AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

Western Governor's Association

***Federal Advisory Committee
To Develop On-Site
Innovative Technologies***

**WASTE CONTAMINANTS
AT
MILITARY BASES
WORKING GROUP REPORT**

November 4, 1993

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

**Waste Contaminants at Military Bases Working Group
Report to the Federal Advisory Committee to
Develop On-Site Innovative Technologies**

November 4, 1993

Table of Contents

EXECUTIVE SUMMARY	vii
1.0 INTRODUCTION	1
2.0 WORK GROUP CHARTER	2
2.1 Mission and Vision Statement	2
3.0 CONTAMINATION PROBLEMS, CURRENT TECHNOLOGY LIMITATIONS, AND INSTITUTIONAL BARRIERS	2
3.1 Environmental Contamination Problems	2
3.1.1 Kirtland Air Force Base	3
3.1.2 March Air Force Base	3
3.1.3 McClellan Air Force Base	3
3.1.4 Williams Air Force Base	4
3.1.5 Air Force Center for Environmental Excellence's Bioventing Initiative/Intrinsic Bioremediation Demonstrations	4
3.2 Technology Limitations	4
3.3 Institutional and Regulatory Barriers	4
3.4 Work Force Issues	5
4.0 SCREENING PROCESS	5
4.1 Step One	5
4.2 Step Two	6
4.3 Step Three	6
4.4 Step Four	8
4.5 Step Five	9
5.0 DEMONSTRATION DESCRIPTIONS - Good Matches	10

5.1	McClellan Air Force Base Demonstration	10
5.1.1	Purpose and Goals of the Demonstration	10
5.1.2	Description of the Project	10
5.1.3	Strengths and Weaknesses of the Demonstration Project	10
5.1.4	Organization and Management of Project	11
5.1.5	Timing and Schedule for Project	11
5.1.6	Estimated Costs/Funding Status	13
5.1.7	Success Measures	13
5.2	Williams Air Force Base Demonstration Project	13
5.2.1	Purpose and Goals of the Demonstration	13
5.2.2	Description of the Project	13
5.2.3	Strengths and Weaknesses of the Demonstration Project	14
5.2.4	Organization and Management of Project	14
5.2.5	Timing and Schedule for Project	15
5.2.6	Estimated Costs/Funding Status	15
5.2.7	Success Measures	15
5.3	Air Force Center for Environmental Excellence Bioventing Initiative	15
5.3.1	Purpose and Goals of the Demonstration	15
5.3.2	Description of the Project	16
5.3.3	Strengths and Weaknesses of the Demonstration Project	16
5.3.4	Organization and Management of Project	17
5.3.5	Timing and Schedule for Project	17
5.3.6	Estimated Costs/Funding Status	17
5.3.7	Success Measures	17
6.0.	DEMONSTRATION DESCRIPTIONS - Close Matches	18
6.1	Air Force Center for Environmental Excellence Intrinsic Bioremediation	18
6.1.1	Purpose and Goals of the Demonstration	18
6.1.2	Description of the Project	18
6.1.3	Strengths and Weaknesses of Demonstration Project	18
6.1.4	Organization and Management of Project	19

6.1.5	Timing and Schedule for Project	19
6.1.6	Estimated Costs/Funding Status	19
6.1.7	Success Measures	19
6.2	Kirtland Air Force Base Demonstration	20
6.2.1	Purpose and Goals of the Demonstration	20
6.2.2	Description of the Project	20
6.2.3	Strengths and Weaknesses of Demonstration Project	21
6.2.4	Organization and Management of Project	21
6.2.5	Timing and Schedule for Project	22
6.2.6	Estimated Costs/Funding Status	22
6.2.7	Success Measures	22
6.3	March Air Force Base Demonstration	23
6.3.1	Purpose and Goals of the Demonstration	23
6.3.2	Description of the Project	23
6.3.3	Strengths and Weaknesses of the Demonstration Project	23
6.3.4	Organization and Management of Project	24
6.3.5	Timing and Schedule for Project	24
6.3.6	Estimated Costs/Funding Status	24
6.3.7	Success Measures	25
7.0	ADDITIONAL CANDIDATE DEMONSTRATION PROJECTS	26
7.1	Port Hueneme Navy Construction Battalion Center	26
7.1.1	Purpose and Goals of the Demonstration	26
7.1.2	Description of the Project	26
7.1.3	Strengths and Weaknesses of the Demonstration Project	27
7.1.4	Organization and Management of Project	27
7.1.5	Timing and Schedule for Project	27
7.1.6	Estimated Costs/Funding Status	28
7.1.7	Success Measures	28
7.2	Ellsworth Air Force Base	28
7.3	Black Hills Ordnance Depot	28
8.0	NEXT STEPS	29

9.0 Appendices

9.1 Correspondence

9.2 Listing of Working Group Members

EXECUTIVE SUMMARY

Over the past six months, the Waste Contaminants at Military Bases Working Group has supported the DOIT Committee in two primary ways: by gathering information on innovative technologies and test sites and by establishing selection criteria to screen potential demonstration projects. The Working Group organized its activities into two phases. Phase I will integrate ongoing demonstrations into the DOIT process to add value in terms of enhanced stakeholder involvement and regulator acceptance. Phase II would use lessons learned to develop new innovative technology demonstrations.

