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ENVIRONMENTAL CONTAMINATION

Department of Defense Activities Related to Trichloroethylene, Perchlorate, and Other Emerging Contaminants

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Natural Resources and Environment

July 12, 2007

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Highlights

Highlights of GAO-07-1042T, a testimony before the Subcommittee on Readiness, Committee on Armed Services, House of Representatives

Why GAO Did This Study

DOD defines emerging contaminants as chemicals or materials with (1) perceived or real threat to health or the environment and (2) lack of published standards or a standard that is evolving or being reevaluated. Two emerging contaminants—trichloroethylene (TCE) and perchlorate—are of particular concern to DOD because they have significant potential to impact people or DOD's mission.

TCE, a degreasing agent in metal cleaning which has been used widely in DOD industrial and maintenance processes, has been documented at low exposure levels to cause headaches and difficulty concentrating. High-level exposure may cause dizziness, headaches, nausea, unconsciousness, cancer, and possibly death. Similarly, perchlorate has been used by DOD, NASA, and others in making, testing, and firing missiles and rockets. It has been widely found in groundwater, surface water, and soil across the United States, Perchlorate health studies have documented particular risks to fetuses of pregnant women.

GAO was asked for testimony to summarize its past work on perchlorate-, TCE-, and defense-activities related to (1) the state of knowledge about the emerging contaminants TCE and perchlorate, (2) DOD responsibilities for managing TCE and perchlorate contamination at its facilities, and (3) DOD activities to address TCE and perchlorate contamination.

www.gao.gov/cgi-bin/getrpt?GAO-07-1042T.

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

What GAO Found

While TCE and perchlorate are both classified by DOD as emerging contaminants, there are important distinctions in how they are regulated and in what is known about their health and environmental effects. Since 1989, EPA has regulated TCE in drinking water. However, health concerns over TCE have been further amplified in recent years after scientific studies have suggested additional risks posed by human exposure to TCE. Unlike TCE, no drinking water standard exists for perchlorate—a fact that has caused much discussion in Congress and elsewhere. Recent Food and Drug Administration data documenting the extent of perchlorate contamination in the nation's food supply has further fueled this debate.

While DOD has clear responsibilities to address TCE because it is subject to EPA's regulatory standard, DOD's responsibilities are less definite for perchlorate due to the lack of such a standard. Nonetheless, perchlorate's designation by DOD as an emerging contaminant has led to some significant control actions. These actions have included responding to requests by EPA and state environmental authorities, which have used a patchwork of statutes, regulations, and general oversight authorities to address perchlorate contamination. Pursuant to its Clean Water Act authorities, for example, Texas required the Navy to reduce perchlorate levels in wastewater discharges at the McGregor Naval Weapons Industrial Reserve Plant to 4 parts per billion (ppb), the lowest level at which perchlorate could be detected at the time. In addition, in the absence of a federal perchlorate standard, at least nine states have established nonregulatory action levels or advisories for perchlorate ranging from 1 ppb to 51 ppb. Nevada, for example, required the Kerr-McGee Chemical site in Henderson to treat groundwater and reduce perchlorate releases to 18 ppb, which is Nevada's action level for perchlorate.

While nonenforceable guidance had existed previously, it was not until EPA adopted its 1989 TCE standard that many DOD facilities began to take concrete action to control the contaminant. According to EPA, for example, 46 sites at Camp Lejeune have since been identified for TCE cleanup. The Navy and EPA have selected remedies for 30 of those sites, and the remaining 16 are under active investigation. Regarding perchlorate, in the absence of a federal standard DOD has implemented its own policies on sampling and cleanup, most recently with its 2006 *Policy on DOD Required Actions Related to Perchlorate*. The policy applies broadly to DOD's active and closed installations and formerly used defense sites within the United States and its territories. It requires testing for perchlorate and certain cleanup actions and directs the department to comply with applicable federal or state promulgated standards, whichever is more stringent. The policy notes, that DOD has established 24 ppb as the current level of concern for managing perchlorate until the promulgation of a formal standard by the states and/or EPA.

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here to discuss our work on the Department of Defense's (DOD) activities associated with emerging contaminants and the cleanup of its hazardous waste sites. DOD defines emerging contaminants as chemicals or materials characterized by (1) a perceived or real threat to human health or environment and (2) a lack of published health standards or a standard that is evolving or being reevaluated. DOD may also classify a contaminant as "emerging" because of the discovery of a new source of contamination, pathway to human exposure, or more-sensitive detection method. Two emerging contaminants—trichloroethylene (TCE) and perchlorate—are of particular concern to DOD because they have significant potential to impact people or DOD's mission.

