United States General Accounting Office

GAO

Report to the Honorable John D. Dingell
Ranking Minority Member, Committee on
Energy and Commerce, House of
Representatives

December 2003

MILITARY MUNITIONS

DOD Needs to Develop a Comprehensive Approach for Cleaning Up Contaminated Sites

GAO-04-147

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GAO Highlights

Highlights of GAO-04-147, a report to the Honorable John D. Dingell, Ranking Minority Member, Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

Over 15 million acres in the United States are suspected of being, or known to be, contaminated with military munitions. These sites include ranges on closing military installations, closed ranges on active installations, and formerly used defense sites. Under the Defense Environmental Restoration Program, established in 1986, the Department of Defense (DOD) must identify, assess, and clean up military munitions contamination at these sites. DOD estimates these activities will cost from $8 billion to $35 billion. Because of the magnitude of DOD's cleanup effort, both in terms of cost and affected acreage, as well as the significant public safety, health, and environmental risks that military munitions may pose, you asked us to evaluate (1) DOD's progress in implementing its program to identify, assess, and clean up military munitions sites and (2) DOD's plans to clean up remaining sites in the future.

What GAO Recommends

We are recommending that DOD develop a comprehensive approach by revising its plan to (1) establish deadlines for completing its site inventory and initial evaluations, (2) reassess the timetable proposed for completing its risk assessment reevaluations, and (3) establish service-specific targets. We are also recommending that after DOD revises its plan, it should work with the Congress to develop budget proposals that will allow timely completion of cleanup activities.

www.gao.gov/cgi-bin/getrpt?GAO-04-147.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Anu K. Mittal at (202) 512-3841 or mittala@gao.gov.

What GAO Found

DOD has made limited progress in its program to identify, assess, and clean up sites that may be contaminated with military munitions. While DOD had identified 2,307 potentially contaminated sites as of September 2002, DOD officials said that they continue to identify additional sites and are not likely to have a firm inventory for several years. Of the identified sites, DOD had initially determined that 362 sites required no further study or cleanup action because it found little or no evidence of military munitions. For 1,387 sites, DOD either has not begun or not completed its initial evaluation or determined that further study is needed. DOD has completed its assessment of 558 sites, finding that 475 of these required no cleanup action. The remaining 83 sites required some cleanup action, of which DOD has completed 23.

DOD does not yet have a complete and viable plan for cleaning up military munitions at remaining potentially contaminated sites. DOD's plan is lacking in several respects, including the following:

- Essential data for DOD's plan may take years to develop. Not all the potential sites have been identified, and DOD has set no deadline for doing so. Also, DOD intends to use a new procedure to assign a relative priority for the remaining 1,387 sites, but it will not complete the reassessments until 2012. Until these are done, DOD cannot be assured that it is using its limited resources to clean up the riskiest sites first.
- DOD's plan relies on preliminary cost estimates that can change greatly and the reallocation of funds that may not be available. For example, the Air Force used estimated, not actual, acreage to create its cost estimates, limiting the estimate's reliability and DOD's ability to plan and budget cleanup for these sites. Also, DOD expects additional funds will become available for munitions cleanup as other DOD hazardous waste cleanup efforts are completed. However, some of these efforts are behind schedule; therefore, funds may not become available as anticipated.
- DOD's plan does not contain goals or measures for site assessment and cleanup. DOD recently established a working group tasked with developing agencywide program goals and performance measures, but not service-specific targets, limiting DOD's ability to ensure that the services are making progress in cleaning the potentially contaminated sites and achieving the overall goals of the program as planned.

Unexploded Military Munition

Source: U.S. Army Corps of Engineers.

Contents

Abbreviations

DOD	Department of Defense
Corps	U.S. Army Corps of Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980

GAO
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, D.C. 20548

December 19, 2003

The Honorable John D. Dingell
Ranking Minority Member
Committee on Energy and Commerce
House of Representatives

Dear Mr. Dingell:

Over 15 million acres in the United States are known to be or are suspected of being contaminated with military munitions, which include unexploded ordnance, discarded military munitions, and munitions constituents such as propellants or other chemicals.[1] These sites, which are no longer in use, include closed ranges on active installations, ranges on military installations that are being closed (closing sites), and formerly used defense sites.[2] Much of the land on which these sites are located has been or will be converted to nonmilitary uses such as farming, residential or commercial development, and recreation. The Department of Defense (DOD) estimates that identifying, assessing, and cleaning up contamination from military munitions at such sites will cost from $8 billion to $35 billion and could take more than 75 years. Within DOD, cleanup of sites on active or closing installations is the responsibility of the military service—Air Force, Army, Navy, or Marine Corps—that currently owns the land. The U.S. Army Corps of Engineers (Corps) is responsible for executing the cleanup of formerly used defense sites.

Military munitions can pose risks to public safety, human health, and the environment. Unexploded ordnance poses a potential explosive hazard and risk of personal injury to those who encounter it. The Environmental Protection Agency, in September 2001, using a DOD database and other sources, identified at least 126 incidents involving civilians who were

[1]Unexploded ordnance, discarded military munitions, and munitions constituents are hereafter referred to as "military munitions" for the purpose of this report. Unexploded ordnance includes ordnance primed and fired but remain unexploded. For a more complete definition, see the National Defense Authorization Act for Fiscal Year 2004, Pub. L. No. 108-136, section 1042 (a)(2).

[2]A formerly used defense site is a property that Department of Defense (DOD) formerly owned, leased, possessed, operated, or otherwise controlled, and was transferred from DOD prior to October 17, 1986.

exposed to unexploded ordnance over the past 83 years, which resulted in 65 fatalities and 131 injuries.[3] The risk of such exposures is expected to grow with an increase in development and recreational activities on land once used by the military for munitions related activities (e.g., live fire testing and training). In addition, human exposure to munitions constituents such as trinitrotoluene (TNT) and perchlorate may cause long-term health problems, such as cancer and damage to the heart, liver, and kidneys. However, the link between such constituents and any potential health effects is not always clear and continues to be studied. (See app. I for a list of common munitions constituents and potential health effects.) Military munitions may also pose an environmental risk because their use and disposal may release constituents that could contaminate soil, groundwater, and surface water. Former ranges on which munitions-related activities were conducted and which are known or suspected to contain military munitions are in a variety of locations, including near ecologically sensitive wetlands, surface waters, and floodplains. While many constituents have been an environmental concern to DOD for more than 20 years, the current understanding of the causes, distribution, and potential impact of constituent releases into the environment remains limited. The nature of these impacts, and whether they pose an unacceptable risk to human health and the environment, depend upon the dose, duration, and pathway of exposure, as well as the sensitivity of the exposed populations. Until recently, DOD has focused primarily on mitigating the public safety risk associated with unexploded ordnance, but it is now giving additional attention to environmental and health concerns posed by munitions constituents.