The Working Group employed a multi-stage process to screen the following six potential demonstrations:

- the McClellan Air Force Base Demonstration Project is testing three innovative remediation technologies: Dual Vacuum Extraction/Steam Injection/Vacuum Extraction, Soil Vapor Extraction, and a Bioventing System;
- the Kirtland Air Force Base Advanced Landfill Cover Demonstration project tests three alternative landfill cover designs against the present conventional design currently required by the Environmental Protection Agency (i.e., the Environmental Protection Agency Advanced Composite Cover, the Los Alamos Bio-Engineered Cover, and the Sandia Dry Barrier design);
- the Williams Air Force Base Demonstration Project is evaluating the effectiveness of horizontal extraction wells in containing and remediating petroleum-contaminated ground water;
- the Air Force Center for Environmental Excellence Bioventing Initiative assesses in situ bioventing as an alternative to pump-and-treat methods for remediating petroleum-contaminated sites;
- the Air Force Center for Environmental Excellence Intrinsic Bioremediation Initiative is developing a protocol for evaluating fuel contaminant destruction rates in ground water; and
- the March Air Force Base Demonstration project is testing two alternative in situ treatment technologies to treat contaminated ground water.

Also included in this report are several projects that have not been screened by the Working Group: the Port Hueneme Naval Construction Battalion Center demonstration project, and the Ellsworth Air Force Base and Black Hills Ordnance Depot remediation programs.

- Port Hueneme Naval Construction Battalion Center is testing alternative ex situ and in situ treatment technologies for fuel hydrocarbon-contaminated soil and ground-water.

The Navy demonstration and the Air Force projects are described in Section 6 of the document.

The Working Group identified the strengths and weaknesses of each demonstration and on that basis grouped the demonstrations into two categories + good matches with DOIT selection criteria and close matches. The Air Force Center for Environmental Excellence Bioventing Demonstration, the McClellan Air Force Base, and the Williams Air Force Base Demonstration Projects are designated as good matches because they fully meet all criteria established by DOIT for Phase I Demonstration Projects. These criteria includes high level of interest, regulator/stakeholder support, level of innovation of the technology, and high commercialization potential. The Air Force Center for Environmental Excellence Intrinsic Bioremediation Demonstration, the March Air Force Base Demonstration, and the Kirtland Demonstration Projects are classified as close matches. While the Working Group felt that these demonstrations did not score as high on certain criteria, they were still worthy of serious consideration by the DOIT Committee.

The Working Group is developing a strategic plan and process for both current and future demonstration projects to meet the DOIT Committee's vision. The Working Group is also outlining a selection process for Phase II projects and establishing internal peer review subgroups.

1.0 INTRODUCTION

The Waste Contaminants at Military Bases Working Group has screened six prospective demonstration projects for consideration by the Federal Advisory Committee to Develop On-Site Innovative Technologies (DOIT) (a working group membership list is attached in Appendix B). These projects include the Kirtland Air Force Base Demonstration Project, the March Air Force Base Demonstration Project, the McClellan Air Force Base Demonstration Project, the Williams Air Force Base Demonstration Project, and two demonstration projects under the Air Force Center for Environmental Excellence. A seventh project (Port Hueneme Naval Construction Battalion Center) was added to list of prospective demonstrations after the September 1993 Working Group Meeting. This demonstration project has not been screened by the working group. Two additional Air Force remediation programs are also under consideration and are described in Section 6 of this document. The following information on prospective demonstrations was collected by the Waste Contaminants at Military Bases Working Group to assist the DOIT Committee in making Phase I Demonstration Project recommendations. The remainder of this report is organized into seven sections:

- Work Group Charter's mission and vision
- Contamination problems, current technology limitations, and institutional and regulatory barriers to technology development and commercialization, and work force issues
- Screening process for initial Phase I demonstration technologies and sites
- Demonstration descriptions - Good Matches
- Demonstration descriptions - Close Matches
- Additional Candidate Demonstration Projects
- Next Steps

These sections provide the following information for each prospective demonstration:

- Purpose and goals of the demonstration
- Description of project
- Strengths and weaknesses
- Organization and management of project
- Estimated costs/funding status of project
- Timing and schedule of project
- Success indicators

2.0 WORK GROUP CHARTER

2.1 Mission and Vision Statement

The mission of the Waste Contaminants at Military Bases Working Group is to support the DOIT Committee's efforts to expedite development and commercialization of innovative technologies acceptable to the public for investigating, remediating, managing, and waste contamination at military bases. This mission will be accomplished through collecting information related to site and technology demonstration selection criteria, issue identification, and by promoting innovative environmental technology development, deployment, and commercialization. The Waste Contaminants at Military Bases Working Group will actively assist the DOIT Committee in establishing positive and enduring partnerships with stakeholders and the public to advance new environmental cleanup technologies. Environmental remediation and waste management processes that facilitate the development and implementation of innovative technologies and encourage partnerships with local, State, and national stakeholders will lead to the faster, better, and more cost-effective cleanup of military bases and installations.

The Waste Contaminants at Military Bases Work Group identified environmental contamination problems, cleanup technology limitations, institutional and regulatory barriers, and work force issues at its first meeting held on May 14, 1993, in Denver, Colorado.

