

July 1990

# CHEMICAL WEAPONS

## Stockpile Destruction Delayed at the Army's Prototype Disposal Facility



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National Security and  
International Affairs Division

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July 30, 1990

The Honorable John Glenn  
Chairman, Committee on Governmental  
Affairs  
United States Senate

The Honorable John Conyers, Jr.  
Chairman, Legislation and National  
Security Subcommittee  
Committee on Government Operations  
House of Representatives

The Honorable Earl Hutto  
Chairman, Subcommittee on Readiness  
Committee on Armed Services  
House of Representatives

This report responds to your requests that we review the Department of Defense's Chemical Stockpile Disposal Program. We discussed the Department's overall efforts to dispose of chemical weapons in our earlier report entitled Chemical Weapons: Obstacles to the Army's Plan to Destroy Obsolete U.S. Stockpile (GAO/NSIAD-90-155, May 24, 1990). This report discusses the operational delays at the Johnston Atoll Chemical Agent Disposal System—the Defense Department's prototype disposal plant.

Unless you publicly announce its contents earlier, we plan no further distribution of this report for 30 days. At that time, we will send copies to the Chairmen of the House and Senate Committees on Armed Services and on Appropriations, the Secretaries of Defense and the Army, the Director of the Office of Management and Budget, and other interested parties.

This report was prepared under the direction of Richard Davis, Army Issues, who may be reached on (202) 275-4141 if you or your staff have any questions. Other major contributors are listed in appendix II.

Frank C. Conahan  
Assistant Comptroller General

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# Executive Summary

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## Purpose

In November 1985, the Congress enacted Public Law 99-145, requiring the Department of Defense to destroy the U.S. stockpile of chemical weapons by September 30, 1994. In September 1988, the Congress extended the completion date for chemical weapons disposal to April 30, 1997. The Army has concluded that high-temperature incineration is the preferred disposal method. In 1988, the Army completed construction of its prototype plant—the Johnston Atoll Chemical Agent Disposal System. However, this plant needs additional testing and verification before it becomes a fully operational chemical weapons disposal plant.

The Chairmen of the Subcommittee on Readiness, House Committee on Armed Services; the Legislation and National Security Subcommittee, House Committee on Government Operations; and the Senate Committee on Governmental Affairs asked GAO to determine the status of the Johnston Island disposal program. Our objectives were to identify and assess (1) the program's current schedule and cost estimates, (2) the causes of schedule slippage, (3) the impact of this slippage on the Army's overall chemical disposal program, and (4) the Army's contractor oversight activities.

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## Background

In fiscal year 1981, the Army planned to build a disposal facility on Johnston Island to destroy M55 chemical rockets. The Congress, in 1985, directed the Defense Department to destroy the entire U.S. chemical weapons stockpile, not just M55s. In that same year, the Army began to construct a disposal plant on Johnston Island. In 1986, the Army's Western Command, headquartered in Hawaii, awarded an 8-year operations and maintenance contract on a cost-plus-award-fee basis for the Johnston disposal plant.

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## Results in Brief

The Army scheduled operational verification tests to begin at Johnston by May 31, 1990,<sup>1</sup> and full-scale operations to start in September 1991—32 months after the original February 1989 full-scale start-up date. The original full-scale start-up date was delayed about 22.5 months by the Army's efforts to comply with the statutory requirements to (1) destroy all types of munitions, not just the M55 rockets, and (2) conduct operational verification tests. The start-up date slipped another 9.5 months because of technical and contractor staffing problems. Further delays are likely if problems continue at the facility.

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<sup>1</sup>As of this date, the Army had not begun these tests. The Army estimates that operations will begin in the summer of 1990.

Moreover, as of March 1990, the Army estimated that the total Johnston disposal program will cost about \$561 million to complete operations through 1994—an increase of \$190 million over the Army's 1985 estimate. Most of the increased estimated cost can be attributed to the two statutory requirements and the technical and contractor problems. If problems continue and the operations and maintenance contract is extended beyond July 1994, the estimated cost will continue to grow.

Because of delays in operational testing at Johnston Island, the Army also delayed the construction of three follow-on facilities—at Anniston, Alabama; Pine Bluff, Arkansas; and Umatilla, Oregon. GAO estimated that the additional time required to store the munitions at Johnston Island and the three follow-on sites will cost the Army more than \$33 million.

To improve the contractor's performance on the operations and maintenance contract, the Army withheld all or significant portions of the contractor's award fee for several evaluation periods. Further, the Army attempted to strengthen its own oversight of the operations and maintenance contract, including controls over contractor overtime costs. However, the Army's oversight of contractor overtime needs to be further improved.

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## Principal Findings

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### Several Problems Caused Johnston Schedule Slippage and Estimated Cost Increases

The Johnston disposal program has expanded significantly since 1985. Until November 1985, when the Congress required the Defense Department to destroy the entire chemical stockpile, the Johnston facility was intended to destroy only M55 rockets, beginning full-scale operations on February 1, 1989. In December 1987, the Congress passed Public Law 100-180, which required the Army to conduct full-scale verification tests with lethal agents to demonstrate that the disposal technology could safely and efficiently destroy chemical weapons. These two statutory changes caused the Army's original full-scale operations start date to slip 22.5 months—from February 1, 1989, to December 15, 1990. The Army moved the full-scale operational date back another 9.5 months—from December 15, 1990, to September 27, 1991—due to equipment, computer, and plant corrosion problems and the contractor's inability to fill some technical and management positions. Further

delays are possible if, as in the past, the Army experiences major slippage in any of the 279 operational testing start-up activities. For example, as of January 1990, 42 of the 279 start-up activities had slipped an average of 22 days; some activities had slipped almost 2 months.

In October 1985, the Army's life-cycle cost estimate for the Johnston disposal program was \$371 million. As of March 1990, the total estimated cost to complete operations through 1994 was about \$561 million. The March 1990 estimate includes about \$421 million for construction, equipment installation, and the operations and maintenance contract and about \$140 million for base and logistical support and other costs.

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### Schedule Slippage Delayed Follow-on Facilities' Construction and Increased Munition Storage Costs

The schedule slippage in the Johnston program has resulted in construction delays at three stateside facilities—at Anniston, Pine Bluff, and Umatilla. Chemical weapons will have to be stored an additional 9.5 months on Johnston Island, 19 months at each of the Pine Bluff and Umatilla sites, and 10 months at Anniston. GAO estimated that the additional time required to store, guard, inspect, and maintain the munitions at Johnston Island and the three follow-on sites will cost more than \$33 million.

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### Army Has Withheld Most of Contractor's Award Fee Due to Unsatisfactory Performance

In 1988 and 1989, the Army took action to correct contractor performance on the operations and maintenance contract. In response to staffing and other problems, the Army gave the contractor successively lower performance ratings from May 1988 through April 1989. For all evaluation periods, beginning in August 1986 and ending in August 1989, the Army awarded 47 percent of the total available award fees. The Army withheld the contractor's entire award fee for one period covering January through April 1989.