As we have previously reported,[1] DOD faces the daunting task of cleaning up thousands of military bases and other installations across the country. Many of these sites are contaminated with toxic and radioactive wastes in soil, water, or containers such as underground storage tanks, ordnance and explosives, and unsafe buildings. Identifying and investigating these hazards will take decades, and cleanup will cost many billions of dollars.

In addition to the federal fiscal implications of the large cleanup costs, defense-related contamination problems have economic consequences for individual communities. Many of these formerly used defense sites are now owned by states, local governments, and individuals and used for parks, schools, farms, and homes. Of particular concern are military facilities closed under DOD's Base Realignment and Closure (BRAC) program that are intended to be redeveloped for productive new uses and must generally be cleaned up before conversion. Environmental cleanup is necessary for the transfer of unneeded contaminated property, which becomes available as a result of base closures and realignment.[2] Concerns have risen in recent years within affected communities about the extent to which contamination on these properties could delay or affect the potential for economic redevelopment to replace jobs that were lost as a

[1]Appendix I provides a selected bibliography of recent GAO studies on Defense-related hazardous waste issues.

[2]When an installation becomes a BRAC action, the unneeded property is reported as excess. Federal property disposal laws require DOD to first screen excess property for possible reuse by defense and other federal agencies. If no federal agency needs the property, it is declared surplus and is made available to nonfederal parties, including state and local agencies, local redevelopment authorities, and the public.

result of the base closures. While most of the land on bases closed between 1988 and 1995 has been cleaned up and transferred for redevelopment, some has been awaiting cleanup and conversion for many years. Additional bases approved for closure in the 2005 BRAC round will increase the inventory of military properties slated for civilian reuse.

As you requested, my remarks today will focus on (1) the state of knowledge about certain emerging contaminants of concern to the Subcommittee—specifically TCE and perchlorate, (2) DOD's responsibilities for managing emerging contaminants for which federal regulatory standards do not exist, as is the case with perchlorate, and (3) DOD's activities to address the emerging contaminants TCE and perchlorate contamination at its facilities. To address these issues, we relied primarily on our May 2005 report and April 2007 testimony on perchlorate[3] and our May 2007 report and June 2007 testimony on drinking water contamination problems at the Marine Corps Base Camp Lejeune (Camp Lejeune).[4] We also used information from related GAO work on DOD cleanup issues[5] and examined recent data and other information from DOD, the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), and the states.

In summary, we found the following:

- While TCE and perchlorate are both DOD-classified emerging contaminants, there are important distinctions in the extent to which they are regulated and in what is known about their effects on human health and the environment. TCE, a degreaser for metal parts that DOD has used widely for industrial and maintenance processes, has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical. TCE has been shown to

[3]GAO, *Perchlorate: A System to Track Sampling and Cleanup Results is Needed,* GAO-05-462 (Washington, D.C.: May 20, 2005) and GAO, *Perchlorate: EPA Does Not Systematically Track Incidents of Contamination*, GAO-07-797T (Washington, D.C.: April 25, 2007).

[4]GAO, *Defense Health Care: Activities Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune*, GAO-07-276 (Washington, D.C.: May 11, 2007) and GAO, *Issues Related to Past Drinking Water Contamination at Marine Corps Base Camp Lejeune*, GAO-07-933T (Washington, D.C.: June 12, 2007).

[5]GAO, *Military Base Closures: Opportunities Exist to Improve Environmental Cleanup Cost Reporting and to Expedite Transfer of Unneeded Property*, GAO-07-166 (Washington, D.C.: January 30, 2007).

cause headaches and difficulty concentrating at low levels of exposure, whereas high-level exposure may cause dizziness, headaches, nausea, unconsciousness, cancer, and possibly death. As a consequence of these health risks from TCE ingestion, EPA adopted a TCE drinking water standard that became effective in 1989. However, health concerns over TCE have been further amplified in recent years as scientific studies have suggested additional risks posed by human exposure to TCE. In addition, ongoing study of the health affects associated with past exposures on Camp Lejeune may affect DOD's decision whether to settle or deny the pending health claims of former residents. Perchlorate, a primary ingredient in propellant used in the manufacture and firing of rockets and missiles, has been found in drinking water, groundwater, surface water, and soil across the United States. Health studies have shown that it can affect the thyroid gland, which helps to regulate the body's metabolism, and may cause developmental impairments in the fetuses of pregnant women. Unlike TCE, EPA has not set a regulatory standard limiting perchlorate in drinking water—a fact that has caused much discussion in Congress and elsewhere. Recent FDA data documenting extensive, low-level perchlorate contamination in the nation's food supply have further fueled the debate about the extent of perchlorate contamination and its health effects.