3.0 CONTAMINATION PROBLEMS, CURRENT TECHNOLOGY LIMITATIONS, AND INSTITUTIONAL BARRIERS

3.1 Environmental Contamination Problems

Environmental contamination at military bases is widespread and involves extensive areas of ground-water and soil contamination. Contamination of these media is the result of frequent fuel and solvent spills, past disposal of waste oils, lubricants and solvents, leaking underground storage tanks, drum burial sites, and accidental spills from manufacturing operations. Hazardous contaminants found at military bases include volatile organic compounds, semi-volatiles, heavy metals, petroleum products, and pesticides. Specific contamination problems at candidate Phase I demonstration sites are described below.

3.1.1 Kirtland Air Force Base

There are three major sites at Kirtland Air Force Base that contain hazardous waste of concern. The Radioactive Buried Site 11 contains biological waste, including radiologically contaminated animal carcasses and animal waste. Radionuclides found at the site include Nb⁹³, Cs¹³⁷, I¹²⁹, and Y⁸⁸. Hazardous waste (corrosive and metal contaminated waste (e.g., acids, mercury, cyanides, and silver)) are also present. Sandia's Mixed Waste Landfill has an inventory that includes tons of radioactive-contaminated equipment, contaminated primary coolant water, low-level miscellaneous waste, spent fuel shipping casks, contaminated missile sections, a plutonium arc tunnel, Cobalt60 sources, reactor vessels, and various solvents. There is also a Chemical Waste Landfill with an inventory that includes used oil, solvents, paint and thinners, freon, alcohols, resins, sealants, contaminated cans, bottles, containers, drums, and many other chemical and nonchemical wastes. In addition, there are five other major landfills and four minor landfills at Kirtland Air Force Base that are being characterized for waste constituents.

3.1.2 March Air Force Base

Site 2 at March Air Force Base has been used as a waste oil disposal and storage pit, a solvent storage area, and an aviation gas fueling station. Ground-water samples collected in 1991 on Site 2 showed the presence of trichloroethylene, benzene, and chloroform. Recent sampling at the same well has indicated that concentrations of these contaminants have increased by 100 percent since the previous sampling quarter.

Site 31 at March Air Force Base contained a weapons cleaning shop and, during the period of 1950-1970, various solvents (1,1,1-TCA, TCE, and DCE) may have been discharged onto the ground. Data from soil borings taken during the remedial investigation indicate contamination with volatile organic compounds, oil, and grease. Environmental contamination at the site is a public health concern because the aquifer underlying the base is used by local industry, agriculture, and for domestic purposes.

3.1.3 McClellan Air Force Base

Contamination at McClellan Air Force Base originated primarily from aircraft maintenance and repair operations performed at the base. The hazardous materials that have been used at McClellan Air Force Base include various industrial solvents, caustics, and aviation fuel. Maintenance operations have also generated large quantities of hazardous waste including electroplating waste contaminated with heavy metals and used oils contaminated with PCBs. Of the four distinct areas of ground-water contamination that have been identified, three of the plumes have migrated offbase, including one plume that has caused closure of domestic and municipal wells. The primary contaminants of concern are volatile organic compounds. Soil contamination is also a problem, and it is estimated that 450 out of 3,000 acres contain some con-

tamination. Solvents and cleaners discharged onto the ground are the probable sources of this contamination.

3.1.4 Williams Air Force Base

The leakage of 650,000 to 1,400,000 gallons of jet fuel over a long period has resulted in extensive ground-water and soil contamination. Soil contamination covers an area of approximately 4.4 acres (to a depth of 225 feet), while the areal extent of ground-water contamination is about 20 acres. Benzene is the primary constituent of concern, although toluene, ethyl benzene, and xylene compounds have also been found in ground-water and soil samples taken at the site.

3.1.5 Air Force Center for Environmental Excellence's Bioventing Initiative/Intrinsic Bioremediation Demonstrations

These demonstrations focus on remediating sites contaminated with petroleum products including gasoline, diesel fuel, jet fuel, and heating oil. A number of sites also contain various chlorinated solvents.

3.2 Technology Limitations

Conventional technologies for cleaning up contaminated ground water, such as pump-and-treat approaches, often take years to complete, may never achieve cleanup standards for certain contaminants, and are expensive to operate and maintain. Furthermore, currently used technologies are not always effective in remediating subsurface soils contaminated with heavy petroleum byproducts or ground water contaminated with volatile organic compounds. There is also a need for better waste minimization and recycling technologies for heavy metals, more effective stabilization and containment technologies for buried waste, and for better aquatic and marine sediment remediation technologies. These shortcomings in currently available technologies warrant strong efforts to develop, test, and commercialize new technologies that will remediate contaminated sites more quickly and more cost effectively.

3.3 Institutional and Regulatory Barriers

The Work Group identified a number of institutional and regulatory barriers that compound technology limitations and impede the implementation of innovative technologies. These barriers include insufficient public involvement and understanding, rigid and sometimes conflicting regulatory requirements, inadequate indemnification of technology vendors and contractors, and lack of awareness on the part of Remedial Project Managers regarding

innovative technology alternatives. Other barriers include the numerous disincentives to developing innovative technologies, including procurement regulations, the lack of clear markets for innovative technologies, the absence of interstate permitting reciprocity, insufficient mechanisms to compile and communicate cost performance and market data, and the lack of standardized performance data collection formats for innovative technologies.

