

February 1997

CHEMICAL WEAPONS AND MATERIEL

Key Factors Affecting Disposal Costs and Schedule





**National Security and
International Affairs Division**

B-266135

February 10, 1997

The Honorable Ted Stevens
Chairman
The Honorable Daniel K. Inouye
Ranking Minority Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Floyd D. Spence
Chairman
The Honorable Ronald V. Dellums
Ranking Minority Member
Committee on National Security
House of Representatives

The Honorable C.W. Bill Young
Chairman
The Honorable John P. Murtha
Ranking Minority Member
Subcommittee on National Security
Committee on Appropriations
House of Representatives

This report describes the Department of Defense's programs for destroying the U.S. stockpile of chemical munitions and planning for the disposal of nonstockpile chemical warfare materiel. The programs' combined life-cycle cost estimate is \$27.6 billion, which includes \$12.4 billion for the Chemical Stockpile Disposal Program and \$15.2 billion for the Nonstockpile Chemical Materiel Program. This report provides an overall assessment of the programs' cost and schedule, alternatives for improving program effectiveness and efficiency, and actions the Army has and is taking to improve the programs.

Should the Congress wish to consider changing the programs' current path, this report discusses several options for addressing the key factors affecting the programs. We are not taking a position on the options or current approach, rather the options are presented in context of the tradeoffs they present.

We prepared this report under our basic legislative responsibilities. We are providing it to you because of your oversight responsibilities for chemical weapons disposal programs.

B-266135

We are sending copies of this report to the Secretaries of Defense and the Army, the Director of the Office of Management and Budget, and other interested parties. We will make copies available to others upon request.

This report was prepared under the direction of David R. Warren, Director, Defense Management Issues, who may be reached at (202) 512-8412 if you or your staff have any questions. Other major contributors are listed in appendix VI.

A handwritten signature in cursive script that reads "Henry L. Hinton, Jr." The signature is written in black ink and is positioned above the printed name and title.

Henry L. Hinton, Jr.
Assistant Comptroller General

B-266135

Executive Summary

Purpose

Since 1985, the Army has spent \$3.2 billion on its programs for destroying the U.S. stockpile of chemical munitions and planning for the disposal of nonstockpile chemical warfare materiel. Today, the programs are still in the early stages of implementation and the Army estimates that \$24.4 billion more will be needed to complete them.¹ Since 1990, GAO has issued a number of reports addressing opportunities to improve various aspects of the disposal programs. Due to continuing congressional and public interest about the progress and cost of the programs, GAO prepared this report under its basic legislative responsibilities to provide an overall assessment of the (1) programs' cost and schedule, (2) alternatives for improving program effectiveness and efficiency, and (3) actions the Army has and is taking to improve the programs.

Background

In 1985, the Congress passed Public Law 99-145 directing the Army to destroy the U.S. stockpile of obsolete chemical agents and munitions. The stockpile consists of rockets, bombs, projectiles, spray tanks, and bulk containers, which contain nerve and mustard agents. It is stored at eight sites in the continental United States and on Johnston Atoll in the Pacific Ocean. To comply with congressional direction, the Army established the Chemical Stockpile Disposal Program and developed a plan to incinerate the agents and munitions on site in specially designed facilities. Recognizing that the stockpile program did not include all chemical warfare materiel requiring disposal, the Congress directed the Army in 1992 to plan for the disposal of materiel not included in the stockpile. This materiel, some of which dates back as far as World War I, consists of binary chemical weapons, miscellaneous chemical warfare materiel, recovered chemical weapons, former production facilities, and buried chemical warfare materiel.² In 1992, the Army established the Nonstockpile Chemical Materiel Program to dispose of the materiel.

In 1993, the United States signed the U.N.-sponsored Chemical Weapons Convention. In October 1996, the 65th nation ratified the convention making the treaty effective on April 29, 1997.³ If the U.S. Senate approves

¹The programs' combined life-cycle cost estimate is \$27.6 billion. This amount includes \$12.4 billion for the Chemical Stockpile Disposal Program and \$15.2 billion for the Nonstockpile Chemical Materiel Program.

²Binary weapons are formed from two nonlethal elements through a chemical reaction after the munitions are fired or launched. The weapons were manufactured, stored, and transported with only one of the chemical elements in the weapon. The second element was to be loaded into the weapon at the battlefield.

³The convention becomes effective 180 days after the 65th nation ratified the treaty.

the convention, it could affect implementation of the disposal programs.⁴ Through ratification, the United States will agree to dispose of its (1) unitary chemical weapons stockpile, binary chemical weapons, recovered chemical weapons, and former chemical weapon production facilities by April 29, 2007, and (2) miscellaneous chemical warfare materiel by April 29, 2002. If a country is unable to maintain the convention's disposal schedule, the convention's Organization for the Prohibition of Chemical Weapons may grant a one-time extension of up to 5 years. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. Should the United States choose to excavate the sites and remove the chemical materiel, the provisions of the convention would apply. As of December 1996, the Senate has not approved the convention. However, the United States is still committed by public law to destroying its chemical stockpile and related warfare materiel.

In prior reports, GAO expressed concern about the Army's lack of progress and the rising cost of the disposal programs. (See Related GAO Products.) In 1991, GAO reported that continued problems in the program indicated that increased costs and additional time to destroy the chemical stockpile should be expected. GAO recommended that the Army determine whether faster and less costly technologies were available to destroy the stockpile.⁵ In a 1995 report on the nonstockpile program, GAO concluded that the Army's plans for disposing of nonstockpile chemical warfare materiel were not final and, as a result, its cost estimate was likely to change.⁶ On July 13, 1995, GAO testified that the Army had experienced significant cost growth and delays in executing its stockpile disposal program and that further cost growth and schedule slippages could occur.⁷

Results in Brief

While there is general agreement about the need to destroy the chemical stockpile and related materiel, progress has slowed due to the lack of consensus among the Department of Defense (DOD) and affected states and localities about the destruction method that should be used. As a result, the cost and schedule for the disposal programs are uncertain.

⁴Under the U.S. Constitution, treaties must be approved by a two-thirds majority of the Senate.

⁵Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991).

⁶Chemical Weapons Disposal: Plans for Nonstockpile Chemical Warfare Materiel Can Be Improved (GAO/NSIAD-95-55, Dec. 20, 1994).

⁷Chemical Weapons Disposal: Issues Related to DOD's Management (GAO/T-NSIAD-95-185, July 13, 1995).

However, they will cost more than the estimated \$24.4 billion above current expenditures and take longer than currently planned. The key factors impacting the programs include public concerns over the safety of incineration, compliance with environmental laws and regulations, legislative requirements, and the introduction of alternative disposal technologies.

The Chemical Stockpile Disposal Program cost and schedule are largely driven by the degree to which states and local communities are in agreement with the proposed disposal method at the remaining stockpile sites. Based on program experience, reaching agreement has consistently taken longer than the Army anticipated. For example, the Army has consistently underestimated the time required to obtain environmental permits for the disposal facilities. Furthermore, congressional direction in the 1997 Authorization and Appropriations Acts to research and develop alternative technologies to destroy assembled chemical munitions indicates that there are continued public concerns about the proposed disposal method. Until DOD and the affected states and localities reach agreement on a disposal method for the remaining stockpile sites, the Army will not be able to predict the Chemical Stockpile Disposal Program cost and schedule with any degree of accuracy. Moreover, many of the problems experienced in the stockpile program are also likely to affect the Army's ability to implement the Nonstockpile Chemical Materiel Program. For example, efforts to dispose of nonstockpile materiel are likely to be driven by the need to obtain state and local approvals for destruction methods. In addition, more time is needed for the Army to prove that its proposed disposal method for the nonstockpile program will be safe and effective and accepted by the affected states and localities.

Recognizing the difficulty of satisfactorily resolving the public concerns associated with each individual disposal location, suggestions have been made by members of the Congress, DOD officials, and others to change the programs' basic approach to destruction. However, the suggestions create trade-offs for decisionmakers and would require changes in existing legal requirements. These suggestions have included deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed, consolidating disposal operations at a national or regional sites, destroying selected nonstockpile chemical warfare materiel in stockpile disposal facilities, establishing a centralized disposal facility for nonstockpile materiel, and modifying existing laws and regulations to standardize environmental requirements.

Notwithstanding these overarching issues, DOD and the Army have taken actions in response to congressional direction and GAO recommendations to improve program management. In December 1994, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program. The objectives of the designation were to stabilize the disposal schedules, control costs, and provide more discipline and higher levels of program oversight. In addition, the Army initiated actions to identify options for reducing costs. Army officials have identified cost-reduction initiatives, which are in various stages of assessment, that could potentially reduce program costs by \$673 million. However, the Army cannot implement some of the more significant initiatives without the cooperation and approval of state regulatory agencies.

Principal Findings

The Stockpile Program's Cost and Schedule Are Uncertain, but Will Exceed Current Estimates

The stockpile program will likely exceed its \$12.4 billion estimate and take longer than the legislative completion date of December 2004.⁸ This is because reaching agreement on site specific disposal methods has consistently taken longer than the Army anticipated. Public concerns about the safety of incineration have (1) resulted in additional environmental requirements, (2) slowed the permitting of new incinerators, and (3) required the Army to research disposal alternatives.

Since 1985, the Army's cost estimate for the stockpile disposal program has increased seven-fold, from an initial estimate of \$1.7 billion to \$12.4 billion, and the planned completion date has been delayed from 1994 to 2004. Although the Army is committed to destroying the stockpile by the legislatively imposed deadline of December 31, 2004, it is unlikely to meet that date. Only two of the nine planned disposal facilities are built and operating, 4 percent of the stockpile has been destroyed, and environmental permitting issues at the individual sites continue to delay construction of the remaining facilities. For example, since the Army developed the most recent cost and schedule estimate in February 1996, the plant construction schedule has slipped at Anniston, Alabama; Blue Grass, Kentucky; Pine Bluff, Arkansas; Pueblo, Colorado; and Umatilla, Oregon.

⁸Approximately \$1 billion of the estimated \$12.4 billion is associated with the Chemical Stockpile Emergency Preparedness Program.

Predicting the disposal schedule for the various sites is difficult. According to Army officials, this is partly due to the uncertainty of the time required to satisfy changing environmental requirements. For example, although based on federal requirements, individual state environmental requirements differ and are occasionally changed. In addition, according to the Army, the original scope of the health risk assessment to operate the disposal facilities was not completely defined, the health assessment requirements have changed, and the requirements currently vary from state to state. According to DOD officials, states have modified the requirements of their health risk assessments well into the process, delaying the development of the final assessment document. According to Environmental Protection Agency officials, the agency has issued several guidance documents concerning health risk assessments and has tried to keep the Army informed of the changes and updates in the guidance. In addition, the Environmental Protection Agency has advised the Army to meet with state officials early in the process to agree on the methodology and standards to use in the development of the assessments.

Based on program experience, the Army's 1996 schedule does not provide sufficient time for the Army to complete the environmental approval process.⁹ For example, the schedule for the Anniston disposal facility includes a grace period of a month for any slippage in the construction, systemization, or operation to meet the legislative completion date of December 31, 2004. Although the Army estimated that the permit would have been issued by the end of September 1996, Alabama regulatory officials expect the permit to be issued in June or July 1997—a slippage of approximately 8 months in the schedule. The Army's revised schedule shows Alabama issuing the permit at the end of March 1997. Based on current expectations, disposal operations at Anniston would extend to mid-2005.

In the 1997 National Defense Authorization Act, the Congress directed DOD to conduct an assessment of alternative technologies for the disposal of assembled chemical munitions.¹⁰ The act also directed the Secretary of Defense to report on the assessment by December 31, 1997. Similarly, the 1997 DOD Appropriations Act provided \$40 million to conduct a pilot

⁹Department of Defense's Interim Status Assessment for the Chemical Demilitarization Program, DOD (Apr. 15, 1996).

¹⁰In the 1993 National Defense Authorization Act, the Congress directed the Army to report on potential technological alternatives to incineration. Consequently, in August 1994, the Army initiated a program to investigate, develop, and support testing of alternative disposal technologies for the two bulk-only stockpile sites—Aberdeen Proving Ground, Maryland, and Newport Chemical Activity, Indiana. This program is still in the development and testing phase.

program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. The act also prohibited DOD from obligating any funds for constructing disposal facilities at Blue Grass, Kentucky, and Pueblo, Colorado, until 180 days after the Secretary reports on the alternatives. Although the prohibition applies only to Blue Grass and Pueblo, public concerns about incineration may prompt state regulators at other locations to delay their final decisions to permit incinerators until the Secretary reports his findings.

According to Army officials, alternative technologies may not reduce costs or shorten disposal operations but are likely to be acceptable to a larger segment of the public than incineration. The Army is currently researching technological alternatives to dispose of chemical agents at the two bulk-only stockpile sites. It is also planning to develop a program to respond to recent congressional direction to research alternative technologies to dispose of assembled chemical munitions. According to the National Research Council, the Army has successfully involved the state and the public in its alternative technology project for the two bulk-only stockpile sites, demonstrating the importance of public involvement to the progress of a program.¹¹ The development of alternative disposal technologies for assembled chemical munitions provides the Army the mechanism for encouraging public involvement and establishing common objectives for the remaining disposal sites.

The Nonstockpile Program's Cost and Schedule Are Also Uncertain

The Army has spent \$105.9 million and estimates that the nonstockpile program could cost another \$15.1 billion and take nearly 40 years to complete. However, given the factors driving the program, it is uncertain how long the program will take or cost. The program is driven by the uncertainties surrounding buried chemical warfare materiel and unproven disposal methods. Although Army officials are confident that the proposed disposal systems will function as planned, the Army needs more time to prove that the systems will safely and effectively destroy all nonstockpile materiel and be accepted by the affected states and communities. Environmental issues similar to those experienced in the stockpile program are also likely to affect the Army's ability to obtain the environmental approvals and permits that virtually all nonstockpile activities require.

¹¹Public Involvement and the Army Chemical Stockpile Disposal Program, National Research Council (Oct. 25, 1996).

The Army estimates that it can dispose of binary weapons, recovered chemical weapons, former production facilities, and miscellaneous chemical warfare materiel within the time frames established by the Chemical Weapons Convention. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. Although the Army estimates that buried chemical materiel accounts for \$14.5 billion (95 percent) of the nonstockpile program cost, the Army is still exploring potential sites and has little and often imprecise information about the type and amount of materiel buried. The Army estimated that it will take until 2033 to identify, recover, and dispose of buried nonstockpile materiel.

Also, additional time is needed for the Army to demonstrate that its mobile disposal systems are safe and effective and will meet state environmental requirements. The Army's disposal concept is based on developing mobile systems capable of moving from one location to the next where the munitions are remotely detoxified and the waste is transported to a commercial hazardous waste facility. Although the systems may operate in a semi-fixed mode, they are scheduled to be available for mobile use at recovered and burial sites after 1998. Whether the systems are allowed to operate at a particular location will depend on the state regulatory agency with authority over the disposal operations. In addition, public acceptance or rejection of the mobile systems will affect their transportation plans and disposal operations.

Alternatives to the Programs' Basic Approach to Destruction

Recognizing the difficulty of resolving the public concerns associated with each individual disposal location, suggestions have been made to change the programs' basic approach to destruction. For example, Members of the Congress and officials from environmental groups and affected states and counties have suggested deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed. Congressional members have also suggested consolidating disposal operations at a national or regional sites. In addition, officials of various DOD organizations have suggested destroying selected nonstockpile chemical warfare materiel in stockpile disposal facilities, establishing a centralized disposal facility for nonstockpile materiel, and modifying existing laws and regulations to standardize environmental requirements.

Deferring disposal operations may eliminate much of the public concern that has influenced the current approach to destroying the chemical stockpile because alternative technologies are likely to be acceptable to a

larger segment of the affected states and local communities than incineration. However, given the current status of alternative technologies, the cost and schedule would remain uncertain, and there would be a corresponding increase in the risk of an accident from continued storage of the munitions. Although the Army has been researching technological alternatives to incineration for chemical agents stored in bulk containers, only recently have research and testing demonstrated potentially effective alternatives. Currently, there is no proven alternative technology to incineration capable of safely and effectively destroying assembled chemical munitions.

Consolidating disposal operations could reduce construction and procurement costs, but the required transportation of chemical munitions could be an insurmountable barrier. This option would extend the disposal schedule and result in increased risk not only from storage but also from handling and transportation. Although consolidating disposal operations could reduce estimated facility construction and operation costs by as much as \$2.6 billion, the savings would be reduced by uncertain but potentially significant transportation and emergency preparedness costs. To help reduce costs, the Army would have to consolidate three or more stockpile sites, develop less expensive transportation containers, and control emergency response costs. In 1988, the Army and many in the Congress rejected transporting the chemical stockpile weapons to a national or regional disposal sites because of the increased risk to the public and the environment from moving the munitions. DOD and Army officials continue to be concerned about the safety of moving chemical weapons and public opposition to transportation of the munitions has grown since 1988.

