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ENVIRONMENTAL CLEANUP

Case Studies of Six High Priority DOD Installations

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

Dear Mr. Chairman:

This is a supplement to our report entitled Environmental Cleanup: Too Many High Priority Sites Impede DOD's Program (GAO/NSIAD-94-133, Apr. 21, 1994). It provides six installation case studies addressing issues outlined in your request and discussed in our report. These issues include the status of the restoration program, the cost of cleanup to date and projected costs, the cleanup options considered, the option selected, expected completion, and the applicable cleanup standards. The case studies also provide installation specific information on reasons an installation was listed on the National Priorities List (NPL), the regulatory process, cooperation between the installation and the regulatory agencies, staffing at the installations and the regulatory agencies, and the process for funding the cleanup. (See apps. I through VI.)

In our April 1994 report, we stated that despite spending a reported $3.76 billion as of September 1993, the Department of Defense's (DOD) environmental cleanup program for high priority installations has proceeded slowly over the past 10 years, with relatively few hazardous waste sites being cleaned up. Most of the time and money have been spent studying the problem. The cost estimate for cleaning up high priority installations is $18.2 billion.[1] However, this cost estimate is based on preliminary information and is likely to increase.

The Environmental Protection Agency's (EPA) system for identifying high priority sites has led to a large number of individual sites on installations with that designation. In addition, some sites not designated as high priority are more contaminated than high priority sites and pose a greater risk to human health and the environment than those on the NPL, according to DOD officials. EPA usually scores only the four to six worst sites on an installation in determining whether an installation, which may have hundreds of sites, should be placed on the NPL. Many of these sites may have only minor contamination, but DOD program managers must apply the

[1]The estimated cost to clean up DOD installations is based on data provided by the installations, commands, and services as of September 30, 1993.

entire Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process (see app. VII) to all the sites on an NPL installation, including those with only minor contamination.

DOD will not be able to efficiently institute cleanup efforts until it and EPA evaluate the large number of sites currently on the NPL or the closure list and determine which should be designated as high priority. Even a relatively few high priority sites could strain resources and force difficult choices. The Deputy Under Secretary of Defense (Environmental Security) has proposed a new approach to solving cleanup problems, which includes developing cooperative rather than adversarial relationships with regulatory agencies, setting priorities based on risk, and trying to accelerate cleanups.

We also identified other key factors that have affected DOD's cleanup of high priority installations in a timely and cost-effective manner.

- The complex and time-consuming CERCLA study and cleanup process.
- Prolonged study of hazardous waste sites rather than cleanup.
- Disagreements with regulatory agencies over the extent of cleanup required.
- Addressing issues during the CERCLA process, such as liability, that generally do not pertain to governmental installations.
- Scarce resources including limited technology and expertise.

Appendix VIII discusses our methodology and scope, including a list of the installations and organizations visited. We conducted our review from September 1992 to October 1994 in accordance with generally accepted government auditing standards. As requested, we did not obtain formal agency comments on a draft of this report. However, we provided officials at each of the six installations an opportunity to provide comments and have included their comments where appropriate. We also discussed our April 1994 overall report (NSIAD-94-133) with DOD representatives and included their comments where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time, we will send copies to congressional committees; the Secretaries of Defense, the Army, the Navy, and the Air Force; the Administrator, Environmental Protection Agency; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

If you or your staff have any questions concerning this report, please call me on (202) 512-8412. Major contributors to this supplement are listed in appendix IX.

Sincerely yours,

Donna Heivilin
Director, Defense Management
and NASA Issues

Contents

Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DERA	Defense Environmental Restoration Account
DOD	Department of Defense
EPA	Environmental Protection Agency
IRP	Installation Restoration Program
NPL	National Priorities List
PCB	polychlorinated biphenyls
ppb	parts per billion
TCE	Trichloroethylene

Aberdeen Proving Grounds Case Study

Aberdeen Proving Grounds, Maryland, is an Army Test and Evaluation Command installation within the Army Materiel Command. The installation, situated on 79,000 acres, over half of which is covered by water, is split between Aberdeen (north end) and Edgewood (south end) areas, separated by a river with both areas consisting primarily of peninsulas and islands in the upper Chesapeake Bay in Harford and Baltimore counties.

Aberdeen Proving Ground's mission includes development and testing of equipment such as weapon systems, rockets and missile systems, munitions, and components. The Army's Chemical Biological and Defense Command, a tenant at the installation, is involved in research of materials such as blister agents, tear gas, and nerve agents. About 85 percent of the installation's area is used for vehicular testing, ballistic testing, and artillery and other weapon testing impact areas.

Throughout its history, the Edgewood area has been the primary U.S. chemical warfare research and development center. During World Wars I and II, the Edgewood area manufactured chemical agents. Past mission activities and disposal practices have resulted in contamination, including volatile organic compounds, arsenic, phosphates, napalm, unexploded ordnance, nitrates, chemical agents, and other contaminants typically found on military installations.

Listing on National Priorities List

The two National Priorities List (NPL) sites on the installation are the entire Edgewood area, which includes 78 individual sites,[1] and the Michaelsville Landfill site in the Aberdeen area. Because all of the preliminary assessment studies had not been completed, only one site on the Aberdeen area was listed as an NPL site.

The Edgewood area was placed on the NPL on February 1, 1990. The site has a composite Environmental Protection Agency's (EPA) Hazard Ranking System score of 53.57 based on severe contamination from numerous sites. Installation officials agree that the area should be on the NPL because of the contamination. Groundwater is not used for drinking on the Edgewood Peninsula; however, there may be some private citizens near the Edgewood area boundary that may have private wells that may be affected. There also is concern that the contamination may affect the

[1]An NPL site can be made up of numerous potentially contaminated locations on an installation. These locations are referred to as individual sites when discussing the contaminated locations.

surface waters near the installation, including the Chesapeake Bay, which could, in turn, affect the fish and wildlife in the area.

The Michaelsville Landfill covers about 20 acres, and it was placed on the NPL on October 1, 1989. EPA assigned it a Hazard Ranking System score of 31.45 largely because of the potential for groundwater contamination caused by leacheate from the landfill. Groundwater in and around the Aberdeen area is used as a backup drinking water supply for the installation. Installation officials do not agree with EPA that the landfill contamination detected so far warrants NPL listing.

Even though the fire fighting training site located in the Aberdeen area was not listed on the NPL, subsequent information indicates it may be the worst site in the Aberdeen area because of the potential adverse effect on the environment. Tests indicate that the site is contaminating the groundwater, which supplies drinking water to the communities around the installation. Groundwater in and around the Aberdeen area is used extensively for drinking in Harford County (50,000 to 60,000 people) and in the town of Aberdeen (14,000 people). A major concern is that the continued pumping of the wells will establish a low spot in the groundwater table that could further draw contaminated groundwater from the site.

Installation officials have not tested any of the off-base drinking water wells to determine if there is any contamination, but the county and the state have found low levels of volatile organic compounds and Trichloroethylene (TCE) in their testing of some of the county wells. In 1992, one of the county wells was shut down because of the TCE contamination. In June 1993, the Army completed construction of a water treatment system, at a cost of about $1.3 million, to remove TCE from the water used. The well was also put back in operation in June 1993.

Status of the Installation Restoration Program

Under the Department of Defense's (DOD) installation restoration program (IRP), the installation has completed most of the preliminary assessment/site inspection phase and is in the remedial investigation/feasibility study phase of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) cleanup process. The remedial investigation/feasibility study has been severely restricted by the presence of explosives and chemical agents at some of the 79 sites.[2] These

[2]The 79 sites consists of 319 solid waste management units. Each unit could be a place where hazardous waste was disposed of or was spilled or is an operating facility.

79 sites have been divided into 13 study areas, with each study area to have a Record of Decision.[3] Nine study areas make up the Edgewood NPL site and four study areas make up the Aberdeen portion. Table I.1 shows the status of sites on the installation.

Table I.1: Status of Sites at Aberdeen Proving Grounds

CERCLA process phase	No. of sites that reached or will reach phase
Study	79
Interim remedial action-underway	10
Interim remedial action-complete	17
Remedial action	67
Remedial action in place and operating	0
Remedial action complete	0
Closed out-no further action	2

Installation officials do not think they have found all of the sites because they are still finding new sites on a regular basis. The state and EPA have said the installation does not have to do any more preliminary assessment/site inspection work to find new sites. However, if a new site is found, the applicable parts of the preliminary assessment/site inspection must be done.

Cost

The Army has spent $129.1 million through September 1993, even though the installation has not entered into the remedial action phase. The estimated projected total cost to complete the work required by the Interagency Agreement,[4] as included in the Annual Report to Congress, is $1.3 billion.

Installation officials believe costs must be controlled and they have instituted cost control reporting for the work being done and scheduled to be done. Each project manager has to maintain records on the work done, perform an analysis of what has been done and how much the contractor should be paid, and record the amount of payments. These statistics are reported to the Chief of the Environmental Conservation and Restoration Division monthly, quarterly, and annually. These reports are forwarded to higher command for their review, analysis, and approval.

[3]A record of what the installation and the regulatory agencies agree is needed to clean up a site.

[4]An agreement among the installation, EPA, and the state regulatory agencies outlining what the installation agrees to do to remediate the site. At some installations, a Federal Facilities Agreement has been signed, but in this report we will call all agreements Interagency Agreements.

Another cost control measure is that all participants in the IRP meet annually to review the entire program. During the meetings, they discuss program status, share information, break down all aspects of the work, discuss options, identify and try to avoid duplication, and identify procedures or processes to reduce the cost. For example, in reviewing a contract proposal from a U.S. Army Corps of Engineers' contractor to remove some hazardous waste from a Carroll Island site, installation officials noted that the $1-million cost appeared to be inflated. Upon further review, the removal action was completed with installation personnel and contractors for about $258,000.

Options Considered

Options were considered for only 2 of the 13 study areas—the Old "O" Field site and the Michaelsville Landfill. Study work is continuing at the remaining areas.

As shown in table I.2, a number of options and cost estimates were considered for the Old "O" Field site.

Table I.2: Options Considered for the Old "O" Field Site Cleanup

Dollars in millions

Option	Cost estimate
Down-gradient extraction with discharge to surface water	$1.8
Extraction with capping and discharge to surface water	4.1
Extraction with spray irrigation/source flushing	3.0
Extraction with down-gradient reinjection	3.0
Air stripping/carbon adsorption (liquid phase)	9.4
Chemical precipitation/ultraviolet-oxidation	7.4
Chemical precipitation/activated sludge biological treatment/carbon adsorption	6.4
Chemical precipitation/powdered activated carbon treatment	5.6
No action	0.0

As shown in table I.3, a number of options and cost estimates were also considered for the Michaelsville Landfill.