3.4 Work Force Issues

These demonstration projects address work force planning, training, and education issues by offering the opportunity for employment through contracting opportunities, retraining of the work force into environmental restoration jobs, and development of educational opportunities with local educational institutions. Assessments of these demonstrations will provide examples of employment patterns and training activities associated with site remediation activities. Information gathered will include the extent to which military and civilian personnel effectively transition into environmental cleanup activities, as well as information on critical environmental training needs and training opportunities for both military and civilian personnel.

The following section outlines the steps followed by the Working Group to identify and screen Phase I demonstrations for consideration and/or recommendation by the DOIT Committee:

4.0 SCREENING PROCESS

4.1 Step One

The process of identifying demonstration projects was initiated at the Waste Contaminants at Military Bases Working Group Meeting that was held in Sacramento, California, on June 14, 1993. At this meeting, the Working Group decided that because of the complexity and time involved in developing an effective solicitation process, the most appropriate way to proceed was to divide the procedure into two phases. Phase I involves ongoing technology demonstration projects and will allow the DOIT Committee to add value to these demonstrations by collecting and disseminating significant information. Phase II will use lessons learned during Phase I to develop a DOIT process for conducting new demonstrations and commercialization efforts.

The Working Group evaluated several potential candidate sites and projects that would be appropriate for Phase I. Sites discussed included March Air Force Base, where vacuum pressure vaporized well technology is being tested to reduce overall pump and treatment times; McClellan Air Force Base, where a number of

innovative technologies are being implemented; and Williams Air Force Base, which is using the deepest horizontal wells in existence to lower the water table, thereby facilitating the recovery of free product.

No final decisions were reached during the meeting regarding primary sites and alternates for DOIT Committee consideration and possible selection. However, criteria for selecting sites for Phase I were discussed. The Working Group also agreed to develop a standard questionnaire form to assist Working Group members in collecting consistent information from each proposed site.

4.2 Step Two

The Waste Contaminants at Military Bases Working Group's meeting held on July 26-27, 1993, enabled members and participants to present information gathered on potential sites for Phase I, review and finalize selection criteria for Phase I, and agree upon an approach for obtaining more information on potential sites prior to the DOIT Committee meeting in November 1993. The result of this meeting was that the individual members and participants of the Working Group nominated four sites and one technology based on presentations from a draft questionnaire that was filled out for each site. These sites were Kirtland Air Force Base, March Air Force Base, McClellan Air Force Base, and Williams Air Force Base. The Air Force Center for Environmental Excellence nominated two technologies — the Bioventing Initiative and the Natural Attenuation Initiative.

Criteria for site and technology selection were also identified. These criteria included those originally proposed by the Ad Hoc General Criteria Working Group as well as additional criteria that the Working Group identified as critical to its fact finding responsibilities under DOIT.

4.3 Step Three

The Working Group decided that the most efficient way to finalize these potential demonstration sites for consideration by the DOIT Committee would be to form a Site Review Subgroup (Fact Finding Task Force) consisting of both members and participants of the Working Group. The Subgroup's responsibilities were to disseminate a revised version of the draft questionnaire, perform actual site visits (time permitting), and to develop a matrix from the revised questionnaire that compared sites against selection criteria.

Once the questionnaires were filled out by the individual site owners, the Working Group's Site Review Subgroup (Fact Finding Task Force) developed a matrix that summed up the information gathered regard-

ing criteria for selection into three categories — High, Medium, and Low. The matrix was designed to make it easier for the Sub-group, and later the Working Group, to identify any potential impediments that should be considered by the DOIT Committee in making final site and technology recommendations. The criteria used are listed in the table below.

Selection Criteria for Demonstration Projects

1. Schedule Flexibility Participation	2. Level of interest in DOIT	3. Resource Availability
4. Funding Stability Support	5. Level of Management	6. Political/Institution Obstacles
7. Willingness to Publicize Project	8. Willingness to Support Additional DOIT Work	9. Technical Proposal Quality
10. Unresolved Applicable or Relevant and Appropriate Requirements	11. Demonstration and DOIT Schedule Compatibility	12. Level of Regulator Buy-in
13. Level of Stakeholder Buy-in	14. Commercialization Potential	15. Potential Applicability to Other Sites
16. Level of Technology Development	17. Potential Economic Benefits Over Alternative Methods	18. Innovativeness of Technology
19. Potential for Success	20. Potential Contribution to Waste Reduction, Product Recovery, and Recycling	21. Key Benefits to Current Demonstration Projects
22. Potential Barriers to Success and/or Conditions for DOIT Involvement		

4.4 Step Four

At the Working Group Meeting held in Denver on September 20 and 21, 1993, the Sub Group presented its findings that the proposed demonstrations met the selection criteria. Site owner representatives from each of the proposed sites then made presentations to the full Working Group.