Similarly, using the chemical stockpile facilities or a national disposal facility to destroy nonstockpile chemical materiel has the potential for reducing costs. Although selected nonstockpile items could be destroyed in stockpile disposal facilities, the 1986 DOD Authorization Act, and subsequent legislation, specifies that the chemical stockpile disposal facilities may not be used for any purpose other than the disposal of stockpile weapons. This legislative provision, in some cases, necessitates that the Army implement separate disposal operations for nonstockpile materiel along side of the stockpile facilities. In its 1995 implementation plan, the Army suggested that the stockpile disposal facilities could be used to process some nonstockpile weapons, depending on the location,

the type of chemical weapon or materiel, and condition.¹² Another method for destroying nonstockpile chemical materiel could be based on the use of a central disposal facility with equipment designed specifically for destroying nonstockpile materiel. Although a national disposal facility could reduce program costs, the legislative restrictions on the transportation of nonstockpile chemical material and the prevalent public attitude that such a disposal facility should not be located in their vicinity would be significant obstacles that would have to be resolved.

Modifying existing laws and regulations to standardize environmental requirements could enhance both the stockpile and nonstockpile programs' stability and control costs. The current process of individual states establishing their own environmental laws and requirements and the prevalent public attitude that the Army's disposal facilities should not be located in their vicinity have been obstacles to the stockpile disposal program and are also likely to affect the nonstockpile program. For example, individual state environmental requirements differ and are occasionally changed. As a result, there is no standard environmental protocol and requirements for stockpile and nonstockpile disposal sites. According to the Army, establishing standardized environmental requirements for all disposal sites would enhance the programs' stability. However, efforts to modify existing laws and regulations to standardize the environmental requirements for chemical weapons disposal would likely be resisted by the affected states and localities, and environmental organizations.

Steps Taken to Improve the Disposal Programs

DOD and the Army have taken encouraging steps, some in response to GAO's recommendations, to improve their management and oversight of the stockpile and nonstockpile programs. In December 1994, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program. The objectives of the designation were to stabilize the disposal schedules, control costs, and provide more discipline and higher levels of program oversight. In response to recommendations by the National Research Council and GAO, the Army initiated the Enhanced Stockpile Surveillance Program in 1995 to improve its monitoring and inspection of chemical munitions. On the basis of those activities, the Army estimates that the stockpile will be reasonably stable through 2013.

¹²Non-Stockpile Chemical Materiel Program Implementation Plan, U.S. Army Program Manager for Chemical Demilitarization (Aug. 1995).

The Army's review of the stockpile disposal program has identified several promising cost-reduction initiatives, but the Army cannot implement some of the more significant initiatives without the cooperation and approval of state regulatory agencies. Army officials estimated that the initial cost-reduction initiatives, which are in various stages of assessment, could potentially reduce program costs by \$673 million. The Army plans to submit its assessment of the initiatives to the Congress with its fiscal year 1998 budget request. It also plans to identify additional cost reductions as the stockpile program progresses.

Matters for Congressional Consideration

As the Congress continues its oversight of the chemical stockpile and nonstockpile disposal programs and considers modifications or alternatives to the current approach, it may wish to include consideration of the suggestions discussed in this report relating to the creation of alternative technologies, consolidation of stockpile disposal operations, utilization of stockpile facilities for nonstockpile items, centralization of nonstockpile destruction, and standardization of environmental laws and requirements.

Agency Comments

DOD provided written comments on a draft of this report and they are presented in appendix V. DOD stated that the draft accurately and fairly characterized the current status of the disposal programs and generally concurred with the suggestions of the draft report that changes in existing legal requirements would be necessary to change the current path of the disposal programs. DOD also concurred with GAO's suggestions that should the Congress decide to consider modifications or alternatives to the current approach, it could consider the ones to establish a centralized disposal facility for nonstockpile materiel and to modify existing laws and regulations to standardize environmental requirements for chemical weapons disposal. DOD recommended against consideration of the options to defer incineration plans, consolidate disposal operations, and to use stockpile facilities for destroying nonstockpile items.

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Abbreviations

DOD Department of Defense

Introduction

For nearly 80 years, the United States produced and stored chemical weapons to deter other countries from using them against U.S. military personnel. In 1985, the Congress directed the Department of Defense (DOD) to destroy the U.S. stockpile of chemical munitions and establish a management organization within the Army to be responsible for the disposal programs. In 1992, the Congress directed the Army to plan for the disposal of chemical warfare materiel not included in the stockpile. The Army has spent nearly \$3.2 billion on its efforts and estimates that it will cost \$24.4 billion and take nearly 40 years to dispose of the remaining chemical stockpile weapons and nonstockpile chemical warfare materiel. Although the Army is committed to destroying the chemical stockpile by the legislatively imposed deadline of December 31, 2004, only two of the nine planned disposal facilities are built and operating, 4 percent of the stockpile and little of the nonstockpile materiel have been destroyed, and environmental issues continue to delay the remaining facilities. Currently, the Army has more than 30,000 tons of chemical agent stored at 9 sites and an unknown amount potentially buried at 64 locations in the United States and its territories.

The U.S. Chemical Warfare Materiel

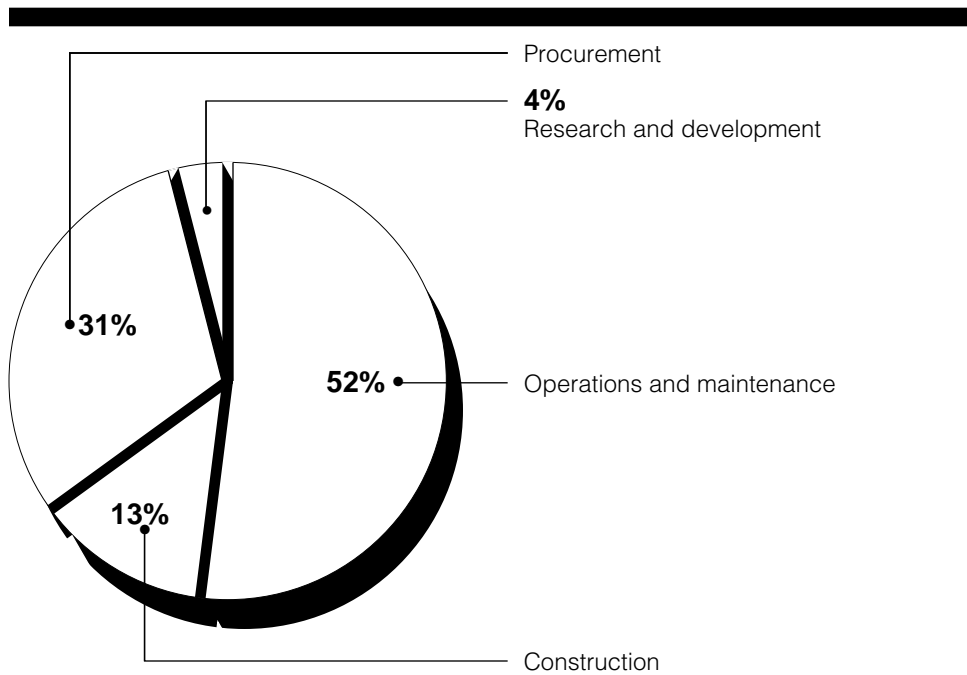
U.S. chemical warfare materiel is classified as either chemical stockpile or nonstockpile materiel. Since World War I, the United States has maintained a stockpile of chemical weapons and agents to deter the use of chemical weapons against its troops. The stockpile consists of rockets, bombs, projectiles, spray tanks, and bulk containers. Some munitions contain nerve agents, which can disrupt the nervous system and lead to loss of muscular control and death. Others contain a series of mustard agents that blister the skin and can be lethal in large amounts. Nonstockpile materiel consists of all other chemical warfare items, including binary chemical weapons, miscellaneous chemical warfare materiel, recovered chemical weapons, former production facilities, and buried chemical warfare materiel.

Historically, DOD has placed a higher priority on the destruction of the chemical stockpile because most nonstockpile items did not pose an immediate hazard to the environment or public health. Potential threats to the chemical stockpile include external events such as earthquakes, airplane crashes, and tornadoes; and internal events such as spontaneous leakage of chemical agents, accidents during normal handling and maintenance activities, and self-ignition of propellant. Nonstockpile items, such as binary weapons' components, miscellaneous warfare materiel, and recovered chemical weapons, were placed in storage and old chemical

production facilities were closed years ago. Although documentation surveys, interviews, and site visits have been conducted, much of the information concerning burial sites remains unknown. The priority for destroying nonstockpile materiel has increased because of recent accidental discoveries of buried materiel, congressional interest, and international efforts to destroy chemical weapons.

The Army has spent nearly \$3.2 billion on its efforts to destroy its chemical stockpile weapons and nonstockpile chemical warfare materiel. (See app. II.) As shown in figure 1.1, more than half of the funds has been appropriated for operations and maintenance activities, such as operating salaries and utilities, and systems engineering and program management. The balance has funded procurement of equipment, construction of facilities, and research and development activities.

Figure 1.1: Percent of Appropriated Funds by Category for Fiscal Years 1988 through 1996



Source: Based on data from DOD's Selected Acquisition Report dated December 31, 1995.

Evolution of the Disposal Process

From 1917 through the 1960s, obsolete or unserviceable chemical warfare agents and munitions were disposed of by open pit burning, land burial, and ocean dumping. In 1969, an Army plan to dispose of chemical agents and munitions at sea raised public concerns about the safety of transporting chemical weapons from their storage sites to a port of embarkation and about the potential effects of ocean dumping on the environment. In June 1969, the National Academy of Sciences recommended that ocean dumping be avoided and that public health and environmental protection be emphasized. It suggested two alternatives to ocean disposal: incineration of mustard agents and chemical neutralization of nerve agents. In response, the Army stopped ocean dumping operations.¹ (See chronology in app. IV.)

Use of Incineration and Chemical Neutralization

During the 1970s, the Army destroyed obsolete chemical weapons primarily by high-temperature incineration or by chemical neutralization. The neutralization process involves altering the chemical, physical, and toxicological properties of a chemical warfare agent to render it ineffective for use as intended. In 1984, the National Research Council, under the auspices of the National Academy of Sciences, decided that incineration was the more desirable disposal method. It concluded that the neutralization process was more costly and produced larger quantities of waste than incineration. In 1986, the Army submitted to the Congress a plan to dispose of the chemical stockpile. Its plan considered the costs and potential problems associated with three options: (1) transferring the entire stockpile to one site for disposal, (2) transferring it to two regional disposal sites, and (3) operating separate disposal facilities at each of the storage locations. In 1988, the Army formally announced that on-site incineration was its preferred disposal method. The Army and many in the Congress rejected transporting the chemical stockpile weapons to a national or regional disposal sites because of the increased risk to the public and the environment from moving the munitions.

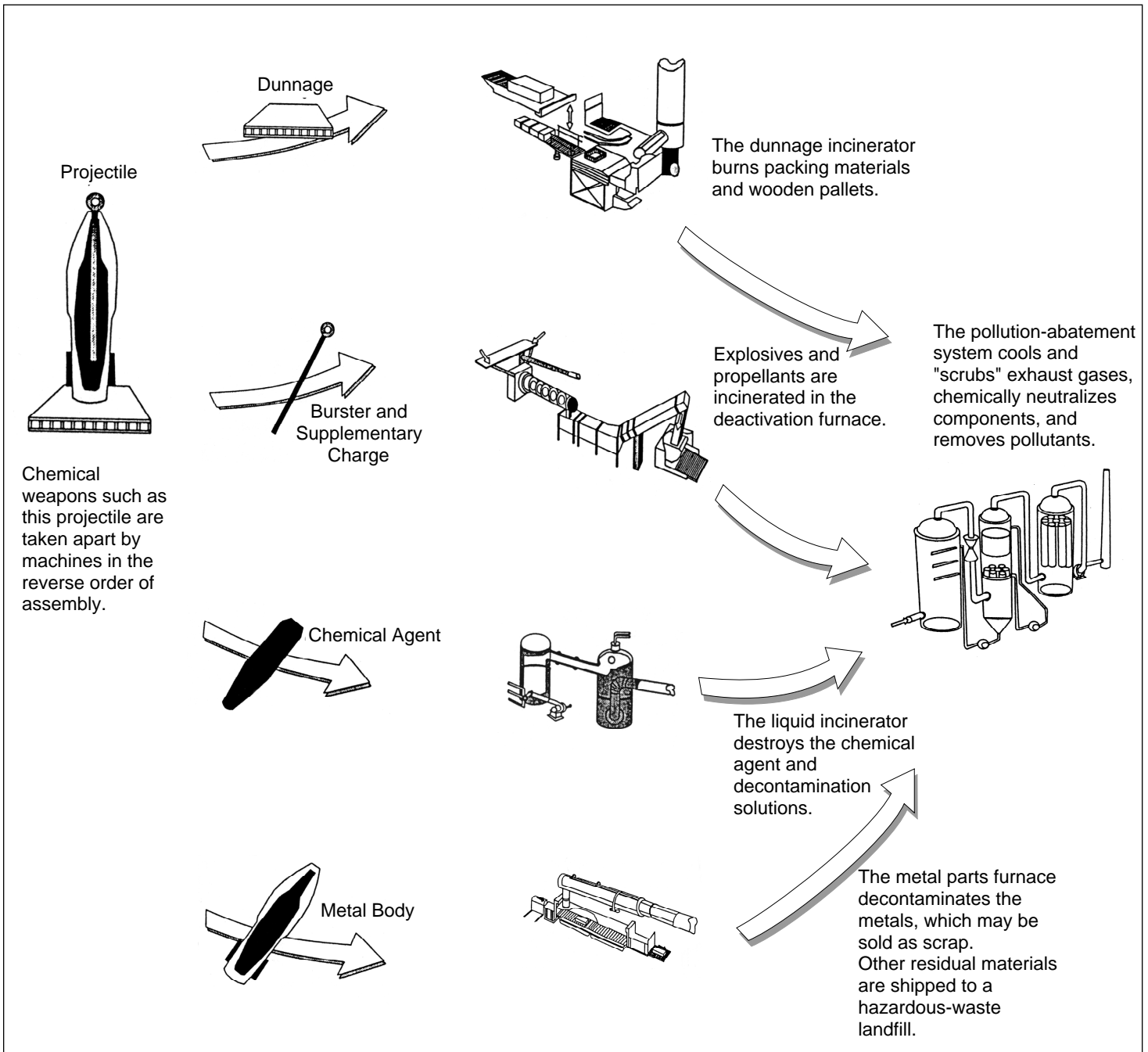
The Army's Baseline Incineration Process

A baseline incineration process uses a reverse-assembly procedure that drains the chemical agent from the weapons and containers and takes apart the weapons in the reverse order of assembly. (See fig. 1.2.) Once disassembled, the chemical agent and weapon parts are incinerated in separate furnaces and the gaseous and solid waste is treated. Liquid brine resulting from the treatment of exhaust gases in the pollution abatement

¹The last chemical munitions ocean dump occurred in August 1970.

system is dried to reduce the volume and transported to a commercial hazardous waste management facility.

Figure 1.2: The Baseline Disassembly and High-Temperature Incineration Process



Source: Based on data provided by the Army's Program Manager for Chemical Demilitarization.

Potential Alternatives to Incineration

In November 1991, because of public concern about the safety of incineration, the Army requested the National Research Council to evaluate potential technological alternatives to the baseline incineration process. In the 1993 National Defense Authorization Act (P.L. 102-484), the Congress directed the Army to use the National Research Council's evaluation and report on potential technological alternatives to incineration.² The Congress also directed the Army to consider safety, environmental protection, and cost-effectiveness when evaluating alternative technologies. Consequently, in August 1994, the Army initiated a more aggressive research and development program, called the Alternative Technologies and Approaches Project, to investigate, develop, and support testing of two technologies based on chemical neutralization of chemical agents at the bulk-only stockpile sites—Aberdeen Proving Ground, Maryland, and Newport Chemical Activity, Indiana. In addition, three other technologies—molten metal pyrolysis, high-temperature hydrogenation, and electrochemical oxidation—have been tested and are undergoing further development by the commercial firms promoting them. This research and development effort is conducted in conjunction with activities to implement the baseline incineration program.