Table I.3: Options Considered for the Michaelsville Landfill Cleanup

Dollars in millions

Option	Cost estimate
Redressing the landfill cap	$ 7.0
Installing a new cap in accordance with Maryland's requirements using off-post clay	9.2
Installing a new cap in accordance with the Resource Conservation and Recovery Act requirements for hazardous waste landfill closure	9.6
Installing a new cap in accordance with Maryland's requirements using a geosynthetic (plastic) membrane	8.8
Excavating and hauling the waste off-site	135.5
Excavating and incinerating the waste	182.8
Excavating the waste, lining the cavity, replacing the waste, and capping the landfill	21.1
No action	0.0

Options Selected

Records of Decision concerning remedial actions or cleanup have been signed for the Old "O" Field site and the Michaelsville Landfill. In addition to these two study areas where options were considered, a Record of Decision for no action was also signed for the White Phosphorous site study area. EPA Region III officials told us that the options considered and selected and the no action decision for the White Phosphorous site met with their approval.

For the Old "O" Field site, a pump and treat system was selected. The treatment consisted of chemical precipitation and ultraviolet-oxidation. The effluent from the treatment plant is discharged into the adjoining river. After the system was installed, installation officials decided to afford more protection against the danger of explosion. To do this, they decided to also install a sand cap over the site that would absorb some of the effects of an explosion. The cap would also permit rain to wash through the site, flushing out some of the waste that would be captured and treated in the new pump and treat system.

For the Michaelsville Landfill site, the Army chose to install a new cap in accordance with Maryland's requirements using a special plastic liner.

Expected Completion

Installation officials said no date has been projected for when all the cleanup work will be completed. The installation is contemplating funding for cleanup until the year 2010. As at other installations that use pump and treat systems, it can take decades for the groundwater to be cleaned. In most cases, the study work has not progressed far enough to know what cleanup actions are required. Even with the landfill cap, continuous monitoring is required, and if the cap fails, cleanup work may be required. For a number of Aberdeen Proving Ground's sites, installation officials do not believe there is adequate technology available to do the cleanup work.

Regulatory Process

Installation officials stated that the CERCLA process is time-consuming and costly and takes a large number of people to implement. However, they stated that there are some advantages to being placed on the NPL, including (1) a higher funding priority; (2) a single point of contact for the state regulatory agency; (3) better incorporation of the applicable, relevant, and appropriate requirements; and (4) more and better attention from EPA. They also said there are some disadvantages to being placed on the NPL; for example, the required paperwork is difficult to manage and get processed, reviewed, and approved.

Installation officials believe all installation sites should be included in the Interagency Agreement because it provides for orderly and consistent management. All of the installation's sites are included in the agreement.

Because the installation cannot fund and implement all of the projects at once, installation officials review and prioritize all of the projects and determine which ones can be put under contract using existing technology. This approach permits the movement of money to higher priority projects. As a result, there are some quick response actions, and some cleanup projects that are accelerated while others have limited actions taken.

Officials have also tried to accelerate projects by condensing the study plans to enable faster achievement of a Record of Decision and clean up some of the worst sites quicker. To shorten the amount of time to clean up a site, the installation has begun early removal actions or interim remedial actions while the work to come up with a Record of Decision is being completed.

DOD/Regulatory Agency Cooperation

So far, the installation has not had any problems with the oversight provided by the regulatory agencies—EPA and the Maryland Department of Environment-CERCLA Section. According to installation, EPA, and state officials, the working relationship has been great. They told us that they have informally agreed to proceed with the job and to work together. Installation officials told us that EPA keeps them busy trying to comply with CERCLA requirements.

Cleanup Standards

Installation officials like the idea of one cleanup standard versus the cleanup being based on a risk assessment. However, they believe the standard should have provisions for adjustments to accommodate local conditions and a significant threat if there is one. They said for the Aberdeen area, a risk assessment is crucial because of the potential threat to drinking water supplies.

Staffing

Installation officials told us that, as of August 1994, the installation was authorized 14 restoration positions and they had no problem hiring the 11 people they currently have. For a number of years it was difficult replacing any that left because the Army had a staffing freeze. They stated that the freeze had not caused any major problems. The freeze has been lifted, but it still could affect the remedial action phase because not enough staff are available to oversee the increased number of contractors working on the IRP. One reason it has not been a major problem yet is that Aberdeen was permitted to replace those staff members who left with the three current staff employees that had lost their jobs because of a reduction-in-force action at the installation. However, these people do not have the technical or managerial expertise needed for the IRP. Installation officials state that without the full number of trained staff authorized, it will be hard to oversee the contractors' work. To overcome the shortage of staff, Aberdeen has signed a contract with the Department of Energy's contractor, HAZWRAP, to oversee and monitor the work of the contractors.

Regulatory Agency Staffing

EPA officials told us that because of the large number of NPL sites in Region III and the staffing restrictions, they have been assigning most of their staff to cover private sector NPL sites. They have a small number of staff dedicated to federal facilities, which they believe is not enough to cover the number of sites. Consequently, the region has used contractors to assist it in reviewing documents.

Installation officials told us that the documents they submit to EPA Region III are reviewed either by regional staff or contractors. According to these officials, the contractors' reviews often result in lengthy comments that are hard to deal with and take considerable time whereas EPA's reviews result in comments that can be dealt with and that do not require excessive work, such as more long-term studies to obtain additional details on the sites. They told us the contractors' reviews have caused them delays in proceeding to the next phase.

Funding

Army officials at the installation, the Army's Environmental Center,[5] and the headquarters level in Washington, D.C., told us that the Army, through the Environmental Center, sets funding priorities based on the following criteria:

- Sites on the NPL with an Interagency Agreement.
- Sites on the NPL without an agreement.
- Sites with notices of violation or consent decrees.
- Sites not on the NPL.
- Removal actions on the NPL.
- Sites with an agreement but not on the NPL.
- Removal actions not on the NPL.

The top two priorities are being fully funded by the Army, and the installation has received all of the Defense Environmental Restoration Account (DERA) funding requested. According to installation officials, two of the worst sites, the fire training area and the Phillips Landfill, have not received adequate funding (non-DERA) because they are not listed on the NPL, even though they are included in the agreement. For example, the installation requested $1 million in fiscal year 1993 to do some of the site investigation work at the fire training site, but the Army only allotted $200,000 for some preliminary study work.

According to installation officials, the fire training area was not adequately funded for a number of years because of the Army's funding priority system. However, during the last 2 years, the funding priority has increased to near the highest priority because installation and regulatory agency officials consider it to be one of the highest risk sites on the installation due to the fact that the site is contaminating local drinking water supplies. In addition, the installation is receiving a larger share of the funds because installation officials have begun to identify a number of

[5]The Environmental Center manages the IRP, including funding and other resources.

projects each year that could be done if additional funds become available. The installation has received a significant amount of year end funds when other installations could not get their projects under contract.

Also, according to installation officials, some removal projects in the past had not received the required funding because removals were given a low priority under the Army's funding system. These removal projects were not given a high priority because the installation could not prove a direct health or environmental risk. To prove a risk, installation officials would have to do all of the study work, which would take time. As a result, installation officials said that several removal projects had not been implemented and the installation had run the risk of contaminating the groundwater and causing a more costly cleanup problem. They also stated that during the last 2 years, a number of these projects have been funded because year end money became available.

At least once a year, installation officials meet with EPA to determine which sites EPA thinks should have the highest funding priority because of the environmental risk observed by the regulatory agencies. At these meetings, installation and EPA officials have stated that they do not believe the Army has assigned the proper funding priority to some of the sites, including the fire training area. This site has not received funding because the study phase was not complete when the Hazard Ranking System scoring was done for the installation, and as a result, the site was not listed as an NPL site. Even though it is a high risk site, according to EPA and the state, it is not on the NPL, and because it is not on the NPL, the Army has not assigned it a high funding priority.

Fort Wainwright Case Study

The primary mission of Fort Wainwright, Alaska, which covers over 900,000 acres, is to train soldiers in the arctic environment, prepare troops to defend the state, and deploy worldwide. Industrial operations include the maintenance of fixed-wing aircraft, helicopters, and support vehicles. The waste generated and the contamination Fort Wainwright has to address include petroleum products, chemicals, pesticides, volatile organic compounds, heavy metals, batteries, solvents, paints, and radiologically contaminated wastes. The U.S. Army, Alaska, Public Works at Fort Richardson, manages and provides oversight of the environmental programs at the fort. Fort Wainwright's environmental staff provides limited on-site assistance in the cleanup program.

Listing on the NPL

Fort Wainwright was placed on the NPL with a Hazard Ranking System score of 42.4 in August 1990 because of possible groundwater contamination from a landfill, and the North Post sites, and six sites contaminated with heavy metals. The score was a composite score of a number of sites on the installation.

EPA officials, based on the preliminary studies, believed a North Post site was leaking benzene into the groundwater; however, a subsequent review of the data indicates this may not be true. A removal action removed all contaminated dirt, and a groundwater investigation will be done to confirm whether there is benzene contamination of the groundwater according to Army officials.

The Army has records indicating mustard gas canisters were disposed of on the fort, and an effort was made to locate the sites. One was found and a partial cleanup was done in the 1960s. Another removal action is planned. An EPA official believes the site still contains contaminants and the site by itself could qualify the installation for the NPL.

Status of the IRP

Several studies, including the preliminary assessment, have been completed. The preliminary assessment, done in 1987, evaluated the landfill, the North Post sites, and other petroleum, oil, and lubricant sites scattered throughout the installation. In 1992, EPA, the state, and the Army recommended that some sites be closed out, with no further action, and that others be studied further, including some testing. During the follow-up studies, possible chemical disposal sites in the Birch Hill area and other sites that may require additional work were identified. Work on

the remedial investigation/feasibility study was begun in fiscal year 1993. Table II.1 shows the status of CERCLA work at Fort Wainwright.

Table II.1: Status of Sites at Fort Wainwright

CERCLA process phase	No. of sites that reached or will reach phase
Study	61
Interim remedial action-underway	2
Interim remedial action-complete	19
Remedial action	15
Remedial action in place and operating	0
Remedial action complete	11
Closed out-no further action	34

Some of the North Post sites have been cleaned up and others are under remediation. So far, the material taken from the North Post sites has had very low levels of contamination. The installation's petroleum, oil, and lubricant pipeline has significant leaking problems. U.S. Army, Alaska, officials plan to use ground penetrating radar to pinpoint any waste sites, especially the alleged chemical waste disposal sites.

The Army found that only one of two possible sites had evidence of possible radiological contamination. The radiation was believed to be what was left from disposing of the remains of airplane instruments and dials. An Army official stated that the contamination from this site was removed in the 1960s, and EPA and the state formally agreed with the Army's decision for no further action on this site.

