STUDY PROJECT

EFFECTIVE HAZARDOUS WASTE MANAGEMENT: THE NEWEST DOD CHALLENGE

BY

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Handlirg environmental matters effectively is the most difficult challenge facing the Department of Defense (DOD) in the years ahead. After a history of disregard and apathy for environmental concerns, the military community has begun to reduce and eliminate environmental pollutants. Although DOD is making progress on many environmental issues, hazardous waste management still poses the greatest challenge. In order to reduce subsequent hazardous waste disposal costs and avoid potential cleanup problems, DOD, Defense Logistics Agency (DLA) and installations must provide a coordinated approach to hazardous waste management and minimization. To accomplish this, the author provides specific recommendations: 1. Characterize hazardous waste accurately. 2. Dispose of hazardous waste only through reputable firms. 3. Eliminate bureaucratic hindrances to environmental compliance. 4. Train to specific tasks. 5. Increase environmental staffing and funding. 6. Interface actively with regulators. Implementation of the aforementioned recommendations will subsequently enhance DOD's efforts to achieve its long range environmental goals.

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EFFECTIVE HAZARDOUS WASTE MANAGEMENT: THE NEWEST DOD CHALLENGE

AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

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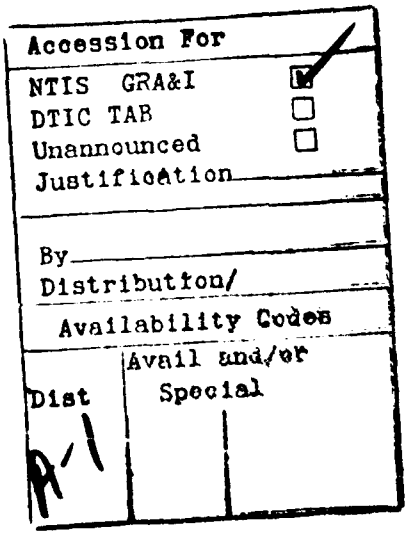
Handling environmental matters effectively is the most difficult challenge facing the Department of Defense (DOD) in the years ahead. After a history of disregard and apathy for environmental concerns, the military community has begun to reduce and eliminate environmental pollutants. Although DOD is making progress on many environmental issues, hazardous waste management still poses the greatest challenge. In order to reduce subsequent hazardous waste disposal costs and avoid potential cleanup problems, DOD, Defense Logistics Agency (DLA) and installations must provide a coordinated approach to hazardous waste management and minimization. To accomplish this, the author provides specific recommendations: 1. Characterize hazardous waste accurately. 2. Dispose of hazardous waste only through reputable firms. 3. Eliminate bureaucratic hinderances to environmental compliance. 4. Train to specific tasks. 5. Increase environmental staffing and funding. 6. Interface actively with regulators. Implementation of the aforementioned recommendations will subsequently enhance DOD's efforts to achieve its long range environmental goals.



EFFECTIVE HAZARDOUS WASTE MANAGEMENT: THE NEWEST DOD CHALLENGE

Americans are now beginning to perceive the environmental impacts of the Cold War.[1] In 1989, Americans ranked global environmental issues first among potential threats to national security.[2] In an April 1990 New York Times/CBS News poll, seventy-four percent of Americans said that protection of the environment is so important that we should make greater efforts to clean up and preserve the environment, regardless of the cost. In addition, fifty-six percent of the working class indicated greater concern for their communities' environment than concern for keeping their jobs.[3] Unfortunately, the United States Armed Forces must share a large part of the blame for worldwide environmental problems which will remain for years to come.[4] According to U.S. Government officials, the total cost of bringing military facilities into compliance with environmental laws could exceed an estimated $150 billion.[5]

In the 1970s and 1980s, while civilian industries and municipalities were being forced to plan for and adjust to new environmental standards, DOD largely ignored these laws and remained focused on its military mission. But with the growing demand today that federal installations clean up pollution, DOD leaders can no longer overlook environmental problems.[6] The time has come for DOD to cooperate fully with the environmentalists. Otherwise, DOD may lose in confrontations with federal environmental enforcers. Of course, playing this "catch up" game will strain military budgets. It will require

the Pentagon to set aside billions in cleanup funds which otherwise could be spent to achieve additional strategic goals.[7] But now, the war to improve and preserve the world environment is every bit as essential as the Cold War once was.

The military's current environmental crisis can be largely attributed to a history of disregard for and apathy toward environmental considerations and neglect and failure to place a fiscal priority upon environmental programs. As DOD begins the 1990s, it will be faced with substantial challenges to improve and maintain environmental quality. These improvements will be slow and expensive.

America's environmental movement began in 1962 when Rachel Carson published Silent Spring, a book which awakened the environmental spirit in the U.S. Nonetheless, the ensuing legislation was virtually ignored by DOD until recently. The National Environmental Policy Act (NEPA) of 1969 was landmark environmental legislation. This act requires that public officials consider environmental consequences when formulating policies which in any way may impact upon the environment. NEPA stipulates that environmental considerations must share the stage with other national goals.

