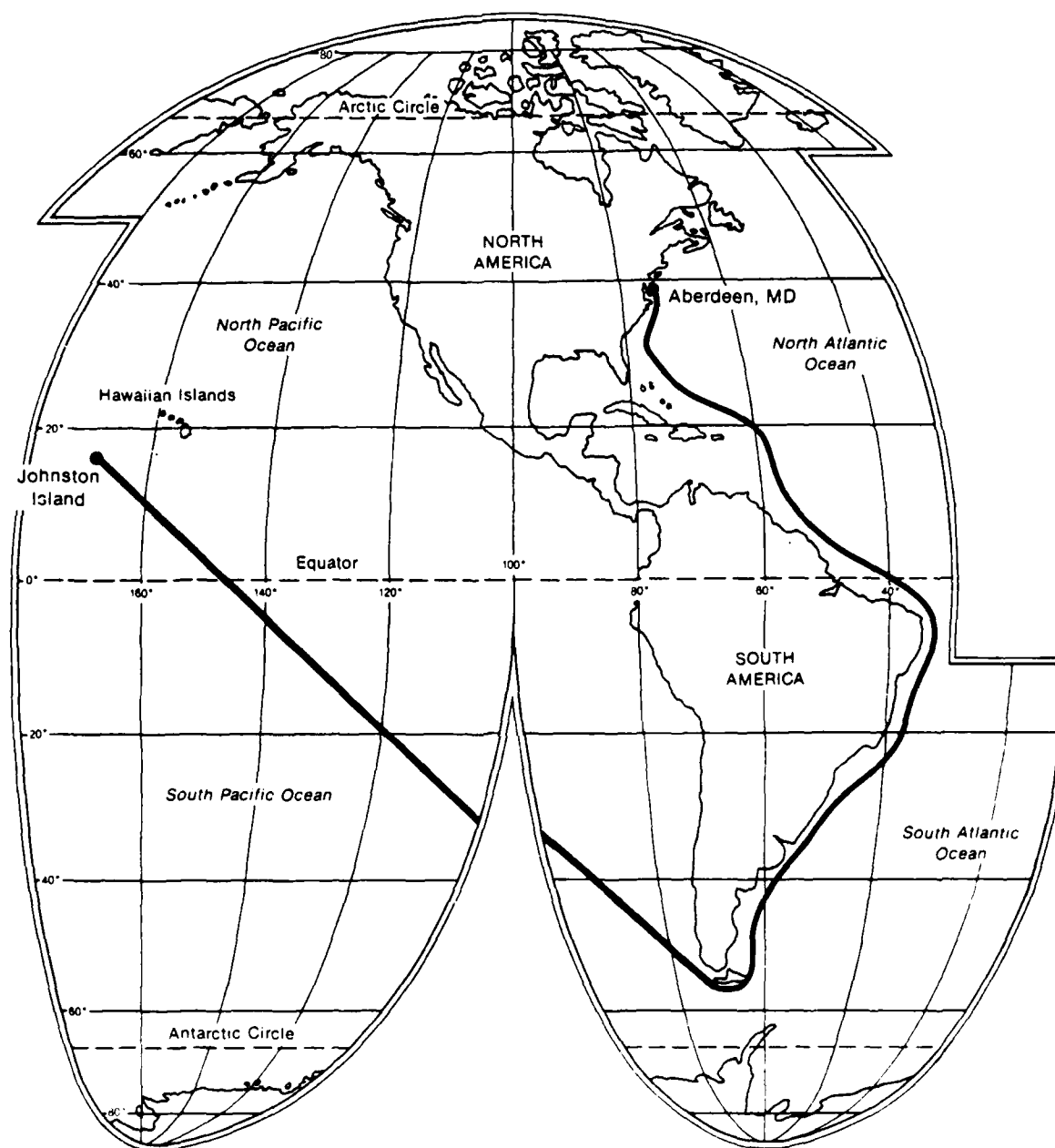


FIGURE 8-4
ROUTE OF THE LASH VESSEL FROM ABERDEEN PROVING GROUND,
MARYLAND TO JOHNSTON ISLAND

will be determined from the results of a vulnerability assessment to be undertaken by the Army.

The description of operations given below includes all activities beginning with preparing ton containers at Aberdeen Proving Ground for packing and ending with disposition of ton containers at Johnston Island.

8.1 Programmatic Considerations

The Army will undertake several planning and coordination activities before a water transportation program is implemented (see Section 5.0). Discussed below are the details of some of these activities that are specific to water transportation. Additional discussion of safety assurance functions is in Section 9.0.

8.1.1 Training Requirements

A training program will be developed and implemented. Training will be required for the following personnel.

8.1.1.1 Container Handling Crews. Shipping container handling crews will be trained on the handling equipment to be used for loading and unloading operations. The training program will include practice of lighter and ship loading and unloading operations and procedures using shipping containers and lighters without munitions but of loaded weight similar to shipping containers and lighters loaded with munitions.

Longshoremen employed for loading lighters at Aberdeen Proving Ground will receive training on chemical agent self-protection procedures. Self-protection training includes the fitting and use of personal protective equipment, familiarization with toxic chemical agents and their characteristics, operation of agent monitor alarms, and actions to take in the event an alarm sounds. Training also includes agent exposure symptoms, self-aid and first aid for agent exposure, and evacuation plans in the event of accidental agent release.

8.1.1.2 LASH Ship and Towboat Operating Crews. The merchant marine crew hired to operate the LASH vessel will be provided with self-protection training by the Army. This training is described in Section 8.1.1.1. In addition to self-protection training, crew commanders will also receive training from the Army in safety and emergency response procedures.

8.1.1.3 Other Personnel. Any U.S. Coast Guard and Navy personnel associated with munition vessel operations will be informed of the hazardous nature of the cargo and of their role in en route emergency procedures and response activities. Training will be provided as required.

8.1.1.4 Escort Personnel. All Army personnel escorting the munition vessels will receive refresher training in their assigned areas of responsibility. All Army personnel will be trained in all aspects of emergency response and handling and monitoring of chemical agents. This includes use of protective clothing, surety and safety procedures, emergency procedures, chemical detection, self-aid and first aid and use of decontaminants. Security guards and Technical Escort Unit personnel will be trained in the appropriate use of force to respond to overt and covert actions.

8.1.1.5 En Route Civilian Personnel. Onshore medical personnel will be trained on treating agent casualties and on medical support operations. State and local officials will be briefed on emergency response and security operations.

8.1.2 Emergency Response Plans

Emergency response plans for Aberdeen Proving Ground and Johnston Island as well as en route will be developed and approved before water movement of munitions is begun. The emergency response plan for Aberdeen Proving Ground and Johnston Island will be similar to the response plans for current activities and for on-site destruction of munitions. For the one-time transit of the Chesapeake Bay, emergency response will be coordinated with the states of Virginia and Maryland. Ocean transit will be far enough from shore to prevent danger to onshore populations. Details of the emergency response concept is contained in the Emergency Response Concept Plan for the Chemical Stockpile Disposal Program.

8.1.3 Preoperational Tests and Evaluations

Procedures and activities of the transportation program will be practiced without munitions prior to initiating transport. Results will be evaluated and changes implemented that will improve program performance.

8.2 Preparation and Packaging of Ton Containers

Ton containers filled with mustard comprise the inventory to be moved from Aberdeen Proving Ground to Johnston Island. These ton containers are currently stored in open storage yards within an Army exclusion area on post.

Prior to the beginning of any transportation activities, as part of regular maintenance at Aberdeen Proving Ground, all ton containers will be ultrasonically tested to determine susceptibility to leak development. If indicated by test results, these susceptible ton containers will have plugs and valves replaced with new plugs.

The replacement procedure will be accomplished at the storage location in the Chemical Transfer Facility. This facility consists of a

negative-pressure ventilated room, which provides vapor containment during leaker treatment. Ton container surfaces will be decontaminated after plugs and valves are replaced.

On-site activities associated with transporting the ton containers are depicted in Figure 8-5. All preparation and packaging steps take place at the storage location. Once packaged, the ton containers are loaded on a flatbed truck and moved to the loading dock where they are placed into lighters. Section 8.4 describes subsequent movement of lighters to the LASH ship for shipment to Johnston Island.

8.2.1 Ton Container Preparation

Activities at the storage location begin with monitoring of ton containers. High-level monitoring by two 2-person crews will determine whether any of the ton containers are leaking.

Ton containers found to contain leaks will have plugs and valves replaced with new plugs. This procedure will be identical to that described in Section 8.2; however, leaking ton containers identified during monitoring will be isolated and prepared for shipment after nonleakers.

8.2.2 Loading Ton Containers into Shipping Containers

Within the storage yard, ton containers will be loaded into the shipping containers. The accumulated shipping containers remain stored in the yard and are monitored awaiting movement to the loading dock.

Once verified as not leaking or not susceptible to leak development, a ton container is placed using a forklift into the shipping container. Overpack containers will be packed, sealed, and seals checked as they become filled. The loaded and sealed shipping containers will then be moved to an area within the storage yard using forklifts where they will be stored and monitored awaiting completion of packing of all ton containers.

The loading process will be accomplished by two 4-person crews; two 2-person crews will perform the periodic low-level monitoring of the loaded shipping containers. The process of preparing and packaging the ton containers will be accomplished simultaneously with lighter loading (see Section 8.3.1).

If during this storage time, any shipping container is found to contain a leaking ton container, the shipping container will be separated and subsequently unpacked, and the leaking ton container treated (as described in Section 8.2).

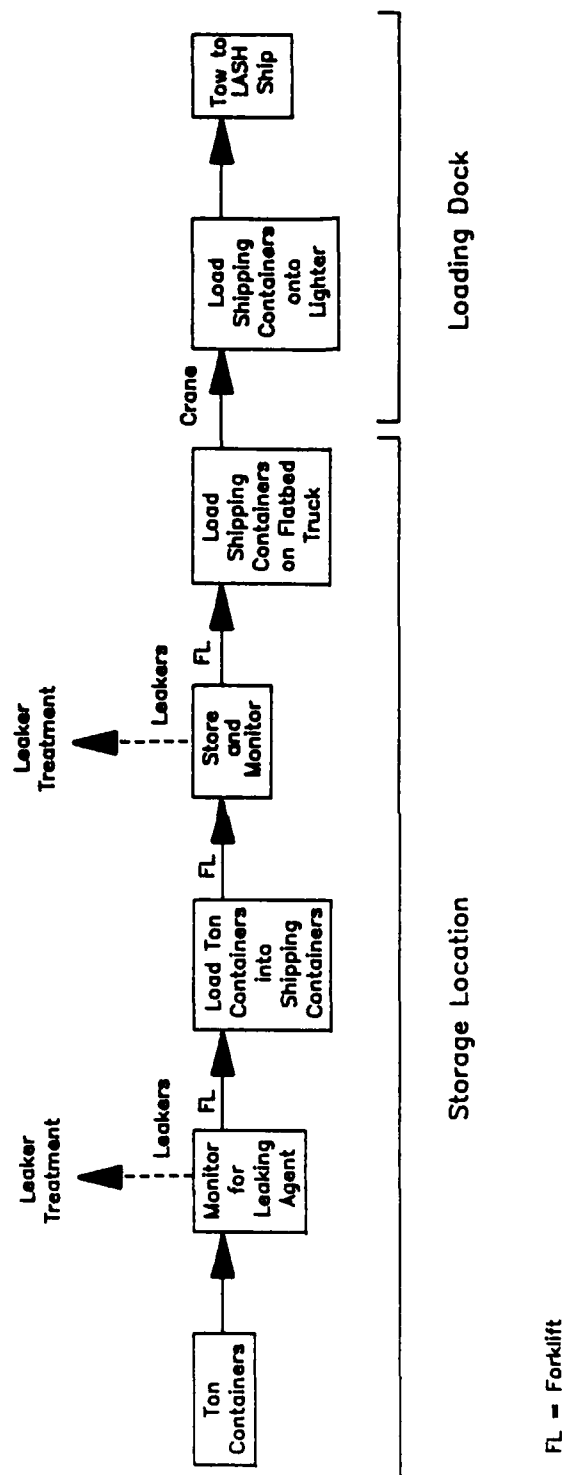


FIGURE 8-5
TON CONTAINER HANDLING AT ABERDEEN PROVING GROUND
PRIOR TO BARGE TRANSPORT

8.2.3 Movement of Shipping Containers to the Loading Dock

After ton containers have been packed into shipping containers, they will be loaded from the storage yard, using forklifts, onto a flatbed truck. The shipping containers will be securely tied down and driven in convoys per standing operating Army procedures. A typical configuration of such a convoy is as follows: 1 munitions truck, 2 security vehicles, 1 decontamination truck, 1 medical support vehicle. The configuration of convoys may vary from installation to installation. The convoys will travel approximately one mile to the loading dock for lighter loading. The entire process of the container and lighter and LASH loading, including this on-site movement will require approximately 14 days.