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### Improved Controls Needed for Overtime Costs

According to the contracting officer's representative, contract employees regularly worked 60 to 80 hours per week. GAO's analysis showed that in July 1989, 19 employees worked at least one 90-hour week. Army officials told GAO that the operations and maintenance contract did not include provisions for the Army to ensure that the contractor's overtime was necessary or that charges were legitimate. The Army tried to persuade the contractor to strengthen its review and reporting procedures for overtime. In January 1990, according to Army officials, the contractor verbally agreed to have its department heads

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approve employee overtime in advance and to report to the Army on overtime usage. However, as of March 1990, the contractor had not fully complied with the terms of the verbal agreement.

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## Recommendations

GAO recommends that the Secretary of the Army direct the Army's Western Command to negotiate a formal agreement with the operations and maintenance contractor regarding the approval and the use of overtime and incorporate it into the existing contract. Such an agreement could help the Army in its oversight responsibility of the contractor's use of overtime.

Included in chapter 3 of this report are other recommendations to the Secretary of the Army, which are designed to improve the Army's oversight of contractor operations at the Johnston plant and at the follow-on disposal plants.

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## Agency Comments

As requested, GAO did not obtain official agency comments on this report. However, it discussed the report with agency officials and included their views where appropriate.

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**Abbreviations**

DOD	Department of Defense
GAO	General Accounting Office
JACADS	Johnston Atoll Chemical Agent Disposal System

# Introduction

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In November 1985, the Congress enacted Public Law 99-145, requiring the Department of Defense (DOD) to destroy the U.S. stockpile of obsolete chemical munitions and agents by September 30, 1994. The law also required DOD to establish a management organization within the Department of the Army to carry out the Chemical Stockpile Disposal Program. In September 1988, the Congress extended the completion date for chemical weapons disposal to April 30, 1997.<sup>1</sup>

The chemical weapons to be destroyed contain three types of agents: GB, VX, and HD. The “nonpersistent” nerve agent GB vaporizes and dissipates readily. The “persistent” nerve agent VX remains in liquid form for several days. Both GB and VX disrupt the nervous system. However, VX, the more lethal agent, leads to the loss of muscular control and usually death. The “persistent” mustard agent HD blisters the skin and can be lethal in large amounts.

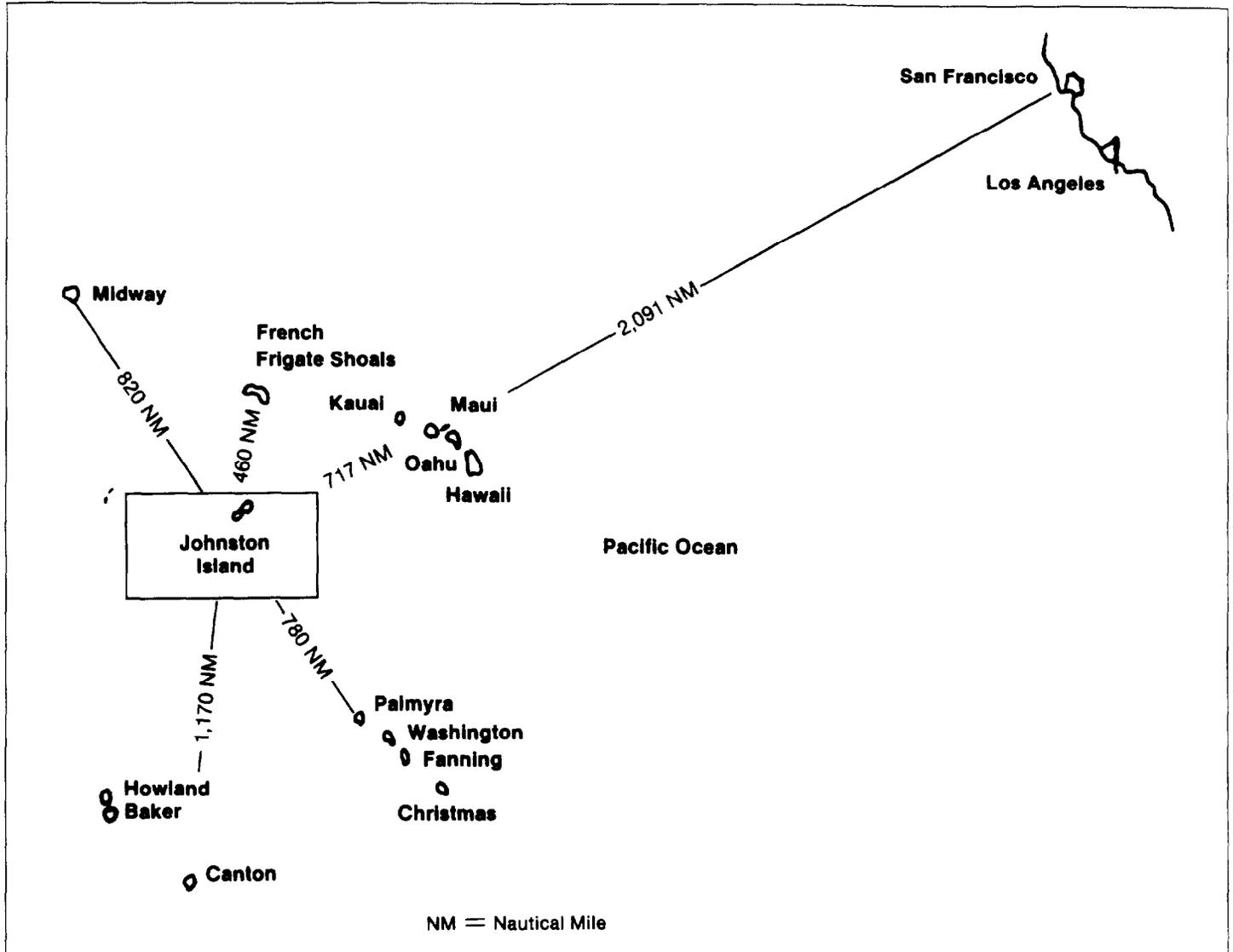
Most of the chemical agent and munition stockpile is stored at eight Army depots in the continental United States: at Anniston, Alabama; Pine Bluff, Arkansas; Pueblo, Colorado; Newport, Indiana; Lexington, Kentucky; Aberdeen, Maryland; Umatilla, Oregon; and Tooele, Utah. A portion of the stockpile is also stored at two overseas locations: the Federal Republic of Germany and at Johnston Island—a U.S. possession in the Pacific Ocean.

The Army selected Johnston Island as the site on which to build and test the first U.S. chemical weapons disposal facility because of the deteriorating condition of the munitions stored there (caused by the highly corrosive climate) and the island’s remote location. By operating the first full-scale disposal facility on Johnston Island, the Army will be able to gain experience in destroying most of the existing combinations of munitions and agents in the nation’s chemical stockpile. Occupying 626 square acres, Johnston Island is the largest of four small islands that comprise the Johnston Atoll. Figure 1.1 shows the location of Johnston Island.

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<sup>1</sup>On April 5, 1990, the Assistant Secretary of the Army for Installations, Logistics and Environment testified before the Senate Committee on Armed Services that the disposal program should be completed at the end of 1998.

Figure 1.1: Location of Johnston Island



The various chemical munitions to be destroyed at the Johnston Atoll Chemical Agent Disposal System (JACADS) contain all three types of lethal agents (see table 1.1).