Under the Defense Environmental Restoration Program, established in 1986, DOD is required to identify, investigate, and clean up environmental contamination and other hazards at active and closing installations, as well as at formerly used defense sites.[4] The program is organized into three categories that focus on DOD's primary goals: (1) identification and cleanup of contamination from hazardous substances, pollutants, and contaminants; (2) demolition and removal of unsafe buildings and

[3]U.S. Environmental Protection Agency, Office of Solid Waste, Permits and State Programs Division, *UXO Incident Report (Revision 1)*, (Washington, D.C., 2001).

[4]The Defense Environmental Restoration Program was established by section 211 of the Superfund Amendments and Reauthorization Act of 1986, which amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

structures; and (3) correction of other environmental damage, such as detection and disposal of military munitions. Most of DOD's past focus had been on identifying and cleaning up contamination from hazardous substances. To better focus DOD's efforts on identifying, assessing, and cleaning up sites containing military munitions, DOD established the Military Munitions Response program in September 2001. Subsequently, in December 2001, the Congress passed the National Defense Authorization Act for Fiscal Year 2002, which among other things, required DOD to develop an initial inventory of sites that are known or suspected to contain military munitions and a comprehensive plan for cleaning up these sites. Of the $1.9 billion budgeted by DOD for environmental cleanup in fiscal year 2002, approximately $113 million was designated for sites with military munitions. In fiscal years 2003 and 2004, DOD designated approximately $115 million and $89 million, respectively, for sites with military munitions.

In deciding what actions, if any, are needed to clean up a site identified as potentially contaminated with military munitions, DOD generally follows the process established for cleanup actions under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). CERCLA, as amended, governs the cleanup of hazardous waste sites, including contamination on military installations. After identifying a potential military munitions site, the appropriate DOD military service or the Corps performs a preliminary assessment, during which DOD determines if military munitions may be present and if further study or cleanup action is needed. If necessary, DOD may conduct a site investigation to better identify the types and extent of potential hazards present. For specific areas suspected to contain military munitions, DOD surveys the land and evaluates and selects alternatives, in consultation with stakeholders, for addressing the potential hazards. These cleanup alternatives could include removing the military munitions, limiting public contact with the site through signs and fences, or determining that no further action with regard to the site is warranted. After implementing the chosen cleanup alternative, DOD periodically monitors the site and reviews the alternative chosen to ensure its continued effectiveness.

Because of the magnitude of DOD's cleanup effort, both in terms of cost and affected acreage, as well as the significant public safety, human health, and environmental risks posed by military munitions, you asked us to evaluate (1) DOD's progress in implementing its program to identify, assess, and clean up sites containing military munitions and (2) DOD's plans to clean up remaining sites in the future.

To evaluate DOD's progress in identifying, assessing, and cleaning up military munitions, we reviewed and analyzed DOD's database for sites identified under the Military Munitions Response program as of September 30, 2002, the end of their most recent reporting cycle. We assessed the reliability of relevant fields in this database by electronically testing for obvious errors in accuracy and completeness, reviewing information about the data and the system that produced them, and interviewing agency officials knowledgeable about the data. When we found inconsistencies, we worked with DOD and military service officials to correct the discrepancies before conducting our analyses. We determined that the data needed for our analyses were sufficiently reliable for the purposes of our report. We also reviewed project files from 38 of the 75 sites where, according to DOD's database, cleanup action is either complete or under way.[5] These files represented 52 percent of the 23 sites with a completed cleanup action and 50 percent of the 52 sites with a cleanup action under way. We used our file reviews to develop case examples of changes in estimated costs to complete cleanup over time and cleanup actions taken. These case examples are for illustration only. We conducted our work between November 2002 and October 2003 in accordance with generally accepted government auditing standards. More detail on the scope and methodology of our review is presented in appendix II.

Results in Brief

DOD has made limited progress in its program to identify, assess, and clean up sites that may be contaminated with military munitions. While DOD had identified 2,307 potentially contaminated sites as of September 2002, DOD officials said that the department is continuing to identify additional sites and is not likely to have a firm inventory for several years. For example, the Army had only surveyed and identified closed ranges on 14 percent of its active installations. Of the total 2,307 identified sites, DOD had initially determined that 362 sites required no further study or cleanup action because there was little or no evidence of military munitions. However, because these sites are formerly used defense sites, and the initial evaluations conducted were less comprehensive than for other sites in the program, the Corps has recently decided that some of these sites need to be reassessed to determine if cleanup is needed. For 1,387 sites, DOD either has not begun or not completed its initial evaluation or has determined that further study is needed. DOD has completed its assessment of 558 sites,

[5]There are an additional eight sites for which cleanup action is planned, but not yet begun. These sites were not included in our file review process.

finding that 475 sites required no cleanup action. The remaining 83 sites required some cleanup action, of which DOD has completed 23.

DOD does not yet have a complete and viable plan for guiding its remaining clean up activity at potentially contaminated sites. DOD's plan is lacking in several respects, including the following:

- Essential data for DOD's plan may take years to develop. For example, not all the potential sites have been identified, and DOD has set no deadline for doing so. Because the inventory serves as the basis for other elements of the plan, such as budget development, the sites must first be identified before DOD can have a reasonable picture of the magnitude of the challenge ahead and plan accordingly. Furthermore, DOD intends to use new procedures to reassess the relative risk for the 1,387 sites needing further study, but DOD is not scheduled to complete these reassessments until 2012. The resulting relative risk assessments will be a key component in determining cleanup priorities. Until the assessments are complete, DOD cannot be assured that it is using its limited resources to clean up those sites that pose the greatest risk to public safety, human health, and the environment.

- DOD's plan relies on preliminary cost estimates that may change significantly and reallocated funds from other programs that may not be available as anticipated. For example, at Camp Maxey, Texas, the estimated cost for cleanup in 2000 was $45 million. However, in DOD's Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress, the estimated cleanup cost had grown to $130 million. A June 2003 cost estimate showed a decrease in total costs to $73 million. Furthermore, DOD expects that as other DOD hazardous substance cleanup efforts are completed, increased funds will become available for munitions cleanup. However, not all of these other DOD cleanup efforts are on schedule. For example, between fiscal years 2001 and 2002, the schedule to complete hazardous, toxic, and radioactive waste cleanup at formerly used defense sites had slipped by more than 6 years. As a result, anticipated funds from completing cleanups at these sites may not become available until 2021 or later.

- DOD's plan does not yet contain goals or measures for site assessment and cleanup. In September 2003, 2 years after the establishment of the Military Munitions Response program, DOD established a working group tasked with developing agencywide program goals and performance measures. However, the working group is not expected to

establish service-specific targets, therefore DOD will have limited assurance that the services and the Corps are (1) making progress in cleaning their Military Munitions Response program sites and (2) are contributing to achieving the overall goals of the program as planned.

We are recommending that DOD revise its plan to (1) establish deadlines for completing its site inventory and initial evaluations; (2) reassess the timetable proposed for completing its reevaluation of sites, using the new risk assessment procedures; and (3) establish interim goals based on criteria, such as relative risk levels or cleanup phases, for the services and the Corps to target. We are also recommending that after DOD revises its comprehensive plan, it should work with the Congress to develop realistic budget proposals that will allow DOD to complete cleanup activities in a timely manner.