- While DOD has certain regulatory compliance responsibilities with regard to emerging contaminants such as TCE that are regulated by EPA or state governments, responsibilities are less definite for other emerging contaminants, such as perchlorate, that lack federal regulatory standards. In the absence of a federal regulatory standard, DOD's designation of perchlorate as an emerging contaminant indicates its concern about the significant potential impact the chemical has on people or the department's mission. That designation also has resulted in DOD deciding to take certain actions and cleanup efforts even without a federal requirement. While there is no nationwide perchlorate standard, DOD has taken steps to address perchlorate in individual cases in response to EPA regional or state agency actions under various environmental laws such as the Clean Water Act. For example, pursuant to its authority under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program, Texas required the Navy to reduce perchlorate levels in wastewater discharges at the McGregor Naval Weapons Industrial Reserve Plant to 4 parts per billion (ppb), the lowest level at which perchlorate could be detected. Also, in the absence of a federal perchlorate standard, at least eight states have established nonregulatory action levels or advisories for perchlorate ranging from 1 ppb to 51 ppb. Nevada, for example, required the Kerr-McGee Chemical site in Henderson to treat groundwater and reduce perchlorate concentration releases to 18 ppb—

Nevada's action level.

- DOD is taking a number of actions to address emerging contaminants, including TCE and perchlorate. In 1979, EPA issued nonenforceable guidance establishing "suggested no adverse response levels" for TCE in drinking water. However, the guidance did not suggest actions that public water systems should take if TCE concentrations exceeded those values. Ten years later, EPA's drinking water standard for TCE of 5 ppb became effective. The new standard served as a regulatory basis for many DOD facilities to take concrete actions to control TCE. According to EPA's Region 4 Superfund Director, for example, 46 sites at Camp Lejeune have since been identified for TCE cleanup. The Navy and EPA have selected remedies for 30 of those sites, and the remaining 16 are under active investigation. Regarding perchlorate, in the absence of a federal perchlorate standard, DOD adopted its own policies on sampling and cleanup—specifically a 2003 interim policy followed by a more comprehensive 2006 policy that required more aggressive sampling and, in some cases, cleanup. The 2006 policy applies broadly to DOD's active and closed installations and formerly used defense sites within the United States, its territories and possessions. It directs testing for perchlorate and certain other cleanup actions and directs DOD to comply with applicable federal or state promulgated standards, whichever is more stringent.

The State of Knowledge About TCE and Perchlorate

While TCE and perchlorate are both DOD-classified emerging contaminants, there are key distinctions between the contaminants that affect the extent to which they are regulated, and the information that may be needed before further steps are taken to protect human health and the environment. Since 1989, a maximum contaminant level (MCL) under the Safe Drinking Water Act has been in place for TCE. In contrast, EPA has not adopted an MCL for perchlorate, although recent government-sponsored studies have raised concerns that even low-levels of exposure to perchlorate may pose serious risks to infants and fetuses of pregnant women.

EPA Has Established a Standard for TCE and Knowledge is Evolving

We provided details about EPA's evolving standards for TCE and the evolving knowledge of its health effects in our May 2007 report and June 2007 testimony on issues related to drinking water contamination on Camp Lejeune. TCE is a colorless liquid with a sweet, chloroform-like odor that is used mainly as a degreaser for metal parts. The compound is also a component in adhesives, lubricants, paints, varnishes, paint strippers, and pesticides. At one time, TCE was used as an extraction solvent for

cosmetics and drug products and as a dry-cleaning agent; however, its use for these purposes has been discontinued. DOD has used the chemical in a wide variety of industrial and maintenance processes. More recently, the department has used TCE to clean sensitive computer circuit boards in military equipment such as tanks and fixed wing aircraft.

Because TCE is pervasive in the environment, most people are likely to be exposed to TCE by simply eating, drinking, and breathing, according to the Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR). Industrial wastewater is the primary source of release of TCE into water systems, but inhalation is the main route of potential environmental exposure to TCE. ATSDR has also reported that TCE has been found in a variety of foods, with the highest levels in meats, at 12 to 16 ppb, and U.S. margarine, at 440 to 3,600 ppb. In fact, HHS's National Health and Nutrition Examination Survey (NHANES) suggested that approximately 10 percent of the population had detectable levels of TCE in their blood.

Inhaling small amounts of TCE may cause headaches, lung irritation, poor coordination, and difficulty concentrating, according ATSDR's Toxicological Profile. Inhaling or drinking liquids containing high levels of TCE may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, or possibly death. ATSDR also notes that some animal studies suggest that high levels of TCE may cause liver, kidney, or lung cancer, and some studies of people exposed over long periods to high levels of TCE in drinking water or workplace air have shown an increased risk of cancer. ATSDR's Toxicological Profile notes that the National Toxicology Program has determined that TCE is "reasonably anticipated to be a human carcinogen" and the International Agency for Research on Cancer has determined that TCE is probably carcinogenic to humans—specifically, kidney, liver and cervical cancers, Hodgkin's disease, and non-Hodgkin's lymphoma—based on limited evidence of carcinogenicity in humans and additional evidence from studies in experimental animals.