**Table 1.1: Munitions and Chemical Agents to Be Destroyed at JACADS**

<b>Munitions</b>	<b>Agent</b>
M55 rockets	GB and VX
M23 land mines	VX
Bombs	GB
105-mm artillery shells	GB and HD
155-mm artillery shells	GB, VX, and HD
4.2-inch artillery shells	HD
8-inch artillery shells	GB and VX
1-ton containers	GB, VX, and HD

None of these agents or munitions have been manufactured since 1968. All are at least 22 years old, and some are more than 45 years old.

## Background

In 1971, the United States moved its chemical weapons from Okinawa and stored them on Johnston Island. In this same year, the Congress enacted Public Law 91-672, which prohibited the transportation of the chemical weapons that had been stored on Okinawa into the United States and authorized funding for DOD to destroy these weapons only outside the United States.

During the 1970s, the Army, as DOD's lead service in chemical matters, constructed and operated a pilot Chemical Agent Munitions Disposal System at the Tooele Army Depot in Utah. Using this pilot system, the Army (1) developed and tested disposal technology, (2) generated maintenance data for disposal equipment, (3) generated technical engineering data for the design of production-scale disposal plants, and (4) disposed of various quantities of deteriorating chemical stocks. The Army's disposal technology is known as the "reverse assembly and incineration process." This technology disassembles and drains chemical agents from the munitions before the component parts are incinerated in a series of furnaces. A more detailed discussion of this process is included in appendix I.

In fiscal year 1981, the Army planned to build a disposal facility on Johnston Island, which would use the reverse assembly and incineration process to destroy chemical weapons stored on the island. Although the Army designed the Johnston disposal facility to destroy all types of munitions, it initially planned to equip the facility to destroy only one type of chemical munition—the M55 rocket. Determining that the M55 rockets were in poor condition and were no longer militarily useful,

the Army established an M55 rocket disposal program to destroy the nerve-agent-filled rockets stored at Johnston Island and five chemical storage sites in the continental United States.

In 1985, the Congress approved funds to build the first chemical weapons disposal facility on Johnston Island. On September 27, 1985, the Army awarded a construction contract. However, 2 months later, the Congress enacted Public Law 99-145, which required DOD to destroy the entire existing U.S. chemical weapons stockpile. In response to this law, the Army had to completely revise its M55 destruction program to include all types of chemical weapons.

In December 1987, 11 months before the construction of JACADS was completed, the Congress passed Public Law 100-180. This law required the Army to conduct full-scale verification tests to demonstrate that the selected disposal technology could safely destroy the different agents and munitions while meeting all environmental requirements. The Army estimated that this testing, which would be conducted in four phases, should run for 16 months. In effect, the law required the Army to incorporate lessons learned from this testing into the designs of the future disposal plants planned for the continental United States.

In February 1988, the Army formally announced that it would build disposal facilities like JACADS at each of the eight stateside chemical weapons storage sites. It also announced that the reverse assembly and incineration process would be the method used to destroy the chemical munitions stockpile at these sites.

## JACADS' Management Structure

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Three Army organizations manage the JACADS program. The Program Manager for Chemical Demilitarization, who is located in the Edgewood area of Aberdeen Proving Ground, Maryland, is the head of the management organization. The Program Manager is responsible for providing technical, engineering, and direct management control over the preparations being made to destroy the Johnston stockpile, as well as the stockpiles at the eight follow-on facilities. Once JACADS begins full-scale operations, the Program Manager also will assume oversight responsibility for the day-to-day chemical disposal activities. The Program Manager reports to the Office of the Assistant Secretary of the Army for Installations, Logistics and the Environment.

The U.S. Army Support Command-Hawaii provides the contracting officer for the JACADS operations and maintenance contract. The U.S.

Army Chemical Activity-Western Command maintains and guards the chemical munitions stored on Johnston Island. The Western Command also provides the contracting officer's representative on Johnston Island, who will oversee the operations and maintenance contractor's performance until full-scale operations begin.

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## Objectives, Scope, and Methodology

The Chairmen of the Subcommittee on Readiness, House Committee on Armed Services; the Legislation and National Security Subcommittee, House Committee on Government Operations; and the Senate Committee on Governmental Affairs asked us to determine the status of DOD's program to destroy the stockpile of obsolete chemical munitions and agents stored within the continental United States and on Johnston Island. We addressed DOD's overall efforts to dispose of chemical weapons in an earlier report.<sup>2</sup> This report discusses DOD's efforts to dispose of chemical weapons at the Johnston Island disposal plant.

Our objectives were to identify and assess (1) JACADS' current program schedule and cost estimates, (2) the causes of any schedule slippage and associated cost increases, (3) the Army's oversight activities for the operations and maintenance contractor, and (4) the impact of JACADS' schedule slippage on the Army's overall chemical disposal program. We concentrated our work on the operations and maintenance contract because most of the schedule slippage that was unrelated to the statutory requirements occurred on this contract.

To accomplish these objectives, we interviewed and obtained and analyzed data from officials of the Department of the Army in Washington, D.C.; the Office of the Program Manager for Chemical Demilitarization in Aberdeen, Maryland; the U.S. Army Chemical Activity-Western Command on Johnston Island; the offices of the operations and maintenance contractor on Johnston Island and at Fort Shafter in Honolulu, Hawaii; and the U.S. Army Support Command-Hawaii and the Army Corps of Engineers' Pacific Ocean Division in Honolulu, Hawaii. We also contacted officials with the Army Corps of Engineers' Huntsville Division in Huntsville, Alabama.

To identify program schedule and cost estimates, we collected and analyzed schedule and cost documents and discussed the causes of schedule slippages and cost increases with Army and contractor officials. To

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<sup>2</sup>Chemical Weapons: Obstacles to the Army's Plan to Destroy Obsolete U.S. Stockpile (GAO/NSIAD-90-155, May 24, 1990).

assess the extent and causes of schedule slippage, we also reviewed Army and contractor technical and management reports concerning JACADS' staff requirements, the extent and nature of contractor staff shortages, contractor management qualifications and turnover, and activity scheduling. To assess the extent and nature of JACADS' contract cost increases, we reviewed contract files for construction, equipment installation, and operations and maintenance contracts, as well as cost reports and contract modifications.

We interviewed Army and contractor officials and reviewed Army documents concerning program management on the operations and maintenance contract to identify current Army oversight activities. We examined Army correspondence and memoranda, analyses of contractor cost invoices, and evaluations of the operations and maintenance contractor's performance.

To determine whether JACADS' schedule slippage had resulted in stateside program delays, we interviewed Army officials, reviewed documents on technology transfer to the stateside program, and analyzed JACADS' and stateside program schedules. We estimated the impact of JACADS' schedule slippage on munitions storage costs by multiplying the Army's monthly estimates of storage costs at the Johnston Island and stateside sites by the number of months of delays at these facilities that were caused by JACADS' schedule slippage.

We conducted our review from June 1989 to March 1990 in accordance with generally accepted government auditing standards. As requested, we did not obtain official agency comments, but we discussed our findings with agency officials and incorporated their views in the report where appropriate.