The installation is continually finding new sites, especially buried petroleum products in drums. During World War II, in anticipation of a possible Japanese attack on above ground petroleum, oil, and lubricant storage facilities, the installation buried a very large number of drums with these products in them. Even though the preliminary assessment identified a large number of these sites on the installation, U.S. Army, Alaska, installation, and contractor officials are continually finding others. Recently, installation, contractor, and U.S. Army, Alaska, officials identified a site where they thought about 40 to 60 drums were buried. However, the contractor found over 1,600 drums, many still containing petroleum products. Army officials told us that as of August 1994 all of the drums had been removed from the site.

EPA and state regulatory agencies' officials told us that the IRP at Fort Wainwright is a good one and that they believe the installation is identifying its sites through the IRP. The installation has been very diligent. For example, unlike other installations, it closely coordinated the preliminary assessment with both state and EPA regulators and incorporated their comments into the assessment plan.

The sites have been divided into five operable units. Operable Unit 5 has been left open to add new sites when found.

The Army, in studying the groundwater flow, is having difficulty determining the amount of contamination, the direction of the contamination plume migration, and the source of the contamination because of the uncertainty caused by the permafrost. For example, based on normal geological formations, groundwater would flow in a certain direction. However, with the permafrost, the direction of the groundwater flow can change, at times even be reversed. In addition, the effect changes with the seasons.

U.S. Army, Alaska, officials believe that with the extent of contamination, the geological formations, the permafrost, and available technology, the installation cannot clean up the groundwater to drinking water standards. They stated that attempts to clean up the groundwater would be very difficult and costly.

Cost

The Army had spent $21.4 million through fiscal year 1993, and it expects to spend a total of about $72.7 million to implement the requirements of the Interagency Agreement. However, installation officials told us the cost estimate could increase as further study work is completed and the final remedial actions are decided.

U.S. Army, Alaska, and the Corps of Engineers are responsible for ensuring cleanup is being accomplished in the most cost-effective manner. U.S. Army, Alaska, officials believe that if the following were implemented, the cost of cleanup could be minimized.

- Clean up some sites while studies are being done at others.
- Remove the contamination from some sites and not do anything else, such as installing expensive pump and treat systems that often do not clean up the groundwater.
- Do nothing at all at some of the lesser contaminated sites.

Installation officials stated that another way to minimize costs is to improve environmental contracts so that they are more flexible. An Army official stated that 5 years ago, a "Blue Ribbon Panel" concluded that the Corps' construction contracts were not specific enough to prevent unnecessary cost growth. In response, the Corps set up rigid procedures for contracting and contract administration to prevent cost growth during facility construction.

However, U.S. Army, Alaska, officials believe these rigid procedures conflict with the need for flexibility in environmental contracts. Environmental contracts are not like construction contracts because there is not a definite structure being built. Also, there are many unknowns concerning hazardous waste cleanup. Thus, it is almost impossible to tell what will be encountered as the work progresses. As a result, there is a need to constantly change the scope of work to adjust for the unknowns.

According to U.S. Army, Alaska, officials, the rigid procedures had caused them to delay the IRP while the contracts are amended to include additional problems found. These delays can extend the IRP by months and cause costs to increase because contractors must wait while the contracts are amended. The total effect is to allow the contamination to continue to spread, thus necessitating additional cleanup work and possibly more contract changes.

Army officials stated that Corps officials agreed that the rigid procedures for construction type contracts have caused problems in environmental contracting. They state that the Corps is reviewing its procedures to determine if changes can be implemented to accommodate the need for more flexibility while at the same time minimizing costs.

Options Considered

U.S. Army, Alaska, officials told us that they have not reached the point where they would consider which options to use in cleaning up the installation.

Option Selected

U.S. Army, Alaska, officials told us that nothing has been decided concerning final clean up actions at the sites and for the cleanup of groundwater. However, for selected sites, to prevent further environmental contamination, the installation has taken interim remedial actions to remove contaminants. These actions include removing

contaminated barrels, digging up contaminated soil and removing it from the installation, and installing a groundwater treatment facility. Most of these sites were considered to be "hot spots" that could be cleaned up relatively easy and with minimal costs. The installation has used various methods and some technological advances in the cleanup program such as bioremediation, land farms, and biopiles. The regulatory agencies concurred with the actions taken to date. However, it has not been decided if further work will be required at these sites because final agreement with the regulatory agencies has not been reached.

Expected Completion

U.S. Army, Alaska, and installation officials told us that because they are still in the early stages of the IRP, they do not know when the cleanup work will be completed, what the extent of contamination is, or what the final remedies for most sites will be. The officials stated that, if the installation is allowed to limit work to the interim remedial actions at all of the sites, then the IRP could be completed within the next 10 years, otherwise it could take longer.

Regulatory Process

Installation and U.S. Army, Alaska, officials told us that as long as the work is being done under the CERCLA process they have no problems with the regulatory agencies. However, they believe the CERCLA process as a whole is time-consuming and costly and slows down the cleanup process. The Interagency Agreement was signed by the state on December 24, 1991, by EPA on March 25, 1992, and the Army on March 19, 1992. Installation officials believe that all of the sites should be included in the agreement because it enables everyone to concentrate on what needs to be done and provides a mutually agreed upon basis for managing the work. As decisions are made on each site, they will be incorporated into the agreement. Installation officials firmly believe that the CERCLA process would have been much slower if the procedure outlined in the Interagency Agreement had not been in place.

DOD/Regulatory Agency Cooperation

The Alaskan Department of Environmental Protection and EPA located their program managers near the fort with the authority to act for each agency. Officials from the involved organizations (U.S. Army, Alaska, EPA, and state regulatory agencies) told us that having all three project managers located near each other, and their willingness to work together, has resulted in a good working relationship. They also told us that almost all of the decisions these three have made have been right, resulting in

little change to actions being taken. The Army, at the DERA conference in Denver, Colorado, designated Fort Wainwright as an example of how to implement the program and has included the installation's IRP in its CERCLA management training.

The three program managers meet monthly, more if necessary. Actions planned or being done by one activity are always discussed with the other two. They deal with the small problems before they become big ones. If they have a difficult problem, they check with their supervisors to make sure the right decisions are implemented. They each have technical experts either in-house or by contractor who provide assistance.

An important feature of the close working relationship of the three project managers is that they meet often to informally work out some of the difficult problems. This arrangement leads to a better understanding of the views of each manager. They believe that not having frequent meetings and a good working relationship could result in actions that may not be required or that are wrong. If this happens, a lot of time and money could be spent correcting the actions.

U.S. Army, Alaska, officials said that EPA and the state have been extremely helpful to installation officials. They have conducted tests, made the required analyses, and generally done whatever is necessary to help get the work done. EPA has provided its technical expertise to either start or complete the study and remediation work.

One concern, however, is that the state has placed stricter standards on the installation's cleanup of petroleum, oil, and lubricant sites than it has placed on the city. In this instance, the contractor is required to dig up the contaminated dirt and take it to a storage location where the state requires it to be placed in plastic-lined storage facilities until it can be burned. (At the time of our visit, the contractor was testing its proposed burning operation for the fort on the city's petroleum-contaminated soil.) However, unlike the contaminated soil at Fort Wainwright, the city's contaminated soil is placed on the ground with no protection to the environment. Installation officials believe that the city is not being held to the same standard for treating waste as the installation is. By being held to a stricter standard, to build the plastic-lined storage facilities, the installation is incurring higher costs.

Cleanup Standards

Installation, EPA, and state officials state that in an ideal world one standard for each chemical would be the optimal solution for cleaning up hazardous waste. But realistically, that cannot be done. Each site is different and each chemical reacts differently depending upon the environmental conditions.

Installation officials said that the cleanup standard for each installation should be based on a risk assessment that considers what the installation will be used for in the future. Thus, each assessment would entail different goals for different installations for the same contaminant. Like California, Alaska considers petroleum, oil, and lubricant products to be hazardous waste, and most of the sites on the fort to be cleaned up are contaminated with these products. As of now, the state standard that Fort Wainwright has to clean up to is drinking water standards.

Staffing

U.S. Army, Alaska, including Forts Greely, Wainwright, and Richardson, has 26 authorized positions to do all environmental work, including installation restoration or CERCLA work. The U.S. Army Force Integration Support Agency made a study of the U.S. Army, Alaska's, environmental staffing in December 1993 and determined that to adequately do all of the required environmental work, U.S. Army, Alaska, would need 54 staff members. U.S. Army, Alaska, officials stated that it is unlikely they will get any additional staff until the Army lifts its hiring freeze. They also stated that one of the primary reasons Army installations were assessed over $5 million in punitive and stipulated fines since January 1993 was the shortage of environmental staff to do the required work.

These officials stated that by not having the number of people required there has been adverse effects on the total environmental program. The primary one is that they have not been able to adequately oversee the work being done by the environmental contractors on the installations.

One staff member, the program manager (GS-12), oversees the IRP at U.S. Army, Alaska, headquarters at Fort Richardson. Fort Wainwright has four people working full time in the environmental area and a number of "borrowed" military people assisting them. U.S. Army, Alaska, and installation officials depend heavily on the Corps for the contracting portion of the work, including the awarding, administering, and monitoring of the contracts.

U.S. Army, Alaska, officials stated that keeping environmental staff is difficult for the Army because it does not assign as high a grade structure (top grade is a GS-13 at U.S. Army, Alaska, and GS-11 at the fort) to its environmental programs at the installations as does the Air Force (GS-13 at each Alaskan installation), the Navy (GS-13), and the Bureau of Land Management Office in Anchorage (GS-13). The officials have characterized the Army's program as the training ground for all of the other federal agencies in Alaska. The training that the Army provides is outstanding and recognized by all other federal agencies in the state. However, to get more money and a promotion, the Army staff have to go somewhere else, often doing the same job or at times a lesser job.

U.S. Army, Alaska, and installation officials told us that the staffing for the IRP work is not enough to oversee contractor work, a responsibility of U.S. Army, Alaska. Because of its staffing shortage, they have to rely too much on contractors. The contractors are put in a position of getting the CERCLA work done, even though they do not have the authority to act for the government in dealings with the regulatory agencies.

Army officials told us staffing is not adequate to properly spend the money now available, much less any more that might be provided them. If the budget continues to grow and the Army continues to have its current staffing problems, some funds could be inappropriately used. For example, contractors may take actions not required (drill unnecessary monitoring or test wells), will do things wrong (not properly preserving test samples), or will not comply with requirements (not using EPA-approved laboratories to perform the tests), which could lead to additional costs in the future.

Regulatory Agency Staffing

Fort Wainwright and U.S. Army, Alaska, officials told us they have not experienced any problems with the Alaskan Department of Environmental Control because of any staffing shortages. State officials, however, told us that they are beginning to experience some serious funding and personnel problems and that these problems could affect the adequacy of their work in the future.