8.3 Vessel Loading Operations and Procedures

Lighters will be loaded with shipping containers, towed to the LASH ship, and the lighter and its cargo loaded by shipboard crane into the hold of the LASH ship. Monitoring for chemical agent leaks will take place at several steps. Security will be maintained at the loading dock, at the LASH vessel, and while bringing the lighters to the LASH vessel.

8.3.1 Loading Operations

Loading operations involve the preparation of the lighters, loading of the shipping containers onto the lighters, movement of lighters to the LASH vessel, and loading aboard the vessel. Loading operations are expected to require about 14 days.

8.3.1.1 Preparation of Lighters. Empty lighters will be off-loaded from the LASH vessel at the anchorage (Figure 8-3) and towed to the pier, where a wooden floor will be installed and preparations for blocking and bracing of the cargo made.

8.3.1.2 Loading, Blocking, and Bracing Shipping Containers into Lighters. Shipping containers will be loaded onto flatbed trucks at the storage area and brought to the loading dock (Section 8.2). The shipping containers will be loaded by crane into the lighters. Blocking and bracing will be installed. Blocking and bracing will then be inspected by marine cargo safety specialists. Hatch covers will be installed on the lighters in preparation for the ocean voyage. The loading operation will be performed by two longshoremen crews of 20, under contract to the Military Traffic Management Command.

8.3.1.3 Loading and Securing Lighters Aboard the LASH Ship. Upon completion of loading, lighters will be towed to the LASH ship. The lighter will be lifted aboard the LASH ship over the stern, using the on-board crane, and placed in the hold.

8.3.2 Safety and Medical Support

Low-level agent monitoring of the munition shipping containers will be carried out before the shipping container is taken from the storage area. If agent is detected in any shipping container, it will be returned to the chemical transfer facility for decontamination and repair.

The containers will be loaded on lighters during daylight hours only. Standard Army chemical agent monitors and alarms will be operational during loading operations. All workers associated with loading operations will wear work gloves and protective boots, and will carry a mask for protection against agent exposure.

Towboats used to move loaded lighters will have standard chemical agent monitors and alarms on board.

The cargo hold of the loaded lighter will be sampled for agent presence while stored in the anchorage. A sample will be taken immediately prior to moving the lighter to the LASH vessel for loading. This sampling method can detect very low concentrations of agent. If agent is detected, the lighter will be returned to the dock, the leaking shipping container will be identified and returned to the chemical transfer facility.

Medical support for loading operations will be supplied by Aberdeen Proving Ground, Kirk U.S. Army Health Clinic, U.S. Army Health Services Command medical personnel. Backup medical support will be provided by the supporting regional/area Army or other military medical centers. Disaster response will be specified in the emergency response plan (Section 8.1.2).

Medical support to the LASH vessel will be provided by on-board medical personnel.

8.3.3 Security

Security will be assured by certification of personnel through the Army Chemical Personnel Reliability Program, and use of armed guards and U.S. Coast Guard vessels.

8.3.3.1 Personnel Security. All personnel involved in any aspect of storage, handling, maintenance, shipping, or security of the materials must be in compliance with the Chemical Personnel Reliability Program (Section 5.6). This program requires that all personnel assigned to chemical surety positions are certified acceptable prior to their being assigned to a chemical surety position. These personnel will be screened, medically evaluated, interviewed by a qualified official, and certified acceptable before they are assigned to chemical surety duties. This policy applies to civil service employees, military personnel and contractor employees.

8.3.3.2 Security During Lighter Loading Operation. Security for the lighter loading operation will be maintained by the armed Aberdeen Proving Ground security forces who are assigned the responsibility of protecting the chemical surety material. These personnel will be supplemented by additional personnel, both military and civilian, as needed to insure that adequate security is maintained during all portions of the exercise. In addition to the Aberdeen Proving Ground civilian and/or military security forces, the U.S. Army Technical Escort Unit personnel assigned to serve as the government's custodians of the chemical material will be armed, and will provide additional security capability should the need arise. These Technical Escort Unit personnel will also travel with the cargo as it is brought by truck to the pier for loading into the lighters. They will also be at the lighters during loading operations.

8.3.3.3 Security at the LASH Ship Awaiting Loading. Prior to placing the LASH vessel in service, the lighters will be inspected to Coast Guard vessel specifications for seaworthiness. After the ship is anchored in the Chesapeake Bay near the Bush River, the lighters will be visually inspected inside and out. The empty lighters will then be placed into the water, and moved by towboat to be loaded with shipping containers at the loading dock. At this point the ship will undergo a complete security inspection by the Technical Escort Unit and security personnel. The ship will be under constant armed guard from the point of the security inspection onward. In addition, it will be under constant surveillance by armed Coast Guard vessels. The lighter movement to the loading area or to a holding area will be escorted by Coast Guard and/or Aberdeen Proving Ground security vessels. Beginning from the time the lighters are initially inspected, during the holding time, preparation for loading, the loading operation itself, and afterward, until the lighters are loaded aboard the ship, the lighters will be under constant surveillance.

8.3.3.4 Security and Escort Requirements for Transporting the Lighters to the LASH Ship, and for the Ship Loading Operation. Once the loaded lighters have been prepared for shipment, they will be escorted by security personnel who will travel on the towboat. Security personnel and an armed escort vessel will travel with the lighters to the LASH ship for loading.

8.3.3.5 Security of the LASH Vessel. Security aboard the LASH vessel will be provided by on-board armed Technical Escort Unit personnel. The vessel will be accompanied at all times by a Coast Guard escort. The LASH vessel will be in communication with personnel of the loading operation.

8.4 En route Operations and Procedures

Once the LASH ship has been loaded and the cargo secured for the ocean voyage, the ship will travel with a Coast Guard escort via the Chesapeake Bay to open water for travel to Johnston Island (Figure 8-4).

Two tugboats will also accompany the vessel in the Chesapeake Bay for control of the ship if power or steerage is lost. The trip in the Chesapeake Bay will be made using the commercial shipping channels.

An escort ship will accompany the LASH ship upon entering the Atlantic Ocean. The escort ship will carry support personnel and equipment sufficient to respond to an emergency aboard the LASH ship that cannot be handled by on-board medical and Technical Escort Unit personnel.

Once the LASH ship, with its escort, has reached international waters, its progress will be monitored by satellite to ensure that its position is known at all times.

8.4.1 Vessel Operations

The LASH vessel will be operated by a merchant marine crew of approximately 38 personnel. A commercial ship pilot will also be on board during transit in the Chesapeake Bay. Standard procedures for ocean voyages will be followed after leaving the Chesapeake Bay.

8.4.2 Safety and Medical Support

A chemical agent monitoring system will operate continuously on the LASH vessel. Each engine room and each of the six holds will have two automatic low-level monitors sampling at floor level to monitor for the heavier-than-air mustard agent.

Each lighter will have sample lines for agent monitoring. Each lighter will be sampled once a day. The samples will be processed by an on-board laboratory staffed by ten technicians, who also will be responsible for monitor and other laboratory equipment repair. Each lighter will be equipped with an access port so that decontaminant can be added should a leak be detected, since only the top lighters are readily accessible during the voyage. If a leaking shipping container must be reached, the on-board crane will be used to move lighters to gain access to the lighter with the leaking ton container.

The route of the munition and escort vessel (Figure 8-3) will be southward along the U.S. southeastern coast, through the Caribbean Sea, and along the east coast of South America. From the southern tip of South America, the vessels will proceed directly to Johnston Island. The route in the Atlantic Ocean will be far enough offshore to eliminate danger to land in the event of an agent release, but close enough to allow evacuation of personnel by land-based helicopters. Capability for at-sea movement of personnel and material to and from the escort ship will also be available. Contingencies for dealing with serious vessel equipment malfunctioning will be developed for the operations plan, should the marine transport alternative be selected.

Emergency response capability will be carried on both the LASH vessel and escort ships so that all personnel are not endangered by an accident on the munitions ship. There will be sufficient Technical Escort Unit and medical personnel on the escort ship to respond to most expected agent leak situations that cannot be handled by personnel aboard the munitions ship.

8.4.3 Security

The Coast Guard vessels that have been guarding the ship will accompany the LASH and escort ships in the Chesapeake Bay. In addition, Coast Guard vessels will patrol the shoreline, and will coordinate with local and state police to ensure that traffic is stopped on the William Preston Lane, Jr. Memorial Bridge at Annapolis as the ships pass beneath. Contact with the central Command and Control Office will be maintained to ensure that contact is maintained with personnel during the trip in the Chesapeake Bay. Once the Atlantic Ocean is reached, security will be provided by the U.S. Navy. The method of providing this security will be determined from the results of a vulnerability assessment to be undertaken by the Army.

Technical Escort Unit personnel will provide security on the LASH ship.

8.5 Unloading Operations

After the LASH vessel arrives at Johnston Island, the lighters will be off-loaded from the ship by the on-board cranes. The lighters will then be towed to the dock where cranes will lift the shipping containers and load them onto flatbed trailers. The shipping containers will be driven to an unpacking area. There, they will be monitored by low-level monitors. Shipping containers which have been found to contain no leaking ton containers will be opened, and the ton containers will be taken to a storage area. The ton containers will be stored at this area until the destruction plant is ready to accept them.

The shipping containers which have been identified after monitoring to contain leaking ton containers will be taken to a temporary storage area. These ton containers will be disposed of separately. The shipping containers will be taken to the destruction facility where they will be opened in the unpacking area of the facility.

9.0 SAFETY ASSURANCE FUNCTIONS WITHIN THE TRANSPORTATION PROGRAM

A program carrying out the transportation of the chemical munitions will be necessarily complex. It will require an organization with elements executing many of the functions addressed in this report-- functions such as packaging design and testing, monitoring, loading and unloading, etc. Some of these functions will be organized and implemented in the early stages of the transportation program, while others will be carried out only when the program becomes fully operational.