In the 1997 National Defense Authorization Act (P.L. 104-201), the Congress directed DOD to conduct an assessment of alternative technologies for the disposal of assembled chemical munitions. The authorization act also directed the Secretary of Defense to report on this assessment by December 31, 1997. Similarly, the 1997 DOD Appropriations Act (P.L. 104-208) provided \$40 million to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. The appropriations act also prohibited DOD from obligating any funds for constructing disposal facilities at Blue Grass, Kentucky, and Pueblo, Colorado, until 180 days after the Secretary reports on the alternatives.

Management Structure of the Disposal Programs

The Army was assigned responsibility for the chemical weapons stockpile in 1981 when DOD designated the Army as its single manager for ammunition. In March 1991, DOD directed that the Army be accountable for the disposal of all chemical warfare material. The Assistant Secretary of the Army (Research, Development and Acquisition), as the executive agent for the chemical disposal programs, has oversight and policy authority for the destruction of the chemical stockpile weapons and nonstockpile

²U.S. Army's Alternative Demilitarization Technology Report for Congress, Department of the Army (Apr. 11, 1994).

materiel. The Program Manager for Chemical Demilitarization is responsible for implementing the disposal programs and ensuring the maximum protection to the environment, the public, and personnel.

Because of increasing disposal costs and schedule slippage, changing legislative and regulatory requirements, and growing public concern about incineration, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program in December 1994. The designation was intended to (1) stabilize the disposal schedule, (2) control costs, and (3) provide more discipline and higher levels of program oversight. As such, the Army has been required to

- develop a program cost and schedule baseline;
- prepare quarterly defense acquisition executive summaries, which are intended to provide an early warning that the baseline may be exceeded; and
- submit an annual selected acquisition report to the Congress, which includes variances from the program baseline schedule and cost.

Other organizations within and separate from DOD contribute to the programs. For example, at formerly used defense sites, the U.S. Army Corps of Engineers has overall responsibility for site investigations, planning, excavations, and environmental cleanups of burial sites. In addition, the Department of Health and Human Services oversees public health issues, the Department of Transportation advises DOD on transportation issues, and the Environmental Protection Agency oversees the environmental aspects of the programs.

International Efforts to Eliminate Chemical Agents and Weapons

The 1925 Geneva Protocol established the international norm against the use of chemical weapons in combat, but did not prohibit the production or deployment of chemical agents and munitions. In 1989 and 1990, the United States and Russia entered into two bilateral agreements that required sharing of data on their respective chemical stockpiles, provided for visits to confirm the accuracy of the shared data, and would eliminate chemical weapons production and most of their chemical weapons.

In 1993, the United States, Russia, and more than 150 nations signed the U.N.-sponsored Convention on the Prohibition of the Development, Production, Stockpiling and the Use of Chemical Weapons and on Their Destruction, commonly referred to as the Chemical Weapons Convention.

In October 1996, the 65th nation ratified the Chemical Weapons Convention, making the convention effective on April 29, 1997.³ However, as of December 1996, the United States and Russia have not ratified the convention. The group of ratifiers includes major industrial states such as Australia, Canada, France, Germany, Italy, Japan, and the United Kingdom of Great Britain; and a wide geographical range of nations such as Algeria, Argentina, Armenia, Belarus, Brazil, Czech Republic, Georgia, India, Ireland, Latvia, Mexico, Morocco, New Zealand, Oman, Poland, Romania, Slovak Republic, South Africa, Tajikistan, Turkmenistan, and Uruguay. Egypt, Iraq, Jordan, Libya, North Korea, Syria, and other countries, mainly small island nations, have not yet signed the convention.

If the U.S. Senate approves the convention, it could affect implementation of the disposal programs.⁴ Through ratification, the United States will agree to dispose of its (1) unitary chemical weapons stockpile, binary chemical weapons, recovered chemical weapons, and former chemical weapon production facilities by April 29, 2007, and (2) miscellaneous chemical warfare materiel by April 29, 2002. If a country is unable to maintain the convention's disposal schedule, the convention's Organization for the Prohibition of Chemical Weapons may grant a one-time extension of up to 5 years. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. Should the United States choose to excavate the sites and remove the chemical materiel, the provisions of the convention would apply. On November 30, 1993, the President submitted the convention to the U.S. Senate for its approval. The Senate held hearings in 1994 and 1996, but has not approved the convention. However, the United States is still committed by public law to destroying its chemical stockpile and related warfare materiel.

Once Russia ratifies the convention, it will be committed to destroying its chemical warfare stockpile by April 29, 2007, with a 5-year extension if needed. However, Russia does not have an operational capability to destroy large quantities of chemical weapons and would need to construct several chemical weapons disposal facilities to meet the convention's requirement.⁵

³The convention becomes effective 180 days after the 65th nation ratified the convention.

⁴Under the U.S. Constitution, treaties must be approved by a two-thirds majority of the Senate.

⁵Weapons of Mass Destruction: Status of Cooperative Threat Reduction Program (GAO/NSIAD-96-222, Sept. 27, 1996).

Our Prior Concerns With the Army's Disposal Programs

Since 1990, we have issued a number of reports that focused on interrelated issues involving cost and schedule estimates, performance, environmental compliance, stability of chemical weapons, and alternative disposal technologies. (See Related GAO Products.) For example:

- Chemical Weapons Disposal: Issues Related to DOD's Management (GAO/T-NSIAD-95-185, July 13, 1995). We reported that there was a possibility of further cost growth and schedule slippage for the Chemical Stockpile Disposal Program.
- Chemical Weapons: Stability of the U.S. Stockpile (GAO/NSIAD-95-67, Dec. 22, 1994). We reported that the Army lacked data to conclusively predict the stability of stockpiled chemical weapons.
- Chemical Weapons Disposal: Plans for Nonstockpile Chemical Warfare Materiel Can Be Improved (GAO/NSIAD-95-55, Dec. 20, 1994). We reported that the Army's plans for disposing of nonstockpile chemical warfare materiel were not final and, as a result, its cost estimate was likely to change.
- Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration (GAO/NSIAD-94-123, Mar. 18, 1994). We reported that alternative disposal technologies identified as most likely to be feasible for the chemical stockpile program were in the initial stages of development and over a decade away from operation.
- Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991). We reported that continued problems in the chemical stockpile program indicated that increased costs and additional time to destroy the chemical stockpile should be expected. We recommended that the Army determine whether faster and less costly technologies were available to destroy the chemical stockpile.

Our objectives, scope, and methodology are described in appendix I.

The Chemical Stockpile Disposal Program Will Require More Time and Funds Than Currently Planned

In 1985, the Congress directed the Army to destroy the U.S. stockpile of chemical agents and munitions. To comply with congressional direction, the Army established the Chemical Stockpile Disposal Program and developed a plan to incinerate the agents and munitions on site in specially designed facilities. The Army has spent \$2.6 billion and estimates that the stockpile program could cost another \$9.8 billion and take until December 2004 to complete. However, the program will likely cost more than estimated and continue past the estimated completion date. This is because reaching agreement on site specific disposal methods has consistently taken longer than the Army anticipated. Furthermore, recent congressional direction in the 1997 Authorization and Appropriations Acts to research and develop alternative technologies to destroy assembled chemical munitions indicates that there is continued public concerns about the incineration disposal method. Recognizing the difficulty of satisfactorily resolving the public concerns associated with each individual disposal location, suggestions have been made to change the program's basic approach to destruction. These have included developing an acceptable alternative disposal technology to incineration and consolidating disposal operations at a national or regional sites. Although many suggestions offer some benefit, no one change is likely to materially reduce costs, shorten the disposal schedule, and increase public acceptance. They also generate other obstacles and issues that need to be resolved to make them viable.

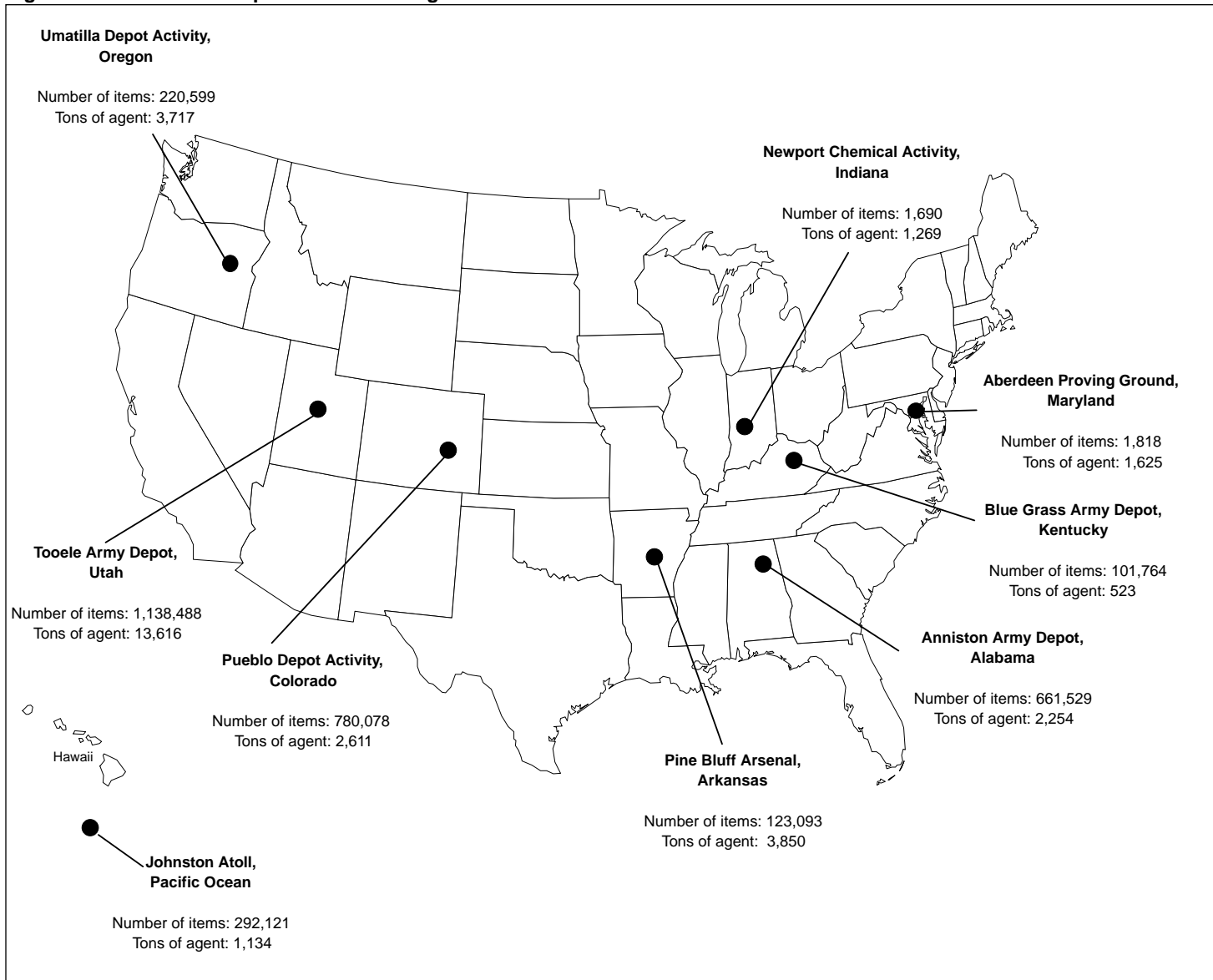
The Army's Chemical Stockpile Disposal Program

In the DOD Authorization Act for Fiscal Year 1986 (P.L. 99-145), the Congress mandated that the Army destroy the U.S. stockpile of obsolete chemical agents and munitions, which are stored at eight sites in the continental United States and on Johnston Atoll in the Pacific Ocean. (See fig. 2.1.) As of December 15, 1995, the stockpile consisted of 3.3 million items.¹ The objectives of the Chemical Stockpile Disposal Program are to (1) destroy the stockpile of unitary chemical weapons and (2) provide for the maximum protection of the environment, the public, and personnel involved in the storage, handling, and disposal of the stockpile.

¹The chemical weapons stockpile information was declassified on January 9, 1996.

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Figure 2.1: The U.S. Stockpile of Chemical Agents and Munitions



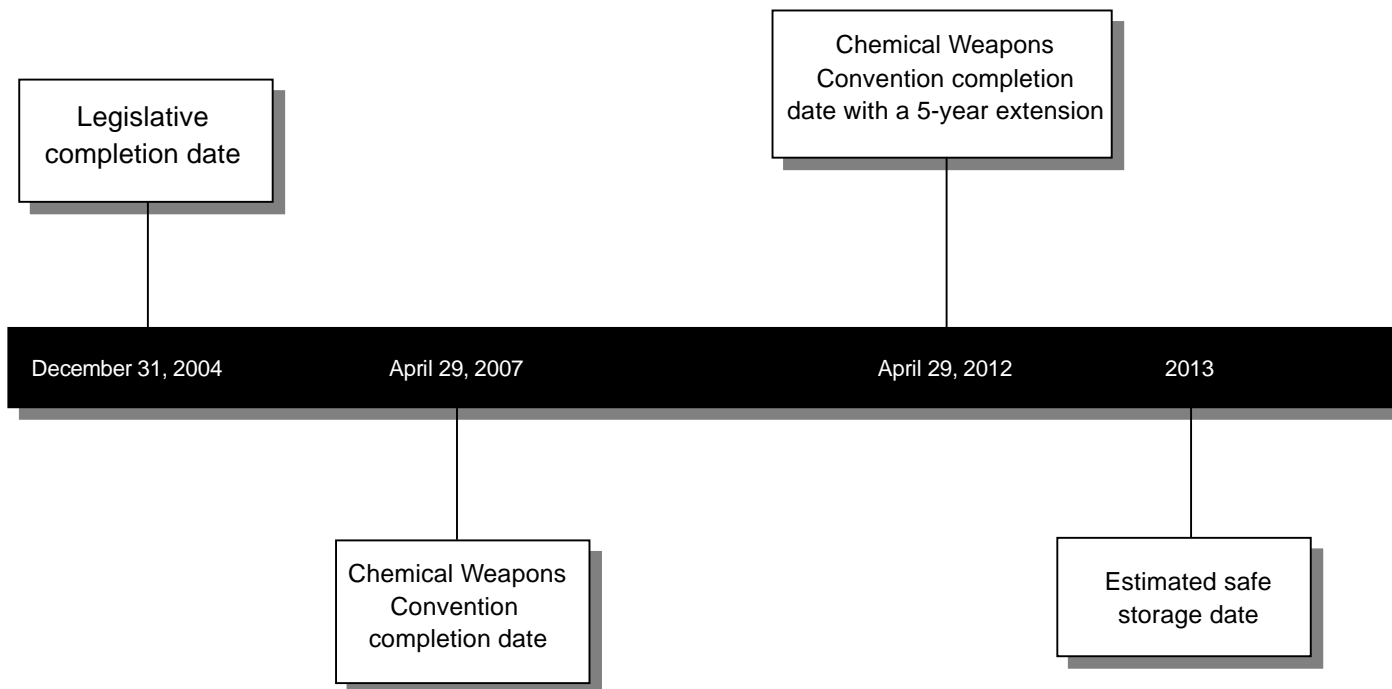
Note: As of December 15, 1995.

Source: DOD.

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There are several key dates that congressional and defense decisionmakers will consider as they determine future funding and program direction for the stockpile program. (See fig. 2.2.) For example, the National Defense Authorization Act for Fiscal Year 1993 (P.L. 102-484) directed the Army to destroy the stockpile by December 31, 2004. If the United States ratifies the Chemical Weapons Convention, the United States will agree to dispose of its unitary chemical weapons stockpile by April 29, 2007, and the convention's signatories may grant a one-time extension of up to 5 years. In addition, on the basis of its stockpile assessment and monitoring activities, the Army estimates that the stockpile will be reasonably stable through 2013. However, according to Army officials, most of the risk to chemical munitions in storage result from external events such as earthquakes, airplane crashes, lightning strikes, and tornadoes.

Figure 2.2: Key Dates for the Chemical Stockpile Disposal Program After January 2004



Source: Based on data provided by the Army's Program Manager for Chemical Demilitarization.

The Army has taken encouraging steps, some in response to our recommendations, to improve its management and oversight of the Chemical Stockpile Disposal Program. In December 1994, DOD designated the Army's chemical demilitarization program, consisting of both stockpile and nonstockpile munitions and materiel, as a major defense acquisition program. The objectives of the designation were to stabilize the disposal schedules, control costs, and provide more discipline and higher levels of program oversight. In addition, in response to the National Research Council's and our recommendations, the Army initiated the Enhanced Stockpile Surveillance Program in 1995 to improve its monitoring and inspection of chemical munitions.