U.S. Army, Alaska, officials told us that they have experienced some problems in getting documents reviewed by EPA Region X officials within the time frames set forth in the Interagency Agreement. A Region X official told us that they have experienced some problems reviewing documents timely because they do not have enough staff and thus, the region has used

contractors to review and analyze the installation's submissions. U.S. Army, Alaska, officials state that this approach has complicated the CERCLA process because a contractor generally recommends to EPA that more work be done for each site. By having the installation do more at each step of the process, the contractor is able to continue working. As a result, the program is delayed and costs increase significantly. A Region X official told us they minimize the chances of this happening by requiring all contractor work to be reviewed and approved by EPA staff.

Funding

Being on the NPL forces installation and U.S. Army, Alaska, officials to focus on the problem, work out solutions, and deal with the issues. It also enables them to get DERA funding easier. They believe that the only way to get adequate cleanup money is to be listed on the NPL.

The amount of funds received has been adequate. Additional money could not have been used because Fort Wainwright and U.S. Army, Alaska, do not have enough people to adequately oversee any more contracting work. All of the sites identified on the installation have been given equal priority for DERA funding.

McChord Air Force Base Case Study

McChord Air Force Base, Washington, was formally dedicated in May 1938 on land deeded from Pierce County and occupies about 4,600 acres near the city of Tacoma. As an Air Mobility Command facility, McChord's current mission is to provide rapid airlift capability of personnel and equipment to anywhere in the world. Significant quantities of solvents, protective coatings, industrial products, petroleum, oils, and lubricants have been used in maintenance and operational activities in support of this mission and past missions. As a result, McChord has some contaminated sites, which are similar to those found on many other Air Force and Navy aviation installations.

Listing on the NPL

Unlike the current practice of DOD and EPA to place an entire installation from fence to fence on the NPL, only two sites on the installation were placed on the NPL. These two sites were (1) the off-base American Lake Garden Tract with a Hazard Ranking System score of 31.94 and the adjoining contiguous Area D, which has seven individual sites, including the Whispering Firs Golf Course (site 5 landfill) and (2) the Washrack Treatment Area, including sites 54 and 60 with a score of 42.24. The American Lake Garden Tract and the Washrack Treatment Area were placed on the NPL in September 1984 and July 1987, respectively.

Two landfills may be leaching contaminants into the groundwater and a contamination plume was documented to be spreading under the American Lake Garden Tract from Area D and the site 5 landfill. The groundwater, at the 140- to 500-foot level, is used for drinking water, and it is contaminated with TCE and other wastes from both NPL sites. TCE has shown up in two of McChord's wells; however, most of the sample test readings were below the 5 parts per billion (ppb) Maximum Contaminant Level set by EPA. The readings for the highest test well ranged from 0.08 to 120 ppb. The Washrack Treatment Area has a stationary layer of fuel and oil floating on the water table.

Even though there is some groundwater contamination, McChord officials do not believe any installation sites should be on the NPL. The contamination is not very bad, and the installation has paid to have the American Lake Garden Tract area hooked up to the regional water system. They believe the decision to put McChord's sites on the NPL was a "political decision," not one based on significant evidence. In other words, during the early stages of the Superfund program, EPA was under pressure to get sites on the NPL, and McChord's sites were two possibilities where the listing could be done rather quickly and easily.

EPA officials stated that in the early stages of the NPL effort, there were very few sites with enough data to determine if they should be listed. In the case of McChord, they knew the installation had some groundwater contamination and they decided to list it.

Status of the IRP

McChord officials believe the IRP Phase I study and the follow-on CERCLA preliminary assessment and other investigative work have identified all sites on which McChord has any data. However, there is the possibility that unknown sites may be found.

The Phase I study identified 62 sites. Subsequent study work confirmed most of these sites and identified 2 additional sites, for a total of 64 hazardous waste sites. In addition, 22 DERA eligible underground storage tanks with contamination problems were designated as site 65. These 22 tanks were later removed from the DERA-funded effort to an environmental compliance-funded project, which is complete. Table III.1 depicts the status of CERCLA work at McChord.

Table III.1: Status of Sites at McChord Air Force Base

CERCLA process phase	No. of sites that reached or will reach phase
Study	65
Interim remedial action-underway	0
Interim remedial action-complete	1
Remedial action	6
Remedial action in place and operating	1
Remedial action complete	0
Closed out-no further action	58

Of the original 62 sites, a large number of them were included in the Phase I study because someone believed some waste may have been disposed of at the site, but there was no evidence or documentation supporting this belief. McChord officials said that 52 sites should not have been included and would not have been if they had been in the private sector. McChord submitted to EPA a No Further Response Actions Planned document on August 15, 1994, for 58 sites. Installation officials consider these sites to be finished. EPA and the state have agreed to the no further action decisions on 24 of the 58 sites.

Cost

Through 1993, McChord had spent $12.5 million, and it expects to spend, based on its understanding of the Interagency Agreement requirements, a total of $20.1 million through 2005. The total cost does not include any changes that may be made to the IRP or any additional requirements resulting from changes in the laws or regulations.

McChord is using a task order contract, which officials believe permits the installation to get the work done in a timely manner and at the lowest costs possible. The preliminary assessment cost about $50,000. The remedial investigation/feasibility study for the American Lake Garden Tract cost $3.1 million and took over 37 months to complete. However, McChord officials believe that the annual costs will start to decrease because future costs will be for long-term monitoring and the operation and maintenance of the pump and treat system, which was built at a cost of $1.5 million.

Options Considered

The options considered for the American Lake Garden Tract were

- no action, with monitoring only;
- one groundwater extraction system, one carbon adsorption treatment facility, and irrigation/recharge of treated groundwater;
- three groundwater extraction systems, two carbon adsorption treatment facilities, and irrigation/recharge of treated groundwater; and
- three groundwater extraction systems, two carbon adsorption treatment facilities with addition of bioremediation, and irrigation/recharge of treated groundwater.

The options considered for the Washrack Treatment Area were

- no action except monitoring of the groundwater;
- institutional controls to prevent access to the site;
- containment of the floating layer of oil by installing a cap and institutional controls;
- installation of a groundwater/fuel extraction system, a treatment system to remove the fuel from the groundwater, and off-site recycling of the recovered fuel;
- an excavated trench, passive fuel removal, off-site recycling of recovered fuel, and bioremediation of the soil excavated from the trench at a contractor's site off the installation; and
- bioremediation of the fuel and fuel contaminated soil in place at the site.

Option Selected

For the American Lake Garden Tract, the Record of Decision calls for installing a pump and treat system with long-term monitoring. At first, McChord officials believed it was a "bad decision" to try and clean up the aquifer. But now McChord, EPA, and Washington Department of Ecology officials agree that the aquifer will not be cleaned up in the near future, maybe decades, if ever. However, they agreed that the pump and treat system will be used to contain and/or manage the contamination plume so that contamination will not spread further. McChord will provide institutional control to prevent any disturbances of the contamination.

The Record of Decision for the Washrack Treatment Area calls for installing a fuel extraction trench and collection system for passive fuel removal. The collected oil will be sent to a recycling treatment facility. Long-term monitoring of the groundwater will determine if the contamination leaves the installation, and institutional controls to prevent disturbance of the contamination will be implemented.

However, a pilot study, conducted as part of the remedial design phase, showed that the amount of fuel at the site was over estimated in the remedial investigation/feasibility study. Consequently, it was determined that the selected remedial action was not feasible. Therefore, McChord, in agreement with the state and federal regulators, developed an Explanation of Significant Difference document that recommended that no remedial action be taken, but that long-term monitoring should be done. As agreed upon, the long-term monitoring program should begin in fiscal year 1995.

Expected Completion

According to the October 1993 Management Action Plan, remedial actions at McChord will not be completed until 2005. McChord officials state that even then long-term monitoring will probably continue for an unknown length of time, maybe decades.

Regulatory Process

McChord officials believe all sites on the installation should have been included in the Interagency Agreement. However, a three-party agreement (EPA, state, and McChord) was signed to include only the two NPL sites. A Consent Decree, or two-party agreement, with the Washington Department of Ecology was signed for 29 additional sites covered by the state's Model Toxic Control Act. The act allows the installation to have more latitude on what is to be done, to focus its study efforts, and to set time frames or deadlines for those sites not on the NPL.

McChord officials believe that the CERCLA process has delayed the remedial investigation/feasibility study phase. EPA has issued a number of guidance documents for this phase that requires an installation to conduct studies, prepare reports, submit draft reports to EPA for review, and incorporate EPA's comments in the reports and plans. This is a problem because EPA wants the installation to do the study and analysis work to come up with an iron-clad case that will stand up to public scrutiny. McChord officials said that EPA officials have told them that for the remedial decision to stand up to public scrutiny, the installation must prepare the same documents that would be needed to make the case stand up in the courts.

Each section of the process usually has several versions of any reports or plans. For example, a preliminary draft is prepared and submitted to EPA for review and comment. EPA provides its comments, which are prepared by its contractors, to McChord, which then has its contractor review EPA's comments and incorporate the changes and resubmit the draft to EPA as a final draft. EPA reviews and submits its comments on the final draft to McChord, which incorporates the comments into the final report.

For the period July 1988 through September 1991, McChord officials analyzed the time spent preparing and revising documents submitted to EPA. During that time, 25 documents were prepared, often including multiple versions that incorporated EPA's and the state's comments. Review of each version of each plan or report usually costs $20,000 to $30,000.

EPA and the state required McChord to make a risk assessment for the two NPL sites. Even though the Washrack Treatment Area is in an area where industrial activity continues, EPA required McChord to use residential standards. EPA said that McChord should assume in its risk assessment that condos will be built on the site and children will be playing in the area and all people living in the condos will get their drinking water from the shallow aquifer.

The installation has faced difficulties in resolving differences between the regulatory agencies. If they require different actions or set different standards, McChord resolves the differences and determines what is to be done, which takes time and causes IRP delays. EPA officials told us that they are trying to minimize their differences with state officials so the IRP can proceed.

DOD/Regulatory Agency Cooperation

Generally, during the last couple of years, McChord has had a very good working relationship with the regulatory agencies. There are no problems with the way things are being done at the present time. This increased cooperativeness has come about partially because of the changes instituted by the Air Force and EPA due to the good working experiences EPA has had with Fort Wainwright.

The Washington Department of Ecology is the state regulatory agency responsible for oversight. McChord officials state the working relationship with Ecology has been outstanding because it is willing to work with the installation to accomplish the cleanup.

McChord officials state they had trouble getting EPA to review their documents in a timely manner, which has caused delays in getting work done. EPA uses contractors to review the documents and reports submitted by McChord because EPA does not have the staff to do it. EPA officials state that any products prepared by their contractors must be reviewed by EPA staff before being released to McChord. At times, this review by EPA staff has been less than desired because of the workload. McChord officials do not believe this has caused any insurmountable problems.