The transportation program will be managed by the Office of the Program Manager for Chemical Munitions, located at Aberdeen Proving Ground, Edgewood Area, Maryland. A detailed program plan covering all aspects of the transportation program will be established early in the program and updated, as needed. Overall program direction, responsibilities of the Office of the Program Manager for Chemical Munitions, supporting elements and federal agencies, and integration activities will be defined in the program plan. Specific areas of responsibility will be identified and elements of work assigned. Program management activities will include management of a safety program and implementation of a public outreach program.

The safety program management function will be directed by the Safety and Surety Division of the Office of the Program Manager for Chemical Munitions; a public outreach program will be developed by the Public Affairs Office and coordinated with the affected states.

The following sections address the implementation of these two safety assurance programs: safety program management and a public outreach program, within the transportation program.

9.1 Safety Program Management

A major element of program management is management of the safety program. The safety program includes many elements, such as:

- System Safety Engineering and Management
- Site Plans/Safety Submissions
- Preoperational Surveys
- Test and Evaluation
- System Safety Working Group
- Accident/Incident Reporting and Investigation
- Emergency Preparedness and Response

These elements are described and discussed in the following sections, with respect to implementation of transportation activities. The safety program will also include guidelines for industrial accident prevention, safety inspections, safety promotion, and training. Specific training requirements for the transportation program are contained in Sections 5.8 and 5.9.

The Army safety program is established in Army Regulation 385-10 to reduce accidental loss and provide a safe and healthful environment for Army personnel and others exposed to Army operations. Procedures for organizing the Army safety program, set forth in this regulation, will be followed to support the transportation program. The following sections address implementation of specific activities included in the safety program.

9.1.1 System Safety Engineering and Management

Although system safety policy and guidelines established by the Department of Defense do not explicitly apply to transportation, the techniques and principles will be applied to the transportation program. Emphasis will be on identifying and controlling hazards associated with personnel, munitions, equipment and facilities of the various transportation operations.

The Army will establish a system safety program specific to the transportation program, applying the principles of Department of Defense MIL-STD-882B and implementing regulations. A System Safety Program Plan will be prepared, describing the planned methods to implement the system safety program. Included will be organizational safety responsibilities, resources, methods of accomplishment and integration with other transportation program activities.

The objective of the system safety program is to establish a systematic approach to achieve and ensure optimal safety in a timely, cost-effective (as opposed to retrofit) manner. To this end, hazards will be identified, evaluated, and either eliminated or have their associated risks reduced to an acceptable level. As transportation procedures are refined, more sophisticated inductive and deductive analyses may be used to better identify and evaluate hazards in an iterative manner. Other system safety approaches to be taken to meet the overall objective include:

- Use of historical safety data from other movements, and trend analysis of any transport program mishaps or "close calls".
- Full documentation of hazards analyses results and actions taken to eliminate hazards or reduce risk (mitigation).

- Re-analysis of all changes in procedures, equipment, or facilities, including changes to mitigate identified hazards.

The Army will strive to "design for minimum risk;" that is, eliminate identified hazards or minimize associated risks through engineering design or safety devices in a manner that minimizes risk created by human error. Where resolving identified hazards must involve procedural methods, training and certification of personnel will be used. Human factors engineering activities will be coordinated and integrated with system safety to minimize the opportunities for and consequences of human error.

9.1.2 Site Plan/Safety Submissions

Safety Site Plans are vehicles for formal approval of operation locations and safe separation distances by the Department of Defense Explosives Safety Board. Safety submissions are similarly approved by the Department of Defense Explosives and Safety Board and contain details regarding the safety of operations, equipment, and facilities. Both will be submitted for the transportation program.

9.1.3 Preoperational Survey

Prior to implementation of mode-specific transportation, a comprehensive Preoperational Survey will be undertaken by the Office of the Program Manager for Chemical Munitions. This survey will involve simulation of proposed activities and will augment the hazards identification and analysis process discussed in Section 9.1.1. These surveys serve to detect and eliminate potential safety/surety problems and operational bottlenecks. This survey may be conducted prior to, or simultaneously with, the Preoperational Safety Survey required by Army Materiel Command safety regulations.

A Preoperational Survey team will be staffed with personnel with expertise to fully evaluate the transportation program. The team will be chaired by the Safety and Surety Division of the Office of the Program Manager for Chemical Munitions. The team will be responsible for reviewing all relevant documentation, inspecting all equipment and witnessing selected system tests. Specific areas to be addressed include:

- Operational capability of all equipment, including supporting laboratory equipment (e.g., monitors)
- Adequacy of the standing operating procedure to be implemented
- Personal protective equipment
- Operator training (e.g., crews at igloo operations on-site, mode-specific vehicular crews)

- Supervisory control
- Personnel and equipment decontamination
- Emergency procedures
- Overall industrial and operational safety
- Agent detection capabilities, including the container monitors

9.1.4 Test and Evaluation Plan

A Test and Evaluation Master Plan will be developed early in the program development. This plan will address critical safety issues to validate the results of system safety analyses. Included in the plan are tests for individual items, as well as for systems as a whole. Results of tests will demonstrate safe operations for future transportation activities.

This plan will also include necessary test procedures to ensure that design criteria are met and incorporated into the transportation packages (see Section 3.0).

9.1.5 System Safety Working Group

A System Safety Working Group will be formally chartered to ensure coordination within the transportation program activities. The Safety and Surety Division, as well as other organizations associated with the transportation program, will be represented to provide a coordinated effort to achieve the system safety program objectives.

9.1.6 Accident/Incident Reporting and Investigation

Accidents and other mishaps will be reported and investigated in accordance with established Army Regulations (Army Regulation 385-40). Mishaps are categorized by severity and cause as follows:

- Accidents - The most severe mishap, involving loss of life, permanent injury, substantial property damage, or presence of harmful amounts of chemical agents where the public has access. The causes may be industrial, motor vehicle, chemical (toxic chemical agent), or other. Chemical accidents will be investigated by an Army Materiel Command team as a minimum and probably by higher headquarters as well, depending upon severity.

Incidents - A less serious mishap involving injury, property damage, or agent exposure for chemical workers. Chemical incidents will be investigated as a minimum by either an Army Materiel Command team or a major subordinate command team.

Occurrence - A mishap causing no significant damage or injury but which might have under slightly different circumstances. Generally investigated by a safety team from the responsible organization for "lessons learned" value.

9.1.7 Emergency Preparedness and Response

The Army will develop detailed plans for emergency preparedness and response. These plans will be prepared as an extension to existing Chemical Accident and Incident Response and Assistance plans. Each installation currently has such a plan in place to handle chemical agent mishaps on post. These plans will be evaluated and used for training by conducting simulation exercises.

As part of the Chemical Stockpile Disposal Plan Environmental Impact Statement process, the Army has initiated development of an Emergency Preparedness Response Concept Plan.

9.2 Establishment of a Safety Promotion and Outreach Program

The transportation alternatives involve states which are traversed during operations. An outreach program with these states and affected jurisdictions will be initiated early in the development of the program. Such a program will offer assistance to and cooperation with the states, and will be prepared consistent with the Emergency Response Plan.

One purpose of this outreach program is to assist these states in developing emergency preparedness programs to respond to emergencies during transportation activities. All states have preparedness programs to respond to emergencies, such as fire and floods. Many also have programs for emergencies involving hazardous materials and the transportation of these materials. The transport of chemical munitions through the states adds an incremental risk. This program is to assist the states in enhancing their preparedness capability to meet this added risk. The states will be provided with an understanding of the nature of the hazards and what that implies in terms of preparedness components, such as training, equipment, and medical treatment.

A second purpose is to develop procedures to be followed in the event of an accident/incident during interstate transport. The responsibility for managing an incident or accident rests with state and local officials.

Army personnel will provide technical assistance in such an event; however, command authority will remain with the state or local officials. The development of the procedures will be coordinated with the Federal Emergency Management Agency, the federal agency which has purview over preparedness planning activities.

Another component of the outreach program involves communication between the Army and the states to resolve other issues which could arise due to munitions transport. Portions of such a program will include such items as: preparation of educational material in the form of pamphlets (technical as well as nontechnical) for public distribution; designation of a central point of contact in each state for public and citizen inquiries, as well as for Army-state communication; designation of a central point of contact at the transportation program office level who is solely responsible for supplying information to the media, as well as other roles.

In the case of marine transport from Aberdeen to Johnston Island, (see Section 8.0), the Army will work with the U.S. Department of State to determine requirements for international considerations. This coordination would be necessary since foreign governments along the route would have to be notified in the event marine transport from Aberdeen is implemented.

Prior to implementation of the transportation program, the Public Affairs Office of the Office of the Program Manager for Chemical Munitions will prepare detailed public affairs plans for all originating and destination site installations. A generic public affairs plan will be prepared for communities along the transportation routes which could be affected.

APPENDIX A
DESCRIPTION OF CHEMICAL MUNITIONS

APPENDIX A

DESCRIPTION OF CHEMICAL MUNITIONS

A description of each munition and bulk storage container is provided below. Diagrams are provided after the text.

115mm Rockets

The 115mm rockets are filled with either GB or VX. The rockets are equipped with fuzes and bursters which contain explosives. Propellant is also built into the motor of the rocket. The rocket casing is made of aluminum which may slowly react with nerve agent to form hydrogen gas. Pressure buildup in some of the rockets has caused a leakage problem.

The rockets are individually packaged in fiberglass shipping tubes with metal end caps. Fifteen containers with rockets are packed on a wooden pallet.

Land Mines

Mines contain VX and explosive charges. The mines are packaged three to a steel drum. Mine activators and fuzes are packaged separately in the same drum. Twelve drums of mines are contained on a wooden pallet.

Projectiles and Mortars

The munitions stockpile contains 105mm projectiles with GB or mustard, 155mm projectiles with GB, VX, or mustard, 8-inch projectiles with GB or VX, and 4.2-inch mortar projectiles with mustard. Some 105mm projectiles are stored as complete rounds containing fuze, burster with explosive, cartridge case and propellant, while others are stored without bursters, fuzes and propellant. Mortars and 155mm and 8-inch projectiles are also stored with and without bursters and fuzes. Mortars may contain fuzes.

The 105mm projectiles and the 4.2 inch mortar projectiles are packed 24 projectiles to a pallet.

8- and 8-inch projectiles are packaged 8 and 6 projectiles on a pallet, respectively.

There are three types of bombs, all containing GB agent. These are the MK-82 500-pound bomb, the MK-94, a 500-pound bomb, and the MK-116 500-pound bomb. The 500-pound bomb is designed to release

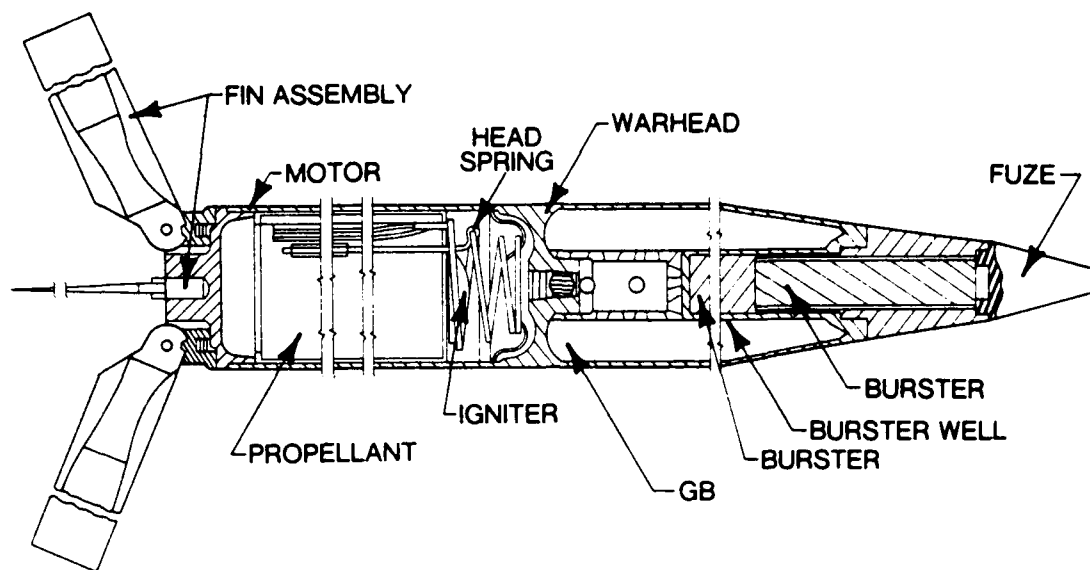
an aerosol spray of agent on detonation. The bombs are stored without explosives. The MC-1 bombs are packaged two to a wooden pallet and the others in individual metal shipping containers.