The Army has also expanded its public outreach activities to promote dialogue between the Army and the public. For example, the Army has established storefront information offices near some of the storage sites, developed public outreach pamphlets and information videos, distributed information to public libraries and locations, provided toll-free telephone numbers, and conducted town meetings. However, the National Research Council recently recommended that the Army increase substantially and institutionalize public involvement throughout the Chemical Stockpile Disposal Program.² The Council reported that the credibility of the Army was low and that the treatment of public concerns had been inadequate. It concluded that the Army's public relations and outreach efforts to educate the public about chemical stockpile activities by themselves will not be enough to facilitate the safe and timely disposal of the stockpile. The Council recommended that the Army expand its public affairs program to ensure public involvement in the program, giving the affected communities a participatory role and a sense of ownership in the program's decision-making process. According to the National Research Council, the Army has successfully involved the state and the public in its alternative technology project for the two bulk-only stockpile sites, demonstrating the importance of public involvement to the progress of the program.

Program Delays Past 2004 Are Likely

Although the Army is committed to destroying the stockpile by the legislatively imposed deadline of December 31, 2004, its ability to meet that date is questionable. The program cost and schedule are largely driven by the degree to which states and local communities are in agreement with the proposed disposal method. Historically, reaching

²Public Involvement and the Army Chemical Stockpile Disposal Program, National Research Council (Oct. 25, 1996).

agreement has consistently taken longer than the Army anticipated. Since the Army began planning the destruction of the chemical weapon stockpile in 1985, it has destroyed 4 percent of the stockpile, built and operated two of nine proposed facilities, and the program has been extended more than 10 years—from September 1994 to December 2004. The Army plans to phase in the construction, systemization, and operation of the remaining seven disposal facilities over the next 8 years. However, environmental permits for the remaining facilities have already slipped by 3 years or more since April 1992. At the Tooele Chemical Agent Disposal Facility, obtaining Utah's approval to operate the facility took 17 months longer than the Army estimated it would in 1992.

Obtaining Environmental Permits Will Require More Time Than the Army Has Allowed

Before constructing or operating a chemical weapon destruction facility, the Army must obtain permits to comply with federal, state, and local environmental laws and regulations. The Resource Conservation and Recovery Act, as amended, regulates the storage, treatment, and disposal of most chemical weapons and materiel. (Environmental laws are summarized in app. III.) The Resource Conservation and Recovery Act controls hazardous waste through a permit process that requires government approval for individuals who generate, transport, store, or dispose of hazardous waste. Under the act, the Environmental Protection Agency may authorize individual states to administer and enforce hazardous waste programs that are at least as stringent as the federal program. The act also allows states to establish requirements more stringent than federal standards. The Clean Air Act, as amended, governs potential sources of air pollutants and establishes emission standards. The Army must obtain permits for air pollution control prior to operating a chemical stockpile disposal facility.

According to the Army's 1994 risk assessment, there was a high possibility states would use their authority under these laws to delay or prevent the construction of incinerators in their states.³ For example, states can place restrictions on hazardous waste generators as well as the disposal of the hazardous waste generated by the chemical agent incinerators, or prohibit disposal of the waste within their jurisdictions. States may also simply delay the permit review process for an inordinate amount of time. These actions could increase the Army's costs, cause it significant administrative difficulties, or delay operations. To illustrate, before it will issue a permit for a chemical stockpile disposal facility, Kentucky requires that

³Programmatic Risk Assessment Final Report, U.S. Chemical Materiel Destruction Agency (Sept. 30, 1994).

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information showing that no alternative disposal method, including, but not limited to, neutralization and transportation, exists or could be developed. Maryland and Indiana have also passed laws or adopted regulations specific to the disposal of chemical agents within their jurisdictions.

Although the Army's 1994 risk assessment acknowledges the potential for delays due to environmental regulations, its program schedule provides little leeway for dealing with potential problems at the remaining stockpile sites. For example, the Army's 1996 schedule only allows for slippage ranging from 1 to 6 months for delays in the permitting process, construction, systemization, and operation of the proposed facilities at Anniston, Pine Bluff, and Umatilla.⁴ The schedule for the Anniston Chemical Agent Disposal Facility shows that to destroy all of the chemical munitions at Anniston by the end of December 2004, Alabama would have to issue its permit to start construction no later than October 1996. Army officials now estimate that the permit will be issued by March 31, 1997, approximately 6 months later than scheduled. (See table 2.1.) Alabama regulatory officials expect the permit to be issued in June or July 1997—a slippage of approximately 8 months. Unless the Army can shorten construction, systemization, or destruction time frames, disposal operations at Anniston would extend to mid-2005.

⁴Department of Defense's Interim Status Assessment for the Chemical Demilitarization Program, DOD (Apr. 15, 1996).

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Table 2.1: Slippage in the Army's Estimated Dates for Construction Permits at the Remaining Seven Disposal Sites

Site	Estimated date of permit to start construction		Slippage
	February 1996 schedule ^a	August 1996 schedule ^b	
Aberdeen Proving Ground ^c	Before January 1, 1999	November 12, 1998	None
Anniston Army Depot	Before October 1, 1996	March 31, 1997	6 months
Blue Grass Army Depot ^d	Before January 1, 1998	September 20, 1998	None
Newport Chemical Activity ^c	Before January 1, 2000	August 18, 1999	None
Pine Bluff Arsenal	Before October 1, 1996	June 24, 1997	9 months
Pueblo Depot Activity ^d	Before April 1, 1997	February 4, 1998	10 months
Umatilla Depot Activity	Before October 1, 1996	January 30, 1997	4 months

^aBased on DOD's interim status assessment for the chemical demilitarization program dated April 15, 1996.

^bBased on data provided by the Program Manager for Chemical Demilitarization dated September 27, 1996.

^cSchedules are subject to change pending alternative technology decision for the bulk-only stockpile sites.

^dSchedules are on hold as the result of the 1997 DOD Appropriations Act requirement to research alternative technologies.

The February 1996 schedule for the Pine Bluff Chemical Agent Disposal Facility shows construction starting by the end of fiscal year 1996 and provides a 6-month leeway to complete disposal operations by the end of 2004. Based on the Army's current schedule for the environmental permits, the start of construction in 1996 is no longer possible because the schedule shows an issuance date of June 24, 1997—a slippage of 9 months. This delay eliminated the 6-month leeway and operations now are likely to continue past December 2004. The disposal schedule for the Umatilla Chemical Agent Disposal Facility provides a leeway of 4 months. The Army had expected Oregon to issue the Resource Conservation and Recovery Act and Clean Air Act permits for the facility by the end of September 1996. However, Army officials had estimated that the permits would have been issued by January 30, 1997, approximately 4 months later than scheduled. This delay eliminated the grace period for starting disposal operations at Umatilla.

According to Army officials, implementation of the health risk assessment requirement has added another layer of uncertainty to the schedule. They said that the original scope of the health risk assessment to operate the disposal facilities was not completely defined, the health assessment requirements have changed, and the requirements currently vary from state to state. According to DOD officials, states have modified the requirements of their health risk assessments well into the process, delaying the development of the final assessment document. According to Environmental Protection Agency officials, the agency has issued several guidance documents concerning the health risk assessments over the last 5 years and has tried to keep the Army informed of the changes and updates in the guidance. In addition, the agency has advised the Army to meet with state officials early in the process to agree on the methodology and standards to use in the development of the risk assessment.

Public Support for More Research on Alternative Disposal Technologies

Congressional direction in the 1997 Authorization and Appropriations Acts to research and develop alternative technologies to destroy assembled chemical munitions indicates that there is continued public concerns about the proposed disposal method. In the 1997 Authorization Act, the Congress directed DOD to conduct an assessment of alternative technologies for the disposal of assembled chemical munitions. The act also directed the Secretary of Defense to report on the assessment by December 31, 1997. Similarly, the 1997 Appropriations Act provided \$40 million to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. The act also prohibits DOD from obligating any funds for constructing disposal facilities at Blue Grass, Kentucky, and Pueblo, Colorado, until 180 days after the Secretary reports on the alternatives.

According to Army officials, the construction and the procurement of equipment for the disposal facilities at Blue Grass and Pueblo has been placed on hold because of the 1997 Appropriations Act's requirement to research alternative technologies. If the report is not issued before December 31, 1997, the Army cannot obligate construction funds for Blue Grass and Pueblo until June 30, 1998. This would delay the planned award of the construction contract at Blue Grass by 6 months and the planned award of the construction contract at Pueblo by 15 months. According to these officials, the Army and the states will continue to work together to process the environmental permits. However, a recent Army schedule shows Blue Grass disposal operations ending in June 2005, 6 months past

the mandated completion date. Although the prohibition applies only to Blue Grass and Pueblo, public concerns about incineration may prompt state regulators at other locations to delay their final decisions to permit incinerators until the Secretary reports his findings.

Program Costs Will Likely Exceed \$12.4 Billion

The Army has spent \$2.6 billion and estimates that the stockpile program could cost another \$9.8 billion to complete. Since 1985, the Army's cost estimate for the Chemical Stockpile Disposal Program has increased seven-fold, from an initial estimate of \$1.7 billion to \$12.4 billion.⁵ Reasons for the cost increases include (1) program enhancements to respond to concerns for maximizing the safety of the public and environment, (2) delays in completing the operational verification tests at the Johnston Atoll Chemical Agent Disposal System, (3) technical problems resulting in lower than expected disposal rates, (4) additional legislative requirements, and (5) implementation of the National Research Council's recommendations.

The Chemical Stockpile Disposal Program will likely cost more than the estimated \$9.8 billion above current expenditures to complete because of the schedule slippages since February 1996 and the additional costs to research alternative disposal technologies. Schedule delays, such as those previously discussed at Anniston, Blue Grass, Pine Bluff, Pueblo, and Umatilla, will increase program cost at these locations. These delays increase direct costs, including personnel, storage, emergency preparedness, and program management at each disposal site. In addition, the Congress appropriated the Army \$40 million in fiscal year 1997 to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. This appropriation was not included in the Army's cost estimate.

The Stockpile Should Be Stable Through 2013

On the basis of its stockpile assessment and monitoring programs, the Army estimates that the stockpile will be reasonably stable through 2013. Although continued storage of the M55 rockets is a concern, the Army will continue to monitor the stockpile until it is destroyed and has developed a contingency plan to deal with the M55 rockets, which pose a risk. According to Army officials, most of the risk to chemical munitions in

⁵Approximately \$1 billion of the estimated \$12.4 billion is associated with the Chemical Stockpile Emergency Preparedness Program.

storage result from external events such as earthquakes, airplane crashes, lightning strikes, and tornadoes.

In December 1994, we reported that the Army's assessment that the chemical stockpile could be safely stored until the legislatively imposed deadline of December 31, 2004, was subject to question based on the nature of the supporting information.⁶ The data on which the Army based its assessment were old and may no longer represent the chemical weapons in storage. For example, at that time, field samples of the M55 rocket propellant had not been taken since 1989. Also, the assessment did not include an analysis of leaking munitions. Leaks increase the risk of auto-ignition during handling, which could lead to fires and potential explosions in the stockpile storage area. In addition, a contingency plan for disposal of the rockets was needed because they cannot readily be reconfigured to remove their propellant. Propellant is inherently unstable and must be stabilized to help prevent reactions that could lead to a spontaneous ignition. Manufacturers added stabilizing compounds, but they deteriorate over time.

Recent Army initiatives to obtain better information to predict the safe storage life of the stockpile, including the M55 rockets, are encouraging. For example, the Army initiated an Enhanced Stockpile Assessment Program to determine the effects of an agent on a propellant, identify the most appropriate predictive methodology, develop sampling plans, and perform periodic assessments. In 1995, the Army completed a reassessment of the stability of the M55 rockets and concluded that the likelihood of propellant ignition through 2013 was negligible. However, data were obtained from leaker rockets on Johnston Atoll that were consistent with the theory that exposure to agent accelerates the degradation of the propellant stabilizer. Gaining a better understanding of this chemical process and its impact on the rockets' stability will be a major thrust of the Army's stockpile assessment activities in 1997.

Program Alternatives Generate Trade-offs

The concern about incineration and the cost and progress of the disposal programs have led to suggestions for alternative technologies, the transportation of agents and munitions to a national or regional site, and other measures to improve efficiency and effectiveness. Two widely discussed suggestions are (1) changing the planned disposal technology to something other than incineration or (2) transporting the weapons to a regional or national site rather than building local disposal sites. Although

⁶Chemical Weapons: Stability of the U.S. Stockpile (GAO/NSIAD-95-67, Dec. 22, 1994).

changing the technology could improve public acceptance and using national and regional sites could save money, these changes raise other issues that present trade-offs for decisionmakers. Thus far, these trade-offs have not been acceptable to one or more of the parties involved in the program. In addition, the Army is developing other measures to improve program effectiveness and efficiency.

Alternative Technologies
May Not Reduce Costs or
Shorten Disposal
Operations

Since 1994, the Army has been researching five technological alternatives for destroying chemical agents stored in bulk containers. The results are promising but, according to the Army, the alternative technologies are not likely to significantly affect the program's overall cost or duration. Additionally, any alternative, including neutralization, will have its own set of problems such as hazardous waste disposal and the possibility of leaks or accidents.

In August 1994, the Army initiated a research and development project to investigate, develop, and support testing of two technologies based on chemical neutralization of chemical agents at the bulk-only stockpile sites—Aberdeen Proving Ground, Maryland, and Newport Chemical Activity, Indiana. A neutralization process involves altering the chemical, physical, and toxicological properties of a chemical warfare agent to render it ineffective for use. In addition, three other technologies—molten metal pyrolysis, high-temperature hydrogenation, and electrochemical oxidation—have been tested and are undergoing further development by the commercial firms promoting them. DOD will decide in 1997 whether to construct pilot facilities to further demonstrate the alternative technologies. The Army also will continue laboratory and bench-scale testing of disposal technologies in support of the program. This research and development effort is conducted in conjunction with activities to implement the baseline incineration program.

Transportation Could
Reduce Costs, but There
Are Some Trade-offs

Concerns about the cost and progress of the Chemical Stockpile Disposal Program have generated interest about moving chemical stockpile weapons to a national or regional site to improve the program's effectiveness and efficiency. However, the Army is prohibited from transporting stockpile weapons to any of the eight storage sites in the continental United States by a general provision in DOD's annual appropriations act. This provision prohibits the Army from using funds to prepare studies on the feasibility of transporting chemical weapons. Transportation options offer some cost benefits, but they also increase the

risk to the general public and are likely to be opposed by most affected states and communities.

Although transporting chemical weapons has the potential to reduce construction and procurement costs by as much as \$2.6 billion, the reduction could be offset by shipping and emergency preparedness costs. The potential savings come from reducing the number of disposal facilities that must be built. According to the Army estimates, construction and procurement of a disposal facility and related equipment cost from \$243 million for a small facility that will handle only bulk agent such as Newport, to \$471 million for a large facility that will process all types of explosively configured munitions such as Umatilla. The reduction in costs is offset by increased storage, emergency preparedness, and program management costs from extending disposal operations at the consolidated sites. Using existing disposal rates, a national destruction facility at Tooele could extend the program to 2017 and add as much as 770 months of storage, emergency preparedness, and management costs to the program. Similarly, regional disposal sites at Anniston and Tooele could extend the program to 2010 and add as much as 320 months of storage, emergency preparedness, and management costs.

In addition, potential savings would be offset by large transportation costs. In 1987, an Army transportation panel recommended that, prior to transporting any agent or munitions, the Army develop a shipping container that (1) provides redundant protection against agent release during normal transport, (2) prevents agent release in most transportation accidents, (3) is compatible with standard cargo handling and transport equipment, and (4) has the capability for automated agent and temperature monitoring within the transport container. In 1987, the Program Manager for Chemical Demilitarization estimated that 400 containers would cost \$96.4 million.⁷ An Army official who developed the on-site transportation containers estimated that the containers would cost significantly more and could cost as much as \$2 million for each container. In addition, the Army's transportation concept plan found that using the rail system would require 70 to 75 rail shipments to a national disposal site, each consisting of a convoy of 136 railcars. Shipping by truck to a national disposal site would require 820 convoys, and airlifting would require several thousand sorties using C-141 aircraft. According to an Army study, transporting the Blue Grass stockpile would take 1,200 to 1,500 flights. Further, airfields capable of handling large aircraft would

⁷Conceptual Design of a Chemical Munitions Transport Packaging System, Program Manager for Chemical Demilitarization (Aug. 1987).