Effective in 1989, EPA adopted an MCL of 5 ppb of TCE in drinking water supplies pursuant to the Safe Drinking Water Act.[6] Despite EPA's regulation of TCE as a drinking water contaminant, concerns over serious long-term effects associated with TCE exposures have prompted additional scrutiny by both governmental and nongovernmental scientific organizations. For example, ATSDR initiated a public health assessment in 1991 to evaluate the possible health risks from exposure to contaminated drinking water on Camp Lejeune. The health concerns over TCE have been further amplified in recent years after scientific studies have suggested additional risks posed by human exposure to TCE. ATSDR is continuing to develop information about the possible long-term health consequences of these potential exposures in a subregistry to the National Exposure Registry specifically for hazardous waste sites.

As we previously reported with respect to Camp Lejeune, those who lived on base likely had a higher risk of inhalation exposure to volatile organic compounds such as TCE, which may be more potent than ingestion exposure. Thus, pregnant women who lived in areas of base housing with contaminated water and conducted activities during which they could inhale water vapor—such as bathing, showering, or washing dishes or clothing—likely faced greater exposure than those who did not live on base but worked on base in areas served by the contaminated drinking water.

Concerns about possible adverse health effects and government actions related to the past drinking water contamination on Camp Lejeune have led to additional activities, including new health studies, claims against the federal government, and federal inquiries. As a consequence of these growing concerns—and of anxiety among affected communities about these health effects and related litigation—ATSDR has undertaken a study to examine whether individuals who were exposed in utero to the contaminated drinking water are more likely to have developed certain childhood cancers or birth defects. This research, once completed later in

[6]For contaminants that are known or anticipated to occur in public water systems and that the EPA Administrator determines may have an adverse impact on health, the act requires EPA to set a nonenforceable maximum contaminant level goal (MCLG) at which no known or anticipated adverse health effects occur and that allows an adequate margin of safety. Once the MCLG is established, EPA may set an enforceable standard for water as it leaves the treatment plant, the maximum contaminant level (MCL). The MCL generally must be set as close to the MCLG as is feasible using the best technology or other means available, taking costs into consideration.

2007, is expected to help regulators understand the effects of low levels of TCE in our environment.

In addition, some former residents of Camp Lejeune have filed tort claims and lawsuits against the federal government related to the past drinking water contamination. As of June 2007, about 850 former residents and former employees had filed tort claims with the Department of the Navy related to the past drinking water contamination. According to an official with the U.S. Navy Judge Advocate General—which is handling the claims on behalf of the Department of the Navy—the agency is currently maintaining a database of all claims filed. The official said that the Judge Advocate General is awaiting completion of the latest ATSDR health study before deciding whether to settle or deny the pending claims in order to base its response on as much objective scientific and medical information as possible. According to DOD, any future reassessment of TCE toxicity may result in additional reviews of DOD sites that utilized the former TCE toxicity values, as the action levels for TCE cleanup in the environment may change.

EPA Has Not Established a Standard for Perchlorate

As we discussed in our May 2005 report and April 2007 testimony, EPA has not established a standard for limiting perchlorate concentrations in drinking water under the SDWA. Perchlorate has emerged as a matter of concern because recent studies have shown that it can affect the thyroid gland, which helps to regulate the body's metabolism and may cause developmental impairments in the fetuses of pregnant women. Perchlorate is a primary ingredient in propellant and has been used for decades by the Department of Defense, the National Aeronautics and Space Administration, and the defense industry in manufacturing, testing, and firing missiles and rockets. Other uses include fireworks, fertilizers, and explosives. It is readily dissolved and transported in water and has been found in groundwater, surface water, drinking water, and soil across the country. The sources of perchlorate vary, but the defense and aerospace industries are the greatest known source of contamination.

Scientific information on perchlorate was limited until 1997, when a better detection method became available for perchlorate, and detections (and concern about perchlorate contamination) increased. In 1998, EPA first placed perchlorate on its Contaminant Candidate List, the list of contaminants that are candidates for regulation, but the agency concluded

that information was insufficient to determine whether perchlorate should be regulated under the SDWA.[7] EPA listed perchlorate as a priority for further research on health effects and treatment technologies and for collecting occurrence data. In 1999, EPA required water systems to monitor for perchlorate under the Unregulated Contaminant Monitoring Rule to determine the frequency and levels at which it is present in public water supplies nationwide.[8]

Interagency disagreements over the risks of perchlorate exposure led several federal agencies to ask the National Research Council (NRC) of the National Academy of Sciences to evaluate perchlorate's health effects. In 2005, NRC issued a comprehensive review of the health effects of perchlorate ingestion, and it reported that certain levels of exposure may not adversely affect healthy adults. However, the NRC-recommended more studies on the effects of perchlorate exposure in children and pregnant women and recommended a reference dose of 0.0007 milligrams per kilogram per day. In 2005, the EPA adopted the NRC recommended reference dose, which translates to a drinking water equivalent level (DWEL) of 24.5 ppb. If the EPA were to develop a drinking water standard for perchlorate, it would adjust the DWEL to account for other sources of exposure, such as food.