Since the 1970's, Congress has enacted more than two dozen laws to deal with the problems of hazardous material and waste, along with air and water pollution. The major statutes governing management of hazardous waste and enforcement of cleanup requirements at hazardous waste sites are the Resource Conservation and Recovery Act (RCRA) of 1976 and the

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. RCRA regulates hazardous waste generation, treatment, shipment, storage and disposal from "cradle to grave." CERCLA, also known as Superfund, encompasses the cleanup of abandoned or inactive hazardous material disposal sites and the release of hazardous materials into the environment from any source. The Hazardous and Solid Waste Amendments (HSWA) of 1984 and the Superfund Amendments and Reauthorization Act (SARA) of 1986 were later enacted to strengthen and expand the scope of the provisions of RCRA and CERCLA.[8]

The Pentagon's own version of the Superfund, the Defense Environmental Restoration Program (DERP), was established at least in part to circumvent interference by outside agencies at some sensitive military installations. To date the program has identified 8,000 sites of potential contamination at 900 installations.[9] So far, DOD reports only 287 sites have actually been cleaned up, although action is planned or has begun at another 905.[10] Since the Environmental Protection Agency's (EPA) Superfund list must now include military facilities, the list will certainly grow. National Priority List (NPL) sites are those designated under the 1980 Superfund Act as posing the greatest risk to human health and the environment. Currently, 59 of the 78 federal sites that the EPA has placed on its NPL are DOD facilities; another 400 sites remain under consideration.[11]

If DOD felt it could somehow steer clear of the energetic environmental movements in America, the indictments and subsequent convictions of three civilian managers at Aberdeen

Proving Ground in 1988 proved otherwise. These convictions sent shock waves throughout the military community, which had until that time claimed immunity to such prosecutions. The Aberdeen Case made one thing clear: There is no way for DOD to avoid responsibility for its environmental problems.[12] In addition, the trial illustrated that in the future, legal actions involving environmental violations will be taken against individuals, not organizations.

Sensitivity to this crisis and concerns for change are now being displayed at the highest levels of government. During the 1988 presidential campaign, President Bush said "in the future federal facilities will meet or exceed environmental standards."[13] So far, the President's verbal commitment and the repercussions of the Aberdeen Case have been the catalyst for DOD to change its attitude toward environmental problems and the methods it uses to control them. After years of neglect, President Bush has reversed the downward trend and returned environmental policy to center stage.[14]

In the Report of the Secretary of Defense to the President and Congress, Secretary of Defense Cheney stated that one of DOD's specific environmental goals is to "minimize pollutants from installations and operations worldwide." DOD is making progress in treating sewage and industrial waste, providing safe drinking water, ensuring safe use of pesticides and managing wetlands and natural resources. The most pressing environmental problem now facing DOD is hazardous waste management.

RCRA hazardous waste is material listed specifically in Title 40, Code of Federal Regulations (CFR), by name or process, and it is material possessing characteristics of ignitability, corrosiveness, reactivity or TCLP (toxicity characteristic leaching procedure) toxicity which can no longer be used for its intended purpose.[15] DOD has 1,579 facilities that generate and dispose of hazardous waste and 14,401 hazardous waste sites. The largest hazardous waste generators are depots and government-owned contractor-operated (GOCO) facilities; they account for approximately 80% of all hazardous material used by DOD.[16] These installations generate a variety of hazardous wastes (contaminated sludges, spent solvents, battery acid, paint strippers and thinners) primarily through industrial operations and equipment repair. Generated waste also includes outdated and unserviceable petroleum, oil and lubricant (POL) products, chemical decontamination agents and medical supplies. In addition, waste generated at ammunition plants and proving grounds has caused some of the most severe pollution problems.[17] DOD estimates that the military annually produces between 400,000 and 750,000 tons of hazardous waste--more than the top five civilian chemical companies combined.[18&19]

Although the federal government owns a relatively small proportion of all hazardous waste sites. these federal sites contain some of the nation's most extensive hazardous waste contamination. Since 1943, Rocky Mountain Arsenal (RMA)--near Denver, Colorado--has manufactured, tested and destroyed chemical weapons and high explosives. RMA's severe contamination problems

give it the dubious first ranking among DOD's NPL sites that pose the greatest threat to the environment. Government officials have described the center of the arsenal as the "most polluted square mile on earth." Although off-site environmental contamination from the arsenal was noted as early as 1951, cleanup was delayed for 37 years. Cleaning up just one basin of the 165 contaminated sites has already cost $40 million, and the estimated total cleanup cost is between $3 and 6 billion.[20]

The costs of cleanup remain with the military even when bases are closed. DOD maintains responsibility for environmental restoration, so it is just a question of when the costs will be incurred.[21] For over 50 years, Jefferson Proving Ground (JPG) in Madison, Indiana, has been the Army's ammunition testing site for machine guns, artillery, tanks and other weapons. As a result, JPG's 52,000 acres are literally covered with duds, some of which contain uranium dust that will decompose into radon gas. The cost of closing and cleaning JPG could be as high as 5 billion dollars, which could greatly exceed the anticipated six-year savings of $694 million dollars from 85 base closures. According to the General Accounting Office (GAO), the costs of closing JPG could take 200 years to recover.[22]

DOD environmental compliance is thus extremely costly. Over $650 million has been spent through FY 89 for investigations and remedial actions from the DOD Environmental Restoration Account alone. Last summer, the Armed Services Committee allocated an additional $82 million to DOD's 1991 budget specifically for cleaning up military bases slated for closed.[23] But as

previously noted, responsibility for hazardous waste does not end when DOD relinquishes control of facilities. DOD is responsible for more than 7,000 hazardous waste sites that it no longer owns.[24] Under current laws, DOD remains liable, regardless of the particular regulations and technologies available at the time of contamination. It makes no difference that substances generated in past years were thought to be harmless and have subsequently been identified through new criteria as being hazardous. It does not matter that present laws are much more restrictive.