In commenting on a draft of this report, DOD concurred with our recommendation to work with the Congress to develop realistic budget proposals that will allow DOD to complete cleanup activities on potentially contaminated sites in a timely manner. In addition, DOD partially concurred with our recommendations to (1) establish deadlines to complete the identification process and initial evaluations; (2) reassess the timetable proposed for completing the reevaluation of sites, using the new risk assessment procedure; and (3) establish interim goals for cleanup phases for the services and the Corps to target. DOD also suggested some technical changes throughout the report that we have incorporated as appropriate. DOD's comments appear in appendix III.

Background

To better focus its munitions cleanup activities under the Defense Environmental Restoration Program, DOD established the Military Munitions Response program in September 2001. The objectives of the program include compiling a comprehensive inventory of military munitions sites, developing a prioritization protocol for sequencing work at these sites, and establishing program goals and performance measures to evaluate progress. In December 2001, shortly after DOD established the program, the Congress passed the National Defense Authorization Act for Fiscal Year 2002, which among other things, required DOD to develop an initial inventory of sites that are known or suspected to contain military munitions by May 31, 2003, and to provide annual updates thereafter. DOD

provides these updates as part of its Defense Environmental Restoration Program Annual Report to Congress.[6]

To clean up potentially contaminated sites, DOD generally follows the process established for cleanup actions under CERCLA, which includes the following phases and activities:

- *Preliminary Assessment*—Determine whether a potential military munitions hazard is present and whether further action is needed.
- *Site Investigation*—Inspect the site and search historical records to confirm the presence, extent, and source(s) of hazards.
- *Remedial Investigation/Feasibility Study or Engineering Evaluation/Cost Analysis*—Determine the nature and extent of contamination; determine whether cleanup action is needed and, if so, select alternative cleanup approaches. These could include removing the military munitions, limiting public contact with the site through signs and fences, or determining that no further action is warranted.
- *Remedial Design/Remedial Action*—Design the remedy and perform the cleanup or other response.
- *Long-Term Monitoring*—Periodically review the remedy in place to ensure its continued effectiveness, including checking for unexploded ordnance and public education.

For sites thought to be formerly used defense sites, the Corps also performs an initial evaluation prior to the process above. In this initial evaluation, called a preliminary assessment of eligibility, the Corps determines if the property is a formerly used defense site. The Corps makes this determination based on whether there are records showing that DOD formerly owned, leased, possessed, operated, or otherwise controlled the property and whether hazards from DOD's use are potentially present. If eligible, the site then follows the CERCLA assessment and cleanup process discussed earlier. When all of these steps have been completed for a given site and long-term monitoring is under way, or it has been determined that

[6]In the report issued on April 21, 2003, DOD provided aggregate high and low program cost estimates for clean up of military munitions at Military Munitions Response program sites, as well as operational ranges, to satisfy a one-time congressional reporting requirement.

no cleanup action is needed, the services and the Corps consider the site to be "response complete."

DOD Has Made Limited Progress in Its Program to Identify, Assess, and Clean Up Potentially Contaminated Sites

While DOD has identified 2,307 potentially contaminated sites as of September 2002, the department continues to identify additional sites, and it is not likely to have a firm inventory for several years (see table 1 for the distribution of these sites by service). Of the identified sites, DOD determined that 362 sites require no further study or cleanup action because it found little or no evidence of military munitions. For 1,387 sites, DOD either has not begun or not completed its initial evaluation, or has determined that further study is needed. DOD has completed an assessment of 558 sites, finding that 475 of these required no cleanup action. The remaining 83 sites require some cleanup action, of which DOD has completed 23.

Table 1: Distribution of Military Munitions Response Program Sites by Service

Responsible service	Closed ranges on active installations	Closing ranges on base realignment and closure installations[a]	Formerly used defense sites	Total
Army	105	58	N/A	**163**
Navy	196	16	N/A	**212**
Air Force	241	0	N/A	**241**
Army Corps of Engineers	N/A	N/A	1,691	**1,691**
Total	542	74	1,691	**2,307**

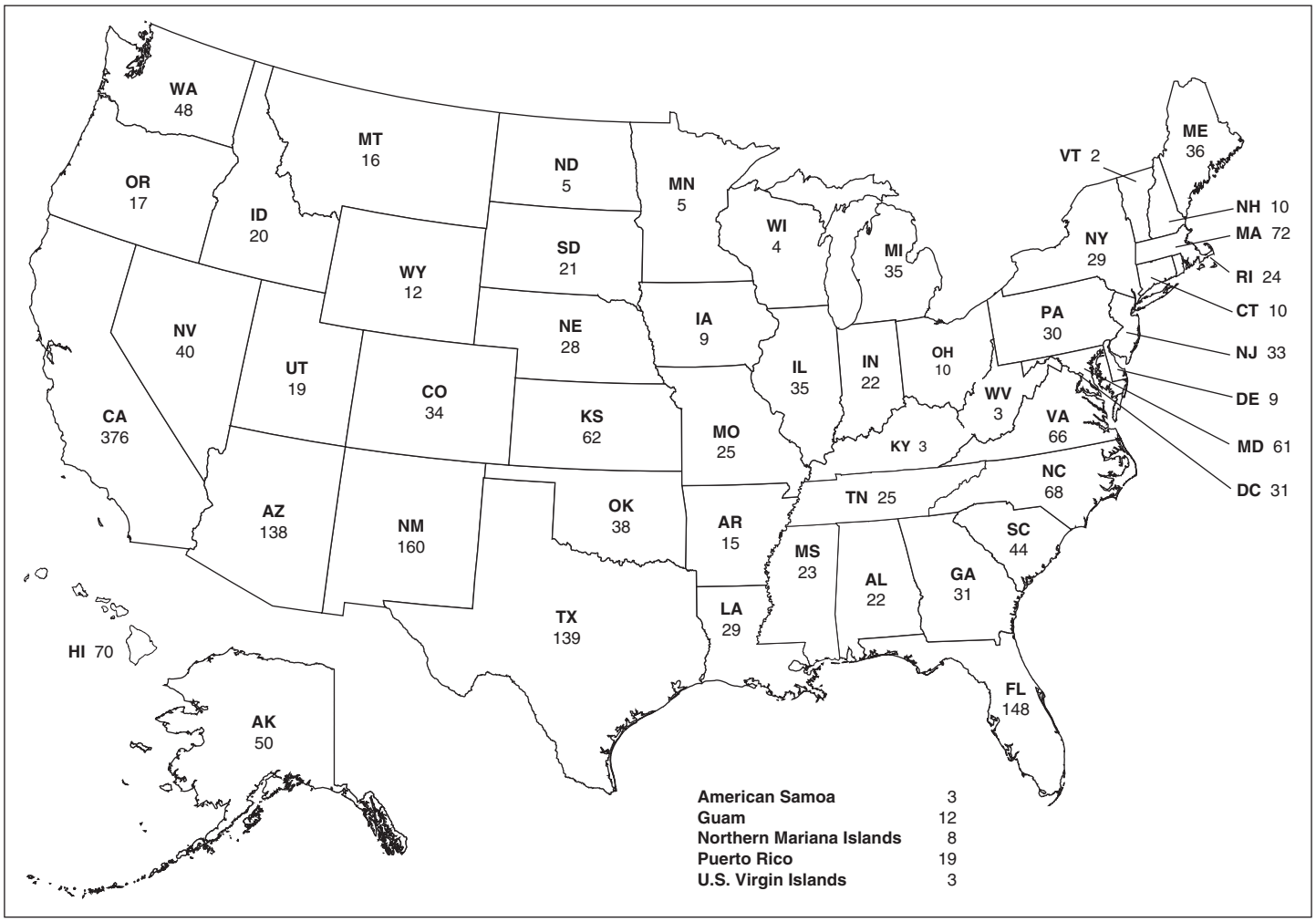
Source: DOD.