Spray Tanks

Spray tanks contain VX agent. They were designed for releasing chemical agent from slow-traveling, low-flying aircraft. The spray tanks are stored in a metal overpack container.

Bulk Agent

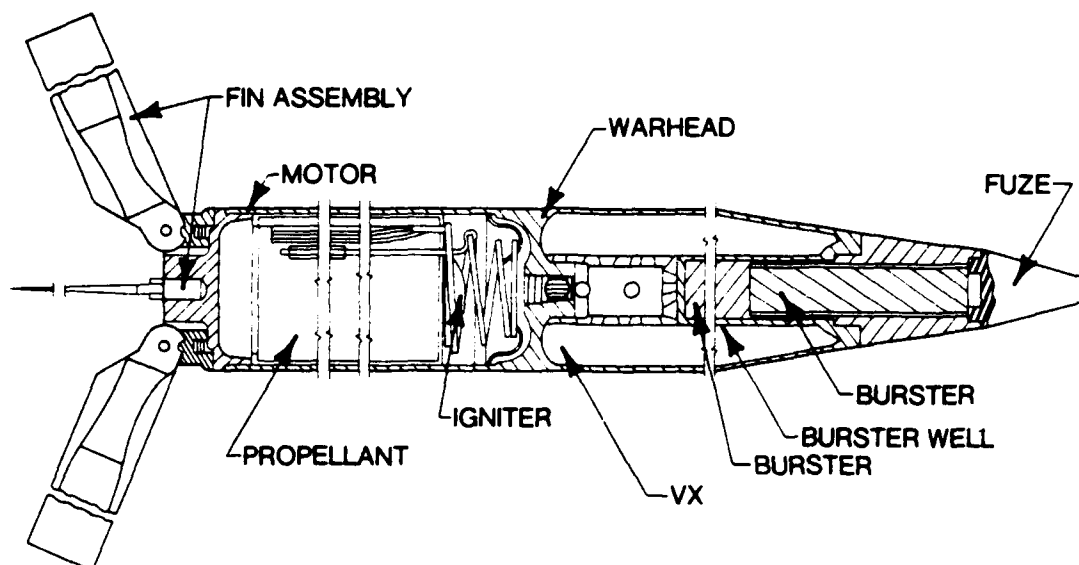
All three types of agent are stored in bulk as liquid in standard one-ton steel containers (called ton containers). Ton containers are not palletized.



LENGTH	78.0 in.
DIAMETER	115mm
TOTAL WT.	57 lb.
AGENT	GB
AGENT WT.	10.7 lb.
FUZE	M417
BURSTER	M34, M36
EXPLOSIVE	Comp B
EXPLOSIVE WT.	3.2 lb.
PROPELLANT	M28
PROPELLANT WT.	19.3
PRIMER	M62
QD/SCG	5A
PACKAGING	15 rounds/wooden pallet

Note: Stored in firing tube with fins folded toward the axis.

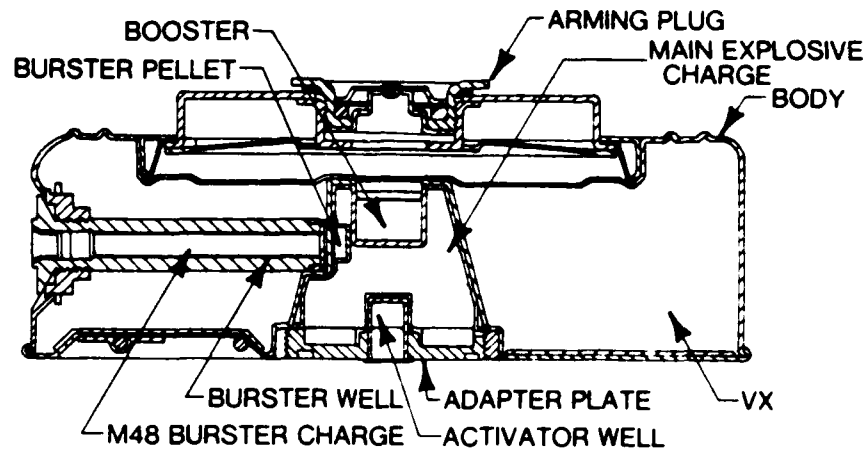
ROCKET, 115mm, GB, M55



LENGTH	78 in.
DIAMETER	115mm
TOTAL WT.	56 lb.
AGENT	VX
AGENT WT.	10.0 lb.
FUZE	M417
BURSTER	M34, M36
EXPLOSIVE	Comp B
EXPLOSIVE WT.	3.2 lb.
PROPELLANT	M67
PROPELLANT WT.	19.3 lb.
PRIMER	M62
QD/SCG	5A
PACKAGING	15 round/wooden pallet

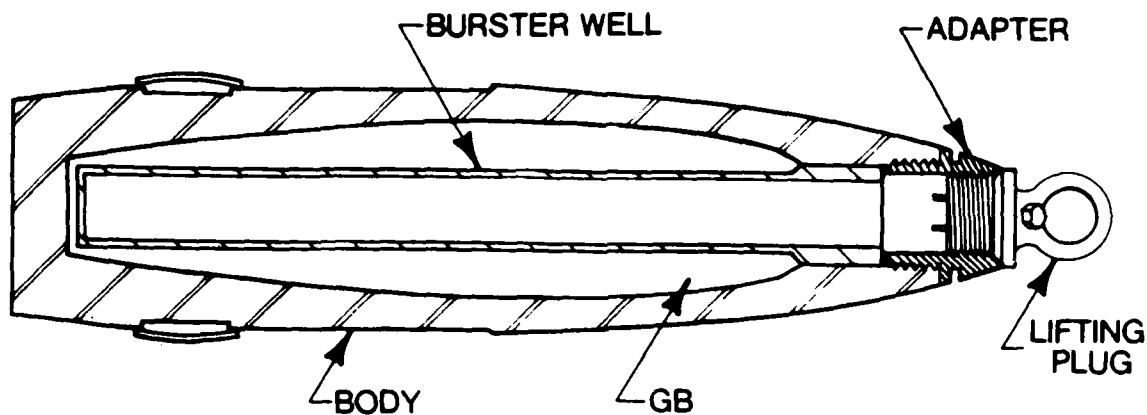
Note: Stored in firing tube with fins folded toward the axis.

ROCKET, 115mm, VX, M55



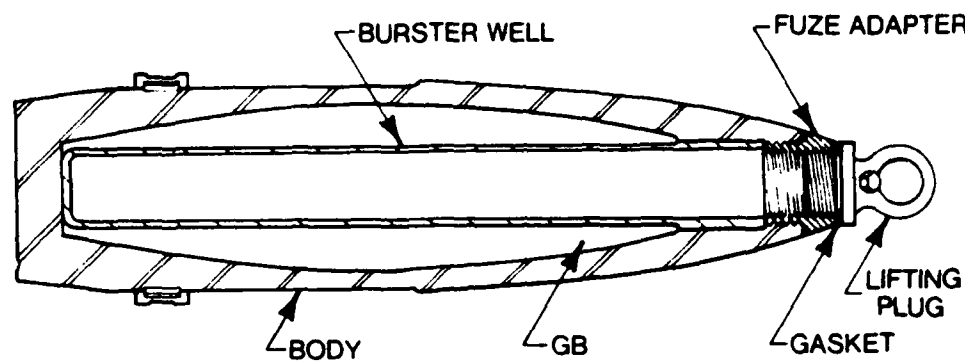
HEIGHT	5 in.
DIAMETER	13.5 in.
TOTAL WT.	23 lb.
AGENT	VX
AGENT WT.	10.5 lb.
FUZE	M603
BURSTER	M38
EXPLOSIVE	Comp B
EXPLOSIVE WT.	.8 lb.
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	N/A
QD/SCG	5A
PACKAGING	3 mines/steel drum

MINE, 2 GALLON, VX, M23



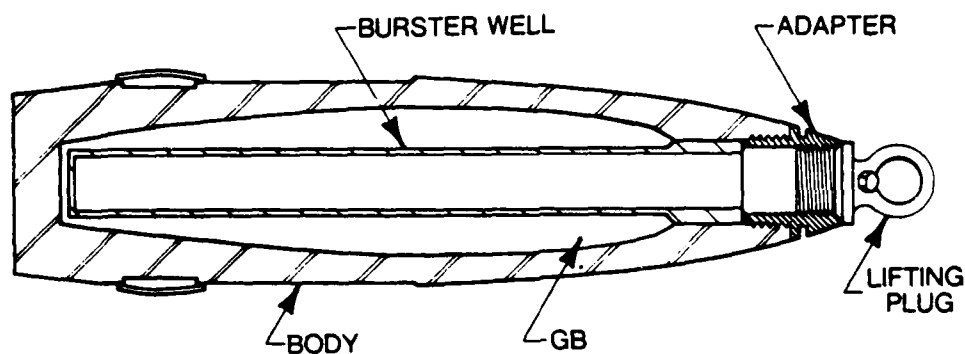
LENGTH	26.7 in.
DIAMETER	155mm
TOTAL WT.	100 lb.
AGENT	GB
AGENT WT.	6.5 lb.
FUZE	None
BURSTER	M37
EXPLOSIVE	Tetrytol
EXPLOSIVE WT.	2.75 lb.
SUPP. CHARGE	0.3 lb. Tetrytol
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	8 rounds/wooden pallet

PROJECTILE, 155mm, GB, M121



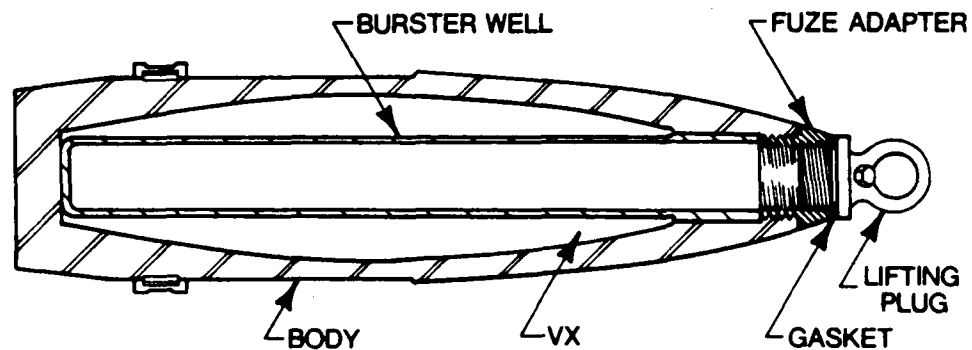
LENGTH	26.7 in.
DIAMETER	155mm
TOTAL WT.	100 lb.
AGENT	GB
AGENT WT.	6.5 lb.
FUZE	None
BURSTER	M71
EXPLOSIVE	Comp B4
EXPLOSIVE WT.	2.45 lb.
SUPP. CHARGE	0.3 lb. Tetrytol
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	8 rounds/wooden pallet