As of 1 October 1989, installations must pay for hazardous waste disposal costs from Operations and Maintenance accounts. As a result, failure to reduce hazardous waste generation can adversely impact upon operational readiness and training of personnel. The Congress, EPA and DOD have increasingly focused on the need for minimizing hazardous waste generation. Sharply rising hazardous waste disposal costs and shrinking landfill capacity offer compelling reasons for examining present waste management practices and development of viable alternatives.

Adequate funding for critical DOD environmental programs is in question now that it seems the Pentagon's budget will be slashed by billions in the 1990s. Undoubtedly, handling environmental matters effectively is the most difficult challenge facing DOD in the coming months and years. Complicating the issue could be the untold costs incurred by environmental pollution in the Middle East and environmental requirements for closure of overseas military facilities. The dollars spent for

environmental compliance and restoration will have a serious impact upon future strategic planning. The expenditures for environmental restoration and protection will continue to comprise larger portions of the national budget. "Environmental defense may eventually overtake the national and global defense shares of the resource pie. It depends on which becomes the more life-threatening."[25]

DOD leadership, sensistive to the need to meet environmental challenges, is now beginning to successfully and cost-effectively protect, preserve and restore environmental quality. In order to do so, DOD has begun to redirect the focus of environmental protection toward the source of the problem, waste generation, instead of relying on the traditionally focused environmental system which controlled pollution through effluent limitations and disposal restrictions. In the past, this "end of pipeline strategy" left many environmental issues unresolved. The new focus on pollution prevention is the most direct route to achieve comprehensive environmental protection.[26]

On April 20, 1990, DOD and EPA signed a Cooperative Agreement to develop a "pollution prevention model community plan." Three military installations along the Chesapeake Bay--Langley Air Force Base, Fort Eustis and Norfolk Naval Base--will participate in this joint endeavor to develop pollution prevention techniques. All operations at these facilities will be evaluated to see how or if they pollute the air, land or water. Various initiatives will be undertaken, such as use of alternative fuels in fleet vehicles and enhanced recycling programs. Such

strategies may prove beneficial to both DOD and EPA. EPA will have greater flexibility within this program to develop strategies which can later be implemented in the private sector.[27] Through the development of a comprehensive environmental policy and implementation of its environmental program, DOD can emphasize environmental compliance and prevention of pollution, especially of hazardous waste.

In 1980, the Office of the Secretary of Defense assigned the current worldwide mission for the management of hazardous material and hazardous waste to the Defense Logistics Agency (DLA). Since that time, the volume of hazardous material and hazardous waste has steadily increased--an 11% increase during the past four years.[28] DLA's management of hazardous material and hazardous waste has come increasingly under fire as a result of critical press reports, increased court cases and criticism by DOD agencies who have been forced to use DLA's services for hazardous waste disposal. Chairman Ray of the House Armed Services Committee's Environmental Restoration Panel stated in a hearing conducted in April 1990 that "he had information on approximately 20 pending court cases associated with DLA sales of hazardous material."[29]

Problems exist in the disposal of hazardous waste as well. The DOD IG has found that DOD hazardous waste generators do not adequately identify waste for disposal. Begining in May 1990, DLA began to require a waste profile sheet with their receipt of hazardous waste, but previously a hazardous waste generator could

simply verify composition by "knowledge of content." One can only speculate about how much misidentified waste has been disposed of through the years.

Contractural restrictions and failures to conduct environmental audits of potential disposal sites have increased DOD's future liability for cleanup. Contracts set aside for small businesses to the exclusion of nationwide reputable hazardous waste management firms have set a dangerous precedent and could result in continued mismanagement. DLA contracts mostly with companies which broker waste to third parties. Thus, the practice of almost automatically granting contracts to the lowest bidder has created a situation where control over liability and waste tracking is very difficult. Here, penny-wisdom could prove to be really dollars-foolish.

Since 1985, DLA has conducted on-site audits of only 25 of the 150 approved disposal sites.[30] Because of the "cradle to grave" liability incurred by generators of hazardous waste, the risk is just too great to continue to send waste to these disposal sites before conducting thorough inspections. Commanders are justified in feeling very uneasy about possible liability.

DOD generating activities often perceive DLA's hazardous material/hazardous waste management system as burdensome and complicated. The system seems to emphasize adherence to bureaucratic turn-in procedures, rather than to effective and safe redistribution and disposal options. This encourages units to improperly dispose of materials in order to avoid such

hassles. Installations have the option to independently contract for waste disposal pursuant to a memorandum of 9 August 1989 from the Office of the Assistant Secretary of Defense, Production and Logistics. However, to date few have done so, probably because they too would be bound by similar contractural restrictions and lack the staff to oversee such disposal. In addition, because DLA facilities are usually the designated hazardous waste storage sites for installations, the installations have no area to accumulate and store hazardous waste past 90 days without violation of hazardous waste storage regulations.