[a]The base realignment and closure program is a DOD program governing the scheduled closing of DOD sites and includes a focus on compliance and cleanup efforts at military installations undergoing closure or realignment.

DOD had identified 2,307 sites potentially contaminated with military munitions, as of September 30, 2002, and it continues to identify additional sites. (Fig. 1 shows the distribution of these sites by state.) DOD officials acknowledge that they will not have a firm inventory for several years. For example, as of September 30, 2002, the Army had not completed a detailed inventory of closed ranges at 86 percent of active installations; the 105 sites identified by the Army represented sites on only 14 percent of the Army's

installations. The Army is working to identify sites on the remaining installations and plans to have 40 percent of its installations accounted for by the next Defense Environmental Restoration Program Annual Report to Congress in spring 2004. Similarly, the Corps recently identified 75 additional sites to be included in the inventory as a result of its effort to reevaluate sites previously determined not to need further action after the initial evaluation. Because not all of the sites have been identified, DOD has only a preliminary idea of the extent of cleanup that will be needed. To help complete the identification process, DOD has developed a Web site that stakeholders, such as states, tribes, and federal regulators, can use to suggest additions and revisions to the inventory. DOD plans to update the inventory in its future Defense Environmental Response Program Annual Report to Congress using, in part, the information collected from this Web site.

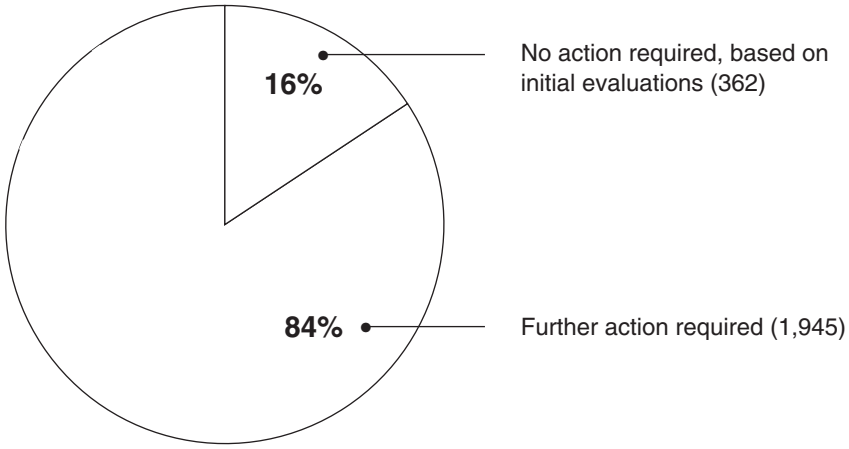
Figure 1: Distribution of 2,307 Suspected Military Munitions Response Program Sites Identified by DOD



Source: GAO.

Of the 2,307 sites identified, DOD has determined, based on an initial evaluation, that 362 do not require any further DOD action (see fig. 2). However, these 362 sites are formerly used defense sites, and the Corps' evaluation of these sites was less comprehensive than other evaluations conducted by DOD under the CERCLA process. [7] In making its determinations, the Corps conducted a preliminary assessment of eligibility and determined that the potential for military munitions hazard was not present. As a result of this determination, the sites were not evaluated further. The Corps is in the process of reviewing these determinations with local stakeholders to ensure that there was a sound basis for the original determination. It has recently decided that some of these sites need to be reassessed to determine if cleanup is needed.

Figure 2: Military Munitions Response Program Site Inventory (2,307 Sites)

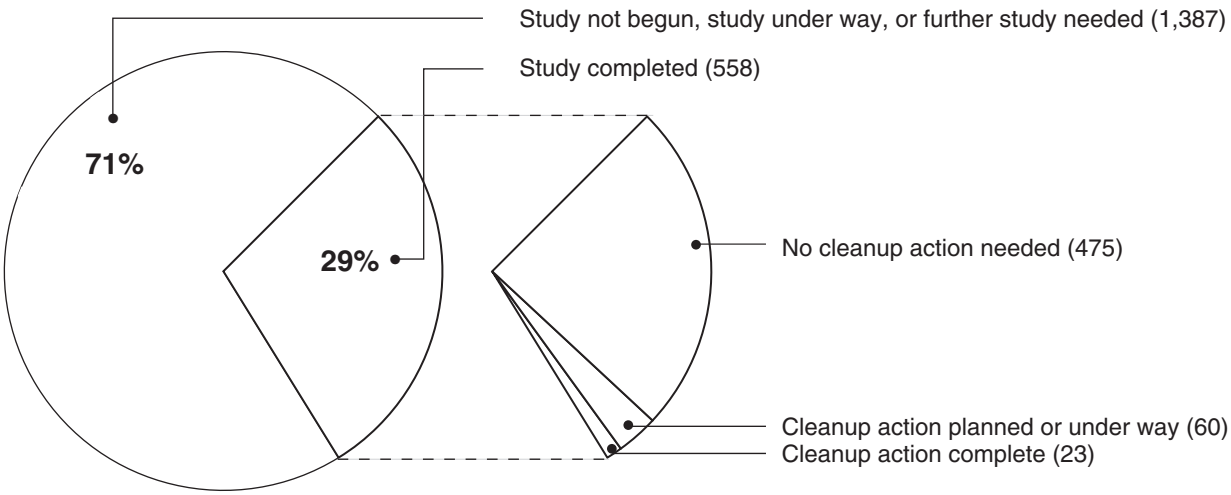


Source: GAO.

[7] In previous GAO work, we estimated that the Corps lacked a sound basis for about 38 percent of its determinations, based on its preliminary assessment of eligibility, that sites did not require any further DOD action; and we recommended that the Corps review these files to determine if these properties should be reassessed. The 38 percent includes all potential formerly used defense sites, including those suspected of containing military munitions. As noted above, the Corps is in the process of reassessing the determinations. See U.S. General Accounting Office, *Environmental Contamination: Corps Needs to Reassess Its Determinations That Many Former Defense Sites Do Not Need Cleanup*, GAO-02-658 (Washington, D.C.: Aug. 23, 2002).