Mr. John Stormont of Sandia National Laboratories reported on the Kirtland Air Force Base Advanced Landfill Cover demonstration project. The project is a field-scale evaluation of cover systems (capillary barrier and dry barrier designs) that are benchmarked to the EPA-recommended landfill cover design (RCRA cap). Mr. Stormont stressed the advantages to the DOIT Committee of this demonstration project, including its strong public outreach component, its working relationships with regulators, and the fact that the demonstration project has sufficient resources. Additionally, the demonstration is on a virgin site, so that it is a scientific data gathering experiment, with no long-term effects.

Mr. John Sabol, program manager for Installation Restoration Program at March Air Force Base, provided an overview of the March demonstration program that will evaluate the effectiveness of alternative in-well air sparging technologies. An IT Corporation demonstration involves the in situ removal of chlorinated and aromatic volatile organic compounds from ground water by converting the contaminants to a gas phase and destroying them with a photocatalytic oxidation unit at the surface. The other demonstration, which involves using a vacuum vaporizing well technology developed and patented by IEG mbH of Germany, was presented by Mr. Jeffrey L. Bannon of Roy F. Weston, Inc.

Major Lee Lewis, McClellan Air Force Base, reported on the McClellan Air Force Base proposal to evaluate three treatment technologies: (1) Dual Vacuum Extraction/Stream Injection Vacuum Extraction Treatment Train, (2) Soil Vapor Extraction and associated air waste stream treatment systems, and (3) bioventing initiatives. Major Lewis noted that by working with the DOIT Committee, McClellan Air Force Base could become a regional center for developing and commercializing innovative environmental cleanup technologies.

Mr. Tim Steele, Arizona Department of Environmental Quality, presented the Williams Air Force Base demonstration proposal to apply conventional river crossing drilling techniques to recovering free product from ground water. One issue raised during the presentation was the extent to which Williams Air Force Base would be willing to work with the DOIT Committee. Mr. Steele indicated that cleanup personnel are very willing to work with the DOIT Committee; however, because the demonstration is located at a National Priority List site, Williams Air Force Base cannot accommodate DOIT activities that would cause schedule delays.

Mr. Patrick Haas of the U.S. Air Force/Air Force Center for Environmental Excellence presented two demonstration proposals + the Air Force Bioventing Initiative and the Intrinsic Bioremediation Initiative (i.e., natural attenuation). Bioventing applies to the remediation of petroleum-contaminated soil and intrinsic bioremediation is viewed as an alternative to conventional long-term pump-and-treat technologies. Mr. Haas asserted that the intrinsic bioremediation strategy is cost-effective and will reduce risks. However, although there was general support for the Air Force Center for Environmental Excellence multi-site bioremediation project, several Working Group members and participants suggested that the intrinsic bioremediation demonstration project did not meet Phase I Selection Criteria and should be considered for Phase II. However, some participants suggested that the intrinsic bioremediation project should be recast as a site characterization demonstration project with the primary goal of developing accurate rate coefficients for biodegradation.

One issue raised regarding all of the proposals was the level of public involvement. Representatives for each of the demonstration projects reported that their projects did have an extensive stakeholder involvement component and that they would be willing to work with DOIT to enhance stakeholder participation where necessary.

4.5 Step Five

The Working Group assessed the specific strengths and weaknesses of each demonstration project. Based upon the Work Group's assessment, potential demonstrations were grouped into two categories — good matches with DOIT selection criteria and close matches with DOIT selection criteria. The Air Force Center for Environmental Excellence bioventing demonstration and the McClellan Air Force Base and the Williams Air Force Base demonstration projects were designated as good matches; the Air Force Center for Environmental Excellence intrinsic bioremediation demonstration, the March Air Force Base demonstration, and the Kirtland Air Force Base demonstration project were classified as close matches.

In response to issues raised by Work Group members and participants, and because of time schedule commitments, Mr. John Sabol, March Air Force Base, elected not to have his project considered as a potential Phase I demonstration.

The McClellan and Williams Air Force Base demonstrations and the Air Force Center for Environmental Excellence bioventing initiative were considered good matches because they meet all the criteria established for Phase I demonstration projects, including high level of interest, regulator and stakeholder buy-in, innovativeness of the technology, and high commercialization potential.

5.0 DEMONSTRATION DESCRIPTIONS - Good Matches

5.1 McClellan Air Force Base Demonstration

5.1.1 Purpose and Goals of the Demonstration

The purpose of the McClellan Air Force Base demonstration is to test and evaluate new treatment technologies to gain cost and performance data that will be shared with private companies participating with McClellan Air Force Base in public/private partnership activities.

5.1.2 Description of the Project

The McClellan Air Force Base demonstration project involves testing three primary technology systems at various contamination sites across the complex:

- The Soil Vapor Extraction and associated air waste stream systems are innovative technologies used to remediate volatile organic compounds in the soil. The Soil Vapor Extraction's development is at a stage where it can be implemented across Department of Defense facilities and could be implemented as a presumptive remedy for volatile organic compounds in soil. A number of air-waste stream treatment technologies are also being tested. These technologies are being developed by small company vendors and need support to gain market acceptance.
- The Dual Vacuum Extraction System and Steam Injection/Vacuum Extraction System at McClellan Air Force Base are emerging technologies that will be used to remediate ground water at four primary areas at McClellan.
- Bioventing technology is a mature technology used to remediate petroleum contamination. This technology has many potential applications across the Department of Defense. The technology is also relatively low cost, which should help reduce overall remediation costs.