The most effective means of managing hazardous waste at installation level is through controlling the source. To achieve this goal, DOD is working to reduce the use of hazardous materials and avoid the generation of hazardous waste as part of an on-going requirement to achieve a 50% reduction in hazardous waste generation by 1992. Hazardous waste minimization is easy to "articulate" but is difficult if not impossible tc implement for several reasons.[31] DOD procurement procedures make hazardous materials accessible through various supply channels to almost anyone. Except in rare cases, few limitations have been imposed if money is available for purchase. A GAO audit found serious problems with these practices. Too many hazardous materials are being bought and then allowed to deteriorate-- a disposal problem.[32] Frequently, a lack of adequate storage contributes to deterioration of containers,and lack of confidence in the military supply system encourages excess procurement to avoid shortages. According to a random sample by

GAO, 40% of the hazardous materials disposed of by DOD in FY 87 had never been used.[33]

Yet DOD is witnessing some progress through substitution of non-hazardous for hazardous materials and engineering controls. In fact, source reduction is EPA's preferred method for minimizing hazardous waste. Environmental restoration funds have been used to promote DOD's total quality management of hazardous material.[34] This approach to pollution prevention explores "up front" ways to eliminate hazardous waste. Source reduction is being utilized by all the services in various ways. For example, the Navy has reduced the number of different lubricants used in the maintenance of some weapon systems by 66%. The Army and Air Force have jointly developed ways to extend the quality of degreasing solvents in order to continue use for longer periods of time. The Marine Corps has purchased chemical agent resistent coating (CARC) paint in refillable containers to eliminate paint waste disposal requirements and associated costs.[34]

Substitution of products which are less hazardous can also minimize hazardous waste. However, care must be taken to avoid substituting one environmental pollutant with another. According to GAO, Army and Navy installations have utilized so-called "environmentally safe" water-based solvents for traditional degreasers. But these solvents may adversely affect national pollutant discharge elimination system (NPDES) effluent discharges and violate water quality under the Clean Water Act when discharged into surface waters or [illegible]ary sewers. In

addition, military specifications must be maintained. Frequently, it is difficult to identify adequate products that conform to these standards. Use of off-specification products may cause equipment failure, reduction of service life and safety hazards to operators. No one can afford such risks.

Until research and development catches up with environmental requirements by designing equipment and material which incorporate non-hazardous materials within their structure and require non-hazardous materials for performance or maintenance, DOD will continue to generate large quantities of hazardous waste. This is the "cost of doing business." Recycling this waste will significantly reduce waste generation and cut procurement costs for new material. Recycling on-site is labor intensive. However, it often reduces hazardous waste volume by 90+% both in real terms and in meeting DOD reporting requirements for minimization purposes. Recycling off-post results in equivalent minimization of waste. However, this will not be reflected in annual reports to DOD. Since the Department of Transportation (DOT) requires all hazardous waste transported over public highways be manifested, EPA mandates yearly reporting based upon these amounts. Even those this waste will be recycled, DOD does not receive credit for the minimization effort.

Paint and its associated hazardous materials rank second only to rechargeable batteries in total procurement volume for the top federal supply classes of hazardous material in 1988. Since 1985, the U.S. Army has had a service painting policy, but it has

largely been ignored. This policy stipulates that complete painting of equipment will be performed only at general support or depot level when paint on the equipment becomes unserviceable or the color of the equipment does not meet mission contingency requirements. Painting at unit level for reasons other than those required to maintain structural integrity is not allowed. However, commanders continue to ignore this and procure paint products, especially CARC, in various quantities without regard to disposal costs and environmental consequences. "Spit shine" images, once regarded as signifying a good organization, encourage frequent painting. Such practices are no longer affordable or prudent.

Facility managers have not had sufficient staffing and funding to manage environmental programs within the regulatory framework to protect their environmental resources and personnel. DOD environmental professionals are required to understand and implement a multitude of federal, state and local environmental requirements contained in thousands of pages of environmental regulations. Since 1984, EPA alone has promulgated over 2,000 increasingly complicated new rules. The enactment of the Clean Air Act in 1990 and the upcoming RCRA reauthorization in 1991 signals a barrage of more and tougher new legislation. Installation managers must develop working relationships with local and state regulators based on creditability and cooperation. This approach will increase confidence in the military's desire and ability to solve difficult pollution problems. Environmental problems usually demand immediate

solutions, frequently at great cost. But such expensive fixes are often impossible, considering the nature of DOD's appropriation and budgetary process, which is drawn out over a period of years. The system simply is not designed to respond to immediate environmental crises. Federal facilities are unique in respect to their mission and structure. DOD is centralized for reporting, budgeting and dealing with Congress. By contrast, all other requirements of the environmental program are decentralized at the installation level. Not only must facilities be self-sustaining, but they also must depend on DOD for representation to EPA and Congress. In the past, this representation has been lacking.

The toxicity characteristics rule, which became effective 25 September 1990, greatly increased the number of large waste streams which will be regulated because of toxicity. This came about with the implementation of a new analytical method for determining this hazardous characteristic. According to DOD, no one even made a comment to EPA on this proposal on behalf of the services. This regulation requires modification of permits, increased disposal and analytical costs. Many installations simply are not prepared for this more rigorous requirement. Some facilities may already be out of compliance. In addition, hazardous waste minimization goals are certainly out the window for many facilities with the implementation of this rule.