Although EPA has taken some steps to consider a standard, in April 2007 EPA again decided not to regulate perchlorate—citing the need for additional research—and kept perchlorate on its Contaminant Candidate List. Several human studies have shown that thyroid changes occur in human adults at significantly higher concentrations than the amounts typically observed in water supplies. However, more recent studies have since provided new knowledge and raised concerns about potential health risks of low-level exposures, particularly for infants and fetuses. Specifically, in October 2006, researchers from the Centers for Disease Control and Prevention (CDC) published the results of the first large study

[7]Under the Safe Drinking Water Act, EPA's determination to regulate a contaminant must be based on findings that: (a) the contaminant may have an adverse effect on the health of persons; (b) the contaminant is known to occur or there is a substantial likelihood that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and (c) in the sole judgment of the Administrator, regulation of such contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems.

[8]EPA recently determined that it had collected sufficient data and that further monitoring was not needed, 72 *Fed. Reg.* 374, January 4, 2007.

to examine the relationship between low-level perchlorate exposure and thyroid function in women with lower iodine levels. About 36 percent of U.S. women have these lower iodine levels. The study found decreases in a thyroid hormone that helps regulate the body's metabolism and is needed for proper fetal neural development.

Moreover, in May 2007, FDA released a preliminary exposure assessment because of significant public interest in the issue of perchlorate exposure from food. FDA sampled and tested foods such as tomatoes, carrots, spinach, and cantaloupe; and other high water content foods such as apple and orange juices; vegetables such as cucumbers, green beans, and greens; and seafood such as fish and shrimp for perchlorate and found widespread low-level perchlorate levels in these items. FDA is also planning to publish, in late 2007, an assessment of exposure to perchlorate from foods, based on results from its fiscal year 2005-2006 Total Diet Study—a market basket study that is representative of the U.S. diet.

Some federal funding has been directed to perchlorate studies and cleanup activities. For example, committee reports related to the DOD and EPA appropriations acts of fiscal year 2006 directed some funding for perchlorate cleanup. In the Senate committee report for the Department of Health and Human Services fiscal year 2006 appropriations act, the committee encouraged support for studies on the long-term effects of perchlorate exposure. The Senate committee report for FDA's fiscal year 2006 appropriations act directed FDA to continue conducting surveys of perchlorate in food and bottled water and to report the findings to Congress. In the current Congress, legislation has been introduced that would require EPA to establish a health advisory for perchlorate, as well as requiring public water systems serving more than 10,000 people to test for perchlorate and disclose its presence in annual consumer confidence reports.[9] Other pending legislation would require EPA to establish a national primary drinking water standard for perchlorate.[10]

[9]S. 24.

[10]S. 150 and H.R. 1747. A national primary drinking water standard is a legally enforceable standard that applies to public water systems. It sets an MCL or specifies a certain treatment technique for public water systems for a specific contaminant or group of contaminants.

DOD's Responsibilities to Address Perchlorate and Other Emerging Contaminants Where Federal Regulatory Standards Do Not Exist

DOD has certain responsibilities with regard to emerging contaminants such as TCE that are regulated by EPA or state governments, but its responsibilities and cleanup goals are less definite for emerging contaminants such as perchlorate that lack federal regulatory standards. As we have previously reported, DOD must comply with any cleanup standards and processes under all applicable environmental laws, regulations, and executive orders, including the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act's National Pollutant Discharge Elimination System (NPDES), and the SDWA. DOD's designation of perchlorate as an emerging contaminant reflects the department's recognition that the chemical has a significant potential impact on people or the Department's mission. DOD's recognition of a substance as an emerging contaminant can lead DOD to decide to take to certain cleanup efforts even in the absence of a federal regulatory standard. In addition, federal laws enacted in fiscal years 2004 and 2005 required DOD to conduct health studies and evaluate perchlorate found at military sites. For example, the Ronald W. Reagan National Defense Authorization Act for fiscal year 2005 stated that the Secretary of Defense should develop a plan for cleaning up perchlorate resulting from DOD activities when the perchlorate poses a health hazard and continue evaluating identified sites.[11]