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have to be constructed. Costs for these transportation alternatives have not been estimated. However, we reported that moving more than 100,000 U.S. chemical-filled munitions from West Germany to Johnston Atoll in 1990 cost \$61.6 million, including \$13.6 million for shipping containers.⁸ The Army shipped the munitions in sealed steel boxes called secondary steel containers, which were loaded into shipping containers.

Another significant cost element could be emergency preparedness along the transportation corridor. Proposed rail routes to a national destruction center total approximately 13,000 miles and pass through 20 states. Rail routes to regional destruction sites total approximately 7,100 miles and pass through 16 states. In its response to the Army's 1987 Final Programmatic Environmental Impact Statement, the Department of Health and Human Services stated that the difficulties in preparing adequate contingency plans for a transportation alternative are staggering and that resources to cope with a worst case scenario in a consistent manner could never be mobilized. The Department reported that while it might be possible to provide hospitals near the eight existing storage sites with enough respirator equipment to support a number of casualties, it would be difficult to supply all communities along a transportation route. Few communities along the transportation routes would have the necessary equipment available to them without federal assistance.

Any movement of chemical weapons or material could be opposed by federal agencies and the affected states and localities. Before the Army can transport a chemical weapon, it must (1) coordinate efforts with the Department of Health and Human Services and must adopt any precautionary measures that it recommends, (2) meet all regulations imposed by the Department of Transportation, and (3) obtain permits from the receiving state and potentially from each state traveled through. Although the departments of Health and Human Services or Transportation have not formally opposed transportation, both have expressed strong reservations about transportation alternatives. In 1988, 13 states provided written comments on the Army's Final Programmatic Environmental Impact Statement. Twelve of the states opposed transporting the chemical weapons, including 7 of the 8 states where chemical weapons are stored, and endorsed an on-site disposal option. Only Kentucky wanted the Army to transport its agents and munitions elsewhere. Utah has gone on record opposing receipt of chemical weapons from other states.

⁸Chemical Warfare: DOD's Effort to Remove U.S. Chemical Weapons From Germany (GAO/NSIAD-91-105, Feb. 13, 1991).

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The Army's Cost-Reduction Initiatives

Environmental permitting is the most likely area to affect the disposal schedule for the stockpile program. According to its 1994 risk assessment, the Army concluded that high-level involvement, possibly from the Congress or the White House, was needed in the environmental permitting process to overcome opposition from state regulators. In 1996, DOD assembled an environmental management team comprised of federal and state officials to track new and revised environmental requirements to maintain the current disposal schedule and ensure compliance. In addition, the Army is reviewing whether the number of trial burns and time necessary to gain state approval to initiate disposal operations can be reduced.

The Army is also reviewing the stockpile program's contracting structure, disposal operations, and incineration process to identify potential cost-reduction initiatives. As a result, Army officials have already identified some cost-reduction initiatives, which are in various stages of assessment, that could potentially reduce program costs by \$673 million. (See table 2.2.) They also plan to identify additional cost reductions as the program progresses.

Table 2.2: The Army's Initial Cost-Reduction Initiatives as of August 1996

Dollars in millions		
Category	Confidence ^a	Estimated savings
Reduction in consumables	High	\$50
Engineering improvements in the pollution abatement filter system	High	55
Removal of the pollution abatement filter system at Tooele	High	95
Removal of the pollution abatement filter system at Aberdeen and Newport	Medium to high	85
Elimination of the dunnage furnaces	Medium	10
Elimination of the pollution abatement filter system at Anniston and Umatilla	Low to medium	145
Improved disposal rates for projectiles	Medium	160
Elimination of the pollution abatement filter system at Pine Bluff	Low to medium	73
Total		\$673

^aIndicates the Army's level of confidence that the initiative will be implemented.

The Army cannot implement some of the more significant cost-reduction initiatives without the cooperation and approval of state regulatory

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agencies. Regulatory requirements connect the initiatives to the National Environmental Policy Act process and the Resource Conservation and Recovery Act and Clean Air Act permitting processes. The Army plans to submit its assessment of the initiatives to the Congress with its fiscal year 1998 budget request.

The Nonstockpile Program Is Likely to Be Affected by Issues Similar to Those in the Stockpile Program

Recognizing that the stockpile disposal program did not include all chemical warfare materiel that requires destruction, the Congress directed the Army to plan for the disposal of nonstockpile chemical warfare materiel. The Army has spent \$105.9 million and estimates that the nonstockpile program could cost another \$15.1 billion and take nearly 40 years to complete. However, given the factors driving the nonstockpile program, it is uncertain how long the program will take or cost. For example, the program is driven by uncertainties surrounding buried chemical warfare materiel, environmental requirements, and disposal methods. The Army has limited and often imprecise information about the nature and extent of buried chemical materiel, which accounts for \$14.5 billion (95 percent) of the program cost. Environmental issues similar to those experienced in the stockpile program are also likely to affect the Army's ability to obtain the environmental approvals and permits that virtually all nonstockpile activities require. In addition, the Army's disposal concept is not yet fully developed and the Army has not proven that its proposed process can safely and effectively destroy all nonstockpile materiel and will be accepted by the affected states and localities. The nonstockpile program offers some savings opportunities; however, these opportunities create obstacles and issues that would have to be resolved.

The Army Is Far From Accomplishing Its Objectives

Although the Army has made some progress in defining the scope of the program and removing nonstockpile materiel from some locations, more work is required. The Army's objectives for the nonstockpile program are to (1) develop and implement disposal schedules and cost estimates; (2) determine the magnitude of the nonstockpile chemical problem in terms of locations, qualities, and types of agents and materiel; and (3) develop implement transportation and disposal procedures. The Army plans to continue to refine the cost and schedule estimates as the program matures, collect information on the magnitude of nonstockpile materiel, research disposal technologies, and develop disposal plans.

The Army has spent \$105.9 million and estimates that it will cost another \$15.1 billion to dispose of its nonstockpile materiel. The Army's cost estimate is considered a "rough order of magnitude" estimate, typically used when a program is not fully developed. According to the Army, it will issue a revised cost estimate in 1997. To date, nonstockpile materiel has been disposed of on a limited basis, such as the emergency disposal of dangerous items. (See table 3.1.)

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Table 3.1: Summary of Nonstockpile Program Activities

Category	Activity
Binary chemical weapons	Some of the key chemical components have been destroyed and advance planning has been completed.
Miscellaneous chemical warfare materiel	The Army's BZ agent, an incapacitating agent, and bomb bursters have been destroyed. Empty ton containers at Rocky Mountain Arsenal, Colorado, have been shipped to Rock Island Arsenal, Illinois, for smelting.
Recovered chemical warfare materiel	Using isotopic neutron spectroscopy and enhanced X-ray systems, the Army has evaluated and inventoried recovered chemical materiel. The Army discovered that some previously classified recovered chemical materiel did not contain chemical agents and transferred them to the appropriate agency for use or disposal. Some recovered chemical weapons considered dangerous were destroyed.
Former chemical weapons production facilities	A contract was awarded in 1994 to assess requirements, develop technical alternatives, and prepare a statement of work for the disposal of the former production facility in Indiana. Rocky Mountain Arsenal facilities are in the process of remediation. Lessons learned from this effort form the basis for the disposal method and cost estimate for the remaining three sites.
Buried chemical warfare materiel	On the basis of documentation surveys, site visits, and interviews, the Army has developed a database on potential burial sites. In June 1995, the Army contracted for the recovery, transportation, storage, and disposal of chemical materiel discovered at small burial sites. The Army has completed remediation of the Spring Valley site, Washington, D.C.; Forts Richardson and Wainwright, Alaska; Jackson, Mississippi; and Defense Distribution Depot, Ogden, Utah. Remediation activities at small burial sites at the former Raritan Arsenal, New Jersey, and former Fort Segarra, U.S. Virgin Islands, are in process. The Army has initiated remediation actions at large burial sites at Aberdeen Proving Ground and Rocky Mountain Arsenal.

Recovery and Disposal of Buried Chemical Warfare Materiel Will Be Problematic

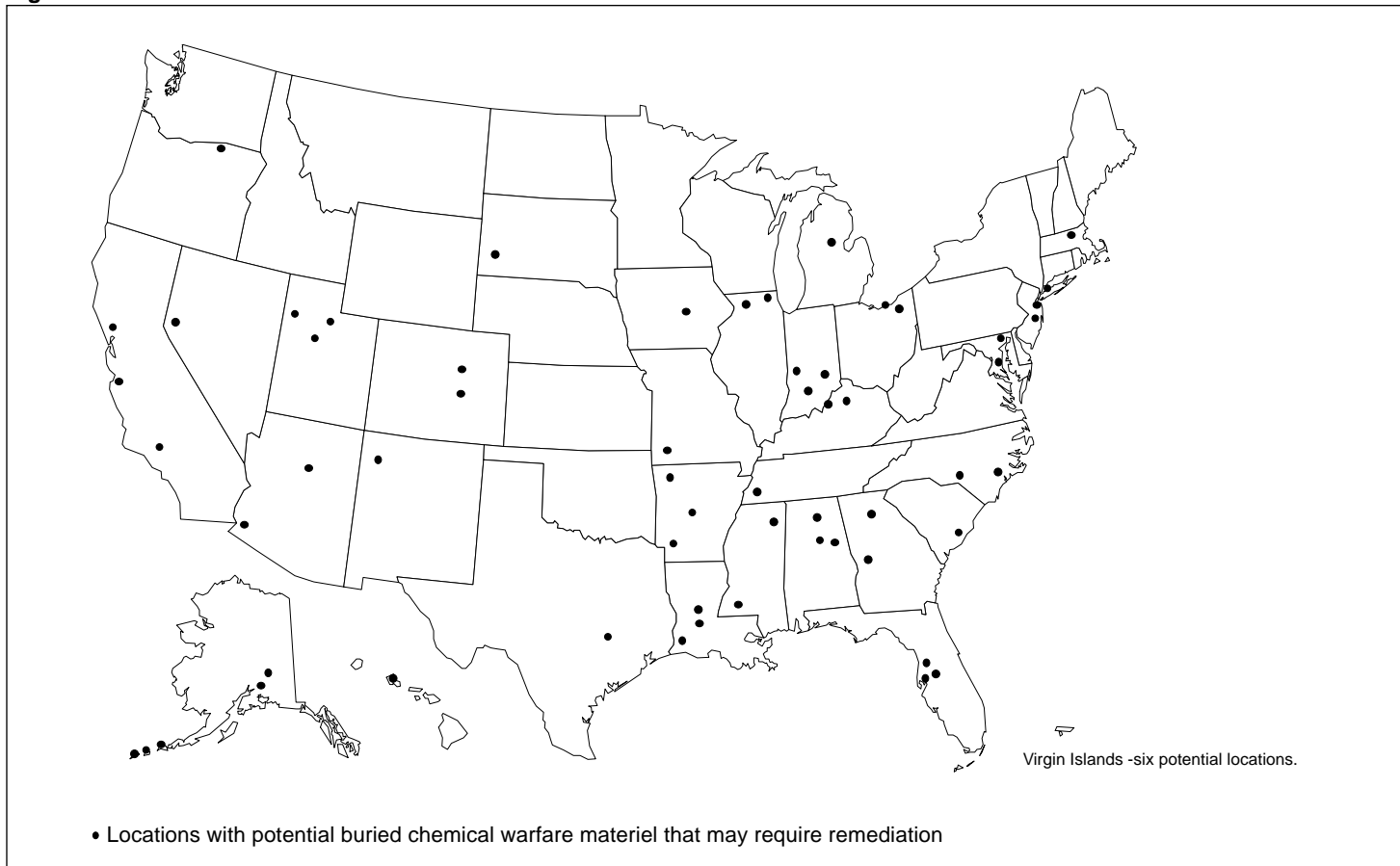
Although the Army has good information about most nonstockpile materiel, it has limited and often imprecise information about the nature and extent of buried items. The Army estimates that it can dispose of binary weapons, recovered chemical weapons, former production facilities, and miscellaneous chemical warfare materiel by the time frames established by the Chemical Weapons Convention. Under the terms of the convention, chemical warfare materiel buried before 1977 is exempt from disposal as long as it remains buried. The Army is still exploring potential sites and has little and often imprecise information about the type and amount of materiel buried. This lack of data can critically affect the successful implementation of the program, because recovering and disposing of buried materiel accounts for 95 percent of the program cost.

Buried Chemical Warfare Materiel Accounts for 95 Percent of Program Cost

The Army estimates that the disposal of buried chemical materiel will cost \$14.5 billion and be completed in 2033. Burial was a common disposal method for chemical warfare materiel until the late 1950s and considered to be the final disposal act. As a result, little record-keeping was done for burial activities and additional chemical burial sites are likely to be discovered. Based on its preliminary analyses, the Army has identified potential buried chemical warfare materiel at 64 locations in 31 states and the U.S. Virgin Islands that may require further investigation or remediation actions. (See fig. 3.1.) Of these locations, 40 are active military installations and 24 are located on formerly used defense sites, which DOD no longer controls. Some locations have multiple sites and include one or more burial pits, weapon ranges, or chemical test sites.

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Figure 3.1: Potential Locations With Buried Chemical Warfare Materiel



Source: Based on 1996 data provided by the Army's Project Manager for Nonstockpile Chemical Materiel.

Even at well-documented sites, the actual amount, chemical agent, condition, and type of buried materiel will remain relatively unknown prior to excavation and visual identification. For example, in 1995 a chlorine-filled projectile was discovered at Fort Lewis, Washington, and more than 260 vials of chemical agent were found buried under the Mississippi State Fairgrounds in Jackson. The Army moved the vials to Pine Bluff Arsenal, where they remain in storage waiting disposal.

In some locations, chemical materiel was expected to be found but was not. For example, a 3-day excavation in 1995 at Fort Wainwright, Alaska,

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uncovered no buried chemical materiel, despite evidence of a burial in the area. The Army's 1993 Survey and Analysis Report indicated that up to 30 cylinders of mustard agent may have been buried in the area.¹ Subsequent ground-penetrating radar also indicated the potential for buried materiel. Upon excavation, the Army discovered the objects detected by the radar were pockets of groundwater sitting on bedrock. The water created an electrical condition that produced the unexplained reading.

Other Nonstockpile
Materiel Has Been Easier
to Locate, but Still Difficult
to Destroy

Over the years, the Army has located and inventoried nonstockpile materiel that has not been buried. Nevertheless, this materiel, which may include energetics and partially deteriorated weapons, will still be difficult to destroy.²

Binary Chemical Weapons

The locations and quantities of binary chemical weapons are well-documented. Binary chemical weapons are formed from two nonlethal elements (called precursors) through a chemical reaction after the munitions are fired. Binary weapons were manufactured, stored, and transported with only one of the chemical elements in the weapon. The second element was to be loaded into the weapon only at the battlefield. As of October 1996, the precursors for the binary chemical weapons are stored at Aberdeen, Pine Bluff, Tooele, and Umatilla.

Miscellaneous Chemical
Warfare Materiel

The Army has documented the location, configuration, quantity, and type of miscellaneous chemical warfare materiel to be destroyed. The materiel was designed for use in the employment of chemical weapons and includes unfilled munitions and components, simulant-filled munitions, dummy rounds, rocket motors, cartridge containers, and other metal and plastic parts. Some items contain explosive charges that may need to be extracted before disposal. According to the Army, miscellaneous materiel is stored at Aberdeen, Anniston, Blue Grass, Pine Bluff, Pueblo, Tooele, Umatilla, and Dugway Proving Ground.

Recovered Chemical Weapons

Chemical weapons have been recovered from range-clearing operations, chemical burial sites, and research and development test areas. According to the Army, most recovered items are stored at Aberdeen, Dugway, Johnston Atoll, Pine Bluff, Tooele, and Rocky Mountain Arsenal. The Army

¹Non-Stockpile Chemical Materiel Program Survey and Analysis Report, Program Manager for Nonstockpile Chemical Materiel (Nov. 1993).

²Energetics are the explosives and propellants in the munitions.

believes that handling and disposing of recovered chemical weapons will be difficult because they are more likely to have deteriorated than other nonstockpile materiel and the identity of the agent is unknown in some of the items.

According to the Army, the most immediate concern of the nonstockpile program is the treatment and disposal of Chemical Agent Identification Sets because of the relative frequency of their recovery and tendency to be found by the general public. The sets consist of chemicals contained in glass ampoules, vials, and bottles that are packed in metal shipping containers and wooden boxes.³ In the late 1930s, approximately 110,000 of the sets were produced in various configurations to train soldiers and sailors how to identify chemical warfare agents. Thousands of the sets are not accounted for and, in some cases, only the glass vials or bottles filled with chemicals have been recovered. A small quantity of sets are stored at Camp Bullis, Texas; Fort Richardson, Alaska; Johnston Atoll, Pacific Ocean; Redstone Arsenal, Alabama; and Tooele Army Depot, Utah.