Mismanagement of hazardous waste occurs at the user level, on installations in given units. The pollution which results can be attributed to several factors. First, there is often a genuine

lack of knowledge of environmental principles, regulations and requirements. Also, complicated restrictions placed upon installations can hinder compliance and prevent sounder environmental practices. Finally, implementation of effective programs is hindered because of lack of command emphasis.

In the past, quick fixes were applied with increased funding and stop-gap education. But this approach has not solved the problem. Hazardous waste management involves a great deal of "common sense" and "good housekeeping" skills. Commanders must communicate "environmental consciousness" on the grass-root level. The wheeled vehicle mechanic, aircraft repairman and naval seaman must understand their responsibilities for protecting the environment. They must understand that hazardous waste spills must be reported, that hazardous waste must be segregated by type for recycling purposes, and that environmental non-compliance because of operational necessity is no longer part of the "anything it takes to get the job done" work ethic.[36] DOD's training courses should be given a high priority to enhance environmental awareness with training at all levels, from initial entry training to the commander's seminars. For greater effectiveness, training should be streamlined to address issues pertinent to specific tasks. Extended courses which demand much classroom time can be a waste of manpower and resources. On-the-job environmental training or train-the-trainer programs have proven to be extremely successful at many installations.

In the future, the challenges and demands upon DOD to comply with environmental laws and improve and maintain environmental

quality will be enormous. In order to succeed, DOD must tackle the hazardous waste management and minimization effort on three fronts--DOD, DLA and installation. Ideally, legislation which would increase appropriations and strengthen contractural laws would have the greatest positive impact on DOD's environmental programs. Until these changes are made, more realistic methods for improving hazardous waste management must be utilized.

DOD must become proactive in providing input to EPA on all proposed environmental rules and regulations which can in any way affect DOD installations. DOD must solidify and support existing hazardous waste management and minimization programs at installations, rather than complicating them with additional bureaucratic requirements which have no local, state or federal compliance implications. DOD should immediately standardize reporting criteria for hazardous waste generation data in order to adequately access accurate volume, disposal requirements and cost. Otherwise, the potential for unknown liability can occur. Since 1987, DOD has had a 50% minimization goal and still is unable to accurately access yearly generation volume. DOD needs to fund specifically for need as soon as accurate data can be gathered; it must extend the time for expenditures of any appropriations to avoid waste and incomplete remediation efforts.

DLA can effectively minimize hazardous waste generation by continued reutilization, transfer, donation and sale of useable hazardous material and expansion of markets for hazardous waste recycling. Adverse press should not be allowed to deter such efforts, as long as procedures for marketing these products

conform to all federal regulations for safety, health and transportation. DLA should require complete chemical analysis of all hazardous waste streams that contain mixtures and processed wastes to limit future liability for installations. Waste profile sheets may be inadequate to completely identify contents of hazardous waste. One hundred percent of all DOD potential hazardous waste disposal facilities must be audited periodically to assess compliance as a basis for contract awards. Turn-in procedures should be evaluated to accommodate generators and subsequently prevent pollution which occurs when units opt for the "closest alternative"--namely the dumpster.

Installations are responsible for generated waste forever. To reduce liability now and in the future, they must characterize all hazardous waste streams by approved EPA analytical methods. Environmental staffs have to be commensurate in size and experience with those in industry to fully protect the environment and reduce chances of personal liability of the organization. Training of personnel should be streamlined and made specific to task. Within the supply system, installations should reduce procurement of hazardous material as much as possible, evaluate thoroughly all products before substitution, adhere to policy which eliminates useage of hazardous material for purely cosmetic purposes, and rotate and store hazardous material to prevent deterioration and waste. Installations should track all hazardous waste from "cradle to grave" and maintain certificates of destruction of those wastes. Most of

all, commanders should emphasize and reward environmental responsibility.

DOD must seek to comply with environmental regulations and to manage hazardous materials properly in an emerging era of fiscal austerity. But DOD's primary mission will be to contribute to national security.

ENDNOTES

1. "Defending the Environment? The Record of the U.S. Military," The Defense Monitor, No. 6, 1989, p. 1.

2. William H. Parker III, "Environment Moves to the Front Burner," Defense, March/April 1990, p. 21.

3. Richard L. Berke, "Oratory of Environmentalism Becomes the Sound of Politics," The New York Times (New York), 17 April 1990, pp. A1 & B10.

4. "Defending the Environment? The Record of the U.S. Military, p. 1.

5. Ibid., p. 2.

6. Ibid., p. 2.

7. David C. Morrison, "Managing Military Waste," Government Executive, November 1989, p. 30.

8. U.S. Congress, Congressional Budget Office, Federal Liabilities Under Hazardous Waste Laws, p. xiii.

9. U.S. Congress, House, Committee on Armed Services, Overview of DOD Environmental Activities, p. 519.

10. "Cleaning Up Home Base," Friends of Earth, October 1990, p. 7.