Of the 1,945 sites that required further action, DOD has either not begun or has not completed its study, or has determined that further study is needed, for 1,387 sites (see fig. 3). For example, 241 Air Force and 105 Army sites at closed ranges on active installations have not been evaluated. For other sites, primarily formerly used defense sites, DOD has completed its initial evaluation and determined that further investigation is needed.

Figure 3: Military Munitions Response Program Sites Requiring Further Action



Source: GAO.

DOD has completed its assessment of 558 sites, nearly all of which are ranges on formerly used defense sites or closing installations, and determined that no cleanup action was needed for 475; the remaining 83 sites required some level of cleanup action. Of the 83 sites that required cleanup action, 60 have cleanup action planned or under way and 23 are complete. Actions taken at these 23 sites have been varied and include surface and subsurface removal of munitions, and institutional controls, such as the posting of warning signs or educational programs. See figure 4 for examples of cleanup actions at Military Munitions Response program sites.

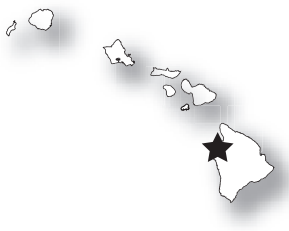
Figure 4: Examples of Cleanup Actions at Military Munitions Response Program Sites

The former Baywood Park Training Area is an 8,810-acre site, located along Morro Bay near San Luis Obispo, California. Currently, the land is used for residential, recreational, agricultural uses as well as for a wildlife refuge. The Corps initially conducted a removal action on 166 acres. It cleared 96 beachfront acres to a depth of 3 feet; 17 acres less susceptible to shifting and eroding sand were cleared to a depth of 2 feet; and 53 acres were cleared at the surface for munitions. Following that work, the Corps also plans to implement institutional controls, such as putting up warning signs on primary trails and public education programs, for additional portions of the site.

Jefferson Barracks is located along the Mississippi River in Saint Louis County, Missouri. Throughout much of the 19th century, the disposal of munitions from this site into the river was a common and acceptable practice. Over time, this practice resulted in potentially hazardous munitions being readily accessible to the public walking along the riverbank. The Missouri Air National Guard currently has responsibility for this land, but because it was a formerly used defense site the Corps has responsibility for cleanup. The Corps evaluated several alternatives and chose an innovative solution – burying the potential hazard, located along approximately 650 linear feet of shoreline, under thousands of tons of rock.

At Seneca Army Depot in Romulus, New York, the primary mission was the receipt, storage, maintenance, and supply of military items, including munitions. Congress approved the closure of this 10,587-acre site under the base realignment and closure process. The Army assessed the site and evaluated the alternatives to reduce the risk posed by military munitions. The alternatives selected included institutional controls (such as fencing, land use restrictions, and public education), subsurface removal of munitions, and the excavation and sifting of soil to remove munitions.

The Waikoloa Maneuver Area in Hawaii, a military training area and live fire range, actually consists of three sites – Waikoloa Maneuver Area, Nansay, and Lalamilo Firing Range and Camp. In total, the three sites encompass more than 100,000 acres and are estimated to be the most expensive to clean up. The Corps has already instituted a number of institutional controls, including notification of 14,000 land owners, the development of an educational package, and the production of a public safety and health video. As the Corps continues to monitor and assess this land, additional cleanup actions, including subsurface removal of at least 680 acres, are planned.



Source: GAO.

DOD Does Not Have a Complete and Viable Plan for Assessing and Cleaning Up Potentially Contaminated Sites

In DOD's Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress, DOD identified several elements integral to the success of the Military Munitions Response program: compiling a comprehensive inventory of sites; developing a new procedure to assess risk and prioritize sites; ensuring proper funding for accurate planning and program execution; and establishing program goals and performance measures. While DOD has established the basic framework to address these elements, DOD's plan is lacking in three key respects. First, essential data for DOD's plan may take years to develop. Second, DOD's plan is contingent upon preliminary cost estimates that may change significantly and a reallocation of funds that may not be available. Finally, DOD's plan lacks specific goals and performance measures to track progress.

Essential Data for DOD's Plan May Take Years to Develop

DOD's inventory of potentially contaminated sites serves as the basis for other elements of its plan, yet this inventory is incomplete. DOD's inventory of 2,307 sites includes only those identified through September 30, 2002. As previously discussed, according to DOD officials, this inventory is not final; and DOD has not set a deadline to complete it. According to DOD, most of the ranges on formerly used defense sites and on military installations that are being closed have been identified and are being assessed or cleanup action is under way. The ranges yet to be identified are primarily located on active installations. For example, the Army, as of September 30, 2002, had completed a detailed inventory of potentially contaminated sites on only 14 percent of its active installations. Because the inventory serves as the basis for other elements of the plan, such as budget development and establishing program goals, most sites must first be identified in order for DOD to have a reasonable picture of the magnitude of the challenge ahead and to plan accordingly.

Furthermore, DOD intends to use a new procedure to reassess the relative risk and priority for 1,387 sites needing further study and any new sites identified as part of the continuing inventory effort, but DOD is not scheduled to complete these reassessments until 2012. DOD recently developed this procedure for assigning each site in the inventory a priority level for cleanup action, based on the potential risk of exposure resulting from past munitions-related activities.[8] Under this procedure, DOD plans to reevaluate the 1,387 sites for three potential hazard types: (1) explosive hazards posed by unexploded ordnance and discarded military munitions, (2) hazards associated with the effects of chemical warfare material, and (3) chronic health and environmental hazards posed by munitions constituents. Once assessed, each site's relative risk-based priority will be the primary factor determining future cleanup order.[9] DOD plans to require assessment of each site on the inventory for at least one of these hazard types by May 31, 2007, and for all three hazard types by May 31, 2012. Until all three hazard types are fully assessed, DOD cannot be assured that it is using its limited resources to clean up those sites that pose the greatest risk to safety, human health, and the environment.

DOD's Plan Relies on Preliminary Cost Estimates That Can Change Significantly and a Reallocation of Funds That May Not Be Available

DOD's plan to identify and address military munitions sites relies on preliminary cost estimates that were developed using incomplete information. The majority of the site estimates were developed using a cost-estimating tool that incorporates variables, such as the affected acreage; types, quantity, and location of munitions; and future land use. These variables can have a significant impact on cost, according to DOD. However, detailed site-specific information was not available for all sites. For example, as mentioned earlier, 105 Army and 241 Air Force sites at closed ranges on active installations have not had an initial evaluation. As a result, the Air Force used estimated, not actual, acreage figures, including assumptions regarding the amount of acreage known or suspected of containing military munitions when preparing its cost estimates. Because changes in acreage can greatly impact the final cost of site assessment and cleanup action, the estimates produced for these sites are likely to change when estimates based on more complete data or the actual cost figures are

[8]DOD proposed a rule establishing this protocol on August 22, 2003, allowing 90 days for a public comment period. 68 Fed. Reg. 50,900.