5.1.3 Strengths and Weaknesses of the Demonstration Project

Strengths: McClellan Air Force Base is located in a western State, and the technologies being tested also have wide applicability to commercial industrial sites. The base has a sophisticated and effective stakeholder involvement program and has already developed very strong relationships with commercial partners with technologies that are ready to be marketed. Moreover, there is strong management support for the demonstration projects as well as strong backing from the State regulatory agencies. McClellan Air Force Base has a long-standing commitment to the development, transfer, and commercialization of innovative environmental technologies. Another positive feature of the McClellan demonstration project is that environmental cleanup programs at the base have significant education and training elements. McClellan Air Force Base is committed to

forging cooperative relations with national laboratories, California universities, and industry.

Weaknesses: Measures of success regarding the Dual Vacuum Extraction System and Steam Injection/Vacuum System to remediate ground water were not provided. In addition, it is not possible to predict funding stability given the fact that McClellan Air Force Base demonstrations are funded through the Federal budgeting process. However, this is a problem that is common to all federally-funded demonstrations.

5.1.4 Organization and Management of Project

The management structure for the McClellan Air Force Base demonstration project includes the Chief of the Installation Restoration Program responsible for base cleanup at McClellan (Mario Ierardi) and the Director of Environmental Management at the base (Paul Brunner). The primary contractors and military/Federal organizations involved in the demonstration project are CH2M Hill, the Radian Corporation, and the U.S. Air Force. McClellan Air Force Base has approximately 100 professionals in its Environmental Restoration Directorate. Forty-five of these professionals are in the Restoration Division that is dedicated to base cleanup.

5.1.5 Timing and Schedule for Project

The schedule for the Dual Vacuum Extraction/Steam Injection technology at McClellan Air Force Base is as follows:

- Phase I investigation is completed – 1992;
- Phase II pre-design investigation is completed – January/February 1993;
- Phase II work plan is developed – ongoing;
- Phase II construction – approximately January 1994;
- Phase II operations – summer 1993.

The schedule for the Soil Vapor Extraction System is as follows:

- System with catalytic oxidation system completed and air treatment systems' resin system (Pardre) – October 1993;
- Test requirements finalized for Corona Reactor (Techogen) – December 1993;
- Construction of Photochemical Process – March 1994;
- Bench scale test for electron beam (Zapit) – May 1993;
- Further bench scale test in November 1993;
- Pilot scale testing – June 1994. Biofilter is also being planned.

The schedule for the Bioventing Technology is as follows:

- Draft pilot test work plan to Air Force Center for Environmental Excellence/McClellan Air Force Base – May 21, 1993;
- Approval to proceed June 18, 1993;
- Begin VW and VMP construction July 6, 1993;

- Begin initial pilot tests July 12, 1993; complete pilot tests August 27, 1993;
- Interim results report – November 1993;
- Biannual respiration tests – March 1994; and
- Final respiration tests and soil sampling – September 1994.

5.1.6 Estimated Costs/Funding Status

Dual Vacuum Extraction/SIVE: Approximately \$1 million has been spent. McClellan Air Force Base expects to receive \$3.2 million in October 1993.

Soil Vapor Extraction: Approximately \$1 million has been spent. McClellan expects to receive \$5 million in October 1993.

Bioventing: This project has been fully funded.

5.1.7 Success Measures

The success of the demonstration will be measured by the ability of these technologies to meet clean-up levels, the generation of cost and performance information, and market acceptance.

5.2 Williams Air Force Base Demonstration Project

5.2.1 Purpose and Goals of the Demonstration

The purpose of this Pilot Study/Demonstration Study is to evaluate the effectiveness of horizontal extraction wells in containing and remediating petroleum-contaminated ground water from a shallow unconfined aquifer. The results of the demonstration will be compared with data from remediation projects using conventional vertical extraction wells. The demonstration will involve the application of conventional river crossing drilling techniques to remove free product and petroleum-contaminated ground water for treatment. To date, there is little experience with this method of recovery because the technique has only recently been applied to ground-water remediation. It is important to note that this demonstration involves the deepest known horizontal environmental well.

5.2.2 Description of the Project

Based on the plume geometry, hydrological characteristics, and modeling results, it was determined that the optimum placement of a horizontal well would have an east-west orientation, with a screen 500 feet in length located approximately 15 feet below the floating jet fuel. During the Pilot Study/Demonstration Study, this well will be evaluated for its ability to depress the ground-water level so that most of the contaminated plume can be isolated

from the non-contaminated ground water. If testing of this horizontal well indicates efficient plume capture, a second horizontal well with a screen of 500 feet in length will be installed parallel to the first well near the downgradient edge of the dissolved plume. Recovery of free product and contaminated ground water will be accomplished using this second well.

The first well at this site is in place and is just completing demonstration. The related technology of underground pipe location for aiming the well is another prime target for innovation. Improvements are possible in well drilling techniques, casing design and placement, and pumping control technologies.