McChord officials told us that the biggest problem encountered with contractors, not just McChord's, is that they are involved in the decision-making process for the program. They believe that a cleanup program should not be controlled by a contractor. DOD needs to insure that adequate numbers of people with the required technical expertise are available (1) to oversee the contractors and (2) to use the contractor-prepared data in deciding what has to be done.

Cleanup Standards

According to McChord officials, there should be only one set of standards. However, since sites are so different, it may be necessary to establish a cleanup goal for large badly contaminated sites. The hydrology is very site specific, and often cleanup standards cannot be technically achieved or are not economically feasible. Any applicable state standard that is more stringent than the comparable federal standard and is legally applicable or relevant and appropriate under the circumstances will apply. McChord officials believe the state of Washington may have gone too far because some standards are not measurable with today's equipment.

Staffing

Generally, McChord was able to hire, train, and retain staff. It currently has seven people, which is enough to manage the work done at the current funding level, and it does not expect to receive additional funds. McChord officials stated that they need to maintain high grades to attract high quality, fully trained staff with experience. Recently the Air Force mandated reductions in DERA-funded staff. Consequently, McChord will lose some of its DERA-funded staff in fiscal year 1996.

Regulatory Agency Staffing

McChord officials are not aware of any insurmountable problems caused by the number and quality of staff at the regulatory agencies other than the time it takes to have documents reviewed.

Funding

Under current Air Force procedures, the NPL sites with signed Interagency Agreements get the highest funding priority. The next priority is for non-NPL sites that have compliance deadlines. Since all of McChord's sites are subject to regulatory deadlines, there have been no problems in obtaining the required funds. However, McChord officials believe that in the future, DERA funds may not be enough to get the work done at all installations. As a result, there is a need for some type of priority setting system to determine which installations and which sites on each installation will receive money. Consequently, according to these officials, DOD may have to tell the regulators it cannot clean up all of the sites. Air Force headquarters has informed McChord officials that the Air Force funding priorities are scheduled to change in fiscal year 1997. A risk assessment approach will replace the current priority scenario.

Two ways to reduce costs are

- clean up only the bad sites and delay or not do the clean up for sites that do not pose a risk to the environment and
- modify the amount of study required for some of the lesser sites so that quick removal actions can be undertaken.

McClellan Air Force Base Case Study

The Sacramento Air Logistics Center, California, is a large industrial complex located on McClellan Air Force Base. The Center's primary mission is aircraft maintenance. In performing its mission, the Center generates more than 470 different hazardous waste streams, including solvents, caustic cleaners, low level radioactive waste, polychlorinated biphenyls (PCB), heavy metals, and a variety of fuel oils and lubricants. The previous disposal practices for wastes from these industrial type operations have resulted in significant environmental contamination.

Listing on the NPL

EPA scored McClellan using the Hazard Ranking System in 1984 and placed the entire installation on the NPL in July 1987. McClellan's score of 57.93 is the highest of any Air Force base. However, McClellan officials state the contamination is actually much worse than what was known in 1984 and what the score indicates. Over the years waste products from industrial activities have been dumped into disposal ponds located throughout the installation. These hazardous wastes have percolated into the soil and groundwater, and the contamination is migrating off the installation. There are three huge plumes of contaminated groundwater containing more than 11 billion gallons and reaching depths of 400 feet beneath the installation.

The worst contaminated groundwater is near the installation's western boundaries and drinking water wells have been closed, the drilling of new water wells banned, water purification systems installed, and 540 off-base citizens connected to public water supplies. More than 400 acres of soil have been contaminated to depths exceeding 300 feet for an estimated total of 1.5 billion cubic feet of contaminated soil and more than 11 billion gallons of contaminated groundwater.

TCE has been detected in the shallow, middle, and deep water-bearing zones of the aquifer with 45,000 ppb as the highest level detected. Other contaminants detected and the amounts are 1, 2 Dichloroethylene (600 ppb), Tetrachloroethylene (1,400 ppb), Vinyl Chloride (2,700 ppb), and Carbon Tetrachloride (500 ppb).

Status of the IRP

An Interagency Agreement was signed with EPA and the California EPA in July 1989. The preliminary assessment/site inspection phase is complete, and 258 potentially contaminated sites have been identified. Most of these sites are now in the remedial investigation/feasibility study phase. Table IV.1 depicts the status of sites at McClellan.

Table IV.1: Status of Sites at McClellan Air Force Base

CERCLA process phase	No. of sites that reached or will reach phase
Study	258
Interim remedial action-underway	15
Interim remedial action-complete	134
Remedial action	255
Remedial action in place and operating	0
Remedial action complete	3
Closed out-no further action	36

The sites are divided into 11 operable units. The following are three examples of an operable unit's location, number of sites, type of contaminant, and actions being taken.

- Operable Unit A, in the southeastern portion of the installation, is the oldest and most densely built-up area and contains 121 sites. Contaminated sites include repair shops, photo and other laboratories, PCB and asbestos storage areas, motor pools, wash racks, gas stations, oil water separators, sewer drains and sumps, industrial waste treatment plants, acid and cyanide disposal pits, and landfills. Regulatory agencies have preliminarily concurred with the Air Force's suggestion of no further investigation at three sites. The Interagency Agreement calls for the remedial investigation/feasibility study to be conducted based on a site prioritization model, with high priority sites proceeding with remediation first. Site prioritization is currently underway.
- Operable Units B and C, in the western and southwestern portions of the installation, contain about 1,350 million cubic feet of contaminated soil and 2 plumes of groundwater contamination that join to create a single 10-billion gallon plume contaminated by several contaminants, including TCE, which reaches depths of 400 feet. Operable Unit B contained 48 sites and Operable Unit C contained 43. Both included waste disposal pits and trenches, landfills, sewer lines, underground storage tanks, and an industrial waste treatment plant with surface impoundments. Most of the underground storage tanks have been removed and/or replaced with above ground storage tanks or state of the art underground storage tanks. The underground storage tank program to remove or replace single walled tanks is scheduled to be completed in 1996, ahead of the 1998 compliance deadline. The surface impoundments were shut off in 1988 and were surface sealed in 1989.

One of the installation's drinking water wells, number 18, was shut down in 1981, after volatile organic compounds were detected in quantities above the action level. An activated carbon filtration system was installed in 1985 for the well. This system is still in operation, and bimonthly filtration system and effluent sampling and analysis has shown no volatile organic contaminants above the action level.

In December 1986, the Air Force completed construction of the groundwater treatment plant at a cost of $4.8 million. This plant treats contaminated groundwater pumped from 15 extraction wells—6 wells in Operable Unit D ($1 million), 7 wells in Operable Unit C ($1.5 million), and 2 wells in Operable Unit B ($700,000). At the time of our visit, the plant was treating 250 gallons per minute, but it was designed to handle up to 1,000 gallons per minute. The plant is effective in controlling the flow of groundwater in shallow, middle, and deep water-bearing zones.

Cost

The Air Force has spent more than $155 million on cleanup at McClellan through fiscal year 1994. Air Force officials recently reduced the cost estimate made in 1992 by $300 million, to $1.3 billion. However, this revised estimate relies on assumptions that new emerging technology can be used, the completion date can be extended to the year 2010, and new initiatives will be successful.

McClellan officials state the science and technology needed to economically clean up massive amounts of contaminated soil and groundwater, like those under McClellan, are not currently available. They state it would cost a prohibitive $10 billion to clean up the installation using existing or current technology by the Air Force's completion goal of the year 2000.

Delaying the cleanup of contaminated sites can increase the cost if the contamination is allowed to migrate and enter the groundwater. However, installation officials state that taking extra time can also be a vehicle to reduce cleanup costs. They note it may be better to contain and manage contaminated sites until emerging technology, now being studied and tested, becomes available and natural remediation is also occurring with the passage of time. They state that if an installation rushes in and installs treatment systems that are not proven, the cost for cleaning up the site may be increased, first by the system installed if it does not work and second by having to install a new system later.

Options Considered

McClellan, in cooperation with EPA, is testing a number of new technologies for remediating massive amounts of both contaminated soil and groundwater economically. These emerging technologies include a two-phased extraction and soil vapor extraction. McClellan officials hope to assess the feasibility of dislodging contaminants trapped in the soil by lowering the localized groundwater table and then extracting the contaminants with vacuum pressure. McClellan officials also hope to assess the feasibility of lowering the localized groundwater table and extracting contaminants associated with vapors, instead of water, using vacuum pumps.

Option Selected

The final options have not been selected, but McClellan officials state that the installation's huge amount of contaminated soil and groundwater are too massive to economically clean up with current technology. Instead, McClellan officials have implemented various actions to limit human exposure to contaminated groundwater and soil as natural remediation occurs and new and better technologies are developed. These actions include installing pump and treat systems and the removal of hot spots or high concentrations of contaminated soil. In addition, they are cooperating with EPA to develop and test various new methods of remediating the soil that may be more economical.

Expected Completion

Installation officials state the Air Force's goal of completing the cleanup by the year 2000 is not realistic. They believe that by stretching the installation's IRP out to 2010 they can use emerging technology and let natural remediation occur. In the interim, they will protect the public by limiting exposure.

Regulatory Process

McClellan officials state the CERCLA process was primarily designed to identify and correct only a few contamination problems at the installation. However, McClellan's contaminated sites have massive amounts of contaminated soil and groundwater and have a variety of problems. According to the officials, the proper evaluation of the problems and their solutions requires that the process be tailored to the conditions on the installation.

McClellan has conducted several removal and interim actions, using the Superfund Accelerated Cleanup Model version of the CERCLA process. Some were implemented prior to the remedial investigation/feasibility

study and/or remedial design phases being completed. These actions were designed to stabilize a site, prevent further degradation, or achieve risk reduction in terms of the threat posed to the public or to the environment.

During our visit, McClellan officials complained about the regulatory process being slow. They stated that EPA had trouble providing timely review of and comment on documents. Also, they stated it was virtually impossible to get regulatory agencies to agree that nothing more needed to be done at sites that have been cleaned up.

However, McClellan and the regulatory agencies created the Environmental Process Improvement Center, a cooperative grouping of the parties to the Interagency Agreement, including McClellan, EPA, and the California EPA. The goals of the Center include accelerating site cleanup, preventing pollution, applying new cleanup technologies, and sharing compliance strategies. Since the creation of the Center, the IRP activities have progressed at a faster rate. For example, the Air Force has implemented removal actions as the expedited response to control the migration of contaminants beneath Operable Unit B before it reached the installation boundary or well Number 18.