[9]DOD recognized that other factors, such as economic, programmatic, and stakeholder concerns, may affect the sequence in which sites are cleaned up.

known. The following examples illustrate how cost estimates can change during the life of the cleanup as better information becomes available:

- Camp Maxey was a 41,128-acre Army post in Texas used from 1942 to 1945 for training infantry in live fire of weapons including pistols, rifles, machine guns, mortars, bazookas, and antitank guns. The Corps confirmed the presence of unexploded ordnance, and in 2000, estimated the cleanup cost for the land at $45 million. In DOD's Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress, the estimated total cost of cleanup had grown to $130 million. A June 2003 cost estimate showed a decrease in total cost to about $73 million, but still 62 percent more than the original cost estimate in 2000. The main factors behind these shifting cost estimates, according to the project manager, were changes in the acreage requiring underground removal of ordnance and changes in the amount of ordnance found.

- Fort McClellan, Alabama, was among the installations recommended for closure under DOD's base realignment and closure effort in 1995. This site had been used since the Spanish American War (1898), including as a World War I and II training range upon which grenades, mortars, and antiaircraft guns, were used. An April 2002 cost estimate prepared for one site on Fort McClellan requiring cleanup showed the anticipated cost of clearing the land of munitions as $11,390,250. A subsequent cost estimate prepared in May 2003, showed the cost of clearing this site at $22,562,200. According to the Army, the increase in estimated costs reflects a change in the final acreage recommended for clearance and the extent to which buried munitions would be searched for and removed.

Moreover, until DOD and stakeholders agree upon a cleanup action, it is often difficult for them to predict the extent of the cleanup action required and cost estimates can change because of the cleanup action implemented at the site. For example, at the former Indian Rocks Range in Pinellas County, Florida, the Corps identified 178 acres that were used as an air-to-ground and antiaircraft gunnery range impact area from 1943 to 1947. Munitions used on this shoreline site included bullets, aircraft rockets, and small practice bombs. Much of the land had been developed, limiting the Corps ability to pursue the alternative of searching for and removing buried munitions. In 1995, the Corps analyzed a number of alternatives to address munitions contamination at the site and developed cost estimates for these alternatives. However, because the development was largely composed of hotels, condominiums, and single-family residences, the Corps chose the

alternative of conducting a community education program. The total cost of this alternative was $21,219. If the Corps had decided to search for and remove the remaining munitions at this site, the cost could have approached $3 million, according to the prepared cost analysis.

Furthermore, at an annual funding level of approximately $106 million (the average amount budgeted or spent annually from fiscal year 2002 to fiscal year 2004), cleanup at the remaining munitions sites in DOD's current inventory could take from 75 to 330 years to complete.[10] To reduce this timeline, DOD expects to use funds currently designated for hazardous, toxic, and radioactive waste cleanup after these cleanups are complete. However, these other cleanup efforts are not on schedule in all of the services and the Corps. For example, between fiscal years 2001 and 2002, the schedule to complete hazardous substance cleanups at formerly used defense sites slipped by more than 6 years. As a result, anticipated funds from completing hazardous substance cleanups at these sites may not become available to clean up munitions sites until 2021 or later. This delay is significant because, as of September 30, 2002, formerly used defense sites account for over 85 percent of DOD's total anticipated costs to complete munitions cleanup, yet the Corps receives about 66 percent of the total munitions cleanup funds. Delays in the availability of anticipated funding from hazardous, toxic, and radioactive waste sites could greatly impair DOD's ability to accurately plan for and make progress in cleaning up Military Munitions Response sites.

DOD's Plan Does Not Contain Goals or Measures for Site Assessment and Cleanup

DOD has yet to establish specific program goals and performance measures in its plan. Specifically, DOD has yet to identify interim milestones and service-specific targets that will help it achieve overall program objectives. In September 2003, 2 years after the Military Munitions Response program was initiated, DOD established a workgroup tasked with recommending overall goals and measures for the program, near-term goals and measures to support its budgeting cycle for fiscal years 2006 to 2011, and a program completion date goal. DOD has asked the workgroup to accomplish these objectives by the end of calendar year 2003. According to DOD, these goals and measures, when developed, should help DOD track the progress of sites through the cleanup phases, and ensure that DOD responds to the sites with the greatest risk first. While it is important

[10]This estimate is a conservative estimate because it was calculated based on annual funding totals that include funding that is needed for program management and administration.

for DOD to establish goals and measures that will track overall program progress and ensure that the riskiest sites are assessed and cleaned up first, DOD will not have the information it needs to do this until 2012. As we discussed earlier, because DOD plans to reassess potentially contaminated sites using a new risk-based prioritization procedure, until these reassessments are complete, DOD will not have complete information on which of the sites pose the greatest risk. Consequently, goals and measures established in 2003 will be of limited use and may not reflect DOD's true priorities.

Moreover, according to DOD, the program goals and measures to be established by the workgroup will be agencywide, and not service-specific, although it may establish interim goals for the services and Corps. However, DOD has not yet decided what these goals will be based on, such as relative risk levels or cleanup phases. In the absence of service-specific goals, each service has implemented the program with a different level of effort. For example, the Air Force has not budgeted any funds to assess and clean up munitions sites, nor do they plan to do so through fiscal year 2004. As mentioned before, the Air Force also has not conducted initial evaluations on any of its 241 sites and has little site-specific information from which to create a reliable cost estimate. In contrast, the Army has undertaken a comprehensive inventory of ranges that will result in detailed site information, such as acreage and the types, quantity, and location of munitions, that can be used to, among other things, create more robust cost estimates. The Army has completed this comprehensive inventory on 14 percent of its installations as of September 2002, and has set a goal to complete this effort by December 2003. This uneven effort in implementing the Military Munitions Response program could continue through various program phases, such as preliminary assessments and site investigations, making it difficult for DOD to assure that each of the services and the Corps are making progress in cleaning up their potentially contaminated sites and achieving the overall goals of the program.

Conclusions

DOD has made limited progress in identifying, assessing, and cleaning up sites known or suspected to contain military munitions. Accomplishing this long and arduous task in a timely manner that best protects public safety, human health, and the environment will require a comprehensive approach that includes effective planning and budgeting. However, DOD lacks the data needed—such as a complete inventory, up-to-date prioritization, and reliable cost estimates—to establish a comprehensive approach. Without such an approach for identifying, assessing, and cleaning up potentially

contaminated sites, DOD will be hampered in its efforts to achieve the program's objectives.

Recommendations

To ensure that DOD has a comprehensive approach for identifying, assessing, and cleaning up military munitions at potentially contaminated sites, we recommend that the Secretary of Defense revise DOD's plan to

- establish deadlines to complete the identification process and initial evaluations so that it knows the universe of sites that needs to be assessed, prioritized, and cleaned up;
- reassess the timetable proposed for completing its reevaluation of sites using the new risk assessment procedures so that it can more timely establish the order in which sites should be assessed and cleaned up, thereby focusing on the riskiest sites first; and
- establish interim goals for cleanup phases for the services and Corps to target.

In addition, after DOD has revised its comprehensive plan, we recommend that it work with the Congress to develop realistic budget proposals that will allow DOD to complete cleanup activities on potentially contaminated sites in a timely manner.