As we reported in our 2005 perchlorate report, DOD has sometimes responded at the request of EPA and state environmental authorities—which have used a patchwork of statutes, regulations, and general oversight authorities—to act (or require others, including DOD, to act) when perchlorate was deemed to pose a threat to human health and the environment. For example, pursuant to its authority under the Clean Water Act's NPDES program, Texas required the Navy to reduce perchlorate levels in wastewater discharges at the McGregor Naval Weapons Industrial Reserve Plant to 4 parts per billion, the lowest level at which perchlorate could be detected. Similarly, after sampling required as part of a RCRA permit detected perchlorate, Utah officials required ATK Thiokol, an explosives and rocket fuel manufacturer, to install a monitoring well to determine the extent of perchlorate contamination at their facility and take steps to prevent additional releases of perchlorate.

[11]Pub. L. No. 108-375, § 318, 118 Stat. 1811, 1845 (2004).

In addition, EPA and state officials also told us during our 2005 review that they have sometimes used their general oversight responsibilities to protect water quality and human health to investigate and sample groundwater and surface water areas for perchlorate. For example, EPA asked Patrick Air Force Base and the Cape Canaveral Air Force Station, Florida, to sample groundwater for perchlorate near rocket launch sites. Previously, both installations had inventoried areas where perchlorate was suspected and conducted limited sampling. DOD officials did not find perchlorate at Patrick Air Force Base and, according to an EPA official, the Department of the Air Force said it would not conduct additional sampling at either installation until there was a federal standard for perchlorate.

Finally, according to EPA, in the absence of a federal perchlorate standard, at least eight states have established nonregulatory action levels or advisories for perchlorate ranging from 1 part per billion to 51 parts per billion. (See table 1.) Massachusetts is the only state to have established a drinking water standard—set at 2 ppb. The California Department of Health Services reports that California will complete the rulemaking for its proposed standard of 6 ppb later this year.[12]

Table 1: States That Have Established Nonregulatory Perchlorate Levels

State	Level (ppb)	Type of Level
Arizona	14	guidance
California	6	notification level
Maryland	1	advisory level
Nevada	18	public notice standard
New Mexico	1	drinking water screening level
Oregon	18	action level
New York	5	drinking water planning level
	18	public notification level
Texas	17	residential protective cleanup level (PCL)
	51	industrial/commercial PCL

Source: EPA and state documents.

[12]In September 2006, the California Department of Health Services (CDHS) proposed a primary drinking water standard (in this case a maximum contaminant level, MCL) of 6 ppb for perchlorate. CDHS reports that the completed rulemaking will be submitted to the Office of Administrative Law by August 31, 2007.

States have used these thresholds to identify the level at which some specified action must be taken by DOD and other facilities in their state, in the absence of a federal standard. For example, Oregon initiated in-depth site studies to determine the cause and extent of perchlorate contamination when concentrations of 18 ppb or greater are found. Nevada required the Kerr-McGee Chemical site in Henderson to treat groundwater and reduce perchlorate concentration releases to 18 ppb, which is Nevada's action level for perchlorate. Utah officials told us that while the state did not have a written action level for perchlorate, it may require the responsible party to undertake cleanup activities if perchlorate concentrations exceed 18 ppb.[13]

DOD Is Taking Several Actions to Address TCE, Perchlorate, and Other Emerging Contaminants

DOD is undertaking a number of activities to address emerging contaminants in general, including the creation of the Materials of Evolving Regulatory Interest Team (MERIT) to systematically address the health, environmental, and safety concerns associated with emerging contaminants. As noted above, DOD is required to follow EPA regulations for monitoring and cleanup of TCE. In addition, DOD is working with ATSDR, which has projected a December 2007 completion date for its current study of TCE's health effects on pregnant women and their children. In the absence of a federal standard, DOD has adopted its own perchlorate policies for sampling and cleanup activities or is working under applicable state guidelines.

DOD Recently Has Established a Mechanism for Addressing Emerging Contaminants

DOD created MERIT to help address the health, environmental, and safety concerns associated with emerging contaminants. According to DOD, MERIT has focused on materials that have been or are used by DOD, or are under development for use, such as perchlorate, TCE, RDX, DNT and new explosives, naphthalene, perfluorooctanoic acid (PFOA), hexavalent chromium (i.e., chromium VI), beryllium, and nanomaterials. MERIT's initiatives include pollution prevention, detection/analytical methods, human health studies, treatment technologies, lifecycle cost analysis, risk assessment and risk management, and public outreach. Another of MERIT's activities was to create an Emerging Contaminant Action List of materials that DOD has assessed and judged to have a significant potential

[13]According to state and EPA officials, in instances where perchlorate was found, state agencies have sometimes taken steps to minimize human exposure or perform cleanup, or required responsible private parties to do so.

impact on people or DOD's mission. The current list includes five contaminants—perchlorate, TCE, RDX, naphthalene, and hexavalent chromium. To be placed on the action list, the contaminant will generally have been assessed by MERIT for its impacts on (1) environment, safety, and health (including occupational and public health), (2) cleanup efforts, (3) readiness and training, (4) acquisition, and (5) operation and maintenance activities.

