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GROUNDWATER CONTAMINATION

DOD Uses and Develops a Range of Remediation Technologies to Clean Up Military Sites

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Highlights

Highlights of GAO-05-666, a report to congressional committees

Why GAO Did This Study

To date, the Department of Defense (DOD) has identified nearly 6,000 sites at its facilities that require groundwater remediation and has invested $20 billion over the past 10 years to clean up these sites. In the past, DOD primarily used "pump-and-treat" technologies to contain or eliminate hazardous contaminants in groundwater. However, the long cleanup times and high costs of using pump-and-treat technologies often make them expensive and ineffective for groundwater remediation.

As directed by Public Law 108-375 and as agreed, GAO (1) described current DOD groundwater remediation technologies and (2) examined whether any new technologies are being used or developed outside the department that may have potential for DOD's use and the extent to which DOD is researching and developing new approaches to groundwater remediation.

GAO provided the Department of Defense with a draft copy of the report for its review and comment. DOD generally agreed with the contents stating that the report is an accurate summary of DOD's use and field tests of remedial technologies. DOD also provided technical clarifications that have been incorporated, as appropriate.

www.gao.gov/cgi-bin/getrpt?GAO-05-666.

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 implemented or field-tested all of the 15 types of generally accepted technologies currently available to remediate contaminated groundwater, including several alternatives to pump-and-treat technologies. Some of these technologies, such as bioremediation, introduce nutrients or other materials into the subsurface to stimulate microorganisms in the soil; these microorganisms consume the contaminant or produce byproducts that help break down contaminants into nontoxic or less-hazardous materials. DOD selects the most suitable technology for a given site on the basis of several factors, such as the type of contaminant and location in the subsurface, and the relative cost-effectiveness of a technology for a given site. DOD has identified a number of contaminants of concern at its facilities, each of which varies in its susceptibility to treatment. The table below shows the technologies DOD used to remediate contaminated groundwater.

GAO did not identify any alternative groundwater remediation technologies being used or developed outside DOD that the department has not considered or used. Most of the new approaches developed by commercial vendors and available to DOD generally use novel materials applied to contaminated sites with existing technologies. DOD actively researches and tests new approaches to groundwater remediation largely by developing and promoting the acceptance of innovative remediation technologies. For example, DOD's Strategic Environmental Research and Development Program supports public and private research on contaminants of concern to DOD and innovative methods for their treatment.

Technologies DOD Components Used for Groundwater Remediation

Technology	Air Force	Army	Army Corps of Engineers	Defense Logistics Agency	Navy
In-situ					
Air sparging	X	X	X	X	X
Bioremediation	X	X	X	X	X
Enhanced recovery	X			X	X
Chemical treatments	X	X	X	X	X
Monitored natural attenuation	X	X	X	X	X
Multiphase extraction	X	X	X	X	X
Permeable reactive barriers	X	X	X	X	X
Phytoremediation	X	X	X		X
Thermal treatments	X	X	X		X
Ex-situ					
Advanced oxidation processes	X	X	X		X
Air stripping	X	X	X	X	X
Bioreactors		X	X		X
Constructed wetlands	X	X	X		X
Ion exchange	X	X	X		X
Adsorption (mass transfer)	X	X	X	X	X

Source: Department of Defense.