PROJECTILE, 155mm, GB, M121A1



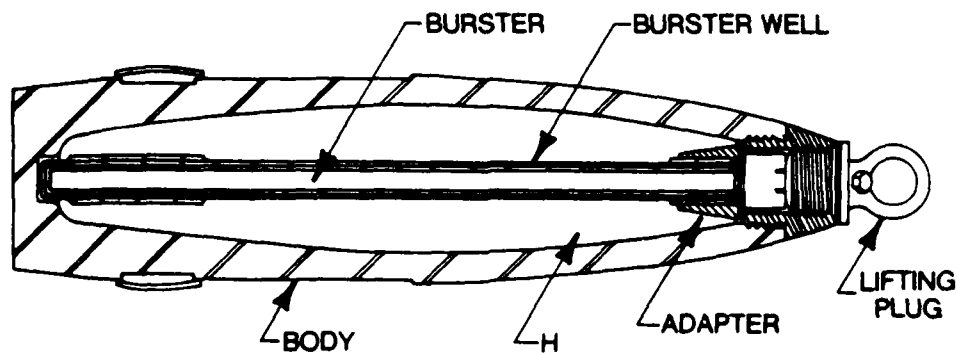
LENGTH	26.7 in.
DIAMETER	155mm
TOTAL WT.	100 lb.
AGENT	GB
AGENT WT.	6.5 lb.
FUZE	None
BURSTER	M37
EXPLOSIVE	Tetrytol
EXPLOSIVE WT.	2.75 lb.
SUPP. CHARGE	0.3 lb. TNT
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	8 rounds/wooden pallet

PROJECTILE, 155mm, GB, M122



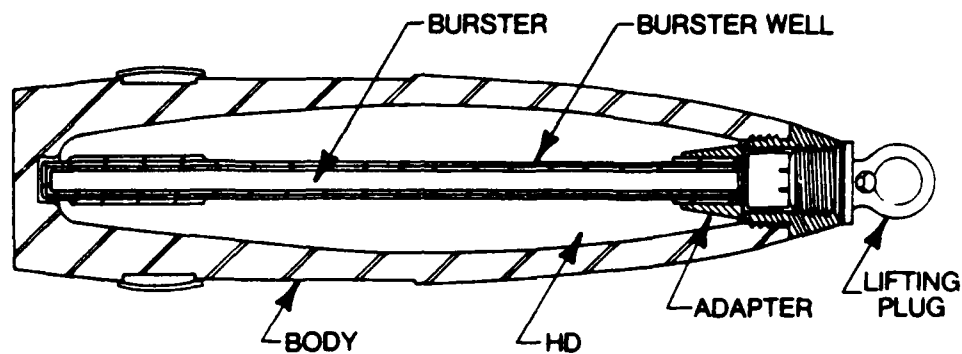
LENGTH	26.7 in.
DIAMETER	155mm
TOTAL WT.	100 lb.
AGENT	VX
AGENT WT.	6.0 lb.
FUZE	None
BURSTER	M71
EXPLOSIVE	Comp B4
EXPLOSIVE WT.	2.45 lb.
SUPP. CHARGE	0.3 lb. Tetrytol
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	8 rounds/wooden pallet

PROJECTILE, 155mm, VX, M121A1



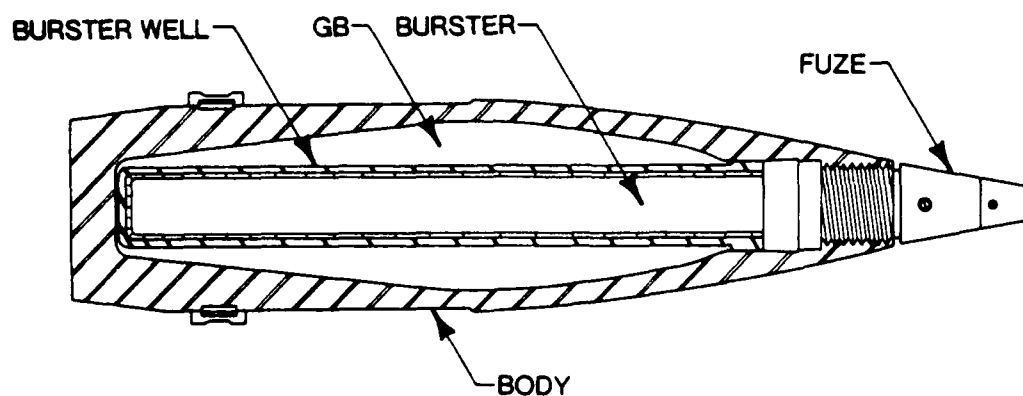
LENGTH	26.8 in.
DIAMETER	155mm
TOTAL WT.	99 lb.
AGENT	H
AGENT WT.	11.7 lb.
FUZE	None
BURSTER	M6
EXPLOSIVE	Tetrytol
EXPLOSIVE WT.	.41 lb.
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	5A
PACKAGING	6 rounds/wooden pallet

PROJECTILE, 155mm, H, M110



LENGTH	26.8 in.
DIAMETER	155mm
TOTAL WT.	95 lb.
AGENT	HD
AGENT WT.	11.7 lb.
FUZE	None
BURSTER	M6
EXPLOSIVE	Tetrytol
EXPLOSIVE WT.	.41 lb.
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	5A
PACKAGING	6 rounds/wooden pallet

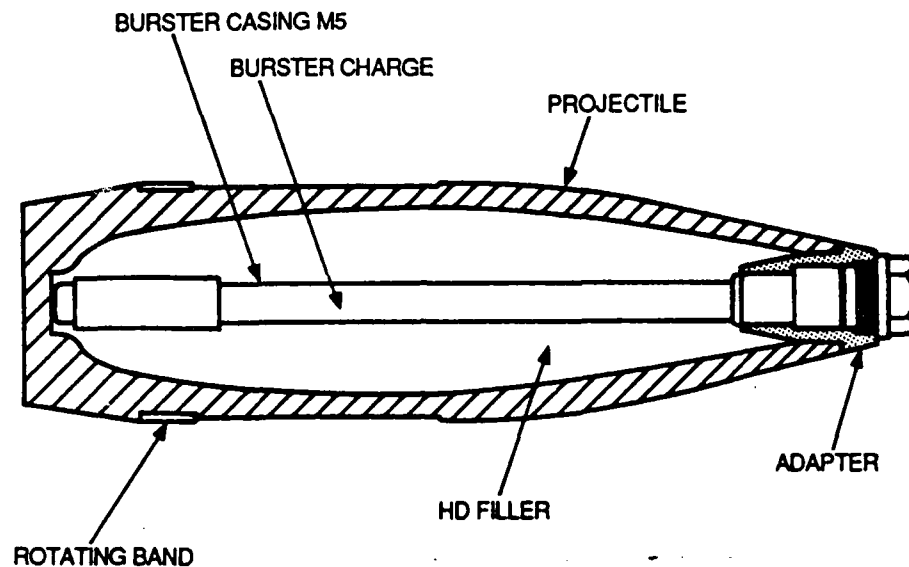
PROJECTILE, 155mm, HD, M104



LENGTH	16.0 in.
DIAMETER	105mm
TOTAL WT.	32 lb.
AGENT	GB
AGENT WT.	1.63 lb.
FUZE	M508
BURSTER	M40, M40A1
EXPLOSIVE	Tetrytol(M-40) Comp B(M40A)
EXPLOSIVE WT.	1.12 lb.
PROPELLANT	Removed
QD/SCG	5A
PACKAGING	24 projectiles/wooden pallet

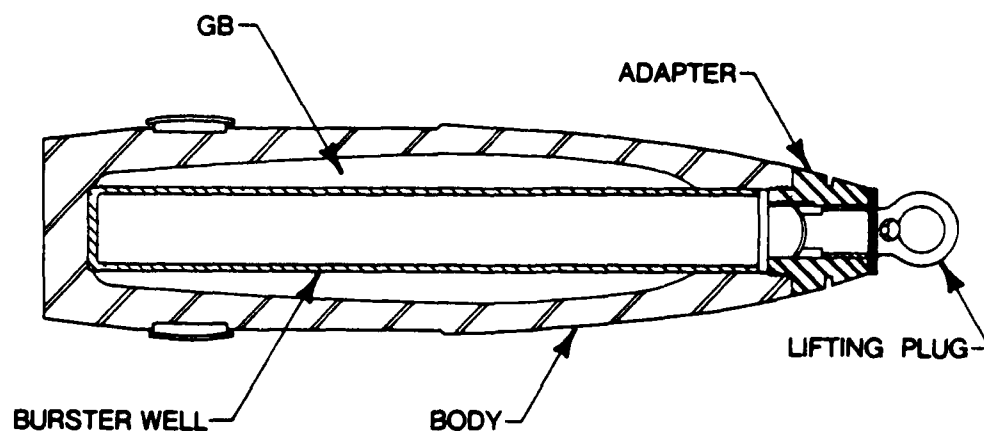
Note: Projectile is stored with and without fuze and burster.
Fuze cavity of unfuzed unburstered projectile is sealed by a closing plug.

PROJECTILE, 105mm, GB, M360



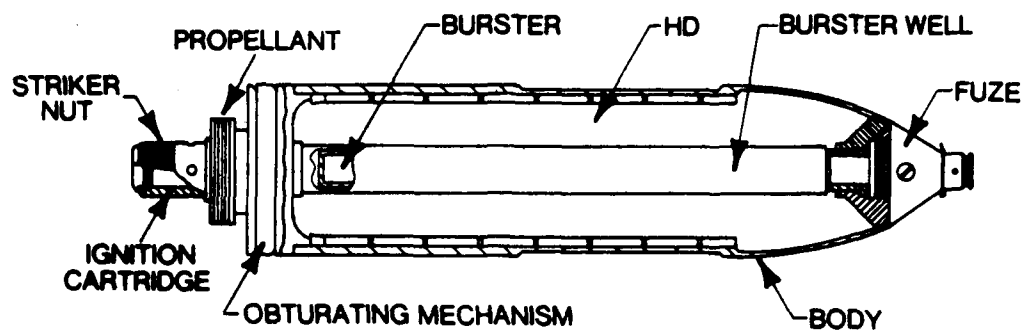
LENGTH	21.0 in.
DIAMETER	105mm
TOTAL WT.	32 lb.
AGENT	HD
AGENT WT.	3 lb.
FUZE	PD M51A5, M57
BURSTER	M5
EXPLOSIVE	Tetrytol
EXPLOSIVE WT.	0.51 lb.
PROPELLANT	Removed
PACKAGING	24 projectiles/wooden pallet