# Program Expansion and Technical and Contractor Problems Caused JACADS' Schedule Slippage and Cost Increases

JACADS is scheduled to begin full-scale operations in September 1991—32 months later than the Army originally planned. As of January 1990, several activities were behind schedule. As a result, the start of operational verification testing and full-scale operations could be delayed even further. Also, the estimated total cost for the JACADS program has increased with each additional statutory requirement and with the discovery of technical and contractor problems. If the technical and contractor problems continue, the estimated cost will likely continue to grow.

The Army is taking advantage of the delays in the JACADS schedule to use the lessons learned to make design changes to the follow-on facilities. The Army believes that these changes should prevent similar problems from occurring at the future stateside sites and avoid the associated cost growth.

## Mandated Disposal Program Expansion and Testing Delayed Operations

As directed by Public Law 99-145, the Army expanded the JACADS program to include the destruction of all agent and munition combinations, rather than just the M55 rockets. In its January 31, 1984, baseline master schedule, the Army planned to procure only the equipment needed to destroy M55 rockets and to start operations by February 1, 1989. The Army's efforts to expand its destruction plan included procuring, installing, and testing the additional munitions processing equipment. The Army's completion of these efforts delayed JACADS' operations about 4 months—from February 1, 1989, to June 1, 1989. JACADS' start-up was delayed another 2.5 months—from June 1, 1989, to August 15, 1989—because the Army did not immediately release the funds needed to purchase the additional equipment.

Public Law 100-180 requires the Army to conduct full-scale verification tests of the disposal technology to be used at JACADS. Previously, the Army planned to conduct systemization tests with simulant agents and nontoxic preoperational tests before beginning full-scale operations. The systemization tests would demonstrate the ability of the process and control systems to function properly, while the preoperational tests would verify that trained personnel, the process system, and the process support systems effectively met various standards for operations, monitoring, quality assurance, maintenance, training, and safety. The Army determined that the additional testing required for full-scale verification would take about 16 months to accomplish. This testing, which was to

have started on August 15, 1989 (after the systemization and preoperational testing was completed), was expected to end on December 15, 1990—22.5 months after the February 1989 start date.

The Army will destroy four types of munitions during operational verification testing: M55 rockets with GB, M55 rockets with VX, 1-ton containers with mustard agent, and projectiles filled with mustard agent. During each test, the Army will destroy a sufficient number of munitions to develop confidence in the technology and to examine the safety and efficiency of personnel, equipment, and operating procedures.

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## Technical and Contractor Staffing Problems Cause Schedule to Slip

Full-scale operations at JACADS slipped another 9.5 months to September 27, 1991, because of technical and contractor staffing problems during the operations and maintenance phase of the program. The operations and maintenance contract, which began in August 1986, is currently scheduled to run through July 1994. This contract covers disposal equipment testing and integration, plant operation and maintenance, and plant closure. The operations and maintenance contractor experienced technical problems during the equipment testing and integration phase of the contract. The contractor also had difficulty filling some staff and management positions with qualified personnel. We could not, nor could the Army, quantify the amount of time or costs that each of these problems individually added to the JACADS schedule overruns.

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## Technical Problems

During equipment testing and integration, technical problems surfaced with (1) the liquid incinerator and deactivation furnace, (2) the process equipment, (3) the JACADS heating and ventilation and air-conditioning systems, and (4) corrosion caused by the salt-air climate on Johnston Island.

The liquid incinerator's secondary chamber was damaged when a hole burned through its outer plate. The Army's analysis indicated that the problem was due to a design flaw, requiring the redesign and repair of the secondary chamber. Also, according to Army officials, the deactivation furnace kiln warped and rubbed against the cover, preventing proper rotation. The cover contains heat and prevents the deactivation furnace room from overheating during operation. To remedy the problem, the thickness and diameter of the deactivation furnace cover had to be increased.

Technical problems also surfaced with the process equipment. For example, the rocket shear machine had to be adjusted to shear rockets into 13-inch lengths to prevent damage to heating coils. During systemization testing, sheared 19-inch rocket parts collected on the conveyor belt from the deactivation furnace, damaging heating coils hanging above the conveyor.

Also, air-balancing and duct installation work with the JACADS heating and ventilation and air-conditioning systems was more time-consuming than anticipated. According to an Army official, JACADS uses a complex air-balancing system to ensure that chemical agents are not spread throughout the building during normal operations or as a result of accidental spills or explosions. The official also told us that fine-tuning this system to meet rigorous standards for environmental hygiene proved more complicated than anticipated.

Finally, the humid, tropical Johnston Island climate corroded parts of the JACADS building and equipment. For example, exterior steel support beams, pipes, and pipe supports rusted and required frequent repainting, and some pipe supports had to be replaced. Also, corrosion caused significant deterioration of exterior valves, instrumentation, and electrical function boxes. Army officials stated that, because they had underestimated how corrosive the environment would be on Johnston Island, they had not initially used appropriate corrosion protection materials. To correct the corrosion problems, the Army now uses corrosion-resistant paints and fiberglass equipment covers. Also, the Army hired additional maintenance personnel to perform preventive maintenance work on the building areas and equipment most susceptible to corrosion.

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## **Contractor Staffing Problems**

Staffing problems experienced by the operations and maintenance contractor also contributed to the schedule slippage. The contractor has suffered from a lack of qualified personnel to fill technical and management positions because of rapidly increasing staffing needs, high employee turnover, and inadequate recruitment efforts.

The operations and maintenance contractor did not sufficiently staff some technical and management positions at JACADS. From May 1988 through November 1989, staffing on the operations and maintenance contract increased from 45 to 258 people. During this period, the average staffing level was supposed to be 191 persons, but the actual average staffing level was 158 persons, or 83 percent of the desired

level. In 1989, many of the shortages occurred in critical occupations and, therefore, hampered operations. A shortage of control engineers caused the installation of process equipment and the performance of interface tasks to fall behind schedule. A lack of control room operators delayed the debugging of computer software, and personnel training lagged due to an inadequate number of trainers. A shortage of maintenance personnel created a 1-year backlog of preventive maintenance work on the disposal equipment and building. Further, according to one contractor official, staffing shortfalls in general had adversely affected the contractor's ability to produce timely and accurate project-related data.

In addition to its failure to recruit sufficient numbers of technical personnel for JACADS, the operations and maintenance contractor filled many management positions with personnel who did not have the appropriate credentials or experience. For example, one of the three persons who held the position of project manager, the senior contractor position on Johnston Island, did not have an engineering degree and did not have plant start-up experience. After serving as project manager for about 20 months, this individual was demoted and reassigned to the plant manager position.

### Increasing Staffing Needs

The operations and maintenance contractor had technical and management staffing problems because staffing needs at JACADS increased as the project progressed. According to Army officials, staffing needs increased because the Army and contractor officials had underestimated the complexity of JACADS' start-up activities and the number of technical and maintenance personnel needed to meet project milestones. For example, they told us that they had underestimated the number of control engineers, control room operators, and trainers that would be needed to keep the project on schedule. They told us that they also had underestimated the number of corrective and preventive maintenance personnel that would be required to keep the equipment operational throughout the JACADS start-up phase and to prevent excessive corrosion of the JACADS disposal building and equipment.