5.2.3 Strengths and Weaknesses of the Demonstration Project

Strengths: The demonstration has great potential to lower the cost of contaminant recovery by reducing the number of extraction wells and their associated operating and maintenance costs (i.e., one pump instead of 30). This technology may further reduce costs by eliminating extensive surface piping requirements that often disrupt normal land use activities during remediation. The technology may also enhance the Department of Defense's ability to remove contamination from beneath structures (e.g., buildings) and could be applied to other remedial activities such as leachate collection from beneath existing landfills, interception of plumes across a broad front, and reinjection of water to establish hydraulic barriers. The successful demonstration of the technology will expedite the cleanup and turnover of prime, closed military facilities to civilian use. Because the base is a closed military facility, it has high visibility with Arizona's congressional delegation and, therefore, carries positive political significance if it proves successful.

Weaknesses: Costs and benefits of horizontal drilling have not been established relative to vertical well technologies. In addition, the schedule is rather inflexible because the demonstration is at a National Priority List site. Schedule inflexibility could limit the extent to which public involvement activities are enhanced via the DOIT process.

5.2.4 Organization and Management of Project

Because Williams Air Force Base is a National Priority List site, it is party to a Federal Facility Agreement that specifies environmental work elements, schedules, individual responsibilities, and provisions for dispute resolution. This agreement was signed by the Environmental Protection Agency, U.S. Air Force, ADEQ, and the Arizona Department of Water Resources. The U.S. Air Force is represented by the Base Disposal Agency who for this project designated HAZWrap as the service center. HAZWrap has sub-contracted to CDM as the primary contractor for this technology. Other onsite investigations are currently supervised by IT Corporation and OpTech.

5.2.5 Timing and Schedule for Project

The project has just completed the demonstration phase for the first well. A report of the results is expected within approximately 60 days. Installation of a second well is planned for January 1994. Installation of a permanent treatment plant is planned for March 1994.

5.2.6 Estimated Costs/Funding Status

The base is funded from BRAC II funding and is fully funded through FY 1994. Total base cleanup funding budgeted for FY 1994 is \$11.655 million. Cleanup funding is expected to be secure due to the site's National Priority List and BRAC status.

5.2.7 Success Measures

Successful removal of free product and recovery of contaminated ground water for treatment. Another success measure would be evidence that the technology is a cost-effective alternative to conventional vertical well technologies.

5.3 Air Force Center for Environmental Excellence Bioventing Initiative

5.3.1 Purpose and Goals of the Demonstration

The purpose of the demonstration is to conduct a nationwide demonstration of bioventing (i.e., petroleum remedial technology) to provide necessary applicability, cost, performance, and design data. This information is a prerequisite to promoting the widespread application of this technology.

In situ bioventing involves relatively low flow soil aeration to enhance the bioremediation of soil contaminated with organic contaminants. Bioventing maximizes biodegradation while minimizing contaminant volatilization. The contaminants of concern are present at all of the Air Force Center for Environmental Excellence sites and are easily measured in the field prior to implementing the bioventing system.

Laboratory and bench-scale through field pilot testing has been conducted, and numerous full-scale systems have been installed. This technology is ready for widespread implementation at appropriate sites.

5.3.2 Description of the Project

This demonstration project will apply of bioventing technology at the following bases: AF Plant 4, Texas; AF Plant PJKS, Colorado; Beale Air Force Base, California; Davis-Monthan Air Force Base, Arizona; Dyess Air Force Base, Texas; Edwards Air Force Base, California; Ellsworth Air Force Base, South Dakota; Elmendorf Air Force Base, Alaska; Fairchild Air Force Base, Washington; F.E. Air Force Base, Wyoming; Hickam Air Force Base, Hawaii; Hill Air Force Base, Utah; Kelly Air Force Base, Texas; Kirtland Air Force Base, New Mexico; Los Angeles Air Force Base, California; Malmstrom Air Force Base, Montana; March Air Force Base, California; McClellan Air Force Base, California; Nellis Air Force Base, Nevada; Offutt Air Force Base, Nebraska; Randolph Air Force Base, Texas; Travis Air Force Base, California; Vandenberg Air Force Base, California; Eielson Air Force Base, Alaska; Fairchild Air Force Base, Washington; and Galena Airport, Alaska. A total of 77 sites will be involved in this phase of the demonstration project at 26 bases.

5.3.3 Strengths and Weaknesses of the Demonstration Project

Strengths: The strengths of this project stem from the fact that it has an Environmental Protection Agency-validated protocol for testing. The technology is already being tested at multiple sites and is moving towards commercialization. Another advantage to a multiple site demonstration, is that the Department of Defense can compare the relative success of stakeholder programs across the different sites.

Bioventing can also be monitored using highly effective and relatively inexpensive tests at the site eliminating the cost of expensive laboratory analysis. The Air Force Bioventing Team has extensive experience in developing nationwide demonstration projects. This program is centrally executed by the Air Force as well as Engineering Science and Battelle, Columbus. Thus, dedicated functions have been established in all organizations. This has, in turn, resulted in a high level of technical expertise, quality assurance control, efficiency, and cost control. This multi-site demonstration will yield extensive cost and performance data and have good economies of scale compared to other fragmented demonstration projects.

Weaknesses: Multiple sites increase the probability that stakeholder resistance could present itself in unanticipated ways. Moreover, because the technology is now being tested at multiple sites, it is considered to be less innovative than technologies that have not undergone extensive field testing.