11. Federal Liabilities Under Hazardous Waste Laws, p. 13.

12. Penelope Schmitt, "Could You Be Prosecuted? Straight Talk From Army Environmental Chief," DEH Digest, August 1989, p. 15

13. "Managing Military Waste," p. 31.

14. Norman J. Vig and Michael E. Kraft, Environmental Policy in the 1990s, p. 53.

15. Code of Federal Regulations (CFR), Title 40, Part 261 Section 20 (Characteristics of Hazardous Waste).

16. Overview of DOD Environmental Activities, pp. 7 and 26.

17. Federal Liabilities Under Hazardous Waste Laws, p. xvi.

18. "Defending the Environment? The Record of the U.S. Military," p. 6.

19. Overview of DOD Environmental Activities, p. 43.

20. "Defending the Environment? The Record of the U.S. Military," p. 4.

21. Overview of DOD Environmental Activities, p. 520.

22. "Closing Proves Costly," Army Times (Springfield), 28 January 1991, p. 10.

23. William Matthews, "Pentagon Vows to Mop Up Hazardous Waste," Army Times (Springfield), 10 September 1990, p. 8.

24. Federal Facilities Under Hazardous Waste Laws, p. xviii.

25. Paul J. Yaroschak, "Environmental Protection and Compliance: Past, Present, and Future," The Military Engineer, August 1989, p. 5.

26. "Military Community Pollution Prevention Demonstration Programs Within the Chesapeake Bay (Draft Paper Concept)," 24 October 1990. p. 1.

27. "Three Federal Facilities Selected to Participate in Pollution Prevention Model Community Plan," Environmental Protection Agency Press Advisory, 21 September 1990, p. 1.

28. U.S. Congress, House, Committee on Armed Services, DLA's Management of Hazardous Materials and Hazardous Waste, p. 15.

29. Ibid., p. 1.

30. Ibid., p. 37.

31. Richard A. Guida, Commander, "Waste Not," Proceedings, April 1989, p. 78.

32. DLA's Management of Hazardous Materials and Hazardous Waste, p. 2.

33. U.S. General Accounting Office, Hazardous Materials-Attention to DOD Inventories of Hazardous Materials Needed, p. 13.

34. Overview of DOD Environmental Activities, p. 99.

35. Ibid., p. 107.

36. "Waste Not," p. 78.

BIBLIOGRAPHY

Ahearn, Major General Joseph A. "Protectors of the Environment." The Military Engineer, Vol. 82, January/February 1990, pp. 8-11.

Adelsberger, Bernard. "Managers Indicted in Illegal Waste Dumping." Army Times (Springfield), 18 July 1988, p. 49.

Anderson, Gene S. "Criminal Prosecutions: Who Gets Indicted Why." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 4-16.

Andreoli, Robert J. "Organizing for Environmental Compliance." Federal Facilities Environmental Journal, Vol. 1, No.3, Autumn 1990, pp. 267-280.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 1-18: "A New Approach for Protecting the Environment," by Doug Bandow.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 29-40: "The Environment and Economic Progress," by John Baden.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 41-56: "The Market Alternative for Land and Wildlife," by Terry L. Anderson.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 57-68: "Creating a Market to Control Pollution," by Benjamin Zycher.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 69-82: "Disposing of Hazardous Wastes: How to Deal with Toxic Terror," by Milton R. Copulos.

Bandow, Doug, ed. Critical Issues-Protecting the Environment: A Free Market Strategy. Washington: Heritage Foundation, 1986. Pp. 83-88: "Getting from Here to There," by Doug Bandow.

Berke, Richard L. "Oratory of Environmentalism Becomes the Sound of Politics." New York Times (New York), 17 April 1990, pp. A1 and B10.

Brown, Neville. "Climate, Ecology and International Security." Survival, Vol. 31, November/December 1989, pp. 519-532.

Carson, Rachel. Silent Spring. Boston: Houghton Mifflin Company, 1962.

Charles, Daniel. "The Energy Mess." Government Executive, Vol. 21, June 1989, pp. 26-28.

"Cleaning Up Home Base." Friends of the Earth, Vol. 20, No. 4, October 1990, p. 7.

Cleveland, Karen S., and Van Kley, Jack A. "Compliance at Federal Facilities: A State Perspective." Federal Facilities Environmental Journal, Vol. 1, No. 1, Autumn 1990, pp. 301-312.

"Closing Proves Costly." Army Times (Springfield), 28 January 1991, p. 10.

Code of Federal Regulations (CFR). Title 40, Part 261, Section 20 (Characteristics of Hazardous Waste). Washington: U.S. Government Printing Office, 1989.

Cooper, Josephine S. "Community Relations at Federal Facilities." Federal Facilities Environmental Journal, Vol. 1, No. 2, Summer 1990, pp. 289-300.

Davidson, Gordon M., and Grundler, Christopher. "EPA's Federal Facility Hazardous Waste Compliance Program." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 55-68.

"Defending the Environment." Defense Issues, Vol. 5, No. 5, 6 September 1990, pp. 1-2.

"Defending the Environment? The Record of the U.S. Military." The Defense Monitor, Vol. 18, No. 6, 1989, pp. 1-8.

"Defense Environmental Restoration Program." Annual Report to Congress for Fiscal Year 1989. February 1990.

"DOD Environmental Ethic." Defense Issues, Vol. 4, No. 32, 6 September 1990, pp. 1-3.