### High Turnover Rates

High turnover rates also contributed to JACADS' staffing shortfalls. According to contractor officials, the average turnover rate for the entire year of 1989 was 29 percent. This rate was 45 percent greater than the 20-percent turnover rate anticipated by the contractor at the beginning of the project. In addition, the contractor experienced severe turnover in most key management positions. For example, the contractor employed three project managers from August 1986 through

August 1989. Similarly, the maintenance, operations, surety/safety, and engineering chief positions were each filled by three separate individuals, and the quality control chief and training manager positions were each held by two individuals. By May 1989 only 1 of 11 key management positions was occupied by the person who had originally been hired.

In general, turnover occurred because employees were dissatisfied with living conditions on Johnston Island, according to the contractor's personnel administrator. He said that persons leaving the project complained about the crowded housing conditions, the poor quality of food, and the lack of recreational activities. He also cited complaints about poor communications (e.g., mail and telephone services) with family members, who are not permitted to live on Johnston Island. The personnel administrator also said that turnover occurred because early in the operations and maintenance contract, employees were dissatisfied with management personnel. He told us that some employees who had left the project complained that the contractor did not show enough concern for their welfare.

## Recruitment Problems

Staffing shortages also occurred because recruiting problems hampered the contractor's ability to respond to increases in JACADS' staffing requirements and higher-than-anticipated project turnover. According to the contractor's personnel administrator, the contractor employed an insufficient number of recruiters until May 1989, when the contractor hired more. Also, he said that many project applicants had refused employment offers at JACADS because of the difficult living and working conditions on Johnston Island. The contractor's personnel administrator also stated that it takes an average of 6 weeks to recruit job applicants.<sup>1</sup>

Some of the contractor's recruiting problems, however, were unavoidable. According to the personnel administrator, lengthy annual negotiations over staffing levels resulted in long periods during which future staffing requirements were uncertain. On occasion, staffing requirements increased after negotiations were completed, allowing recruiters as little as 2 weeks to recruit and process prospective JACADS employees to meet newly negotiated staffing levels.

The contractor took several measures to address the staffing problems. To make employment on Johnston Island more attractive, the contractor

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<sup>1</sup>The contractor performs its own investigation of applicants' reliability, including a psychological test, a background investigation, and a physical examination.

increased wages and the benefits package. According to the contractor's personnel administrator, the contractor also hired more recruiters and began processing more applicants.

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## Continued Technical Problems Could Cause Further Slippage

Continuing technical problems could result in further slippage in the JACADS schedule. After August 1989—the original operational verification testing start date—the Army continued to fall behind schedule in preparing for this testing. By November 1989, 7 of the 10 subsystems in the M55 rocket disposal line, the first line to be tested in operational verification testing, were behind schedule. In December 1989, the Army notified the Congress that, due to continuing technical and contractor staffing problems, operational testing would slip to April 16, 1990. By January 1990, 42, or 15 percent, of the 279 JACADS start-up activities had slipped an average of about 22 days, ranging from 5 to 54 days for each activity. Some of the 42 activities had to do with obtaining environmental permits, certifying the storage area, and implementing fire protection standard operating procedures. In February 1990, there was a fire in the deactivation furnace room, which helped delay the start of operational verification testing beyond April 16, 1990, according to the contracting officer's representative. Army officials told us that the operational testing would start by May 31, 1990.<sup>3</sup>

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## JACADS' Program Costs Increased

The Army's estimated total costs for JACADS have increased \$190 million—from about \$371 million in 1985 to about \$561 million in 1990—and will likely continue to grow. The Army's October 1985 estimate of \$371 million included only the costs of destroying the M55 rockets. By March 1988, after statutory requirements expanded the JACADS mission to include the destruction of all chemical weapons and full-scale verification testing, the Army estimated total costs at about \$500 million.

The March, 1990 estimated JACADS program cost of \$561 million includes about \$421 million for the construction, equipment installation, and operations and maintenance contracts and about \$140 million for base and logistical support, engineering studies, and other estimated contract costs. The current total JACADS program cost estimate is an increase of about \$61 million, or 12.2 percent, more than the Army's 1988 cost estimate. The increase can be attributed as follows: about \$35 million is due to the delay in systemization; about \$5.5 million is associated with costs

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<sup>3</sup>As of this date, the Army had not begun operational verification testing. The Army estimates that operations will begin in the summer of 1990.

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to equip the facility; and about \$20.6 million is due to additional staffing costs and increased base and logistical support costs. Table 2.1 shows cost increases for JACADS' construction, equipment installation, and operations and maintenance contracts.

**Table 2.1: Cost Increases in JACADS' Contracts**

Dollars in millions				
<b>Contract</b>	<b>Award amount</b>	<b>Cost increase</b>	<b>Total</b>	<b>Percent increase</b>
Construction	\$38.5	\$15.3	\$53.8	40
Equipment installation	76.1	59.4	135.5	78
Operations and maintenance	76.4	155.6	232.0	204
<b>Total</b>	<b>\$191.0</b>	<b>\$230.3</b>	<b>\$421.3</b>	<b>121</b>

Of the \$15.3 million cost increases on the construction contract, about \$10.9 million can be attributed to design and structural changes to correct problems with the building and reinforced concrete foundations. The remaining \$4.4 million increase can be attributed to the Army's compensation of contract employees for their loss of income when Johnston Island lost its federal tax-exempt status in 1986. Army officials stated that unless contractor employees were compensated for lost income, many would have left the project.

The Army awarded its equipment installation contract for the purchase and installation of processing equipment and furnaces for M55 rockets only. To comply with the 1985 statutory requirement to destroy the entire chemical stockpile, the Army modified its equipment installation contract to include additional equipment needed to destroy all types of chemical munitions. Additional equipment purchases and installation accounted for about \$39.4 million of the cost increases. Other cost increases on this contract were due to additional project planning and control costs (\$8.5 million); compensation to employees for the loss of Johnston Island's tax-exempt status (\$3 million); and other administrative, engineering, and miscellaneous costs (\$8.5 million). As of March 1990, this contract was about 99 percent complete.

The JACADS operations and maintenance contract should experience the highest cost increases of the three contracts, as costs are estimated to increase about \$155.6 million over the initial award amount of \$76.4 million. In 1986, the Army awarded an 8-year operations and maintenance contract to run through July 1994. This contract includes equipment testing and integration, plant operations and maintenance, and plant closure. Cost increases through 1989, which totaled about

\$32.6 million, can be attributed to additional staffing and overtime, compensation for the loss of Johnston Island's tax-exempt status, equipment purchasing costs, and other miscellaneous costs. Of the estimated \$155.6 million in cost increases, \$123 million can be attributed to (1) the statutory requirement to conduct operational verification testing, (2) a 9.5-month schedule slippage, and (3) higher-than-anticipated operating costs.