DOD/Regulatory Agency Cooperation

McClellan officials state that the working relationship between installation officials and the regulatory agencies has improved since the Center was created. McClellan officials state that they have found the cooperative working relationship and the team partnership approach with regulatory agencies are much better because they eliminate the adversarial relationship and litigation and promote the cleanup process. McClellan officials state that team interaction helps them move through most difficulties, shortens time frames, and reduces costs.

Cleanup Standards

McClellan officials believe cleanup standards should be set by EPA, not the states since EPA's standards are designed to limit exposure to a substance that may be unhealthy. The amount of exposure may vary based on age as the very young and old tend to be more sensitive, but it should not vary by site. However, they believe that cleanup goals, which are based on the cleanup standard and the likelihood of exposure and are usually quite site specific, should be set for each site by EPA, state regulators, and DOD.

McClellan officials state small contaminated sites can be cleaned up to a cleanup standard less expensively by removing or treating relatively small

amounts of contaminated soil rather than conducting a risk assessment. However, it is often not economically feasible, technically possible, or necessary to achieve the cleanup standard for sites with massive amounts of contaminated soil. They also note that it is not possible to return contaminated aquifers to drinking water standards or pristine conditions for decades with existing technology but that the public can be protected by treating the groundwater extracted for drinking purposes. EPA does not fully agree with McClellan's position, but they are working with the installation to develop strategies for cleaning up as many sites as possible and getting out of the CERCLA process.

Staffing

McClellan officials told us that they do not have sufficient staff to support the growth of the IRP. The downsizing of DOD and the federal work force has made it extremely difficult to attract well qualified candidates. During the past year, McClellan has had a 30-percent turnover rate in its IRP resources. When vacancies occurred, it was difficult to hire replacements due to major personnel constraints from base closure and realignment actions. The average time to fill vacancies has tripled during the past year and positions were being filled with personnel with limited or no environmental experience or training. In addition, they stated that proposed reduction-in-force actions would eliminate over 20 percent of their DERA-funded personnel. If this occurs, there will be severe impacts to McClellan's ability to maintain the progress that has occurred in IRP activities over the last decade.

Regulatory Agency Staffing

McClellan officials noted that EPA and the state regulatory agencies have good technically qualified people, but neither have enough, and there has been a significant turnover of EPA's technical staff. State regulatory officials stated that they need more people and that turnover is a significant problem. They also stated it is difficult to hire qualified and experienced people in many of the specialties needed for this work because it is a relatively new area of endeavor.

Funding

McClellan officials stated that funding has not been adequate to achieve the Air Force's goal of completing cleanup by the year 2000. Anticipated funding levels also do not support meeting original Interagency Agreement schedules. However, all agencies recognize that cleaning up all sites, regardless of the risk it poses, is not a cost-effective approach. As a result, McClellan is changing from an operable unit cleanup schedule toward a basewide schedule that is driven by the risk posed. McClellan officials believe that the risk-based approach will be more cost-effective, providing current efforts to accelerate the development of innovative and emerging cleanup technologies.

Pearl Harbor Naval Complex Case Study

The Pearl Harbor Naval Complex,[1] the product of more than a hundred years of peace and wartime development, is located on 6,300 acres along the southern coast of the Island of Oahu. The installation's primary mission since the early 1900s has been ship repair. Shore facilities and wharfs have been constructed, expanded, and improved to meet changing needs of the U.S. fleet. Today, the Complex provides facilities, services (including maintenance), and materials in support of the U.S. Pacific Fleet.

Past inappropriate handling and disposal of hazardous substances, including waste oils, pesticides, heavy metals, PCBs, solvents, chemical wastes, and fuels have contaminated the environment. The releases were often the result of accidents such as leaks, spills, and ruptured containers. However, in many instances, the releases were due to disposal practices deemed acceptable at the time.

Listing on the NPL

The Complex was listed on the NPL in October 1992. In 1991, EPA scored six sites under the Hazard Ranking System. While EPA did not include more than 50 other potentially contaminated sites at these activities in its evaluation, it reserves the right to designate additional sites under its aggregation policy of considering all sites in the Complex as a single NPL site. The Complex's Hazard Ranking System score of 70.82, the highest of any DOD installation, is a composite score based on the six sites.

Navy officials agree that the Complex should be on the NPL, but stated it should not have the highest score of any DOD installation. They are concerned the high score could cause bad publicity and extra EPA requirements and oversight, which could delay cleanup efforts. Navy officials sent a letter to EPA questioning the validity of the score, noting that each of the activities' individual scores would have only been in the low 30s, which would have given the Complex a low NPL ranking.

Status of the IRP

The 1983 Navy Assessment and Control Of Installation Pollutants Initial Assessment Study[2] identified and evaluated 32 potentially contaminated sites with regard to contamination characteristics, migration pathways, and pollutant receptors. Of the 32 sites, 3 were recommended for further

[1]The Complex consists of seven activities: Shipyard, Naval Station, Public Works Center, Inactive Ships Center, Submarine Base, Naval Magazine Lualualei (West Lock Branch), and Fleet Industrial Supply Center.

[2]The assessment is equivalent to the CERCLA Preliminary Assessment.

study and were listed in order of priority: Pearl City Peninsula Landfill, Red Hill Oily Waste Disposal Pit, and Transformer Station D4.

EPA disagreed with the Navy's position taken in its preliminary assessment study and requested further investigation at 16 additional sites of the 32, but made no reference to the remaining 13 sites. Subsequently, the Navy identified another 29 sites for a total of 61. Table V.1 depicts the status of CERCLA work at the Complex.

Table V.1: Status of Sites at Pearl Harbor Naval Complex

CERCLA process phase	No. of sites that reached or will reach phase
Study	61
Interim remedial action-underway	2
Interim remedial action-complete	4
Remedial action	46
Remedial action in place and operating	0
Remedial action complete	0
Closed out-no further action	18

The six sites scored under the Hazard Ranking System included two sites—the former gyro repair shop and the former metal pickling waste disposal site—that the Navy had determined no further action was required under the CERCLA process. Also, EPA's request for further investigation did not include them. According to Navy officials, neither of these sites affected potable water as the groundwater under them is brackish (salty) water. The nearest potable water well is several miles up-grade in the opposite direction of groundwater flow.

As new sites are identified, they are included for investigation on a priority basis. Site inspections have been completed or are being completed for most Pearl Harbor sites.

The Navy, EPA Region IX, and the state's Department of Health entered into an Interagency Agreement in April 1994. The agreement establishes a framework to investigate and clean up the Complex.

Cost

The Navy has spent about $26 million and estimates it will cost about $196 million to complete clean up of the contaminated sites. The cost

estimate is based on initial job scopes and may increase significantly once more is known about the sites and the remediation phase begins.

Options Considered

Navy officials stated that the IRP has not progressed far enough to determine which cleanup options will be considered for the Complex. Progress in the IRP has been slow because the Complex was not designated a NPL installation until October 1992. Without the NPL designation, funding was hard to get and the work done was limited. As interim measures, the Navy is considering bio-remediation and pumping to remove oil floating on the subsurface groundwater. Currently, an oil-water separator, booms, and oil skimmers collect oil that seeps through cracks in a storm drain leading into Pearl Harbor after heavy rains. Another small oil recovery project has been installed to determine the feasibility of pumping the oil out of the aquifers.

Option Selected

The work has not progressed far enough to select the final cleanup options yet.

Expected Completion

During the Interagency Agreement signing ceremony, officials from the Hawaii Department of Health and EPA Region IX announced that the cleanup could take up to 30 years to complete based on the number of sites, collection requirements, and remedial action required.

Regulatory Process

Navy officials believe the elaborate CERCLA process does not need to be performed on small sites that could easily be remediated without a large-scale study and those sites covered by previous agreements with EPA. In addition, the CERCLA process of determining liability is not needed for sites that are the Navy's responsibility, so there is no need to prepare documents in anticipation of litigation to determine who should pay for remediation.

DOD/Regulatory Agency Cooperation

The Naval Facilities Engineering Command's Pacific Division has a good working relation with EPA and state regulatory officials. The Navy informs the state and EPA on the progress of its cleanup studies and actions. Because the Complex was not on the NPL until October 1992, EPA had not been a problem because it focused on NPL sites. However, since October 1992, EPA has begun to provide more oversight at the installation.

The Complex has not encountered any difficulties with multiple controls by the regulatory agencies regarding oversight.

Cleanup Standards

Pacific Division and Pearl Harbor Complex officials all agreed that contaminated sites need to be cleaned. However, they question the need to clean all sites to standards that may exceed naturally occurring conditions or when such cleanup is not technically or economically feasible. They advocated programs such as stopping contamination flow into groundwater and preventing the contamination from spreading.

Navy officials had no opinion as to whether there should be one set of cleanup standards and who should set them. They noted that the state relies upon EPA standards but does provide some state guidelines for specific chemicals. Navy officials state the Navy contractor for Comprehensive Long-Term Environmental Action researched the current federal and state cleanup standards for each site but did not note a specific problem with any standards.

Staffing

Unlike mainland installations, Pacific Division and Pearl Harbor Complex officials told us they are generally able to hire, train, and retain qualified people. Staffing for the Environmental Division, Pacific Division, has more than doubled in the last 5 years to 65 persons, of which 18 are designated for the IRP, because the Navy pays more than the city and county of Honolulu and the state. In addition, because most of the environmental work is done through the Pacific Division, which handles most of the naval installations in the Pacific Ocean area, the Navy is able to provide higher grades to its workers than the state or other services. The limited number of staff (four) that have left so far, have gone primarily to private industry. However, officials noted that they could use more specialized training in areas such as soil assessment and data validation.

The Navy ensures cleanup is being accomplished in the most cost-effective manner with four organizations. The Pacific Division, Navy Facilities Engineering Command, is the focal point for Complex activities, provides technical expertise to the Restoration Advisory Board, assesses cleanup options, distributes DERA and Navy environmental funds, and provides legal advice. The Commander of the Naval Base chairs the Restoration Advisory Board and is the environmental coordinator who ensures consistency of policy with state regulators, facilitates policy distribution and resolution of disputes between field activities, and is in charge of

community relations. The individual field activities have primary responsibility for compliance and own the land. The contractor provides environmental study/evaluation support.

Regulatory Agency Staffing

At the time of our visit, officials from the state's Department of Health, the primary regulator, stated that the Department was severely understaffed to perform oversight on both government and privately owned sites and therefore they had focused on private industry where they felt they could get more accomplished. Since April 1994, the Department has hired what it considers to be an adequate number of staff to do the oversight work. They stated that they do not have a problem with the Navy's efforts because of the good working relationship that they have had since they were able to obtain the needed staff.