DOD is Taking Actions to Address TCE

In 1979, EPA issued nonenforceable guidance establishing "suggested no adverse response levels" for TCE in drinking water. These levels provided EPA's estimate of the short- and long-term exposure to TCE in drinking water for which no adverse response would be observed and described the known information about possible health risks for these chemicals. However, the guidance for TCE did not suggest actions that public water systems should take if TCE concentrations exceeded those values. Subsequently, in 1989, EPA set an enforceable MCL for TCE of 5 micrograms per liter, equivalent to 5 ppb in drinking water.

The new standard served as a regulatory basis for many facilities to take concrete action to measure and control TCE. According to EPA's Region 4 Superfund Director, for example, 46 sites on Camp Lejeune have since been identified for TCE cleanup. The Navy and EPA have selected remedies for 30 of those sites, and the remaining 16 are under active investigation. The first Record of Decision was signed in September 1992 and addressed contamination of groundwater in the Hadnot Point Area, one of Camp Lejeune's water systems. Remedies to address groundwater contamination include groundwater "pump and treat" systems, in-situ chemical oxidation, and monitored natural attenuation.[14]

DOD contends that it is aggressively treating TCE as part of its current cleanup program. It notes that the department uses much less TCE than in the past and requires strict handling procedures and pollution prevention measures to prevent exposure to TCE and the release of TCE into the environment. Specifically, DOD has replaced products containing TCE with other types of cleaning agents such as citrus-based agents, mineral oils and other non-toxic solutions.

[14]Statement of Franklin Hill, Director of Region 4 Superfund Division, U.S. Environmental Protection Agency, Before the Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, U.S. House of Representatives (June 12, 2007).

DOD is Sampling For Perchlorate and Taking Cleanup Actions Under Certain Conditions

In the absence of a federal perchlorate standard, DOD has adopted its own policies with regard to sampling and cleanup. The 2003 *Interim Policy on Perchlorate Sampling* required the military services—Army, Navy, Air Force, and Marines—to sample on active installations (1) where a reasonable basis existed to suspect that a perchlorate release occurred as a result of DOD activities, and (2) a complete human exposure pathway likely existed or (3) where a particular installation must do so under state laws or applicable federal regulations such as the NPDES permit program. However, DOD's interim policy on perchlorate did not address cleanup responsibilities nor did it address contamination at closed installations.

As we detailed in our previous work, DOD only sampled for perchlorate on closed installations when requested by EPA or a state agency, and only cleaned up active and closed installations when required by a specific environmental law, regulation, or program such as the environmental restoration program at formerly used defense sites. For example, at EPA's request, the U.S. Army Corps of Engineers (Corps) installed monitoring wells and sampled for perchlorate at Camp Bonneville, a closed installation near Vancouver, Washington. Utah state officials also reported to us that DOD removed soil containing perchlorate at the former Wendover Air Force Base in Utah, where the Corps found perchlorate in 2004. However, as we previously reported, DOD cited reluctance to sample on or near active installations because of the lack of a federal regulatory standard for perchlorate.

In the absence of a federal standard, DOD has also worked with individual states on perchlorate sampling and cleanup. For example, in October 2004, DOD and California agreed to prioritize perchlorate sampling at DOD facilities in California, including identifying and prioritizing the investigation of areas on active installations and military sites (1) where the presence of perchlorate is likely based on previous and current defense-related activities and (2) near drinking water sources where perchlorate was found.

In January 2006, DOD updated its policy with the issuance of its *Policy on DOD Required Actions Related to Perchlorate*. The new policy applies broadly to DOD's active and closed installations and formerly used defense sites within the United States, its territories and possessions. It directs DOD to test for perchlorate and take certain cleanup actions. The policy also acknowledges the importance of EPA direction in driving DOD's response to emerging contaminants. It stated, for example, that its adoption of 24 ppb as the current level of concern for managing perchlorate was in response to EPA's adoption of an oral reference dose

that translates to a Drinking Water Equivalent Level of 24.5 ppb. The policy also states that when EPA or the states adopt standards for perchlorate, "DOD will comply with applicable state or federal promulgated standards whichever is more stringent."