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## **Army Applies Lessons Learned From JACADS to Follow-on Facilities**

The Army has developed a program for implementing design changes to the follow-on stateside chemical disposal facilities based on the technical problems encountered at JACADS. Lessons learned during construction, equipment installation, and equipment testing at JACADS are documented and reviewed by a facility and process design contractor, who has a field office on Johnston Island. Lessons learned are also reviewed by a stateside design team and incorporated into the follow-on designs as appropriate. According to Army officials, some JACADS lessons, such as the excessive corrosion of the chemical disposal building and equipment, may not apply to the other facilities. The Army has delayed construction of the follow-on facilities, except for Tooele, until the results from operational testing can be integrated.

According to Army officials, numerous lessons learned from JACADS already have been incorporated into the follow-on facilities' designs. For example, JACADS testing resulted in the redesign of the projectile feed system; the addition of control operator consoles; and an increase in the sizes of the explosive containment, liquid incinerator, and deactivation furnace rooms. By applying lessons learned from JACADS' technical problems, the Army hopes to avoid schedule delays and cost increases at the follow-on sites.

# The Army's Oversight of the Operations and Maintenance Contractor Has Improved but Is Still Inadequate

The Army has taken actions to improve the contractor's performance and its own oversight of the operations and maintenance contract. As an initial step, the Army withheld contract award fees to encourage improvements in contractor performance. To improve its oversight of contractor overtime, the Army asked the contractor to require its directors to approve staff overtime in advance and to report to the Program Manager for Chemical Demilitarization on overtime usage. To better control invoice payments, the Army stationed an auditor on Johnston Island to audit invoices for disallowable costs. From January through December 1989, the auditor disallowed \$567,000 on invoices totaling \$25.3 million.

While the Army has taken steps to improve its contractor oversight, further improvements are needed in overtime control procedures and invoice payments. For instance, according to Army officials, the Army's requested overtime procedures have not been fully implemented by the contractor. In addition, early invoices, amounting to about \$18 million, have not been audited for disallowable costs.

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## Army Has Taken Actions to Improve Contractor Performance

The JACADS operations and maintenance contract is a cost-plus-award-fee contract,<sup>1</sup> which allows the Army to control the amount of award fee, or profit, the contractor earns. Every 4 months, the Army evaluates contractor performance and, depending on the evaluation, pays the contractor a percentage of the available fee. During the three evaluation periods from May 1988 through April 1989, the Army withheld increasing amounts of the contractor award fee as the contractor's performance fell.

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## Cost-Plus-Award-Fee Contracts Link Contractor Profit to Performance

Before each evaluation period, the Army contracting officer and his representative on Johnston Island established the contractor performance categories to be evaluated and the criteria for evaluation. Evaluations contained from 9 to 26 performance categories, such as long-term planning, employee suitability, and laboratory activities. The contracting officer and his representative also assigned a weight to each category. The greater the weight, the more the rating for that category influenced the amount of award fee paid.

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<sup>1</sup>This cost-reimbursement contract also provides a fee consisting of (1) a base amount fixed at the contract's inception and (2) an award amount, which may be earned in whole or in part based on the government's evaluation of the contractor's performance.

At the end of each 4-month period, the Army evaluated the contractor's performance in each category by comparing the performance with the evaluation criteria. An award fee board, including representatives from the Army's Western Command and the Office of the Program Manager for Chemical Demilitarization, assigned a score to each category, multiplied each score by the category's weight, and added the weighted scores to get a composite score for the period. The contractor received an award fee based on the composite score.

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### **Army Withheld Fees as Contractor's Performance Fell**

During the first five evaluation periods, from August 1986 through April 1988, the Army's evaluations indicated that the contractor had performed well in quality control and in most management, technical, and safety categories. The contractor received 94 to 100 percent of the available award fee during this time. Small amounts of the award fees were withheld because of poorer performance in subcategories, such as personnel retention and cost control.

In the May through August 1988 evaluation period, more serious contractor performance problems began to surface. The contractor had staffing shortages and did not promptly inform the Army of personnel hiring difficulties and schedule slippages. Also during this period, strained relations developed between contractor management and the work force. As a result, the Army gave the contractor about 78 percent of the available award fee.

In the following two evaluation periods, from September 1988 through April 1989, the contractor's performance continued to deteriorate. The Army's evaluations stated that, despite the Army's repeated requests for improvement, the contractor's long-term planning and recruitment were inadequate. The contractor's consistent tardiness in fulfilling staffing requirements caused problems in several technical areas. Finally, in February 1989, the Program Manager for Chemical Demilitarization decided to delay the scheduled operational verification testing start-up from August 15, 1989, to March 30, 1990—7.5 months. This poor performance caused the Army to give the contractor about 45 percent of the available award fee for the September through December 1988 evaluation period. For the next period, ending in April 1989, the Army withheld the entire award fee.

After this evaluation period, the contractor's performance began to improve in the areas of recruiting and program management, although the contractor still had problems with training, documentation, and

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maintenance. As a result, the Army awarded the contractor about 44 percent of the available fee for this period. Table 3.1 summarizes the Army's fee awards to the operations and maintenance contractor from the inception of the contract through August 1989.

**Table 3.1: JACADS' Operations and Maintenance Contract Award Fees**

<b>Period</b>	<b>Percent of available fee awarded</b>	<b>Fee awarded</b>	<b>Fee withheld</b>
Aug. to Dec. 1986	95.7	\$20,042	\$901
Jan. to Apr. 1987	100.0	29,091	0
May to Aug. 1987	99.0	35,171	355
Sept. to Dec. 1987	94.3	52,467	3,171
Jan. to Apr. 1988	95.3	77,707	3,835
May to Aug. 1988	77.6	70,503	20,351
Sept. to Dec. 1988	45.1	143,027	174,107
Jan. to Apr. 1989	0.0	0	255,274
May to Aug. 1989	44.2	191,600	241,885
<b>Total</b>	<b>47.0</b>	<b>\$619,608</b>	<b>\$699,879</b>

The Army awarded 47 percent of the total available award fees from the beginning of the contract in August 1986 through August 1989.

## **Inadequate Oversight of Contractor Overtime**

Army officials told us that the operations and maintenance contract did not include adequate provisions for the Army to ensure that the contractor's overtime was necessary and that charges were legitimate. Although the Army tried to persuade the contractor to strengthen its review and reporting procedures, as of March 1990, the contractor had not fully implemented the procedures.

Contractor employees regularly worked overtime hours at JACADS. According to the contracting officer's representative, contract employees regularly worked 60 to 80 hours per week. Further, he said that some test managers each worked over 100 hours per week in January and February 1989. Our analysis of contractor time sheets for July 1989 showed that 19 contractor employees had worked at least one 90-hour week that month, and one employee had twice charged over 100 hours per week.

According to the contracting officer's representative, the contractor had its own overtime controls, but Army officials were not confident that

the controls were working. He said that some contractor employees appeared to be working too many hours to be fully productive.

According to the contracting officer, the Army, in January 1990, sought to strengthen its oversight of contractor overtime because of the large number of overtime hours worked by contractor employees. He said that the contractor had verbally agreed to require its directors, who are department heads, to approve overtime in advance and to provide monthly reports to the Army on the number of overtime hours worked, reasons for variances from planned staff-hour expenditures, and accomplishments of overtime. However, the official said that the Army's requirements had not been communicated to the contractor in writing. He said that, while the contractor had provided the Army with some information on overtime usage, the information did not meet the Army's needs. As of March 1990, the official said, the Army still did not have adequate oversight of contractor overtime.