Agency Comments

We provided DOD with a draft of this report for review and comment. In its comments, DOD concurred with our recommendation to work with the Congress to develop realistic budget proposals that will allow it to complete cleanup activities on potentially contaminated sites in a timely manner. DOD partially concurred with our recommendation to establish deadlines to complete the identification process and initial evaluations so that it knows the universe of sites. DOD stated that the military services and the Corps have been working, and will continue to work, with stakeholders to identify additional sites and add these sites to the inventory as appropriate. DOD also stated that it believes most of the remaining sites to be identified are located on active installations still under DOD control. While we have clarified this point in the report, we note that the number of formerly used defense sites identified has increased by about 75 sites since the current inventory was completed and an unknown but possibly significant number of sites may be added as the Army completes

identification of sites on 86 percent of its installations. These sites and many others still need to undergo initial evaluations. Consequently, we continue to believe that it is important for DOD to establish deadlines to complete the identification and initial evaluations for all of the sites in its inventory in order to establish a reasonable approximation of the future workload it faces.

DOD also partially concurred with our recommendation to reassess the timetable proposed for completing the reevaluation of sites using the new risk assessment procedure. DOD stated that the military services and the Corps would need sufficient time and resources to complete each risk assessment. However, DOD stated that it had recently established 2010 as the goal for completing the prioritization of sites, instead of 2012 which was the original goal set forth in the proposed regulation. While we agree that this is a step in the right direction, DOD should continue to look for other opportunities to accelerate these inspections and the prioritization of sites to help ensure that resources are being targeted toward the riskiest sites first.

Finally, DOD partially concurred with our recommendation to establish interim goals for cleanup phases for the services and the Corps. DOD stated that it has established interim goals of completing all preliminary assessments by 2007 and all site inspections by 2010, and that these goals apply to all military components, thereby eliminating the need for separate service-specific goals. However, DOD noted that it is working with each military service to establish additional goals and measures to gauge progress. While we are encouraged by DOD's efforts in this area, we believe that service-specific goals and measures, as they apply to the cleanup phases, will be essential for DOD to ensure that each of the services and the Corps are making progress in cleaning up potentially contaminated sites and achieving the overall goals of the program.

In addition to its written comments on our draft report, DOD also provided a number of technical comments and clarifications, which we have incorporated in this report as appropriate. DOD's written comments appear in appendix III.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees; the Secretary of Defense; Director,

Office of Management and Budget; and other interested parties. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staffs have any questions, please call me or Edward Zadjura at (202) 512-3841. Key contributors to this report are listed in appendix IV.

Sincerely yours,

Anu K. Mittal
Director, Natural Resources
and Environment

Safety, Environmental, and Human Health Risks

Military munitions can pose risks to public safety, human health, and the environment. In terms of the explosive hazard, unexploded ordnance poses an immediate safety risk of physical injury to those who encounter it. Military munitions may also pose a health and environmental risk because their use and disposal may release constituents that may contaminate soil, groundwater, and surface water. Ranges contaminated with military munitions, especially those located in ecologically sensitive wetlands and floodplains, may have soil, groundwater, and surface water contamination from any of the over 200 chemical munitions constituents that are associated with the ordnance and their usage. When exposed to some of these constituents, humans potentially face long-term health problems, such as cancer and damage to heart, liver, and kidneys. Of these constituents, there are 20 that are of greatest concern due to their widespread use and potential environmental impact. Table 2 contains a listing of these munitions constituents, and table 3 describes some of the potential health effects of five of them.

Table 2: Munitions Constituents of Greatest Concern

Type of munitions constituents
Trinitrotoluene (TNT)
1,3-Dintrobenzene
Nitrobenzene
2,4-Dinitrotoluene
2-Amino-4,6-Dinitrotoluene
2-Nitrotoluene
2,6-Dinitrotoluene
4-Amino-2,6-Dinitrotoluene
3-Nitrotoluene
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
2,4-Diamino-6-nitrotoluene
4-Nitrotoluene
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
2,6-Diamino-4-nitrotoluene
Methylnitrite
Perchlorate
1,2,3-Propanetriol trinitrate (Nitroglycerine)
Pentaerythritoltetranitrate (PETN)
1,3,5-Trinitrobenzene
N,2,4,6-Tetranitro-N-methylaniline (Tetryl) (White Phosphorus)

Source: DOD, *Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress.*

While many of these constituents have been an environmental concern to the Department of Defense (DOD) for more than 20 years, the current understanding of the causes, distribution, and potential impact of constituent releases into the environment remains limited. The nature of these impacts, and whether they pose an unacceptable risk to human health and the environment, depend upon the dose, duration, and pathway of exposure, as well as the sensitivity of the exposed populations. However, the link between such constituents and any potential health effects is not always clear and continues to be studied.

Table 3: Potential Effects of the Munitions Constituents Closely Associated with Military Munitions

Constituent	Potential toxicity/effects
TNT	Possible human carcinogen, targets liver, skin irritations, and cataracts.
RDX	Possible human carcinogen, prostate problems, nervous system problems, nausea and vomiting. Laboratory exposure to animals indicates potential organ damage.
HMX	Animal studies suggest potential liver and central nervous system damage.
Perchlorate	Exposure causes itching, tearing, and pain; ingestion may cause gastroenteritis with abdominal pain, nausea, vomiting, and diarrhea; systemic effects may follow and may include ringing of ears, dizziness, elevated blood pressure, blurred vision, and tremors. Chronic effects may include metabolic disorders of the thyroid.
White Phosphorus	Reproductive effects. Liver, heart, or kidney damage; death; skin burns, irritation of throat and lungs, vomiting, stomach cramps, drowsiness.

Source: Environmental Protection Agency, *Handbook on the Management of Ordnance and Explosives at Closed, Transferring, and Transferred Ranges and Other Sites.*

Additional Details on Our Scope and Methodology

The objectives of our review were to evaluate (1) DOD's progress in implementing its program to identify, assess, and clean up sites containing military munitions and (2) DOD's plans to clean up remaining sites in the future. To evaluate DOD's progress in identifying, assessing, and cleaning up military munitions sites, we analyzed data provided to us by DOD's Office of the Deputy Undersecretary of Defense (Installations and Environment) Cleanup Office from its database for sites identified under the Military Munitions Response program. This information includes the status of studies or cleanup actions, as well as cost estimates. The data are complete as of September 30, 2002, DOD's most recent reporting cycle, and were used to develop DOD's Fiscal Year 2002 Defense Environmental Restoration Program Annual Report to Congress. We also analyzed additional data on the status of studies or cleanup actions provided to us by the Army Corps of Engineers (the Corps) from its database of formerly used defense sites. We assessed the reliability of relevant fields in these databases by electronically testing for obvious errors in accuracy and completeness, reviewing information about the data and the system that produced them, and interviewing agency officials knowledgeable about the data. When we found inconsistencies, we worked with DOD and military service officials to correct the inconsistencies before conducting our analyses. We determined that the data needed for our review were sufficiently reliable for the purposes of our report.