Navy officials, however, told us that based on EPA's lack of timely response to routine reports from the installation, EPA may have been understaffed. At the time of our visit in 1993, officials from EPA's Region IX Office told us that because of the very large number of NPL sites in its region and the limited number of staff, they could not accomplish all of the oversight work required for installations on the NPL. As a result, they were doing little oversight of non-NPL installations. In subsequent information provided in October 1994, EPA officials stated that their staffing situation had improved and they were providing the required oversight for federal facilities on the NPL.

Funding

Navy officials told us that there is a funding shortage for the IRP for all installations. However, the Complex does not have a funding problem because it is on the NPL and receives funding priority. According to Navy officials, there is adequate funds available to investigate and clean up the Complex. Pacific Division evaluates each site separately to determine which site will get DERA funding based on the threat to human health and status of remediation projects. For sites that may require remedial or removal actions, the Navy uses the Defense Priority Model score to prioritize funding. The Pacific Division prioritizes sites based on the Chief of Naval Operations' funding policy, which is to fully fund only those sites on the NPL or subject to legal time frames set under federal, state, or local regulations.

Navy officials stated that an entire installation could be designated an NPL site and get priority funding, even if only one site on the installation is a

"worst" site. Such funding disparities could result in less critical sites receiving funding when more critical sites at another installation that is not on the NPL does not. As a result, Pacific Division and Pearl Harbor officials do not believe all of the sites on the installation should be included in the NPL designation.

Schofield Barracks Case Study

Schofield Barracks, established in 1908 for the Army's mobile defense of Oahu, is the largest and most populated installation in Hawaii. As the headquarters of the 25th Infantry Division and the 45th Support Group, its mission is to provide administration, training, and housing facilities for these two units, as well as depot and repair facilities for helicopters, trucks, and other support equipment; a medical facility; and community and housing support. Training includes firing and nonfiring activities. Schofield also provides administrative support, including environmental, to several smaller Army activities in Hawaii.

Listing on the NPL

TCE contamination was found in Schofield's drinking water wells in 1985. These wells extract water from one of the few large groundwater aquifers on the Island, which discharges into the larger Pearl Harbor Aquifer. The TCE source is not known, but tests are being conducted. The presence of TCE at 40 ppb in one of the wells, which was above EPA's maximum contaminant level of 5 ppb, was the reason Schofield was placed on the NPL in September 1990. The Hazard Ranking System score was 28.9, one of the two lowest scores for any DOD installation on the NPL.

Army officials initially disagreed with EPA's decision to place the installation on the NPL because there was no conclusive evidence indicating Schofield was the source of the TCE contamination. They cited suspected sources such as a small industrial area off the installation near the water wells. However, additional study indicates the installation's landfill, other sites on the installation, and Wheeler Army Airfield (formerly Wheeler Air Force Base) could also be sources.

Status of the IRP

Schofield has sites in various study and remediation phases, including the early phases. An August 1990 Army study identified and scored potential hazardous waste sites on the installation. The study was the basis for the sites specified in the Interagency Agreement. With this study, installation officials believe they have identified the potential sites and are developing work plans for further investigation in coordination with EPA. The preliminary assessment/site inspection phase began for most sites during 1992. EPA has expanded the number of sites needing further investigation to 116. Table VI.1 depicts the status of CERCLA work at Schofield Barracks.

Table VI.1: Status of Sites at Schofield Barracks

CERCLA process phase	No. of sites that reached or will reach phase
Study	116
Interim remedial action-underway	0
Interim remedial action-complete	1
Remedial action	30
Remedial action in place and operating	1
Remedial action complete	1
Closed out-no further action	49

Although installation officials believe they have identified all of the sites, it is possible additional sites could be found. To determine whether the contamination is spreading off the installation, Schofield had a contractor test private drinking water wells near the installation for contamination. Results from these tests did not show any TCE contamination at private wells. However, some of the wells on Field Station Kunia, a small Army installation adjoining Schofield, have shown low levels of TCE contamination.

In accordance with the Installation Action Plan, Schofield has established four operable units and set priorities. DOD and EPA officials state that this process will ensure the most contaminated sites or those posing the most imminent danger get funding and cleanup priority. The installation also plans to have a risk assessment of all hazardous waste sites.

Cost

The Army has spent over $17 million to study and solve the contamination problems at Schofield Barracks. The Army and EPA had different approaches for cleaning up the installation. EPA's procedures called for (1) a more comprehensive study and testing program, (2) more work on determining if the treatment of the drinking water as it is used will work, and (3) more testing for contaminants during cleanup actions. It also wanted the Army to consider testing for the full range of contaminants at the landfill. The Army believed the current system to treat the drinking water was adequate and more testing was not needed. There were two cost estimates—$65.7 million for the Army's proposal and $142.1 million using EPA's procedures.

Subsequent to our visits, Schofield officials told us that EPA Region IX agreed to the Army's proposal that the treating of the groundwater as it is

pumped for use will provide adequate protection to those using the water. Further remediation of the groundwater would not be required.

Schofield officials believed EPA was not aware of the high cost of environmental restoration work in Hawaii. For example, EPA wanted the installation to drill a grid of at least 120 test wells to determine the TCE contamination source. According to Schofield officials, the cost for a test well on the mainland is about $50,000 to $100,000, whereas in Hawaii, the cost is about $400,000 for each well because the geological formations are unusual and the groundwater is about 800 feet deep. Thus, the total for the 120 test wells would be $48 million.

Schofield officials said that the cost to determine the extent of the contamination plume could be significantly higher than the $48 million, but they did not have an estimate they were willing to provide us. Any remediation cost for items such as constructing the pump and treat system and the testing that would be a part of the project would be additional. The current cost estimate for a planned limited remediation—contaminant removals from known sites, landfill investigative work and long-term monitoring, installation of a limited number of test wells, and the study of drinking water wells surrounding the installation—is $21 million, less than half the cost of drilling the test wells.

Installation officials state that they follow the feasibility study procedures outlined in EPA's guidance. Cost is considered, but it is not an overriding factor. They are focusing the IRP to target cost-effective cleanups early so the investigation can be concise and cost-effective. EPA has not agreed with all of the installation's focusing initiatives.

Options Considered

When TCE was found in the drinking water wells in 1985, the Army chose to treat the water as it was used, basing its decision on two factors. One, it would be impractical to remediate an aquifer by the pump and treat method because it is 800 feet deep, the aquifer discharges to the Pearl Harbor aquifer at a rate of 115 million gallons per day, and the aquifer is contained in an unusual geological structure under Schofield. Two, the cost of providing the database to support such a pump and treat remediation of the aquifer would be extremely high. The Army stated that its system to treat the water as it is used, to less than 1 ppb for TCE, has been in use for 7 years. It cost about $3.7 million in 1985 to build the treatment plant and costs about $50,000 a year to operate and maintain it.

The Army believes the same approach could be used locally or by the city of Honolulu.

EPA favored the use of a pump and treat system that would remove TCE from the groundwater and return treated water to the aquifer. EPA did not believe the Army Environmental Center had done enough testing to prove that Schofield's current water treatment system worked and there was no documents to support the Army's position. To obtain the needed data, EPA wanted the installation to investigate all known potential sites to determine the TCE contamination source, and then to clean up the sites. The Army's cost estimate to install and operate the pump and treat system and perform the required sampling and testing over a lengthy period of time was several hundreds of millions of dollars.

The installation, the major command, and the Army Environmental Center resisted this idea. They believed the current water treatment system would be the most cost-effective way to supply uncontaminated drinking water. According to Schofield officials, subsequent to our visits, EPA agreed that the point of use system would be the final remediation required. Currently, the stripper reduces the amount of TCE in the drinking water from 40 ppb to less than 1, which is below the maximum contaminant level of 5 ppb.

Option Selected

Although final decisions have not been reached, both EPA and Army officials believe progress is being made. They agree on the following key issues.

- The highest priority is finding the source of TCE contamination and cleaning it up.
- The groundwater should be treated at the point of use.
- The procedures that consider a full range of containment and monitoring options for the largest site, a former landfill, have been streamlined.
- Remediation will focus on the 12 worst sites. An additional 34 sites will continue in the remedial investigation phase and no further work will be required at 70 of the 116 sites.

Schofield officials said that the state has not assessed these issues and as a result, have not taken a position regarding the EPA/Army agreement.

Expected Completion

Installation officials state that the current schedule calls for remedial action to be completed by fiscal year 1996. They estimate that long-term monitoring will continue beyond this date.

Regulatory Process

Installation officials believe the CERCLA process has inhibited timely cleanup at Schofield Barracks. The CERCLA process requires the installation to conduct studies and submit a draft report to EPA, which has 60 to 90 days to review and comment. The installation has from 15 to 45 days to review EPA's comments and respond with a final draft report. EPA then has 30 to 45 days to approve the report. During the process, either party can request time extensions for further work. This review process, however, slows down the CERCLA process because it has to be done for every plan and report prepared under the Interagency Agreement. In addition, each decision point report could require more than one version of the draft and this review process would be repeated for each version.

They believe the study phase is prolonged by the requirements agreed to in the agreement. If the agreement is followed step by step, it ties the installation's hands in getting sites cleaned up using contaminant removal actions. Agreements were once site specific, but now they predominantly cover the installation from fence to fence. Consequently, all sites, regardless of size or contaminant, are to be treated the same in the CERCLA process.

In Schofield's case, EPA has expanded the investigation beyond locating and remediating TCE source(s), the basis for the NPL listing. Because most of the sites do not contain TCE, installation officials questioned why it has to go through the entire CERCLA process for each site. They stated that if EPA was not so involved in the study of the smaller, less contaminated sites, the cleanup could be completed quicker.

Schofield officials told us that EPA is involved with all the sites because it does not trust DOD installations to do a good job. EPA officials state that if TCE is found in one well, there is a potential for any site on the installation to be the source of TCE contamination. Because the installation did do some maintenance of equipment in the past and may have used TCE, EPA expects the installation to do all of the CERCLA required work at all of the sites, even if the site is a minor one and there is no evidence of TCE use at the site.

Schofield officials state the advantages of being on the NPL are (1) the installation receives a higher funding priority and (2) a mechanism is in place to facilitate the completion of cleanup.

DOD/Regulatory Agency Cooperation

Installation personnel spend a lot of time working with the regulatory agencies to get the work done. They state there was very little communication and cooperation in the early stages of the IRP, especially when deciding on what to do to clean up the drinking water. EPA and the Army Environmental Center officials told us that they believed that this disagreement caused delays in the cleanup. EPA and the Army Environmental Center, with assistance from the installation, have initiated a more cooperative effort to determine what needs to be done to remediate the contamination from the installation.

The Interagency Agreement provides for EPA to set up a "project manager" to oversee the installation's IRP. According to installation officials, there have been some disagreements that have slowed down the work.