The contracting officer's representative said that the Army was taking other steps to control the contractor's overtime charges. The Army auditor, on Johnston Island since January 1989, has begun to review the operations and maintenance contract payroll summaries and time sheets in greater detail. For each payroll period, he provides the contracting officer's representative a summary of the number of employees who worked over 72 hours per week. The representative investigates any overtime on these summaries that appears questionable. Also, Army officials are currently reviewing the amount of overtime funding authorized for fiscal year 1990 and are asking the contractor to further delineate overtime costs in its cost proposal. The contracting officer believes that these steps will help the Army maintain better oversight of contractor overtime and provide incentive for the contractor to fully comply with the Army's requested procedures.

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### **First 32 Invoices Need to Be Audited for Disallowable Costs**

The Army auditor told us that, by the time he arrived on Johnston Island, the first 32 invoices, amounting to almost \$18 million, had already been paid. The auditor said that he had begun his review with the 33rd invoice, but he had not audited the previous invoices because of his other responsibilities, which included (1) reviewing contractor payroll summaries and time sheets for excessive overtime charges and supervisory approval, (2) analyzing base support costs, and (3) occasionally serving as a liaison for visitors. According to the contracting officer, the first 32 invoices may not be audited for disallowable costs until the Defense Contract Audit Agency's close-out audit, which may

not occur until 1995 or later. Defense Contract Audit Agency officials could not specify when they might audit these invoices.

As of March 1990, the auditor had reviewed invoices 33 through 48, which totaled about \$25.3 million. Of this total, he disallowed about \$567,000, or 2.24 percent. We estimated that if this same percentage were applied to the first 32 invoices, about \$401,000 of the almost \$18 million could represent disallowable costs. If the invoices are not audited until 1995, as the contracting officer believes, the 6-year delay, assuming an 8.5-percent interest rate,<sup>2</sup> would cost the government about \$253,000 in lost interest.

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## Conclusions

The Army has taken several actions to improve the contractor's performance and its own oversight of the operations and maintenance contract. The contractor's performance did not improve, however, until after the Army withheld the entire award fee for one period. To strengthen its oversight of the contractor's use of overtime, the Army has begun to review the large number of overtime hours charged on the JACADS project by contractor employees. Lastly, the Army also stationed an auditor at Johnston Island to review contractor invoices for disallowable costs.

Despite the Army's corrective actions, its oversight of contractor overtime charges could be improved. The Army also needs to review the first 32 invoices on the operations and maintenance contract to identify disallowable costs. The government could lose about \$253,000 in excess interest payments if the review of the invoices is deferred until 1995.

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## Recommendations

We recommend that the Secretary of the Army direct the Army's Western Command to negotiate a formal agreement with the operations and maintenance contractor regarding the approval and the use of overtime and incorporate it into the existing contract. Such an agreement could help the Army in its oversight responsibility of the contractor's use of overtime.

We also recommend that the Secretary of the Army take steps to ensure that the operations and maintenance contracts for all future chemical

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<sup>2</sup>We estimated the government's interest using the average yield of 10-year U.S. Treasury securities from October 1986 through December 1988.

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weapons disposal facilities in the continental United States include over-time agreements.

We further recommend that the Secretary of the Army direct the Army's Western Command to arrange for a timely audit of the JACADS invoices on the operations and maintenance contract.

# JACADS' Schedule Slippage Delays the Construction of Follow-on Facilities and Increases Munitions Storage Costs

The delays in beginning operational verification testing at JACADS have caused the Pine Bluff, Umatilla, and Anniston construction programs to be delayed so that lessons learned from JACADS can be integrated into the designs of these facilities. Further, because of these delays, chemical munitions at the Johnston Island, Pine Bluff, Umatilla, and Anniston sites have had to be stored, guarded, and maintained longer than originally anticipated. We estimate that delays will cost the Army more than \$33 million in additional munition storage expenses.

If JACADS continues to experience problems, the start of operational verification testing will slip even further. This slippage, which could delay the start of construction at Anniston, would cost about \$412,000 for each month of additional munition storage at that site.

## Operational Testing Should Be Completed Before Construction of Follow-on Plants Begins

In accordance with Public Law 100-180, the Army plans to incorporate lessons learned from operational verification testing at JACADS into the designs of future disposal plants in the continental United States. This testing should identify time and cost savings and safety improvements applicable to the other facilities. For example, the tests should demonstrate whether the liquid incinerator at JACADS, three times larger than the incinerator tested at the pilot disposal system in Tooele, Utah, operates as efficiently as planned. Also, the tests should demonstrate whether the deactivation furnace can control explosive components and associated surges of agent.

According to the Army's March 1988 Chemical Stockpile Disposal Program Implementation Plan, results from JACADS testing are to be available prior to the construction of the other disposal facilities, except for the Tooele Army Depot facility.<sup>1</sup> The plan also included a design and equipment verification period at Tooele and a design verification and update of procurement specifications for the other facilities in order to incorporate lessons learned from JACADS. Construction contracts for the Pine Bluff, Anniston, and Umatilla facilities were to be awarded in January 1991, 1 month after the scheduled completion of JACADS testing. Construction contracts for the other disposal facilities were scheduled to be awarded in 1992.

<sup>1</sup>The Army did not delay the design and construction at the Tooele Army Depot because of the large size of the chemical stockpile at the site. A delay at Tooele would have pushed back the completion of the Chemical Stockpile Disposal Program to 1999 and increased munition storage and program costs.

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## JACADS' Schedule Slippage Causes Delays at Follow-on Plants

JACADS schedule slippage caused construction start-up delays at three other planned facilities. In the August 1989 schedule, the start of operational verification testing at JACADS was pushed back 7.5 months to March 30, 1990, and the construction contracts for the Pine Bluff, Umatilla, and Anniston facilities were pushed back 8 months from January to September 1991—the same month JACADS is scheduled to begin full-scale operations. Similarly, the Program Manager for Chemical Demilitarization delayed the start of operational verification testing 8 months to April 16, 1990, and then delayed it again to May 31, 1990—a total of 9.5 months. Consequently, the Army delayed the start of construction of the Pine Bluff and Umatilla facilities until June 1992.<sup>2</sup>

Further JACADS' schedule slippage could affect the construction start date for the Anniston disposal facility as well as the completion date for the overall chemical disposal program. Anniston disposal operations are scheduled to run through April 1997, the program completion date mandated by the Congress. According to an official from the Office of the Program Manager for Chemical Demilitarization, the Anniston construction date was not delayed in DOD's fiscal year 1991 budget request because the delay would have affected the 1997 completion date. If JACADS' operations slip further and the Anniston construction start date remains unchanged, some lessons learned from operational verification testing at JACADS will not be integrated into the Anniston design before construction begins at that site. Some lessons will have to be integrated through design modifications after Anniston construction starts. This less efficient method of incorporating lessons learned could increase program costs.