PROJECTILE, 105mm, HD, M60



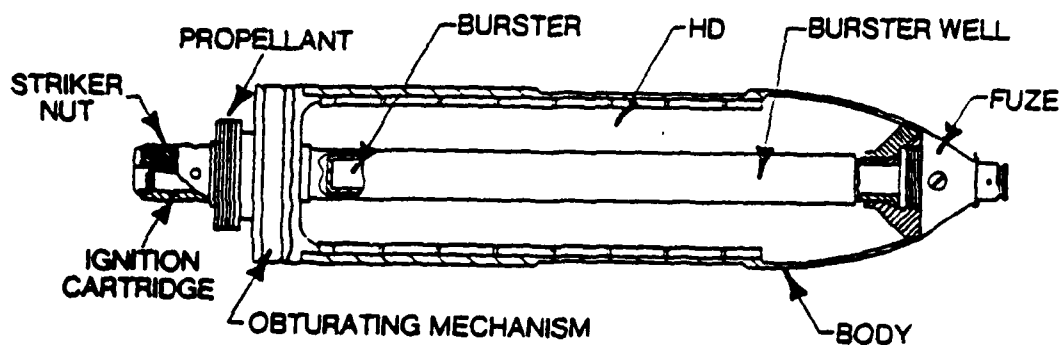
LENGTH	35.1 in.
DIAMETER	8 in.
TOTAL WT.	199 lb.
AGENT	GB
AGENT WT.	14.5 lb.
FUZE	None
BURSTER	M83
EXPLOSIVE	Comp B
EXPLOSIVE WT.	7.0 lb.
SUPP. CHARGE	0.3 lb. TNT
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	6 rounds/wooden pallet

PROJECTILE, 8 INCH, GB, M426



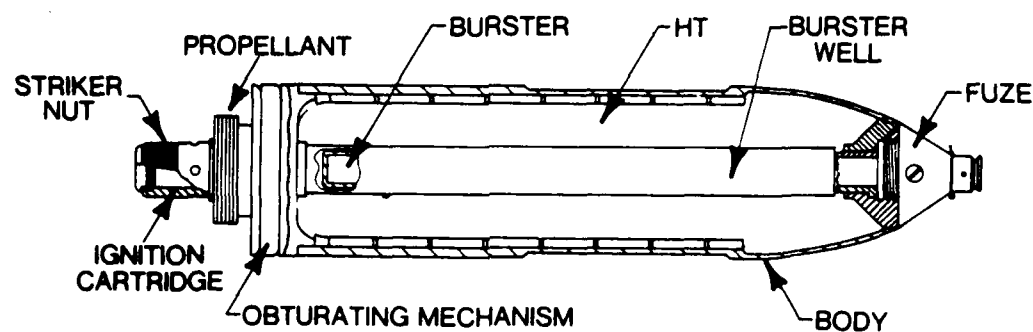
LENGTH	21.0 in.
DIAMETER	4.2 in.
TOTAL WT.	25 lb.
AGENT	HD
AGENT WT.	6.0
FUZE	M8
BURSTER	M14
EXPLOSIVE	Tetryl
EXPLOSIVE WT.	.14 lb.
PROPELLANT	Removed
PRIMER	M28A2
QD/SCG	5A
PACKAGING	24 rounds/wooden pallet

CARTRIDGE, MORTAR, 4.2 INCH, HD, M2/M2A1



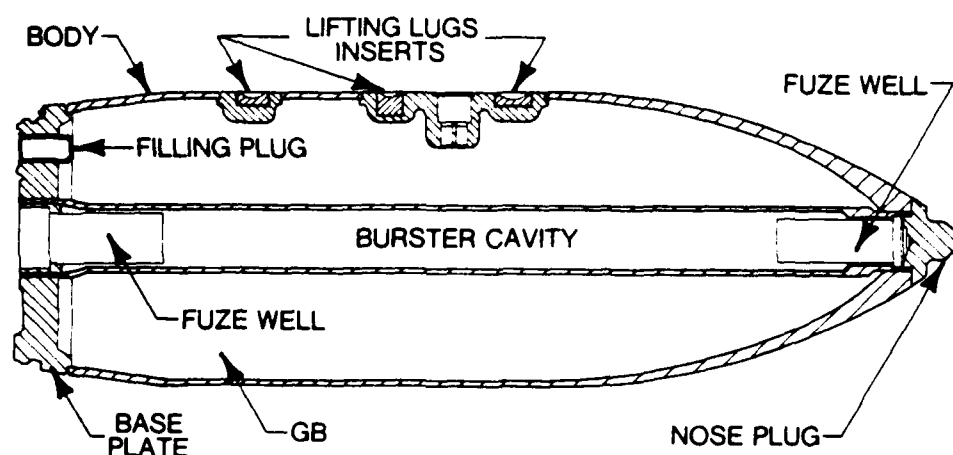
LENGTH	21.0 in.
DIAMETER	4.2 in.
TOTAL WT.	25 lb.
AGENT	HD
AGENT WT.	6.0
FUZE	M8
BURSTER	M14
EXPLOSIVE	Tetryl
EXPLOSIVE WT.	.14 lb.
PROPELLANT	Removed
PRIMER	M28A2
QD/SCG	5A
PACKAGING	24 rounds/wooden pallet

CARTRIDGE, MORTAR, 4.2 INCH, HD, M2/M2A1



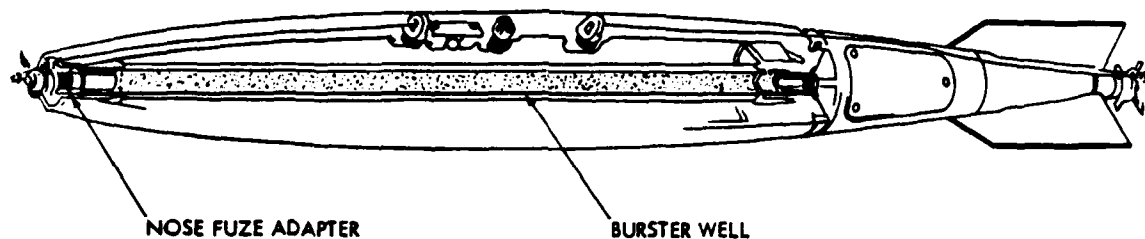
LENGTH	21.0 in.
DIAMETER	4.2 in.
TOTAL WT.	25 lb.
AGENT	HT
AGENT WT.	5.8 lb.
FUZE	M51A5
BURSTER	M14
EXPLOSIVE	Tetryl
EXPLOSIVE WT.	.14 lb.
PROPELLANT	Removed
PRIMER	M28A2
QD/SCG	5A
PACKAGING	24 rounds/wooden pallet

CARTRIDGE, MORTAR, 4.2 INCH, HT, M2/M2A1



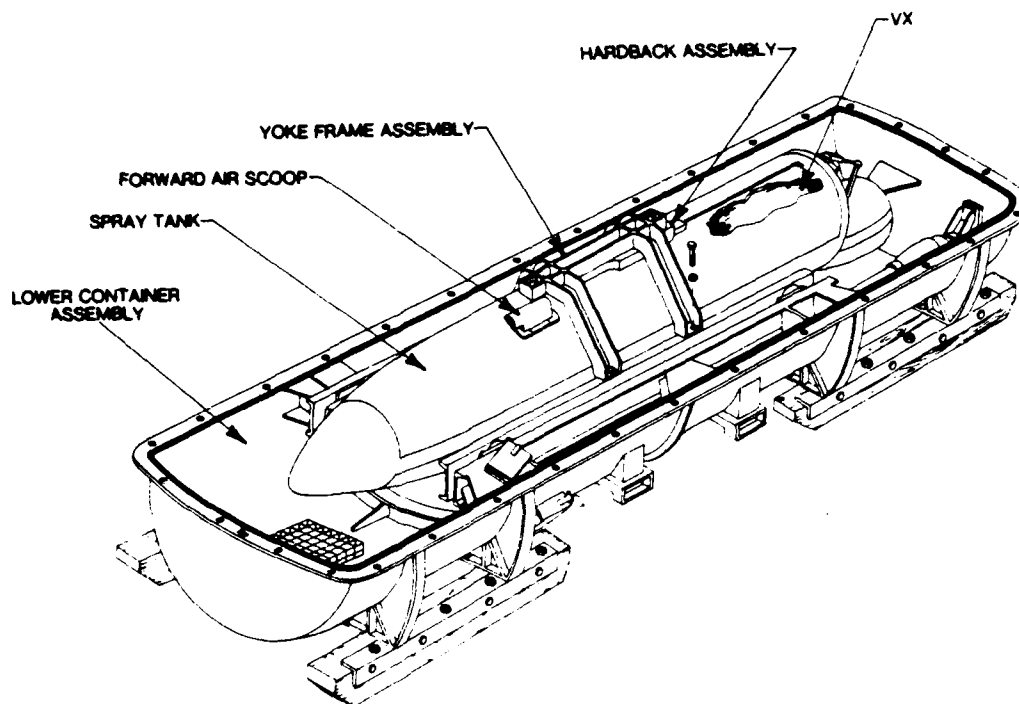
LENGTH	50 in.
DIAMETER	16 in.
TOTAL WT.	725 lb.
AGENT	GB
AGENT WT.	220 lb.
FUZE	None
BURSTER	None
EXPLOSIVE	None
EXPLOSIVE WT.	N/A
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	2 bombs/wooden pallet

BOMB, 750 LB., GB, MC-1



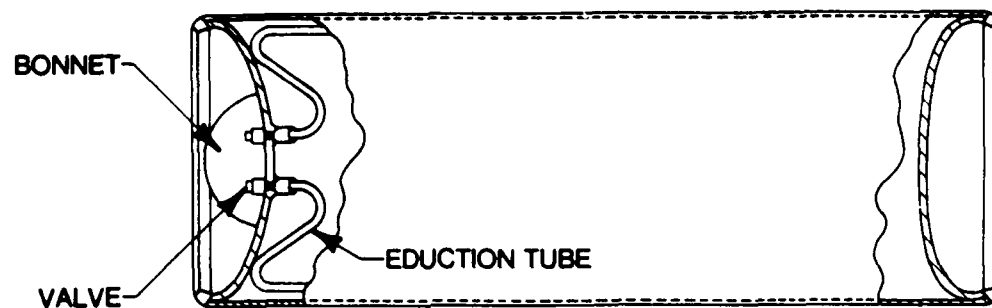
LENGTH	89 in.
DIAMETER	11 in.
TOTAL WT.	441 lb.
AGENT	GB
AGENT WT.	108
FUZE	None
BURSTER	None
EXPLOSIVE	None
EXPLOSIVE WT.	N/A
PROPELLANT	None
PRIMER	None
PACKAGING	1 bomb/pallet

BOMB, 500 LB., GB, MK 94-0



LENGTH	185 in.
DIAMETER	22.5 in.
TOTAL WT.	1935 lb.
AGENT	VX
AGENT WT.	1356 lb.
FUZE	None
BURSTER	None
EXPLOSIVE	None
EXPLOSIVE WT.	N/A
PROPELLANT	None
PROPELLANT WT.	N/A
PRIMER	None
QD/SCG	8A
PACKAGING	1 tank/steel container

TANK, SPRAY, VX, TMU-28/B



LENGTH	81.5 in.		
DIAMETER	30.1 in.		
TOTAL WT.	3100 lb.;	2900 lb.;	3000 lb.
AGENT	HD	GB	VX
AGENT WT.	1700	1500	1600
FUZE	None		
BURSTER	None		
EXPLOSIVE	None		
EXPLOSIVE WT.	N/A		
PROPELLANT	None		
PROPELLANT WT.	N/A		
PRIMER	None		
QD/SCG	8A		
PACKAGING	None		

TON CONTAINER

APPENDIX B

REGULATIONS AFFECTING
CHEMICAL AGENT AND MUNITIONS TRANSPORTATION

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REGULATIONS AFFECTING CHEMICAL AGENT AND MUNITIONS TRANSPORTATION

This appendix outlines federal regulations applicable or relevant to transportation of chemical munitions. Agencies with oversight and/or enforcement roles in this program include the U.S. Department of Transportation, the U.S. Department of Defense, the U.S. Department of Health and Human Services, and the U.S. Environmental Protection Agency.