Cleanup Standards

Schofield officials said that a single standard for each chemical would be very helpful and could reduce investigative costs. However, to protect the most sensitive environments and populations, those standards could translate to higher remediation costs. This may not be realistic, but there should be some way for determining what has to be done at each site using a standard procedure. Having different procedures for determining standards for the same contaminant is not practicable.

Army officials stated that EPA would be the most logical source of standards to provide nationwide coverage; however, its input would have to be tempered by real-world practicalities of conducting cleanups. Also, EPA headquarters would have to bring regional offices into line with a central policy; the 10 regions currently set their own policies, which makes standardization extremely difficult.

Installation officials stated that Hawaii does not have any standards for cleanup, but they believe the state's standards will be more restrictive than EPA's standards. The state has not done any active enforcement at federal facilities yet.

The installation has been working with both regulators to get them to set standards for cleanup that are economically and technically feasible.

Staffing

Installation and the U.S. Army Pacific Command officials told us that they had been unable to hire and retain enough qualified people. The installation only has one staff member (GS-12) assigned to the IRP,[1] and he was the only one funded by DERA. Even this individual was not hired for the IRP, he was "stolen" from another unit on the installation. In addition to his DERA work, he is the Safe Drinking Water Program Manager, the Noise Program Manager, and the Historic Preservation Program Manager. Installation officials state the IRP staffing will increase to the equivalent of three staffyears in the near future. Until the IRP work at the sites on the installation reaches a point where the funding priority is high enough, staffing will not always be available. In the installation cleanup activities, Schofield has less staff than the other two sites we visited in Hawaii—Pearl Harbor Complex and Hickam Air Force Base. Also, Schofield and Pearl Harbor are NPL installations while Hickam is not. The Army's Pacific Command, Schofield's major command, has one environmental engineer and his secretary working in the IRP. They are the only ones funded by DERA.

The U.S. Army Force Integration Support Agency studied the U.S. Army Pacific's and the installation's environmental staffing, including installation restoration or CERCLA work, in May 1994. The agency found that to adequately do all of the required environmental work, the U.S. Army Pacific and the installation would need about 19 staff members of which 4 to 5 would work in the IRP. At the time of the study, the Army had eight authorized positions. Army officials told us that with the recent lifting of the Army's staffing freeze, and the study recommendation, they hope to begin to fill some of the positions.

Army officials stated that all of the installations in Hawaii are competing for each others' environmental staffs, and these individuals are transferring to obtain promotions or improve their careers. Under the current staffing guidance, the Army is constantly losing people to the other services that have higher grades for their environmental people. Table VI.2 shows that the management grade structure at the commands and the installations is higher for the other services. Installation officials told us that because the Navy's and the Air Force's management levels are higher, they are able to have higher grades for the staff.

[1]The one environmental engineer left to go to the Pacific Ocean Engineering Office. Schofield is in the process of replacing him.

Table VI.2: Grade Structure for Environmental Office Managers

Activity	Grade
Army Pacific Command	GS-14
Schofield Barracks	GS-12
Pacific Engineering Field Division	Captain or GM-15
Pearl Harbor Complex	GS-13
Pacific Air Force	Colonel
Hickam Air Force Base	GS-13

Army Environmental Center officials told us that they recognized that there are resource limitations at Schofield and have attempted to alleviate the staffing shortage by helping to manage the preliminary assessment/site inspection contract. Schofield officials told us that they do not expect the Center to continue to supply staffing assistance. The Center's representatives visit the installation two or three times a year, but will come more often if needed. Generally, there is good communication between the installation and the Center.

Regulatory Agency Staffing

Hawaii Department of Health officials told us that the state has provided little oversight or input into the IRP during the early years because of staffing shortages. According to Army and state officials, since April 1994, when additional staff were obtained, the state has provided adequate oversight.

In Hawaii, EPA's Region IX concentrates its resources on NPL installations, such as Schofield, and it does not have a staffing problem that affects Schofield. However, by concentrating its resources on NPL sites, EPA officials told us that it does not have enough staff to provide adequate oversight at non-NPL installations in Hawaii, such as Hickam Air Force Base.

Funding

DERA funds are used because the installation is on the NPL. Table VI.3 shows the funds requested, received, and planned for the IRP.

Table VI.3: Requested, Received, and Planned DERA Funding for Schofield Barracks

Fiscal year	Requested/ planned	Received
1984	$50,000	$50,000
1991	985,380	1,005,400
1992	5,356,220	956,220
1993	8,300,000	12,330,000[a]
1994	10,831,000	
1995	9,000,000	
1996	9,600,000	
1997	700,000	

[a]Includes $4,400,000 not received in fiscal year 1992.

According to U.S. Army Pacific Command and installation officials, the fiscal year 1991 DERA funds were received early enough to conduct the program on schedule. The delay in getting $4.4 million of the $5.4 million requested in fiscal year 1992 caused the major contract award scheduled for late fourth quarter to be deferred to the next year. The Army designated the $4.4 million for other environmental projects that they thought had higher priorities.

Installation officials stated that the Army and DOD headquarters questioned the level of funding projected to conduct the remedial investigation/feasibility study and remedial actions because of the low Hazard Ranking System score and the lack of a direct link between the TCE contamination and the Schofield sites. The major command and Army headquarters have also questioned the need to fund all of the CERCLA work being done at some of the minor sites on the installation.

Installation officials stated that a problem with funding is the untimely receipt of the funds. It is difficult to execute contracts when the money is not received until the last quarter of a fiscal year. For example, in fiscal year 1992, the installation struggled to execute projects to use the funds allocated during the early part of the year. It became even more difficult to use the year-end funds because the installation received the money when it had less than 6 months to get contracts signed. If contracts are not signed, the installation has to return the money to the Army Environmental Center and renegotiate the contracts the next year, if the installation receives the funds.

Installation officials stated that year-end money received does not follow the normal planning, design, and contracting procedures or adhere to project priorities. The project that is closest to having a contract signed is the one funded, which sometimes is not the highest priority project. In addition, the Pacific Ocean Division's engineers are tied up with other projects using year-end money. As a result, needed support services may not be available and thus, the projects may not be fully planned and engineered. The Army shares the Pacific Ocean Division's engineers with the Air Force for technical and engineering.

Installation officials stated that if the installation is allowed only a short time to execute the contracts to accomplish the projects, the whole process needs to be streamlined so that the work can be done with proper planning. They said the installation needs more than 3 months to spend dollars efficiently and properly execute the contracts and as a result get work completed earlier. If the system is not streamlined and some of the study process and testing eliminated, the total remediation project could cost $100 to $200 million.

The short time to get the contracts signed causes the projects to be spread out because the installation has to cover more than one window of opportunity: one for scoping and study, one for negotiating and contracting, and another for the remedial action.

CERCLA Process

Preliminary Assessment	The initial stage of the cleanup program is an installation wide study to determine if sites are present that pose hazards to public health or the environment. Available information is collected on the source, nature, extent, and magnitude of actual and potential hazardous substance releases at sites on the installation.
Site Inspection	The next step consists of sampling and analysis to determine the existence of actual site contamination. Information gathered is used to evaluate the site and determine the response action needed. Uncontaminated sites do not proceed to later stages of the process.
Remedial Investigation	Remedial investigation may include a variety of site investigative, sampling, and analytical activities to determine the nature, extent, and significance of the contamination. The focus of the evaluation is determining the risk to the general population posed by the contamination.
Feasibility Study	Concurrent with the remedial investigations, feasibility studies are conducted to evaluate remedial action options for the site to determine which would provide the protection required.
Remedial Design	Detailed design plans for the remedial action option chosen are prepared.
Remedial Action	The implementation of the chosen remedial option is implemented.
Interim Remedial Action	Remedial actions can be taken at any time during the cleanup process to protect public health or to control contaminant releases to the environment.
Remedy in Place and Functioning as Intended	The remedial action is functioning properly and performing as designed. These include such actions as the operation of pump and treat systems that will take decades to complete cleanup.

Scope and Methodology

The six installations selected for this supplement were chosen because either your office expressed interest in the installation or they were representative of the problems, such as groundwater contamination, encountered at the sites. To develop the information contained in this supplement, we reviewed applicable procedures and records maintained by DOD, EPA, and state regulatory agencies. We also interviewed environmental officials from the DOD agencies, the Army, the Navy, the Air Force, and the Defense Logistics Agency at the headquarters level in Washington, D.C.; at major military commands, engineering field divisions, and service organizations; selected installations; state regulatory agencies; and EPA headquarters and regional offices. We reviewed applicable files and documentation at Washington headquarters offices, command level offices, the installations, state regulatory agencies, and EPA headquarters and applicable regional offices, including such pertinent documents as Interagency Agreements.

Data gathered for the primary report on the installations were used for these case studies. We updated the information when available.

Army

Headquarters offices
Army Materiel Command
U.S. Army Pacific, Honolulu, Hawaii
Army Environmental Center, Maryland
Aberdeen Proving Grounds, Maryland
Fort Lewis, Washington
Fort Sill, Oklahoma[1]
Fort Wainwright, Alaska
Letterkenny Arsenal, Pennsylvania
Rocky Mountain Arsenal, Colorado
Schofield Barracks, Hawaii

Navy

Headquarters offices
Naval Facilities Engineering Command
Chesapeake Engineering Field Division
Pacific Engineering Field Division
Southwest Engineering Field Division
Naval Surface Warfare Center, Dhalgren, Virginia
Pearl Harbor Naval Complex, Hawaii

	North Island, San Diego Naval Complex, California[1]
	Yorktown Naval Weapons Center, Virginia[1]
Air Force	Headquarters offices
	Air Force Center for Environmental Excellence, Texas
	Air Force Materials Command, Ohio
	Hickam Air Force Base, Hawaii[1]
	Kelly Air Force Base, Texas[1]
	Mather Air Force Base, California
	McChord Air Force Base, Washington
	McClellan Air Force Base, California
	Tinker Air Force Base, Oklahoma
	Vance Air Force Base, Oklahoma[1]
Marine Corps	El Toro Air Station, California
	Tustin Air Station, California
EPA	Headquarters offices
	Region III, Philadelphia, Pennsylvania
	Region VI, Dallas, Texas
	Region VIII, Denver, Colorado
	Region IX, San Francisco, California
	Region X, Seattle, Washington
	Environmental Protection Agency Environmental Research Laboratory, Oklahoma
State Regulatory Agencies	Alaska
	California
	Pennsylvania
	Oklahoma
	Texas
	Virginia
	Washington

[1]Although this is neither an NPL nor closure installation, we visited it because of unique contamination problems, including contamination of groundwater. Data from this site was not included in our cost and site analyses.

Major Contributors to This Report

National Security and International Affairs Division, Washington, D.c.	David R. Warren Uldis Adamsons Clementine H. Rasberry Jacob W. Sprouse, Jr. Robert G. Hammons Robert Jones

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