The 2006 policy directs DOD to test for perchlorate when it is reasonably expected that a release has occurred. If perchlorate levels exceed 24 ppb, a site-specific risk assessment must be conducted. When an assessment indicates that the perchlorate contamination could result in adverse health effects, the site must be prioritized for risk management.[15] DOD uses a relative-risk site evaluation framework across DOD to evaluate the risks posed by one site relative to other sites and to help prioritize environmental restoration work and to allocate resources among sites. The policy also directs DOD's service components to program resources to address perchlorate contamination under four DOD programs—environmental restoration, operational ranges, DOD-owned drinking water systems, and DOD wastewater effluent discharges.

Under the 2006 perchlorate policy, DOD has sampled drinking water, groundwater, and soil where the release of perchlorate may result in human exposure and responded where it has deemed appropriate to protect public health. As we have reported, DOD is responsible for a large number of identified sites with perchlorate contamination, and the department has allotted significant resources to address the problem. According to DOD, sampling for perchlorate has occurred at 258 active DOD installations or facilities. Through fiscal year 2006, DOD reported spending approximately $88 million on perchlorate-related research activities, including $60 million for perchlorate treatment technologies, $9.5 million on health and toxicity studies, and $11.6 million on pollution prevention. Additional funds have been spent on testing technology and cleanup. DOD also claims credit for other efforts, including strict handling procedures to prevent the release of perchlorate into the environment and providing information about perchlorate at DOD facilities and DOD's responses. For example, DOD posts the results of its perchlorate sampling, by state, on MERIT's Web site.[16]

[15]DOD's perchlorate website has additional information regarding policy and guidance, http://www.denix.osd.mil/denix/Public/Library/MERIT/Perchlorate/efforts/policy/index.html.

[16]See https://www.denix.osd.mil/denix/Public/Library/MERIT/Perchlorate/index.html.

As we have previously reported, DOD must comply with cleanup standards and processes under applicable laws, regulations and executive orders, including EPA drinking water standards and state-level standards. In the absence of a federal perchlorate standard, DOD has also initiated perchlorate response actions to clean up perchlorate contamination at several active and formerly used defense sites under its current perchlorate policy. For example, at Edwards Air Force Base in California, DOD has treated 32 million gallons of ground water under a pilot project for contaminants that include perchlorate. In addition, DOD has removed soil and treated groundwater at the Massachusetts Military Reservation and Camp Bonneville in Washington State.

In conclusion, Mr. Chairman, DOD faces significant challenges, and potentially large costs, in addressing emerging contaminants, particularly in light of the scientific developments and regulatory uncertainties surrounding these chemicals and materials. To help address them, DOD recently identified five emerging contaminants for which it is developing risk management options. As in the case of TCE, DOD took action to address contamination after EPA established an MCL in 1989. DOD has stated that further efforts to address perchlorate would require a regulatory standard from EPA and/or the states. The fact that some states have moved to create such standards complicates the issue for DOD by presenting it with varying cleanup standards across the country.

As the debate over a federal perchlorate standard continues, the recently-issued health studies from CDC and FDA may provide additional weight to the view that the time for such a standard may be approaching. Until one is adopted, DOD will continue to face the challenges of differing regulatory requirements in different states and continuing questions about whether its efforts to control perchlorate contamination are necessary or sufficient to protect human health.

Mr. Chairman, this concludes my prepared statement. I would be happy to respond to any questions that you or Members of the Subcommittee may have at this time.

Contacts and Acknowledgements

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Marc Castellano, Richard Johnson, and Alison O'Neill also made key contributions.

Appendix I: Selected GAO Reports on Defense-related Hazardous Waste Issues

Defense Health Care: Issues Related To Past Drinking Water Contamination at Marine Corps Base Camp Lejeune, GAO-07-933T (June 12, 2007).

Defense Health Care: Activities Related To Past Drinking Water Contamination at Marine Corps Base Camp Lejeune, GAO-07-276 (May 11, 2007).

Perchlorate: EPA Does Not Systematically Track Incidents of Contamination, GAO-07-797T (April 25, 2007).

Environmental Information: EPA Actions Could Reduce the Availability Of Environmental Information To The Public, GAO-07-464T (February 6, 2007).

Military Base Closures: Opportunities Exist to Improve Environmental Cleanup Cost Reporting and to Expedite Transfer of Unneeded Property, GAO-07-166 (January 30, 2007).

Perchlorate: A System to Track Sampling and Cleanup Results Is Needed, GAO-05-462 (May 20, 2005).

Military Base Closures: Updated Status of Prior Base Realignments and Closures, GAO-05-138 (January 13, 2005).

Environmental Contamination: DOD Has Taken Steps To Improve Cleanup Coordination At Former Defense Sites But Clearer Guidance Is Needed To Ensure Consistency, GAO-03-146 (March 28, 2003).

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