**Former Chemical Weapon
Production Facilities**

Chemical agent and weapons were produced in various government facilities prior to 1968. These facilities are located at Aberdeen, Pine Bluff, Rocky Mountain Arsenal, and Newport Army Ammunition Plant, Indiana, and are in various degrees of deterioration. DOD is reviewing former production facilities at Swannanoa, North Carolina, and Van Nuys, California, to determine whether they require remediation actions.

**Environmental Laws
and Requirements
Govern Most
Nonstockpile
Activities**

The Army has limited experience destroying nonstockpile materiel and is unfamiliar with what types of environmental problems to expect. Prior to recovering, storing, moving, or destroying nonstockpile chemical warfare materiel, the Army must comply with state environmental laws and regulations. These laws and regulations may impose time frames for certain efforts that, in turn, drive other nonstockpile activities and related costs. For example, if an operating permit is delayed for one of the nonstockpile disposal systems because of an unanticipated requirement, virtually all disposal activities at the remediation site must stop until the permit is issued.

The Resource Conservation and Recovery Act controls hazardous waste through a permit process that requires government approval for individuals who generate, transport, store, or dispose of hazardous waste.

³The sets contain sulfur mustard agent, nitrogen mustard agent, lewisite, phosgene, cyanogen chloride, chloroform, chloropicrin, solid chloroacetophenone, solid triphosgene, solid adamsite, and other chemicals.

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Under the act, the Environmental Protection Agency may authorize individual states to administer and enforce hazardous waste programs that are as least as stringent as the federal program. Although based on the Resource Conservation and Recovery Act's requirements, individual state hazardous waste laws and requirements differ and are occasionally changed. According to the Army, changes in the states' laws and requirements may affect the nonstockpile disposal program because they are likely to apply to most aspects of the program on military installations. According to the Army, state regulatory agencies could add unanticipated requirements to the permitting process, including extra demonstrations or tests prior to the start of disposal operations. Depending on the time involved, disposal activities at follow-on sites could be stalled or suspended, resulting in additional costs. The Resource Conservation and Recovery Act requires (1) site-specific operating permits for the Rapid Response System and munitions management devices; (2) specific disposal standards for the hazardous waste generated by the program; and (3) precise permitting, record-keeping, and reporting requirements.

Similarly, changes in the Comprehensive Environmental Response, Compensation, and Liability Act requirements may affect the nonstockpile program. The act provides overall cleanup procedures for some nonstockpile sites and incorporates the standards of other federal and state statutes if they are applicable or relevant and appropriate to the cleanup process. A specific sequence of activities, guaranteeing the participation of federal and state agencies and the public in key decisions, must be followed before a nonstockpile site can be cleaned up. The act requires (1) completion of remedial investigation and feasibility studies for most formerly used defense sites such as the former Raritan Arsenal, New Jersey; (2) site-specific closure standards; and (3) emergency response actions, such as those taken in response to the Spring Valley site in Washington, D.C.

The Hazardous Materials Transportation Act governs the transportation of most nonstockpile chemical materiel and limits the movement of materiel without special permits, licenses, and authorizations. The act delegates regulatory and enforcement responsibilities to the states but limits some state regulations. Nevertheless, states may still implement routing restrictions, transportation curfews, notification deadlines, and public right-to-know requirements. The act requires specialized packaging for transporting nonstockpile materiel and the treatment residues, and limits commercial transportation of selected nonstockpile chemical materiel or neutralized chemical agent. The Army anticipates that every state

nonstockpile materiel travels through will have some jurisdiction over part of the move.

The Army's Mobile Disposal Systems Are Not Fully Developed

The Army's disposal concept is based on mobile systems capable of moving from location to location where the munitions are characterized and the agent is detoxified, the waste is sent to a commercial hazardous waste facility, and the system and equipment are detoxified before the next move. The Army is developing mobile systems to characterize and destroy Chemical Agent Identification Sets, recovered chemical weapons, and bulk chemical warfare materiel. (See table 3.2.) Although Army officials are confident that the proposed mobile remediation systems will function as planned, the Army needs more time to prove that the systems will safely and effectively destroy all nonstockpile materiel and be accepted by the state regulatory agencies and the public.

Table 3.2: Summary of the Nonstockpile Disposal Systems and Estimated Operational Dates

System	Description	Status
Portable Isotopic Neutron Spectroscopy	A portable, gamma ray system used for noninvasive characterization of elemental components of chemical agents in recovered chemical warfare materiel.	Operational
Raman Spectrophotometer	A portable device used to identify chemical agents inside glass containers found in Chemical Agent Identification Sets.	Operational
Chemical Agent Transfer System	A fixed system at Aberdeen Proving Ground that transfers chemical agents from recovered nonexplosive-configured materiel to storage containers and performs other chemical operations.	Operational
Rapid Response System	A portable system designed to process small amounts of chemical agents and materiel contained in Chemical Agent Identification Sets.	Operational in fiscal year 1998
Munitions Management Device-1	A portable system designed to detoxify most nonexplosive-configured chemical warfare materiel.	Operational in fiscal year 1998
Munitions Management Device-2	A portable system designed to detoxify most explosive-configured chemical warfare materiel. The system will be designed to fully contain any potential explosion resulting from operations.	Operational in fiscal year 1999
Munitions Management Device-3	A portable system designed to detoxify nonexplosive-configured bulk chemical warfare items larger than a 500-pound bomb.	Operational in fiscal year 1998

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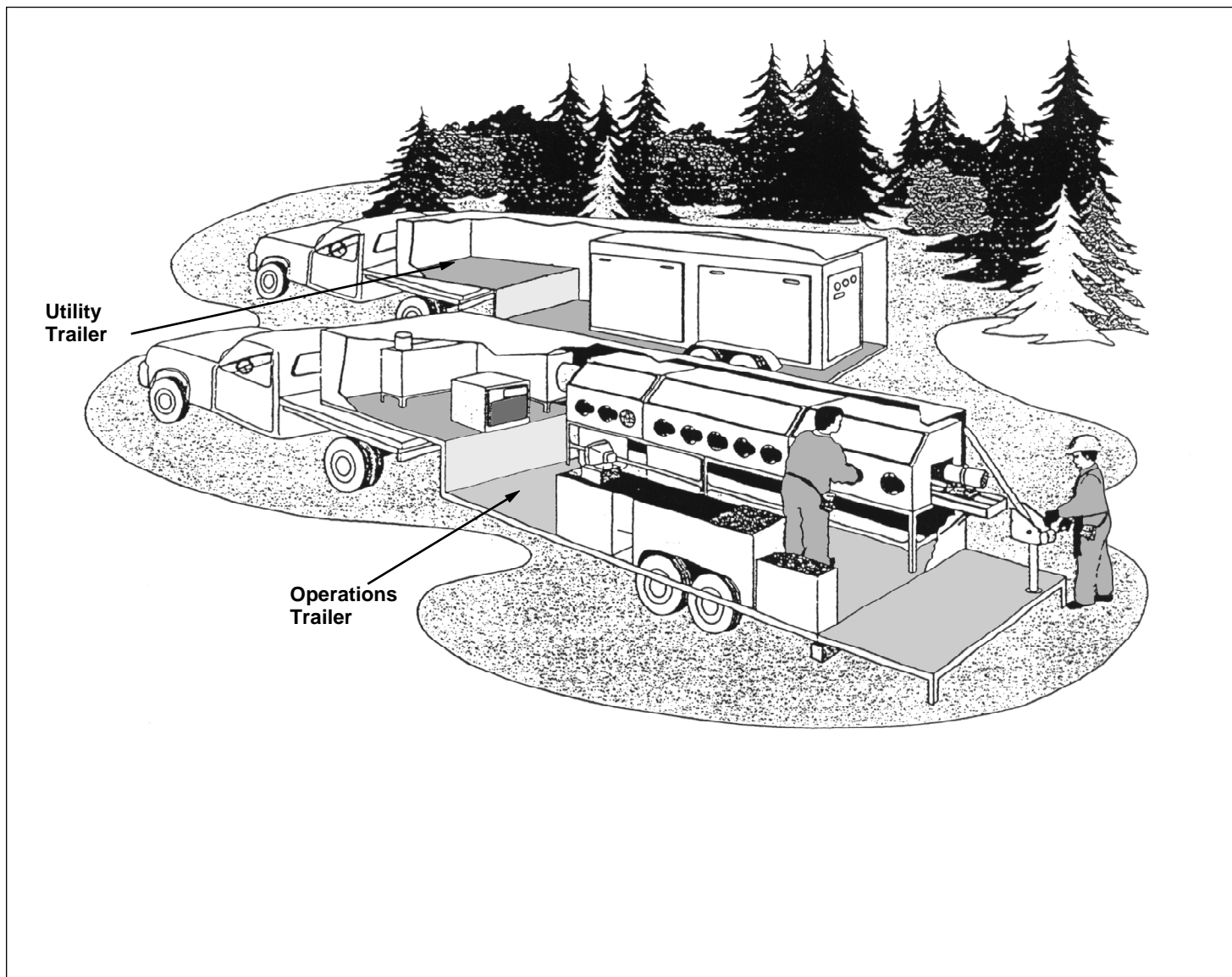
In its 1993 Survey and Analysis Report, the Army concluded that the technical risk for the nonstockpile program was high because the disposal systems were not yet completed. It also reported that if effective processes or procedures were not discovered, it would have to fund “a major research and development program.” In its 1994 risk assessment, the Army reported that the lack of technology for on-site disposal operations could hamper the completion of the nonstockpile program.

Accelerated Program to
Develop the Rapid
Response System

According to the Army, the most immediate concern of the nonstockpile program is the treatment of Chemical Agent Identification Sets because of the relative frequency of their discovery. As a result, the Army accelerated the program to develop a system, called the Rapid Response System, to process and destroy the sets. When operational, the two-trailer system will use commercially available technology. (See fig. 3.2.) The chemical detoxification of the agent, as well as packaging of the waste, will occur inside a glovebox housed in the operational trailer. Air circulating through the glovebox is vented through charcoal filters to entrap agent and other hazardous chemicals prior to discharge from the trailer. The utility trailer houses an electrical generator to use mainly at remote sites and a refrigerator for use in monitoring activities. Once treated with neutralizing chemicals, the residue will be sent to a commercial hazardous waste facility. The system will be detoxified before moving to the next location.

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Figure 3.2: Conceptual Drawing of the Rapid Response System



Source: The Army's Program Manager for Chemical Demilitarization.

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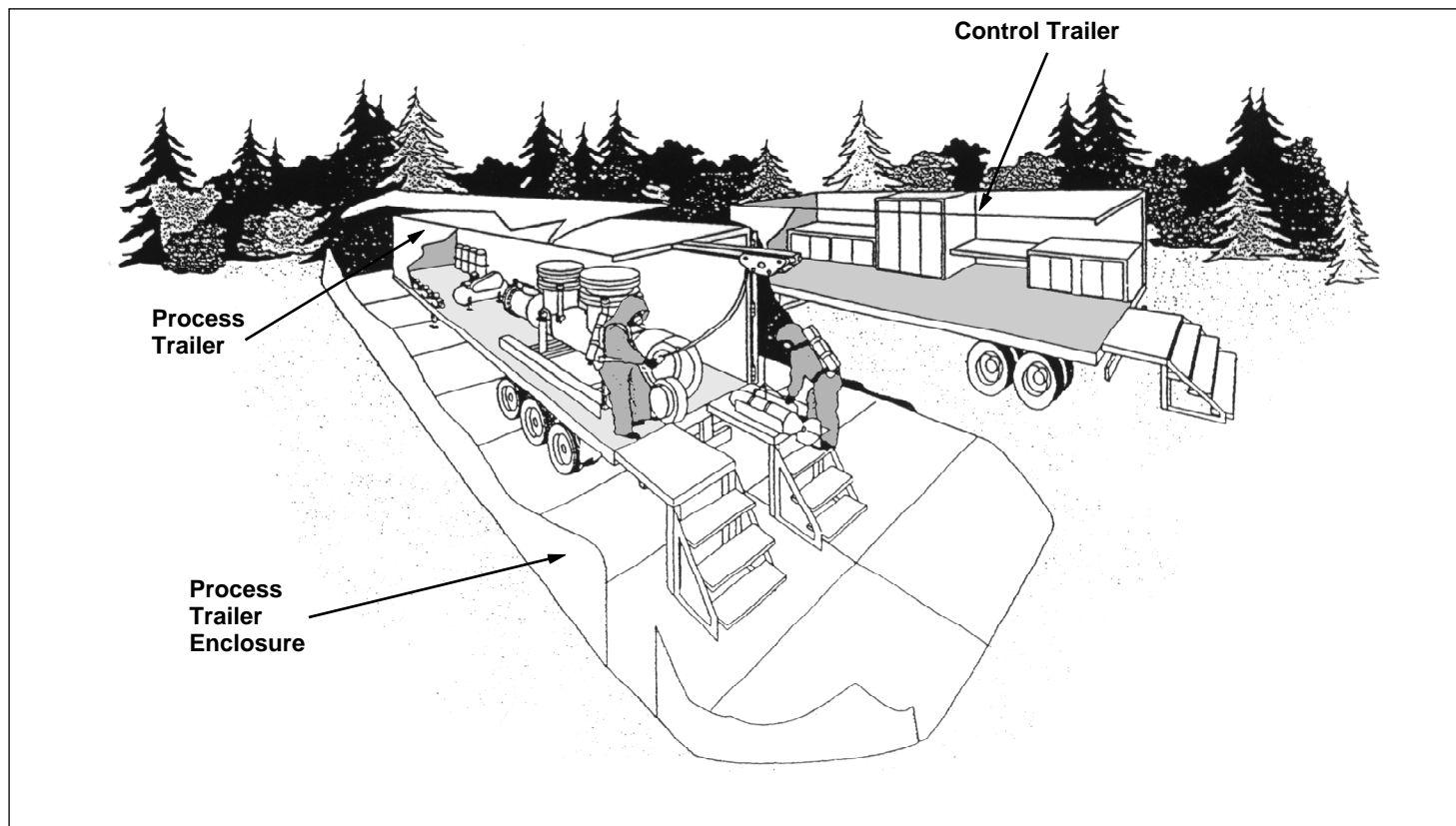
The Rapid Response System has been designed and assembled and is scheduled to be tested at Tooele Army Depot in mid-1997. The Army's slow development of background data for Utah's environmental permitting process has delayed the start of the system's concept demonstration by 9 months. The Rapid Response System is scheduled for its first use at Fort Richardson, Alaska, in fiscal year 1998. It is expected to process 12 to 15 vials of agent each day.

Prototype of the Munitions
Management Devices Is
Scheduled for Operational
Use in Fiscal Year 1998

The Army is developing mobile munitions management devices to assess, access, and dispose of most nonstockpile chemical warfare materiel on site. According to Army officials, the disposal rates are not yet established and could be as low as one or two items per day. The Munitions Management Device-1 consists of two tractor trailers, one for processing nonexplosive configured munitions using chemical neutralization and the other for controlling operations. (See fig. 3.3.) Weapons and materiel will be placed in the treatment vessel, drained of liquid chemical agent, and decontaminated with a neutralizing solution. As a precautionary measure, the process trailer is designed to contain liquid or vapor accidentally released and is surrounded by a tent-like enclosure to provide an additional level of safety. A gas-processing system filters and treats any chemical vapors in the process trailer and the outside is monitored for agent. Neutralized waste is packaged and shipped to a commercial hazardous waste management facility.

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Figure 3.3: Conceptual Drawing of the Munitions Management Device-1



Source: The Army's Program Manager for Chemical Demilitarization.

If the Munitions Management Device-1 proves successful, two other systems will be developed for disposing explosively configured munitions and bulk munitions and containers. The Army considers the Munitions Management Device-2, which will process explosively configured munitions, to be the most technologically challenging of the devices. Its design, fabrication, and testing are scheduled through mid-1998, with two follow-on units scheduled for delivery in 2000 and ready for operation in 2001. The Munitions Management Device-3, scheduled for operations in 1998, will process items larger than 500-pound bombs and recovered ton containers with chemical agent. The Army plans to pack the neutralized chemical waste and ship it to a commercial hazardous waste facility.