We also reviewed 38 of 75 project files at seven Corps districts where, according to DOD's database, site cleanup action is either complete or under way. (See table 4 for a listing of these districts).

Table 4: Districts Visited during Review

Corps district	Total number of sites	Sites with cleanup completed	Sites with cleanup under way
Baltimore	2	1	1
Fort Worth	3	0	3
Honolulu	2	0	2
Huntsville	12	4	8
Jacksonville	8	2	6
Kansas City	4	3	1
Los Angeles	7	2	5
Total	**38**	**12**	**26**

Source: GAO.

We selected these districts based on the number of sites where cleanup was completed or under way and the estimated cost to complete cleanup, with some consideration given for geographic distribution. These files represented 52 percent of the 23 sites with a completed cleanup action and 50 percent of the 52 sites with a cleanup action under way. We used our file reviews to develop case example of changes in estimated costs to complete cleanup over time and cleanup actions taken. These case examples are for illustration only.

To evaluate DOD's plans for addressing the remaining sites, we analyzed the plans, as well as the assumptions upon which those plans are based, including cost and projected completion dates. In addition, we reviewed policies and program guidance, analyzed financial data, and interviewed program managers in DOD and the military services and the Corps. We conducted our work between November 2002 and October 2003 in accordance with generally accepted government auditing standards.

Comments from the Department of Defense

ACQUISITION, TECHNOLOGY AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

DEC 1 2003

Ms. Anu Mittal
Director Natural Resources and Environment
U.S. General Accounting Office
441 G Street N.W.
Washington, DC 20548

Dear Ms. Mittal:

This letter is the Department of Defense (DoD) response to the GAO draft report, "MILITARY MUNITIONS: DoD Needs to Develop a Comprehensive Approach for Cleaning Up Contaminated Sites," November 13, 2003 (GAO Code 360286/GAO-04-147).

The Department concurs with the GAO recommendation in the draft report to work with the Congress to develop realistic budget proposals that will allow DoD to complete cleanup activities on potentially contaminated sites in a timely manner. The Department partially concurs with GAO recommendations to (1) establish deadlines to complete the identification process and initial evaluations, (2) establish interim goals for cleanup phases for the Services and Corps to target, and (3) reassess the timetable proposed for completing the reevaluation of sites using the new risk assessment procedure. Enclosed are specific comments on each of these recommendations.

Additionally, after reviewing the final report, DoD has technical comments, which are also enclosed for your consideration.

Sincerely,

Philip W. Grone
Principal Assistant Deputy Under Secretary of Defense
(Installations & Environment)

Enclosures: as stated

GAO DRAFT REPORT – DATED NOVEMBER 13, 2003
GAO CODE 360286/GAO-04-147

"MILITARY MUNITIONS: DoD Needs to Develop a Comprehensive Approach for Cleaning Up Contaminated Sites"

DEPARTMENT OF DEFENSE COMMENTS TO THE RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense revise DoD's plan to establish deadlines to complete the identification process and initial evaluations so that it knows what the universe of sites is that needs to be assessed, prioritized, and cleaned up. (p. 19/GAO Draft Report)

DOD RESPONSE: Partially concur. Over the last two years, DoD has been working with the Military Components to identify potential munitions response sites. Through the publicly available site of the Defense Environmental Network and Information Exchange (DENIX), DoD has shared the most recent inventory results and continues to solicit information from both the environmental regulatory community and public stakeholders to assist in site identification. This is an ongoing process that will likely continue throughout the early years of the program and is not dissimilar to DoD's traditional hazardous waste cleanup program where limited site discovery takes place to the present. DoD and the Military Components will continue to work with stakeholders to identify additional sites and add sites to the munitions response site inventory, as appropriate. Goals recently established for preliminary assessments and site inspections are sufficient to drive the program at this stage.

Additionally, the GAO report fails to differentiate between the action that DoD has taken and those that it has not. For munitions response sites that are also Formerly Used Defense Sites (FUDS) or that are located on installations under a Base Realignment and Closure (BRAC) action, the inventory accuracy is at the 95% level or better. FUDS, which have already transferred to the public, and BRAC which are, for the most part, in the process of transferring, are correctly being given greater priority than most munitions response sites still under DoD control. For example, Army munitions response sites that are lacking in terms of inventory and initial evaluation are, for the most part, located on active installations still under DoD control.

RECOMMENDATION 2: The GAO recommends that the Secretary of Defense revise DoD's plan to reassess the timetable proposed for completing its reevaluation of sites using the new risk assessment procedures so that it can, in a more timely manner, establish the order in which sites should be assessed and cleaned up, thereby focusing on the riskiest sites first. (p. 19/GAO Draft Report)

DOD RESPONSE: Partially concur. DoD plans to finalize the munitions response site prioritization protocol in 2004 and will immediately begin applying the protocol to sites with sufficient information to evaluate at least one risk module. For sites where little or no information is available, the Military Components will need sufficient time and resources to conduct site assessments and gather information for completion of each risk module. Application of the prioritization process is an iterative process. As new information becomes

available, sites will be reevaluated to ensure that the sites with the highest relative risk are given priority for the sequencing of munitions responses.

Working closely with the Military Components, DoD recently established 2010 as the goal for all site inspections to be complete at all munitions response sites. This date was determined to be both appropriate and achievable after careful evaluation of site information currently available; time and resource requirements to gather needed information; and impact on the traditional hazardous waste cleanup program. This will effectively change the goal of applying the three modules of the prioritization protocol to all munitions response sites from 2012 to 2010.

Lastly, the US Army Corps of Engineers has for a number of years used its relative risk assessment code (RAC) which assigns a relative risk to each munitions response site. Currently, work for the vast majority of munitions response sites is sequenced using this "risk-based" system.

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense revise DoD's plan to establish interim goals for cleanup phases for the Services and Corps to target. (p. 19/GAO Draft Report)

DOD RESPONSE: Partially concur. As part of the current budgeting and programming guidance, DoD established interim goals requiring completion of all preliminary assessments by 2007 and all site inspections by 2010. These goals apply to all the Military Components, eliminating the need to have separate Service-specific goals. DoD is working with each of the Military Components to establish additional goals (including the establishment of a program completion date) and metrics to gauge progress toward goal accomplishment.

RECOMMENDATION 4: The GAO recommended that after DoD has revised its comprehensive plan that DoD work with the Congress to develop realistic budget proposals that will allow DoD to complete cleanup activities on potentially contaminated sites in a timely manner. (p. 19/GAO Draft Report)

DOD RESPONSE: Concur. DoD and the Military Components will be working together to determine realistic program completion cost estimates and budgets that support achievement of program goals in a timely and affordable manner. Consultation with Congress is vital.

GAO Contacts and Staff Acknowledgments

GAO Contacts

Ms. Anu K. Mittal, (202) 512-3841
Edward Zadjura, (202) 512-9914

Acknowledgments

In addition to those named above, Jack Burriesci, Elizabeth Erdmann, Sherry McDonald, and Matthew Reinhart made key contributions to this report. Also contributing to this report were Cynthia Norris, Rebecca Shea, and Ray Wessmiller.

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