U.S. Department of Transportation

The Hazardous Materials Transportation Act of 1974 (Public Law 93-633) seeks to "protect the nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce." Under this Act, the Department of Transportation formulates regulations in order to ensure safety in transit. These regulations cover packaging, marking, loading and handling of materials in transit, and the precautions necessary to determine whether materials to be shipped are in proper condition for transport.

Regulations of the Department of Transportation (49 CFR Parts 146, 171-178, 297 and 379) govern truck and rail transport of hazardous materials. The Department of Defense Explosives Safety Board assigns proper shipping names prior to shipment and also assigns the Department of Defense Hazard Class/Division, Department of Transportation marking and label, and Department of Defense compatibility. The hazard class is a numerical designator explosiveness (1) or toxicity (6) of the material. The hazard division is a numerical designator assigned to denote the character and the predominance of the associated hazards or property damage. Within class 1 (explosives), four divisions indicate the type of hazard expected.

<u>Hazard Class/Division</u>	<u>Hazards</u>
1.1	Mass detonating
	Non-mass detonating
1.2	Fragment producing
1.3	Mass fire
1.4	Moderate fire - no blast

For hazard class 6, only one division is utilized for ammunition (division 1), which denotes poisonous (toxic) substances.

Once the proper shipping name is obtained, the hazardous materials table in 49 CFR Part 172.101 may be used to determine applicable packaging requirements and transportation mode limitations.

According to 49 CFR 173.59 the requirements for transporting explosive chemical munitions are the same as for Class A explosives as described in Part 173.56: "these items can be shipped by and for the Department of Defense and in accordance with established practices and procedures specified by the Department of Defense. Nonexplosive chemical munitions may be shipped only by, for or to the DoD. The packaging, marking, and labeling is as required by DOD regulations."

U.S. Department of Defense

Public Law 91-121 requires the following actions be completed prior to the transportation of chemical munitions between military installations:

1. The Secretary of Defense has determined that the proposed transportation is necessary and in the interest of national security.
2. The Secretary of Defense has brought the particulars of the proposed move (disposal or transportation) to the attention of the Secretary of the Department of Health and Human Services.
3. The Secretary of Defense has implemented any precautionary measures recommended by the Secretary of the Department of Health and Human Services.
4. The Secretary of Defense has provided notification of the move to the Congress of the United States and the governors of the states affected by the move.

In addition, the Defense Appropriations Act of 1986 (Public Law 99-145) requires coordination with the Department of Health and Human Services, the Environmental Protection Agency, and the Department of Defense Explosives Safety Board.

Army Regulation 50-6 implements the Chemical Surety Program, and includes safety guidelines, chemical surety duty positions, transportation policies, and Department of Defense physical security requirements for chemical surety material. Section 3.0 of this regulation delineates requirements for personnel selection and tracking for chemical surety duty positions. Section 4.0 states policies for transport of chemical surety materiel including: "safety procedures for movement within the Continental United States will provide for a level of protection equal to or greater than that required by the Department of Transportation." Other policies, administrative and operational procedures, and requirements may be found in Section 4.0. Section 5.0 addresses the Army's Chemical Accident and Incident Response and Assistance.

System Safety Program Requirements for Department of Defense are contained in MIL-STD-882B:

This standard provides uniform requirements for developing and implementing a system safety program of sufficient comprehensiveness to identify the hazards of a system and to impose design requirements and management controls to prevent mishaps by eliminating hazards or reducing the associated risk to a level acceptable to the managing activity.

Implementation of selected portions of this standard could be used to comprehensively address the safety requirements in the transport of the chemical stockpile program. For example, hazard analyses, human factors considerations, and system safety program plan guidelines should be integrated into the plan, if transportation alternatives are implemented.

U.S. Department of Health and Human Services

Pursuant to Public Law 91-221, the Secretary of the Department of Health and Human Services establishes a committee to review and approve the operation plans, procedures, and equipment used in a proposed move of chemical munitions. The committee includes members of the U.S. Department of Interior and the Department of Transportation.

U.S. Environmental Protection Agency

In November 1980, the Army made effective a new policy and guidance for considering environmental effects in the Army decision-making process (32 CFR, Parts 650-651). This policy sets up a Council on Environmental Quality Regulation to implement the National Environmental Policy Act. Therefore, an Environmental Impact Statement is required for proposed actions that involve the production, storage, transportation, use and disposal of hazardous or toxic materials that have potential to cause significant environmental effects.

The Army has declared that the M55 rockets are obsolete. In discussions with the Environmental Protection Agency, the rockets were classified as hazardous wastes subject to management regulations promulgated under the Resource Recovery and Conservation Act. Thus, demilitarization facilities will be permitted and operated in compliance with all applicable Resource Conservation and Recovery Act regulations, whether the program is administered on a state or federal level.

APPENDIX C

PANEL RECOMMENDATIONS ON PREPARATION AND
PACKAGING BY MUNITION TYPE

APPENDIX C

PANEL RECOMMENDATIONS ON PREPARATION AND PACKAGING BY MUNITION TYPE

The munitions can be categorized into three groups: those containing agent only; those containing agent and explosive bursters; and those containing agent, bursters, fuzes, and propellants. The panel developed specific recommendations for the preparation and packaging for each of the munitions.

Group 1 Munitions: Agent Only

These munitions contain agent only and are configured in ton containers, spray tanks, and bombs.

Ton Containers. First, replace all plugs and valves on all ton containers. This will provide the first level of defense against release.

Second, the exterior overpack should provide for insulation and sufficient strength for proper blocking and bracing. The ton tanks are strong containers. This should be taken into account in designing to meet the accident survival criteria.

Spray Tanks. Spray tanks are already stored in overpacks. These overpacks should be inspected for leaks with leakers overpacked again.

Bombs. Inspect bombs for leakers. Examine or test all bombs for corrosion which may lead to leaking. Overpack leakers and corroded bombs. If tests are infeasible, overpack all bombs for first level leak protection.

The system consisting of the exterior packaging and the bombs should provide for fire and crash protection.

Group 2 Munitions: Agent and Bursters

Group 2 munitions consist of the projectiles of different sizes and land mines with their fuzes removed. These munitions contain agent and explosive explosives.

Projectiles. The projectiles are thick-walled munitions with burster explosives. The preparation and packaging requirements are similar to bombs. Inspect the projectiles for leakers. Examine or test all projectiles for corrosion which may lead to leaking. Overpack leakers and corroded projectiles. If these tests are infeasible, then overpack all projectiles for first-level leak protection. The projectiles and the

exterior overpack provide the fire and impact survivability in the event of an accident.

Land Mines. Land mines are currently stored in 30-gallon drums with their fuzes placed separately in the top tier. Since the fuzes may be removed by opening the drum and lifting out the fuze tray, they should be first removed. The drums should then be inspected for leaks and corrosion and resealed. The leaking and/or corroded drums should be replaced. Exterior overpacking requirements follow as in the other cases for accident survivability.

Group 3 Munitions: Agent, Bursters, Fuzes, and Propellants

These munitions consist of 105mm cartridges, 4.2-inch cartridges, and M55 rockets. These munitions contain agents, burster explosives, fuzes, and propellants.

Cartridges. The propellants on both the 105mm and the 4.2-inch cartridges are relatively easy to remove. They have been designed to have portions of propellants removed in the field to suit specific firing range requirements. The propellants should first be removed prior to shipment. The preparation and packaging requirements then reduce to the case of projectiles.

Rockets. The M55 rocket is a fully-assembled weapon containing agent, fuze, burster and rocket propellant. The propellant is kept stable by means of a stabilizer which is consumed in the act of stabilizing. When the stabilizer is depleted, the rocket propellant could auto-ignite with possible significant release of agent.

The rockets were manufactured, transported to, and stored at their current sites in the early 1960s. They have a history of developing leaks. In a recent sample assay, the level of stablizer still remaining was determined to be adequately high, and the rockets are, therefore, currently stable. What is uncertain is how much longer the propellants will remain stable. There is no reliable theory to predict the depletion rate of the stabilizer, and the data needed to construct an extrapolation are currently insufficient.

In addition to the uncertainty with respect to the future stability of the propellants, there are insufficient data on the impact threshold for ignition. In a 1970 test, 45 rockets in only their shipping tubes were dropped 40 feet onto a concrete pad. In two cases, the rockets ignited. However, there is insufficient information as to the effect of packaging and shock absorption. There is a similar lack of information as to the likelihood and extent of sympathetic ignitions of rockets placed in proximity should one ignite.

Unless these uncertainties are resolved, separation of the toxic and explosive hazards prior to shipment represents the safest way to transport the rockets. It is recognized that the hazard separation process adds to the risk at the facilities. How these risks trade off is beyond the scope of the panel's charter.

If the explosive and agent hazards are separated, then the transportation requirement becomes one of transporting agent alone and explosive munitions with some residual agent. The agent can be loaded and transported in small, strong containers analogous to the ton containers described previously.

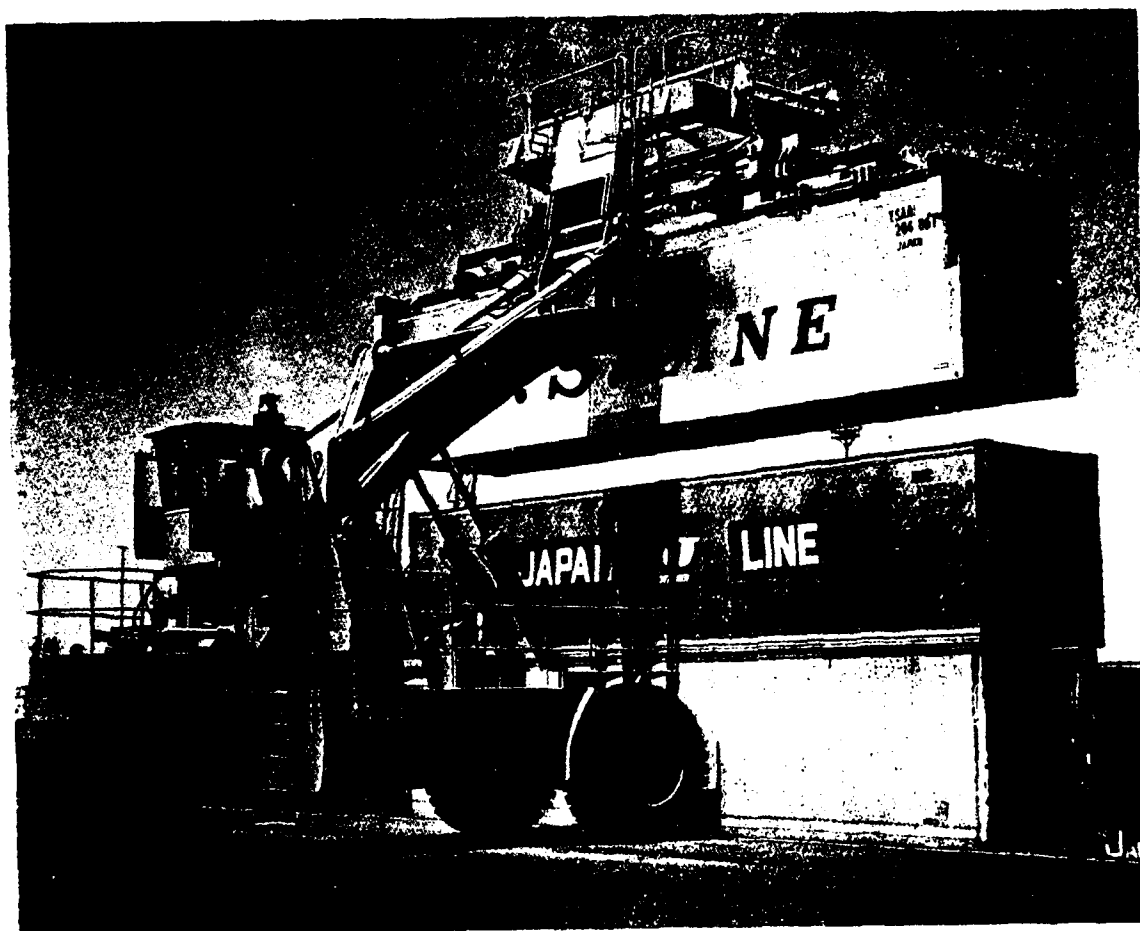
The explosive munitions can be transported according to prescribed Department of Defense procedures.