Opportunities for Cost and Schedule Reductions Are Limited

The Army could potentially reduce costs by using (1) chemical stockpile disposal facilities for destroying selected nonstockpile materiel or (2) a centralized disposal facility designed specifically for destroying nonstockpile materiel. However, according to Army officials, these options create legal and political obstacles and public acceptance issues that would have to be resolved.

Use of Stockpile Disposal Facilities

The DOD Authorization Act of 1986 (P.L. 99-145), and subsequent legislation, specifies that the chemical stockpile disposal facilities may not be used for any purpose other than the disposal of stockpile weapons. The Army interpreted this legislation to mean that the stockpile disposal facilities, with the exception of the Johnston Atoll Chemical Agent Disposal System, may not be used to dispose of other DOD materiel, including nonstockpile chemical materiel. This interpretation necessitates that the Army, in order to comply with the act, implement separate disposal operations for nonstockpile materiel along side of the stockpile facilities.

In its 1995 implementation plan, the Army suggested that the stockpile disposal facilities could be used to process some nonstockpile weapons, depending on the location, the type of chemical weapon or materiel, and condition.⁴ For example:

- The first category of nonstockpile materiel that could be destroyed includes items that are (1) already located at the disposal site requiring no off-base transportation, (2) similarly configured stockpile weapons scheduled to be disposed of in the facility, and (3) the same agent type as those scheduled to be destroyed in the facility. An example is the nonstockpile ton containers previously filled with mustard agent stored at Tooele Army Depot, Utah. The facility is already designed to dispose of stockpile ton containers filled with mustard agent. The containers are exactly the same except that the nonstockpile containers were used in prior sampling and disposal programs and historically recorded as nonstockpile, while the stockpile containers hold production stock.
- A second category of nonstockpile materiel includes items that (1) are already located at the disposal site, (2) are similarly configured to items scheduled for disposal, and (3) contain a different agent type than those scheduled to be destroyed in the facility. An example is the nonstockpile ton containers filled with nerve agent stored at Aberdeen Proving Ground,

⁴Non-Stockpile Chemical Materiel Program Implementation Plan, U.S. Army Program Manager for Chemical Demilitarization (Aug. 1995).

Maryland. With some modifications to a stockpile disposal facility designed to incinerate mustard-filled ton containers, the facility could destroy the containers filled with nerve agent.

- A third, and more difficult, category of nonstockpile materiel includes items that are (1) already located at the disposal site, (2) configured somewhat differently than the stockpile weapons scheduled for disposal, and (3) the same or different agent type as those scheduled to be destroyed. An example is the nonstockpile bottles of mustard agent located at Pueblo Depot Activity, Colorado. Pueblo's proposed facility will be designed to destroy mustard agent and could easily incinerate the bottles.⁵ According to Army officials, some nonstockpile materiel in this category would probably be easier processed, and for less money, by one of the proposed nonstockpile disposal systems.
- The last category involves transporting nonstockpile materiel from its current storage or burial site to an existing stockpile disposal facility. However, the 1995 National Defense Authorization Act (P.L. 103-337) allows the transport of only newly discovered nonstockpile materiel to the nearest storage site that has the necessary environmental permits. The nearest permitted location may not have the appropriate facilities to dispose of the materiel.

The Resource Conservation and Recovery Act also has the potential to limit using the stockpile disposal facilities to destroy nonstockpile materiel. State regulators, under the act's comprehensive body of requirements, can implement disposal limits and controls for the disposal facilities. For example, the state of Utah has established disposal limits for the Tooele Chemical Agent Disposal Facility based on the amounts of chemical weapons and agent stockpiled at Tooele. To dispose of nonstockpile materiel, the Army would have to amend the Resource Conservation and Recovery Act permit to increase the facility's disposal limits. The amendment process, controlled by the state, requires time and money. In addition, DOD and Army officials expect that any efforts to increase the use of the stockpile facilities would likely result in strong state and public opposition and potential delays in the state environmental permitting process.

⁵The 1997 DOD Appropriations Act prohibits DOD from obligating any funds for constructing disposal facilities at Blue Grass, Kentucky, and Pueblo, Colorado, until 180 days after the Secretary reports on disposal alternatives.

**Use of a Centralized
Facility Designed
Specifically for Destroying
Nonstockpile Materiel**

Another method for destroying nonstockpile chemical materiel could be the use of a central disposal facility with equipment designed specifically for destroying nonstockpile materiel. The facility could operate in cooperation with existing government and commercial facilities—much the way it will be done in European countries. According to Army officials, a similar program in the United States would reduce the costs of the nonstockpile program. However, the legislative restrictions on the transportation of nonstockpile materiel would have to be lifted to make a central disposal facility a viable option. In addition, the current process of individual states establishing their own environmental requirements and prevalent public attitude that a chemical weapons disposal facility should not be located in their vicinity would be significant obstacles that would have to be resolved to make a centralized disposal facility viable.

Conclusions, Matters for Congressional Consideration, and Agency Comments

Conclusions

While there is general agreement about the need to destroy the chemical stockpile and related nonstockpile materiel, progress has slowed due to the lack of consensus among DOD and affected states and localities about the destruction method that should be used. As a result, the cost and schedule for the disposal programs are uncertain. However, the programs are likely to cost more than the estimated \$24.4 billion above current expenditures and take longer than currently planned. The key factors impacting the programs include public concerns about the safety of incineration, compliance with environmental laws and regulations, legislative requirements, and the introduction of alternative disposal technologies.

The Chemical Stockpile Disposal Program cost and schedule are largely driven by the degree to which states and local communities are in agreement with the proposed disposal method. Historically reaching agreement has consistently taken longer than the Army anticipated. Furthermore, the recent congressional direction in the 1997 Authorization and Appropriations Acts to research and develop alternative technologies to destroy assembled chemical munitions indicates that there is continued public concern about the proposed disposal method. Until DOD and the affected states and localities reach agreement on a disposal method for individual sites, the Army will not be able to predict the Chemical Stockpile Disposal Program cost and schedule with any degree of accuracy. Moreover, many of the problems experienced in the stockpile program are also likely to affect the Army's ability to implement the Nonstockpile Chemical Materiel Program. For example, efforts to dispose of nonstockpile materiel are likely to be driven by the need to obtain state and local approvals for destruction methods. In addition, more time is needed for the Army to prove that its proposed disposal method for the nonstockpile program will be safe and effective and accepted by the affected states and localities.

Recognizing the difficulty of satisfactorily resolving the public concerns associated with each individual disposal location, suggestions have been made by Members of the Congress, DOD officials, and others to change the programs' basic approach to destruction. However, the suggestions create tradeoffs for decision makers and would require changes in existing legal requirements. These suggestions have included deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed, consolidating disposal operations at a national or regional sites, destroying selected nonstockpile chemical warfare materiel in stockpile disposal facilities, establishing a centralized disposal

facility for nonstockpile materiel, and modifying existing laws and regulations to standardize environmental requirements.

Matters for Congressional Consideration

As the Congress continues its oversight of the chemical stockpile and nonstockpile disposal programs and considers modifications or alternatives to the current approach, it may wish to include consideration of the suggestions discussed in this report relating to the creation of alternative technologies, consolidation of stockpile disposal operations, utilization of stockpile facilities for nonstockpile items, centralization of nonstockpile destruction, and standardization of environmental laws and requirements.

Agency Comments

DOD provided written comments on a draft of this report and they are presented in their entirety in appendix V. DOD stated that the draft accurately and fairly characterized the current status of the disposal programs and generally concurred with the suggestions of the draft report that changes in existing legal requirements would be necessary to change the current path of the disposal programs.

While DOD agreed that the Congress could consider options presented by us, it recommended consideration of the ones to establish a centralized disposal facility for nonstockpile materiel and to modify existing laws and regulations to standardize environmental requirements for chemical weapons disposal. DOD does not support consideration of deferring plans for additional stockpile disposal facilities until an acceptable alternative technology is developed because such delays result in substantial increases in public risk from continued storage of the stockpile. DOD does not recommend transportation of the stockpile at this time because transportation of chemical weapons increases the risk to the general public. In addition, DOD recommended against using stockpile disposal facilities to destroy nonstockpile materiel because of the strong public opposition to both the use of stockpile disposal facilities to treat any other waste materiel and the transportation of chemical materiel for disposal in these facilities.

Our draft report recognized that some options could increase the risk to the general public and would likely be opposed by some of the affected states and localities and other interested parties. We presented the options in context of their tradeoffs should the Congress wish to address the key factors affecting the programs' disposal costs and schedule. We did not

Chapter 4
Conclusions, Matters for Congressional
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take a position on the options or current approach given the associated policy and legislative implications.

Objectives, Scope, and Methodology

Due to continuing congressional and public interest about the progress and cost of the programs, we prepared this report under our basic legislative responsibilities to provide an overall assessment of the (1) programs' cost and schedule, (2) alternatives for improving program effectiveness and efficiency, and (3) actions the Army has and is taking to improve the programs. During our review, we interviewed and obtained data from officials of the Department of Defense (DOD), the Army, the Army Chemical and Biological Defense Agency, the U.S. Army Nuclear and Chemical Agency, and the U.S. Army Corps of Engineers. We also met with U.S. Environmental Protection Agency officials to discuss and collect data on environmental and legal issues related to the disposal programs. We visited Aberdeen Proving Ground, Maryland; Anniston Army Depot, Alabama; Pine Bluff Arsenal, Arkansas; Pueblo Depot Activity, Colorado; Tooele Army Depot, Utah; and Umatilla Depot Activity, Oregon. We also visited state and county officials in Alabama, Arkansas, Colorado, Maryland, Oregon, and Utah. We did not include the Chemical Stockpile Emergency Preparedness Program and overseas U.S. chemical warfare material in our review. We plan to issue a report later this year on the status and the management of the Chemical Stockpile Emergency Preparedness Program in the ten states participating in the program.

To assess the programs' cost and schedule, we reviewed the Army's implementation plans, disposal data, status reports, and data on environmental and legal issues. We reviewed the Army's estimation methodology, potential problems that may affect current cost and schedule estimates, and the causes of previous schedule slippages and cost increases. We analyzed (1) the reasons for the public concerns about incineration of chemical agents, (2) the Army's efforts to obtain environmental permits and current issues, (3) obstacles in the environmental compliance and permitting process, (4) the status of the environmental permits at each of the disposal sites, and (5) federal and state environmental laws and regulations that apply to the disposal programs. We also obtained federal and state officials' views on the accuracy of the Army's estimated schedule to determine how current or proposed state laws or regulations could affect the disposal programs.

To assess alternatives for improving program effectiveness and efficiency, we analyzed the Army's current cost position and initiatives for reducing costs and shortening the disposal schedules. We also examined data on the Army's management approach to contracting, disposal experience at Johnston Atoll and Tooele, the baseline incineration process, and approaches for addressing environmental permitting issues. To assess

technological alternatives, we analyzed data on disposal technologies, the advantages and disadvantages of the baseline incineration process, the advantages and disadvantages of selected alternatives, and public concerns and issues related to the baseline and alternative technologies. We also analyzed plans and methodologies for developing alternative technologies, costs and schedule data related to the alternatives, acquisition strategies and responsibilities, and test and evaluation results. To assess transportation options, we analyzed transportation studies and concepts, packaging methods, and the risk associated with transportation. We reviewed data on chemical weapon movements, chemical munitions transport packaging systems, transportation containers for hazardous material, potential transportation routes, emergency response plans, and transportation modes. In addition, we collected information concerning the public opposition to transportation of chemical weapons, obstacles in the environmental compliance and permitting process for transportation options, and environmental laws and regulations applicable to transportation.

To assess the actions the Army has and is taking to improve the programs, we reviewed DOD's 1994 designation of the Army's chemical demilitarization program as a major defense acquisition program. We documented and analyzed data on lessons learned from disposal operations at Johnston Atoll Chemical Agent Disposal System and Tooele Chemical Agent Disposal System and their effects on the stockpile and nonstockpile programs. Lastly, we reviewed the Army's actions to strengthen its public outreach efforts and improve its monitoring and inspection of chemical munitions.

DOD provided written comments on a draft of this report. These comments are presented in their entirety in appendix V.

We performed our review from August 1995 to November 1996 in accordance with generally accepted government auditing standards.

Appropriated, Obligated, and Disbursement Data for Fiscal Years 1988 Through 1997

Table II.1: Chemical Stockpile Disposal Program

Dollars in millions			
Fiscal year	Appropriated	Obligated	Expended
1988	\$195.8	\$194.3	\$192.9
1989	168.0	165.5	165.4
1990	210.4	208.2	205.9
1991	255.0	252.3	251.5
1992	331.3	330.1	326.8
1993	419.1	417.9	316.0
1994	249.1	246.7	234.9
1995	486.5	472.2	279.2
1996	484.2	346.0	130.5
1997	534.7		
Total	\$3,334.1	\$2,633.2	\$2,103.1

Table II.2: Alternative Technologies and Approaches Project

Dollars in millions			
Fiscal year	Appropriated	Obligated	Expended
1994	\$22.4	\$22.2	\$10.2
1995	9.4	9.4	6.8
1996	22.2	19.6	12.2
1997	56.0		
Total	\$110.0	\$51.2	\$29.2

Table II.3: Chemical Stockpile Emergency Preparedness Project

Dollars in millions			
Fiscal year	Appropriated	Obligated	Expended
1988	\$2.5	\$2.5	\$2.5
1989	11.3	11.3	11.1
1990	43.8	43.7	43.3
1991	37.7	37.6	37.5
1992	40.9	40.5	40.0
1993	88.2	87.5	62.1
1994	71.9	71.6	65.5
1995	56.5	56.4	27.6
1996	80.0	65.2	27.3
1997	82.4		
Total	\$515.2	\$416.3	\$316.9

Appendix II
Appropriated, Obligated, and Disbursement
Data for Fiscal Years 1988 Through 1997

Table II.4: Nonstockpile Chemical Materiel Program

Dollars in millions			
Fiscal year	Appropriated	Obligated	Expended
1992	\$2.2	\$2.2	\$2.2
1993	6.3	6.3	6.0
1994	31.5	31.2	26.4
1995	26.0	25.8	18.5
1996	69.7	40.4	14.6
1997	85.3		
Total	\$221.0	\$105.9	\$67.7

Source: The Army's Program Manager for Chemical Demilitarization.

Summary of Major Federal Environmental Laws Affecting the Army's Disposal Programs

Date	Title	Provisions
1969	The National Environmental Policy Act (42 U.S.C. 4321 <u>et seq.</u>)	Requires the Army to develop an environmental impact statement or assessment about the potential environmental effects of destroying chemical weapons and materiel.
1970	The Clean Air Act, as amended (42 U.S.C. 7401 <u>et seq.</u>)	Governs potential sources of air pollutants and establishes emission standards. The Army must obtain permits for air pollution control prior to constructing and operating any disposal facility.
1972	The Marine Protection, Search, and Sanctuaries Act (33 U.S.C. 1411 <u>et seq.</u>)	Restricts ocean dumping of chemical weapons.
1974	The Hazardous Materials Transportation Act (49 U.S.C. 5101 <u>et seq.</u>)	Regulates the packaging, marking, loading, and transporting of hazardous materials by road or rail.
1976	The Toxic Substances Control Act, as amended (15 U.S.C. 2601 <u>et seq.</u>)	Regulates the disposal of items containing polychlorinated biphenyls and asbestos. The fiberglass matrices of the shipping and firing tubes for stockpiled M55 rockets contain polychlorinated biphenyls, and some former production facilities contain asbestos.
1976	The Resource Conservation and Recovery Act, as amended (42 U.S.C. 6901 <u>et seq.</u>)	Regulates the treatment, storage, and disposal of hazardous waste. The Army must obtain state permits prior to constructing and operating any disposal facility or system where stockpile and nonstockpile items are classified as hazardous waste.
1977	The Clean Water Act, as amended (33 U.S.C. 1251 <u>et seq.</u>)	Governs potential sources of water pollution and specifically prohibits the discharge of any chemical agent into U.S. navigable waters.
1980	The Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9620 <u>et seq.</u>)	Addresses hazardous substance releases into the soil, air, surface water, and groundwater and regulates the cleanup of these releases. A specific sequence of activities guaranteeing the participation of federal and state agencies and the public in key decisions must be followed before cleanup of some nonstockpile sites.