"Environment and Department of Defense." Department of Defense. Washington: U.S. Government Printing Office, 1988.

"Environmental Quality 1990." 20th Annual Report of the Council on Environmental Quality. Washington: U.S. Government Printing Office, 1990.

Fairclough, A. J. "Global Environmental and Natural Resource Problems-Their Economic, Political, and Security Implications." The Washington Quarterly, Vol. 14, No. 1, Winter 1991, pp. 99-113.

Flint, Jeremy; Newton, John; and Sylvestri, Paul. "DOD Developments." Federal Facilities Environmental Journal, Vol. 1, No. 3, Autumn 1990, pp. 361-368.

Goldberg, Steven C. "Mixed Waste Regulation: Understanding the Basics. Federal Facilities Environmental Journal, Vol. 1, No. 3, Autumn 1990, pp. 329-342.

Guida, Commander Richard A. "Waste Not." Proceedings, Vol. 115, April 1989, pp. 73-78.

Gutierrez, Alberto A., and Thomas, Trent H. "Negotiating and Implementing RCRA 3008(h) Orders." Federal Facilities Environmental Journal, Vol. 1, No. 3, Autumn 1990, pp. 313-322.

Hanash, Rami S. "Potential Liability of Federal Employees for Civil Penalties Under Federal Environmental Laws." Federal Facilities Environmental Journal, Vol. 1, No. 4, Winter 1990/91, pp. 371-390.

Hanash, Rami S. "The Legal Grounds for Prosecuting Federal Employees for Environmental Law Violations." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 17-36.

Hatch, Lieutenant General Henry J. "New Direction." The Military Engineer, Vol. 82, January/February 1990, pp. 12-13.

Hoard, David E. "Impacts of Government Agency-Contractor Relationships on Enforcement Actions." Federal Facilities Environmental Journal, Vol. 1, No. 2, Summer 1990, pp. 155-178.

Hoard, David E., and Lyons, Terrence M. "What to Do When Your Installation Is Placed on the National Priorities List." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 4-16.

Hourcle, L. R. "DOD's Budgeting Plan to Meet Environmental Challenges." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 109-116.

Huber, Karl D. "NEPA: Mitigation and the Need for An Environmental Impact Statement." Federal Facilities Environmental Journal, Vol. 1, No. 2, Summer 1990, pp. 209-218.

Jenkins, John A. "Making Safety Part of Organizational Culture." Federal Facilities Environmental Journal, Vol. 1, No. 4 Winter 1990/91, pp. 425-438.

Kane, Hal, and Lebel, Gregory G. Sustainable Development-A Guide to Our Common Future. Geneva: Centre for Our Common Future, 1990.

Klessig, Lavell L., and Stride, Victor L. The ELF Odyssey: National Security Versus Environmental Protection. Boulder: Westview Press, 1980.

Lippman, Thomas W. "U. S. Faces $150 Billion in Toxic Cleanup Costs." The Washington Post (Washington), 25 May 1990, p. A19.

Mathews, Jessica T. "How Green the Pentagon." The Washington Post (Washington), 19 July 1990, p. A23.

Mathews, Jessica T. "Redefining Security." Foreign Affairs, Vol. 68, No. 2, Spring 1989, pp. 162-177.

Matthews, William. "New Weapons Programs to Clean Up Their Acts." Army Times (Springfield), 10 September 1990, p. 10.

Matthews, William. "Pentagon Vows to Mop Up Hazardous Waste." Army Times (Springfield), 10 September 1990, pp. 8-9.

"Military Community Pollution Prevention Demonstration Programs Within the Chesapeake Bay (Draft Paper Concept)." 24 October 1990.

Moore, James R. "Enforcement Against Federal Facilities: The Unitary Executive Theory." Federal Facilities Environmental Journal, Vol. 1, No. 2, Summer 1990, pp. 143-154.

Morrison, David C. "Managing Military Waste." Government Executive, Vol. 21, November 1989, pp. 31-37.

Natural Resources Defense Council. Twenty Years Defending the Environment. New York: 1990.

Parker, William H. III. "Environment Moves to the Front Burner." Defense, March/April 1990, pp. 21-32.

Pollack, Stephanie, and Shulman, Seth. "The Environment-Toxic Responsibility." Atlantic, Vol. 263, March 1989, pp. 26-31.

Portney, Paul R., et al. Current Issues in U.S. Environmental Policy. Baltimore and London: Johns Hopkins University Press, 1978.

Protection and Enhancement of Environmental Quality. U.S. Department of Defense Directive (Draft). Washington: 1990.

"Report of the Secretary of Defense to the President and the Congress." Annual Defense Report. Washington: U.S. Government Printing Office, January 1990.

"Report to the Congress for Fiscal Year 1991." Department of the Navy. Alexandria, Virginia: Naval Internal Relations Activity, 1990.

Rhodes, Steven L., and Wiley, Karen B. "Decontaminating Federal Facilities: The Case of Rocky Mountain Arsenal." Environment, Vol. 29, April 1987, pp. 16-20.

Rowlands, Ian. "The Security Challenges of Global Environmental Change." The Washington Quarterly, Vol. 14, No. 1 Winter 1991, pp. 99-113.