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## Increased Storage Costs

Because of slippage in the JACADS operational verification testing schedule, chemical weapons will have to be stored an additional 9.5 months on Johnston Island, 19 months at each of the Pine Bluff and Umatilla facilities, and 10 months at Anniston. We estimate that it will cost the Army more than \$33 million for the additional munition storage

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<sup>2</sup> According to the Resource Manager for Chemical Demilitarization, the Army originally intended to delay construction of the Pine Bluff and Umatilla facilities 1 month to October 1991. However, he said that delaying construction from fiscal year 1991 to fiscal year 1992 would delay the construction award 9 months because the Army Corps of Engineers would not be able to advertise the request for proposal for the fiscal year 1992 construction projects until the Corps had "reasonable assurance" that the construction contracts would be funded.

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time.<sup>3</sup> The additional storage time includes costs for security guards, facilities maintenance, surveillance, and inspection for leaking agents. We estimate that it will cost about \$412,000 per month at Anniston for each additional month of storage after May 1990.

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<sup>3</sup>Our estimate does not account for differences in the types of munitions stored at each site. According to the Resource Manager for Chemical Demilitarization, data was not readily available on munitions storage costs at each stateside site. Further, he said that our estimate was probably conservative.

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# Overview of the JACADS Disposal Process

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The JACADS reverse assembly and incineration disposal process, which is fully automated, will be executed in several stages. The Johnston chemical stockpile is stored in munitions magazines in an area adjacent to the JACADS facility. Before items are removed from storage for disposal, each magazine and its contents will be inspected and monitored for leaks. Items will be placed on a truck (rockets will be first placed in a special container) and transported to the JACADS munitions disposal building for unpacking.

Munitions will be destroyed in groups by munition type (for instance, all rockets filled with one type of nerve agent or all bulk mustard agent containers) using a three-stage process involving (1) unpacking, (2) disassembling and draining, and (3) incinerating.

In the unpacking area, munitions will be manually removed from their transport containers and wooden pallets. Leaking munitions will remain in vapor-proof containers, and the containers will be conveyed into an agent containment area. The leaking containers will be unpacked by personnel in protective clothing and loaded onto conveyors leading to the disassembly rooms. Non-leaking munitions will be automatically conveyed from the unpacking area to processing rooms for disassembly and drainage.

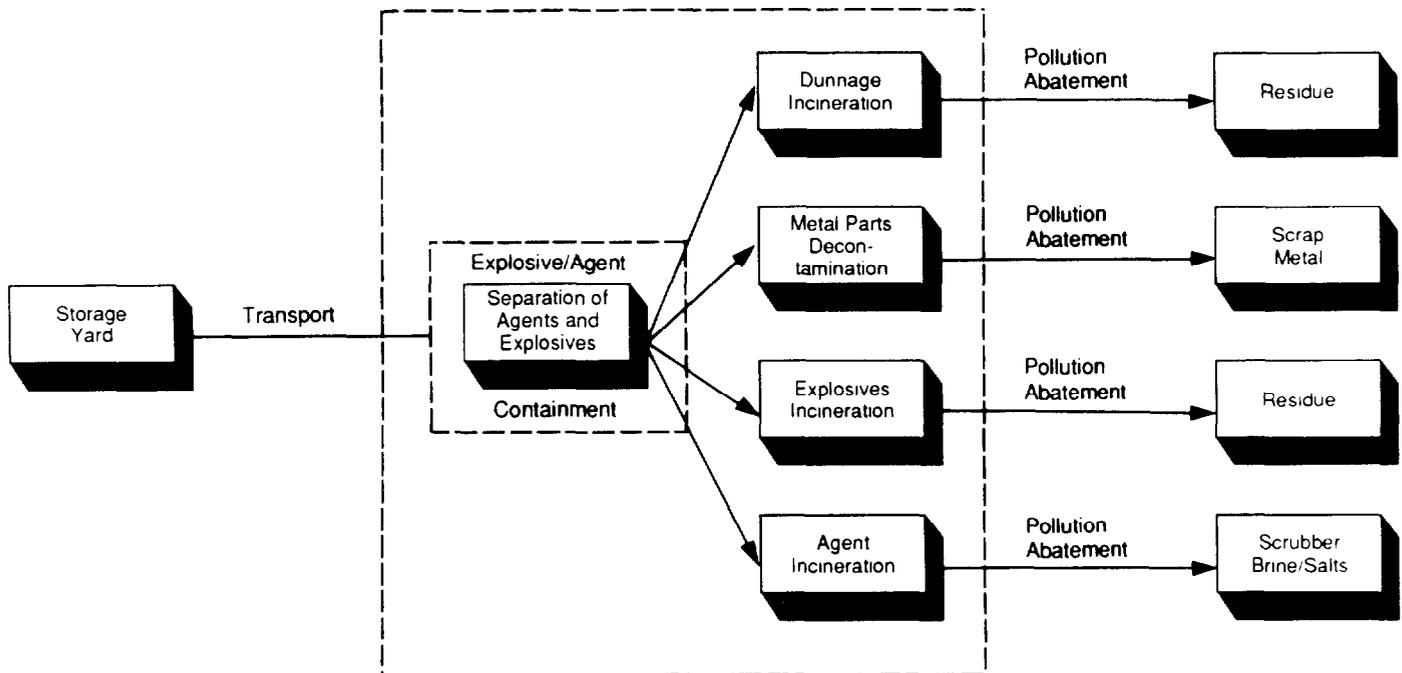
In the processing rooms, munitions will be automatically disassembled and drained of chemical agents by computer-controlled machines. Rockets, projectiles, and land mines will be individually disassembled in rooms capable of containing accidental explosions. Rockets will be drained of liquid agents and mechanically sheared into seven segments. Machines will remove and slice projectile explosive components and then convey the nonexplosive projectiles to a bay where they will be drained of agents. Land mine disassembly machines will punch out booster explosives from land mines and then drain them of agents. Bombs and 1-ton containers have no explosives; therefore, they will be conveyed from the unpacking area directly to a bulk drain station where they will be punctured and drained of agents.

After chemical munitions are disassembled and drained of agents, the munition components, metal parts, chemical agents, and packaging will be destroyed or decontaminated in four different furnaces. The rocket segments, land mines, and explosive components from projectiles will be destroyed in a deactivation furnace capable of containing explosions and associated surges of agent. The projectiles and bulk items will be decontaminated in a metal parts furnace. Liquid agents from all the

munitions and all solutions used to decontaminate equipment will be collected in storage tanks and eventually destroyed in a liquid incinerator. Pallets and packing materials will be burned in the dunnage furnace.

The disposal process produces by-products, which must be certified agent-free. Each furnace contains a pollution abatement system, which cools and neutralizes acidic components and residue from exhaust gases. Residue from the dunnage and deactivation furnaces is packaged for disposal. Solid residue from the deactivation furnace will be disposed of in an approved landfill. An Army official said that the Army would attempt to sell scrap metal from the metal parts furnace and that scrap metal dealers have expressed an interest in the metal. Brine solution from the liquid incinerator will be evaporated through a heating process, and the remaining salts will be loaded into containers for disposal in an approved landfill. Figure I.1 illustrates the JACADS disposal process.

Figure I.1: JACADS Disposal Process



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