Chronology of the U.S. Chemical Demilitarization Program

Time frame	Activity
1917-1960s	Obsolete or unserviceable chemical warfare agents and munitions were disposed of by open pit burning, land burial, and ocean dumping.
1969	The National Academy of Sciences recommended that ocean dumping be avoided and that public health and environmental protection be emphasized. It suggested two alternatives to ocean disposal: chemical neutralization of nerve agents and incineration of mustard agents.
1970	The Armed Forces Authorization Act (P.L. 91-441) required a Department of Health and Human Services review of any disposal plans and detoxification of weapons prior to disposal. It also limited the movement of chemical weapons.
1971	The Foreign Military Sales Act prohibited the transportation of U.S. chemical weapons from Okinawa, Japan, to the continental United States. The weapons were moved to Johnston Atoll in the Pacific Ocean.
1971-1973	The Army tested and developed an incineration process and disposed of several thousand tons of mustard agent stored in ton containers at Rocky Mountain Arsenal.
1973-1976	The Army disposed of nearly 4,200 tons of nerve agent by chemical neutralization at Tooele Army Depot and Rocky Mountain Arsenal. The process was problematic and not very reproducible, making automation difficult.
1979	The Army opened the Chemical Agent Munitions Disposal System at Tooele to test and evaluate disposal equipment and processes for chemical agents and munitions on a pilot scale.
1981	The Army decided to build the Johnston Atoll Chemical Agent Disposal System to dispose of its chemical M55 rocket stockpile.
1981-1986	The Army used the Chemical Agent Munitions Disposal System to test and evaluate incineration of chemical agents and energetic materiel, and decontamination of metal parts and ton containers.
1982	An Arthur D. Little Corporation study for the Army concluded that using incineration, rather than neutralization, to dispose of the stockpile would reduce costs.
1982	The Army declared its stockpile of M55 rockets obsolete.
1983	The Army expanded its chemical disposal program to include the M55 rocket stockpile at Anniston Army Depot, Umatilla Depot Activity, and Blue Grass Depot Activity.
1984	The Army expanded its chemical disposal program to include the M55 rocket stockpile at Pine Bluff Arsenal and Tooele Army Depot.
1984	The National Research Council endorsed the Army's disassembly and high-temperature incineration process for disposing of chemical agents and munitions. It also recommended that the Army continue to store most of the chemical stockpile, dispose of the M55 rockets, and analyze alternative methods for disposing of the remaining chemical stockpile.
1985	The Army began construction of the Johnston Atoll Chemical Agent Disposal System.
1985	The DOD Authorization Act for Fiscal Year 1986 (P.L. 99-145) mandated the destruction of the U.S. stockpile of lethal chemical agents and munitions. It also required that the disposal facilities be cleaned, dismantled, and disposed of according to applicable laws and regulations.
1986	The DOD Appropriations Act for Fiscal Year 1987 (P.L. 99-500) prohibited shipments of chemical weapons, components, or agents to the Blue Grass Depot Activity for any purpose.
1987	Chemical Agent Munitions Disposal System operations were suspended as a result of a low-level nerve agent release.
1988	The Army issued the Final Programmatic Environmental Impact Statement for the Chemical Stockpile Disposal Program. The Army selected on-site disposal of the chemical stockpile because it posed fewer potential risks than transportation and off-site disposal.
1988	The National Defense Act of Fiscal Year 1989 (P.L. 100-456) required the Army to complete operational verification testing at Johnston Atoll before beginning to systematize similar disposal facilities in the continental United States.

(continued)

**Appendix IV
Chronology of the U.S. Chemical
Demilitarization Program**

Time frame	Activity
1989	The Army started construction of the chemical demilitarization facility at Tooele Army Depot.
1990	The Army completed the successful retrograde of all chemical munitions stored in Germany to storage facilities at Johnston Atoll.
1990	The Army initiated disposal of M55 rockets at Johnston Atoll.
1990	A very small amount of nerve agent leaked through the common stack during maintenance activities at Johnston Atoll. The agent release was below allowable stack concentration.
1990-1993	The Army completed four operational verification tests of the Johnston Atoll Chemical Agent Disposal System. During the tests, the Army destroyed more than 40,000 munitions containing nerve and mustard agents. In August 1993, the Secretary of Defense certified to the Congress that the Army had successfully completed the operational verification tests at Johnston Atoll.
1991	The National Defense Authorization Act for Fiscal Year 1991 (P.L. 101-510) restricted the use of funds to transport chemical weapons to Johnston Atoll except for U.S. munitions discovered in the Pacific, prohibited the Army from studying the movement of chemical munitions, and established the emergency preparedness program.
1991	The Army moved 109 World War II mustard-filled projectiles from the Solomon Islands to Johnston Atoll for storage and disposal.
1991	The National Defense Authorization Act for Fiscal Years 1992 and 1993 (P.L. 102-190) required the Secretary of Defense to develop a chemical weapons stockpile safety contingency plan.
1992	The U.S. Army Chemical Materiel Destruction Agency was established to consolidate operational responsibility for the destruction of chemical warfare capabilities into one office.
1992	The National Defense Authorization Act for Fiscal Year 1993 (P.L. 102-484) directed the Army to establish citizens' commissions for states with storage sites, if the state's governor requested one. It also required the Army to report on (1) disposal alternatives to the baseline incineration method and (2) plans for destroying U.S. nonstockpile chemical weapons and materiel identified in the Chemical Weapons Convention.
1993	The Johnston Atoll Chemical Agent Disposal System was shut down during operation and verification tests when residue explosive material generated during the processing of M60 105mm projectiles caught fire, causing damage to a conveyor belt and other equipment in the explosive containment room.
1993	The Army completed construction and started systemization of the Tooele Chemical Agent Disposal Facility.
1993	The Army issued its report on the physical and chemical integrity of the chemical stockpile to the Congress.
1993	A mustard leak from a ton container was discovered at Tooele Army Depot.
1993	The Army issued an interim survey and analysis report on the Nonstockpile Chemical Materiel Program to the Congress.
1994	Approximately 11.6 milligrams of nerve agent were released into the atmosphere at the Johnston Atoll facility during a maintenance activity on the liquid incinerator.
1994	The National Research Council issued its recommendations for the disposal of chemical agents and munitions to the Army.
1994	The Army issued its alternative demilitarization technology report to the Congress. The Army recommended the continuation of the chemical demilitarization program without deliberate delay and the implementation of a two-technology research and development program.
1994	The Army issued its M55 rocket stability report to the Congress. The report recommended that an enhanced stockpile assessment program be initiated to better characterize the state of the M55 rocket in the stockpile.
1994	The Army initiated the Alternative Technologies Project to develop an alternative disposal technology to the baseline incineration process for the bulk-only stockpile locations in Maryland and Indiana. This research and development effort is conducted in conjunction with activities to implement the baseline program.

(continued)

**Appendix IV
Chronology of the U.S. Chemical
Demilitarization Program**

Time frame	Activity
1994	The U.S. Army Chemical Materiel Destruction Agency was redesignated the U.S. Army Chemical Demilitarization and Remediation Activity after a merger with the U.S. Army Chemical and Biological Defense Command. In addition, the Army restructured and centralized its chemical stockpile emergency preparedness program to streamline procedures, enhance responsiveness of operations, and improve the budgeting process.
1994	The Assistant Secretary of the Army for Research, Development and Acquisition became the DOD Executive Agent for the Chemical Demilitarization Program, replacing the Assistant Secretary of the Army for Installations, Logistics, and Environment. The Chemical Demilitarization Program was designated a DOD Acquisition Category 1D Program.
1995	The Army initiated the Enhanced Stockpile Surveillance Program to investigate, develop, and support methods to improve monitoring and inspection of chemical munitions.
1995	The U.S. Army Chemical Demilitarization and Remediation Activity was renamed the Program Manager for Chemical Demilitarization.
1995	The Johnston Atoll Chemical Agent Disposal System surpassed the 1-million pounds target and completed the disposal of all M55 rockets stored on Johnston Atoll. Disposal rates exceeded established goals.
1995	A perimeter monitor located about 100 yards from the demilitarization building at Johnston Atoll detected a trace level of nerve agent. The source of the leak was identified as a door gasket in the air filtration system. Temporary air locks were erected and the gasket replaced. No one was harmed from this event.
1995	The Army awarded the contract for small burial sites and issued its implementation plan for the nonstockpile program.
1995	The Tooele Chemical Agent Disposal Facility completed equipment systemization testing.
1995	The Army certified to the Congress that all Browder Amendment requirements for the award of the Anniston construction contract were met.
1996	The National Defense Authorization Act for Fiscal Year 1996 (P.L. 104-106) directed DOD to conduct an assessment of the Chemical Stockpile Disposal Program and options that could be taken to reduce program costs.
1996	The Army completed disposal of all Air Force and Navy bombs stored on Johnston Atoll ahead of schedule.
1996	The Army awarded the systems contract for the construction, operation, and closure of the proposed Anniston Chemical Agent Disposal Facility. Construction of the facility is scheduled to begin after the state of Alabama issues the environmental permits.
1996	The Army started disposal operations at the Tooele Chemical Agent Disposal Facility. Shortly after the start, operations were shut down for a week after a small amount of agent was detected in a sealed vestibule attached to the air filtration system. No agent was released to the environment and no one was harmed.
1996	Several hair line cracks were discovered in the concrete floor of the Tooele disposal facility's decontamination area. The cracks caused a small amount of decontamination solution to leak to an electrical room below. No agent was detected and the cracks were sealed.
1996	The 1997 National Defense Authorization Act (P.L. 104-201) directed DOD to conduct an assessment of alternative technologies for the disposal of assembled chemical munitions. The act also directed the Secretary of Defense to report on this assessment by December 31, 1997.
1996	The 1997 DOD Appropriations Act (P.L. 104-208) provided the Army \$40 million to conduct a pilot program to identify and demonstrate two or more alternatives to the baseline incineration process for the disposal of assembled chemical munitions. The act also prohibited DOD from obligating any funds for constructing disposal facilities at Blue Grass and Pueblo until 180 days after the Secretary reports on the alternatives.
1996	The Chemical Weapons Convention was ratified by the 65th country needed to make the convention effective. As a result, the convention will go into effect April 29, 1997. Through ratification, the United States will agree to dispose of its (1) unitary chemical weapons stockpile, binary chemical weapons, recovered chemical weapons, and former chemical weapon production facilities by April 29, 2007, and (2) miscellaneous chemical warfare materiel by April 29, 2002.

Comments From the Department of Defense



ATOMIC ENERGY

ASSISTANT TO THE SECRETARY OF DEFENSE
3050 DEFENSE PENTAGON
WASHINGTON, DC 20301-3050



JAN 10 1997

Mr. David R. Warren
Director, Defense Management Issues
National Security and International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Warren:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) Draft Report, "CHEMICAL WEAPONS AND MATERIEL: Key Factors Affecting Disposal Costs and Schedule," dated November 27, 1996 (GAO Code 709134/OSD Case 1260).

The DoD considers the Draft Report to be an accurate and fair characterization of the current status of the United States Chemical Demilitarization Program. The DoD generally concurs with the suggestions of the Draft Report that changes in existing legal requirements will be necessary in order to change the current path of the program.

The comments of DoD in response to the matters for Congressional Consideration suggested by the Draft Report are attached.

Sincerely,

Theodore M. Procv
Deputy for Chemical and Biological Matters

Attachment



GAO DRAFT REPORT - DATED NOVEMBER 27, 1996
GAO CODE 709134/OSD CASE 1260

“CHEMICAL WEAPONS AND MATERIEL: Key Factors Affecting
Disposal Costs and Schedule”

DoD COMMENTS IN RESPONSE TO THE MATTERS FOR
CONGRESSIONAL CONSIDERATION

SUGGESTION 1: The GAO suggested that should the Congress decide to consider modifications or alternatives to the current approach, it could explore deferring plans for additional disposal facilities until an acceptable alternative technology to incineration is developed. (p. 80, p. 82/GAO Draft Report)

Now on pp. 55 and 56.

DoD Response: The Department of Defense concurs with the general conclusion that, if Congress wishes to change the program’s current path, substantial changes in existing legal requirements will be required. The Department agrees that Congress could explore deferring plans for additional disposal facilities until an acceptable alternative technology is developed. However, as has been noted by the National Research Council, such delays result in substantial increases in public risk from the continued storage of the source of such risk -- the stockpile itself. The Department does not support unnecessary or extended delays in the destruction effort.

SUGGESTION 2: The GAO suggested that should the Congress decide to consider modifications or alternatives to the current approach, it could explore consolidating disposal operations at a national or regional sites. (p. 81, p. 83/GAO Draft Report)

Now on pp. 55 and 56.

DoD Response: The Department concurs with the general conclusion that, if the Congress wishes to change the program’s current path, substantial changes in existing legal requirements will be required. The Department also agrees that Congress could explore transportation of elements of the stockpile. In the past, programmatic risk estimates have indicated that this option increases risk to the general public. The Department does not recommend transportation of the stockpile at this time.

SUGGESTION 3: The GAO suggested that should the Congress decide to consider modifications or alternatives to the current approach, it could explore destroying selected non-stockpile chemical warfare materiel in stockpile disposal facilities. (p. 81, p. 83/GAO Draft Report)

Now on pp. 55 and 56.

DoD Response: The Department concurs with the general conclusion that, if the Congress wishes to change the program’s current path, substantial changes in existing legal requirements will be required. The Department also agrees that Congress could

explore the use of the stockpile disposal facilities for destroying non-stockpile materiel. It should be considered, however, that the public has expressed strong opposition to both the use of the stockpile destruction facilities for treating any other waste material and the transportation of material for treatment in a stockpile destruction facility. The Department does not support the use of baseline facilities for treatment of non-stockpile materiel.

SUGGESTION 4: The GAO suggested that should the Congress decide to consider modifications or alternatives to the current approach, it could explore establishing a centralized disposal facility for non-stockpile materiel. (p. 81, pp. 83-84/GAO Draft Report)

DoD Response: The Department concurs with the GAO suggestion as written.

SUGGESTION 5: The GAO suggested that should the Congress decide to consider modifications or alternatives to the current approach, it could consider modifying existing laws and regulations to stabilize environmental requirements. (p. 81, p. 85/GAO Draft Report)

DoD Response: The Department concurs with the GAO suggestion as written.

Now on pp. 55 and 56.

Now on pp. 55 and 56.

Major Contributors to This Report

**National Security and
International Affairs
Division, Washington,
D.C.**

Thomas J. Howard, Assistant Director
Glenn D. Furbish, Senior Evaluator
Mark A. Little, Senior Evaluator
Bonita J. Page, Evaluator

Appendix VI
Major Contributors to This Report

Related GAO Products

Chemical Weapons Stockpile: Emergency Preparedness in Alabama Is Hampered by Management Weaknesses (GAO/NSIAD-96-150, July 23, 1996).

Chemical Weapons Disposal: Issues Related to DOD's Management (GAO/T-NSIAD-95-185, July 13, 1995).

Chemical Weapons: Army's Emergency Preparedness Program Has Financial Management Weaknesses (GAO/NSIAD-95-94, Mar. 15, 1995).

Chemical Stockpile Disposal Program Review (GAO/NSIAD-95-66R, Jan. 12, 1995).

Chemical Weapons: Stability of the U.S. Stockpile (GAO/NSIAD-95-67, Dec. 22, 1994).

Chemical Weapons Disposal: Plans for Nonstockpile Chemical Warfare Materiel Can Be Improved (GAO/NSIAD-95-55, Dec. 20, 1994).

Chemical Weapons: Issues Involving Destruction Technologies (GAO/T-NSIAD-94-159, Apr. 26, 1994).

Chemical Weapons Destruction: Advantages and Disadvantages of Alternatives to Incineration (GAO/NSIAD-94-123, Mar. 18, 1994).

Arms Control: Status of U.S.-Russian Agreements and the Chemical Weapons Convention (GAO/NSIAD-94-136, Mar. 15, 1994).

Chemical Weapon Stockpile: Army's Emergency Preparedness Program Has Been Slow to Achieve Results (GAO/NSIAD-94-91, Feb. 22, 1994).

Chemical Weapons Storage: Communities Are Not Prepared to Respond to Emergencies (GAO/T-NSIAD-93-18, July 16, 1993).

Chemical Weapons Destruction: Issues Affecting Program Cost, Schedule, and Performance (GAO/NSIAD-93-50, Jan. 21, 1993).

Chemical Weapons Destruction: Issues Related to Environmental Permitting and Testing Experience (GAO/T-NSIAD-92-43, June 16, 1992).

Chemical Weapons Disposal (GAO/NSIAD-92-219R, May 14, 1992).

Related GAO Products

Chemical Weapons: Stockpile Destruction Cost Growth and Schedule Slippages Are Likely to Continue (GAO/NSIAD-92-18, Nov. 20, 1991).

Chemical Warfare: DOD's Effort to Remove U.S. Chemical Weapons From Germany (GAO/NSIAD-91-105, Feb. 13, 1991).

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