Schmitt, Penelope. "Could You Be Prosecuted? Straight Talk From Army Environmental Chief." DEH Digest, Vol. 2, No. 3, August 1989, pp.14-16.

Scholl, Colonel Wayne J. Meeting the Environmental Challenge. Thesis. Washington: The Brookings Institution, 29 June 1990.

Seaberry, Jane. "At Fort Belvoir, Army Makes Room for Nature." The Washington Post (Washington), 21 April 1990, p. B3.

Shabecoff, Philip. "40-Year Countdown Is Seen for Environment." New York Times (New York), 11 February 1990, p. 48L.

Shabecoff, Philip. "Senator Urges Military Resources Be Turned to Environmental Battle." New York Times (New York), 29 June 1990, pp. A11-12.

Shabecoff, Philip. "White Panel Says U.S. Can Fight Pollution and Grow." New York Times (New York), 7 June 1990, D22.

Smith, G. Nelson, III. "Should Government Contractors Be Indemnified?" Federal Facilities Environmental Journal, Vol. 1, No. 4, Winter 1990/1991, pp. 439-450.

Stanfield, Rochelle. "New Environmental Law Brings Power to the People." Government Executive, Vol. 19, November/December 1987, pp. 40-42.

Steinbeck, Captain Margaret D. "Liability of Defense Contractor for Hazardous Waste Cleanup Costs." Military Law Review, Vol. 125, Summer 1989, pp. 55-97.

Stubblebine, Scott D. "Why the Compliance Message Must Be Spread: A Practical Guide for Facility Personnel." Federal Facilities Environmental Journal, Vol. 1, No. 3, Autumn 1990, pp. 267-280.

"The Environment the Politics of Posterity." The Economist, Vol. 312 (Supplement), 2 September 1989, pp. 3-18.

"Three Federal Facilities Selected to Participate in Pollution Prevention Model Community Plan." Environmental Protection Agency Press Advisory, 21 September 1990.

Tyler, Patrick E. "Senators Propose Shift of Defense Funds to Study Environment." The Washington Post (Washington), 29 June 1990, p. A7.

Udall, Stewart L. The Quiet Crisis and the Next Generation. Salt Lake City: Peregrine Smith Books, 1988.

U.S. Congress. Congressional Budget Office. Federal Liabilities Under Hazardous Waste Laws. Washington: U.S. Government Printing Office, May 1990.

U.S. Congress. House. Committee on Armed Services. DLA's Management of Hazardous Materials and Hazardous Waste. Hearings, 101st Cong., 2d Sess. Washington: U.S. Government Printing Office, 1990.

U.S. Congress. House. Committee on Armed Services. Overview of DOD Environmental Activities. Hearings, 101st Cong., 1st Sess. Washington: U.S. Government Printing Office, 1990.

U.S. Department of the Air Force. Commander's Guide to Environmental Quality. Washington, D.C., May 1990.

U.S. Department of the Army. Army Regulation 200-1: Environmental Quality: Environmental Protection and Enhancement. Washington: 3 April 1990.

U.S. Department of the Army. Army Regulation 200-2: Environmental Quality: Environmental Effects of Army Actions. Washington: 23 December 1988.

U.S. Department of the Army. Army Message 162048Z Mar 89. Subject: Environmental Liability. Washington: 16 March 1989.

U.S. Department of the Army. Commander's Guide to Environmental Management. Washington, D.C., October 1990.

U.S. General Accounting Office. Efforts to Clean Up DOD-Owned Inactive Hazardous Waste Disposal Sites. Washington: U.S. Government Printing Office, May 1990.

U.S. General Accounting Office. Hazardous Materials-Adequate Safeguards Over Sales Posed Health and Environmental Dangers. Washington: U.S. Government Printing Office, February 1990.

U.S. General Accounting Office. Hazardous Waste-Attention to DOD Inventories of Hazardous Materials Needed. Washington: U.S. Government Printing Office, November 1989.

U.S. General Accounting Office. Hazardous Waste-EPA Cleanup Requirements-DOD Versus Private Entities. Washington: U.S. Government Printing Office, July 1989.

U.S. General Accounting Office. Implications of State Cleanup of Hazardous Waste Sites on Federal Policy. Washington: U.S. Government Printing Office, 7 November 1989.

U.S. General Accounting Office. Superfund-Missed Statutory Deadlines Slow Progress in Environmental Programs. Washington: U.S. Government Printing Office, November 1988.

Vig, Norman J., and Kraft, Michael E. Environmental Policy in the 1990s. Washington: Congressional Quarterly Inc, 1990.

Waite, Thomas A. "Auditing Federal Facilities: A Private Company's Viewpoint." Federal Facilities Environmental Journal, Vol. 1, No.2, Summer 1990, pp. 201-208.

Willingly, Joseph M. "Why EPA's Current Policies on Potential CERCLA-RCRA Authority Conflicts May Be Wrong." Federal Facilities Environmental Journal, Vol. 1, No. 1, Spring 1990, pp. 69-90.

Winslow, Hal. "A Guide to Hazardous Terminology." Federal Facilities Environmental Journal, Vol. 1, No. 2, Summer 1990, 137-142.

Yaroschak, Paul J. "Environmental Protection and Compliance: Past, Present, and Future." The Military Engineer, Vol. 81, August 1989, pp. 2-5.