If the rockets must be shipped in their existing configuration, the precise packaging system requirements should be determined only after a comprehensive test program has been carried out to resolve the impact threshold and sympathetic detonation questions. These tests should be designed to yield such information as the type of cushioning needed to ensure nonignition, and dunnage concepts to eliminate sympathetic ignition if a single rocket ignited.

The total packaging system should provide the redundant leak protection for normal transport and system leak protection in the event of an accident.

APPENDIX D

TYPICAL INTERMODAL CONTAINER HANDLING EQUIPMENT



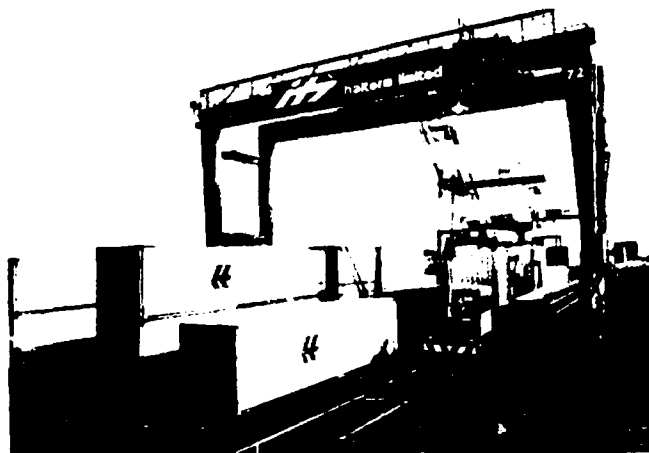
Courtesy of Mi-Jack Products

Typical Wheeled Container Loading Vehicle.

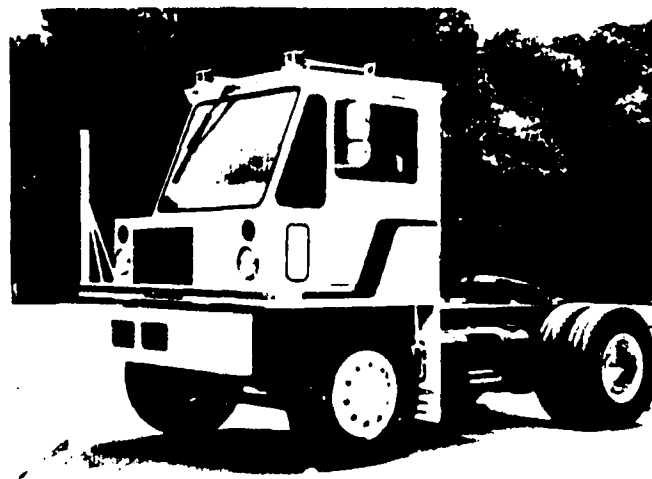


Courtesy of Mi-Jack Products

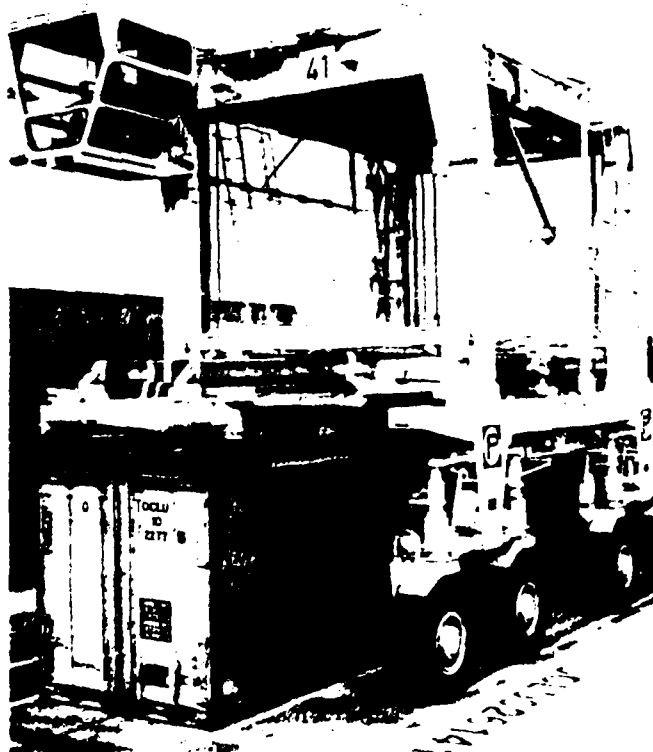
Typical Container Stacking Crane.



Stacking cranes are used to stack containers on the ground, on railcars or on chassis pulled by motor trucks.



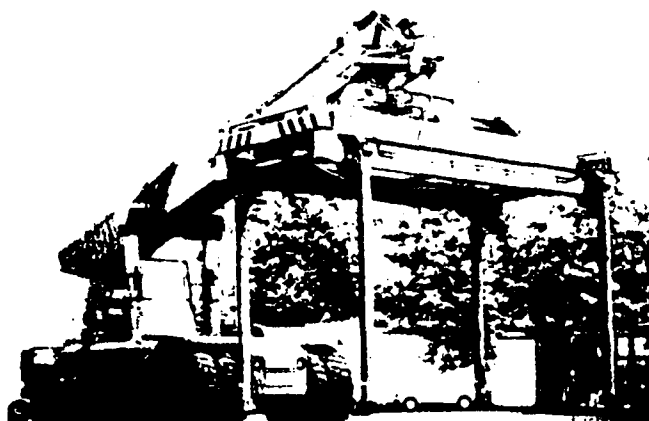
Yardhorses or spotting tractors are designed for fast movement of containers on chassis within terminal areas.



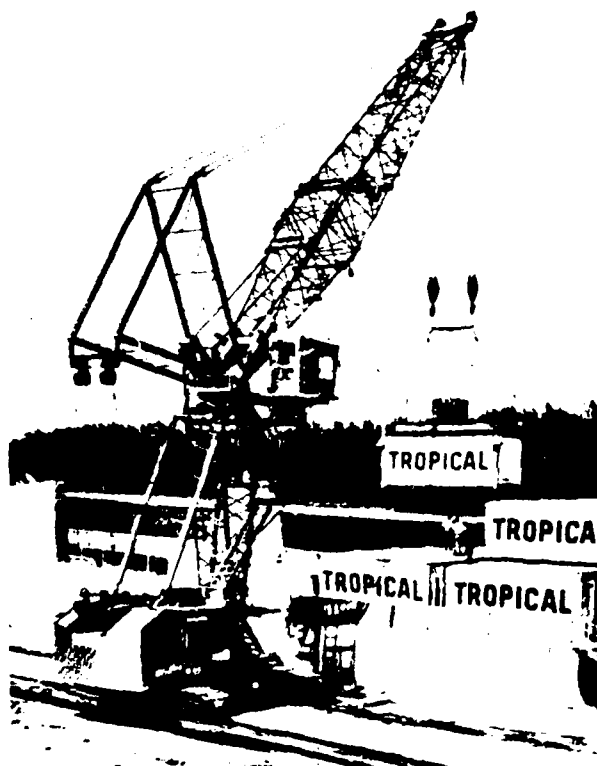
Straddle carriers are used to transfer containers to and from cranes.



Lift truck equipped with a container handling spreader for moving and stacking 20- to 40-foot containers.



Container handlers use a boom to move and stack containers.



Hinged boom crane loads containers aboard barge.



Gantry cranes being used to load containers aboard ocean carrier at the Port of Seattle

APPENDIX E

SECURITY PROCEDURES DURING RAILROAD TRANSPORT
OF CHEMICAL AGENTS AND MUNITIONS

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SECURITY PROCEDURES DURING RAILROAD TRANSPORT OF CHEMICAL AGENTS AND MUNITIONS

A Technical Escort (TE) officer would be responsible for the custody, safety, and security of the chemical munition stocks while en route. A total of 18 TE personnel, divided between the weapons and pilot trains, would be required. These individuals would be on duty 7 days per week and would be responsible for their supplies, including decontamination equipment.

The two-man rule will apply during all safety and security operations. The two-man rule requires the presence of two authorized personnel, each capable of detecting incorrect or unauthorized procedures with respect to the task to be performed and familiar with applicable safety and security requirements. Two authorized personnel shall be considered to be present when they are in a physical position from which they can positively detect incorrect or unauthorized procedures with respect to the task and/or operation being performed. When application of the two-man rule is required, it shall be constantly enforced by the personnel who make up the team, both while they are accomplishing the task or operation assigned and until they leave the area which permits access. The security force shall assure that no lone individual is permitted in a limited and/or exclusion area unless he is further controlled by technical safety escort personnel.

Sufficient guards will accompany the trains en route such that there are two guards per munition car. At any stop, guards will dismount, using the two-man rule and maintain a walking guard on each side of the rail car until time for the train to depart. During this period, the guards will inspect the exterior of the rail cars. If an unsafe condition is found, this information will be reported immediately to the convoy Technical Escort Unit commander. Caution must be exercised during short non-scheduled stops. Direction to dismount will be provided by the train technical escort commander or his designee.

The following security control procedures will be adhered to:

- The cargo will be under surveillance of the assigned security escort guard personnel at all times while in transit.
- Security surveillance over carriers while in a moving situation will be maintained by security guards posted in strategically located guard rail cars, so as to observe and preclude unauthorized access or damage to the material being protected.

- Security surveillance over carriers in a fixed or stationary situation awaiting further movement or awaiting release to an authorized consignee will be maintained by close-in dismounted security guards. When close-in security surveillance might be better maintained from guard escort vehicles, or similar locations, to avoid inviting public attention to the protected material, the employment of security guards in dismounted or walking situations will not be required.
- Written guard orders will be provided for each guard post and will be carried by the guard at all times while on duty, except as provided below. Guard orders will be worded carefully, clearly, and as concisely as possible to facilitate thorough understanding by the guards.
- In cases where displayed or carried guard orders would constitute a security risk in themselves, they will not be carried.
- The train Technical Escort commander will ascertain immediately prior to each mission that each guard thoroughly understands the guard orders for his assigned post.

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