5.3.4 Organization and Management of Project

The Air Force Bioventing Initiative is fully funded as a joint effort of Air Force Center for Environmental Excellence/Technology Transfer Division; Brooks Air Force Base, Texas; and the Armstrong Laboratory/Environmental Quality Directorate, Tyndall Air Force Base, Florida. The Air Force Center for Environmental Excellence/EST has direct oversight authority at all sites (there are approximately 110 sites) handled by Engineering Science Inc. The Armstrong Laboratory/Environmental Quality Directorate has direct oversight authority of all sites (approximately 26) handled by Battelle, Columbus.

5.3.5 Timing and Schedule for Project

Approximately 69 systems are installed and operating at this time. Numerous systems will be installed this fall. With the exception of a few special cases or weather dependent factors, all listed demonstrations will be installed and operating by spring 1994. All initial testing is likely to be completed by January 1994. Each system will operate for a minimum of one year.

5.3.6 Estimated Costs/Funding Status

This project is funded and fully supported at the Air Staff level.

5.3.7 Success Measures

The best indicator for success is a high risk reduction per dollar spent. Bioventing can be monitored using highly effective, inexpensive in situ respiration tests. Another success measure will be the number of installations with fully operating stakeholder involvement programs at the end of 1994.

The following projects were judged to be close matches because they did not receive as high of a rating as good matches on one or more of the selection criteria. However, the Working Group believed that these demonstrations were worthy of serious consideration by the DOIT Committee.

6.0. DEMONSTRATION DESCRIPTIONS - Close Matches

6.1 Air Force Center for Environmental Excellence Intrinsic Bioremediation

6.1.1 Purpose and Goals of the Demonstration

Natural biodegradation processes (i.e., intrinsic bioremediation) can under favorable conditions reduce contaminant concentrations in soil and ground water below levels at which active remedial systems are no longer cost-effective (e.g., after pump-and-treat systems have been employed for an extended period of time). Natural biodegradation is particularly effective in removing fuel hydrocarbon contaminants (e.g., benzene, toluene, xylene) from the environment. However, further study is needed to determine how to optimize the use of these natural processes in remediating contaminated sites. The purpose of the Intrinsic Bioremediation Project is to develop an accurate understanding of contaminant fate and transport under natural conditions. A key objective of this demonstration project is to develop a protocol, including an evaluation of ground water cleanup performance (e.g., degree and rate of contaminant destruction) of intrinsic bioremediation.

6.1.2 Description of the Project

The demonstration will use and further develop innovative technologies like the cone penetrometer. This device will be fitted with a fluorescence sensor for detecting benzene and other constituents and to better delineate ground-water plumes. The demonstration will also develop state-of-the-art computer simulation models. Field labs and innovative field tests will also be used to develop a high quality data set.

6.1.3 Strengths and Weaknesses of Demonstration Project

Several members of the Working Group suggested that the Air Force Center for Environmental Excellence Intrinsic Bioremediation Project did not meet Phase I selection criteria, but may be appropriate for consideration for Phase II. Others suggested that the intrinsic bioremediation project should be recast as a site characterization demonstration project with the primary goal of developing accurate rate coefficients for intrinsic biodegradation.

Strengths: The positive features of this demonstration include the provision of systematic data on the rate of environmental degradation of contaminants. It will also provide advances in engineering techniques related to bioremediation. The demonstration will employ

innovative site characterization technologies. Finally, this process may realize significant cost savings over traditional approaches to remediation.

Weaknesses: This demonstration will not necessarily expedite or complete cleanup. Because the demonstration really does not fit the conventional definition of innovative technology, it may face significant institutional and political acceptability barriers that could jeopardize public support for the DOIT process.

6.1.4 Organization and Management of Project

The Air Force Intrinsic Bioremediation Initiative is under Air Force Center for Environmental Excellence/Technology Transfer Division, Brooks Air Force Base. Actual site investigations are conducted by Engineering Science, Inc.

6.1.5 Timing and Schedule for Project

The first phase of this initiative will include 6 sites at non-closure bases, expanding to approximately 12-20 sites in Fiscal Year 1994.

6.1.6 Estimated Costs/Funding Status

This project is fully supported. Funding is likely to increase in the future. Installations are likely to receive direct funding with fiscal year 1993/1994 dollars. Significant allocations have been identified.

6.1.7 Success Measures

The best indicator is a significant risk reduction per dollar spent. A properly conducted intrinsic bioremediation study can provide conclusive evidence of direct biodegradation of contaminants, as well as the rates at which biodegradation is occurring. This initiative will establish biodegradation rates given existing concentrations of electron acceptors (e.g., oxygen, sulfates, nitrates, iron,). However, it will also provide necessary data in support of active bioremediation scenarios where adding more electron acceptors is being considered (e.g., air sparging, bioaugmentation). This information will advance scientific and engineering knowledge of active bioremediation processes.

Success should also be measured in terms of how rapidly and efficiently site managers proceed through initial investigation, remedy selection, negotiation of cleanup objectives, and ultimately to site closure. A peer-reviewed intrinsic bioremediation protocol will provide a mechanism by which private and public environmental managers can responsibly investigate and select the appropriate remedial response.

6.2 Kirtland Air Force Base Demonstration

6.2.1 Purpose and Goals of the Demonstration

There are many municipal, private, Department of Energy, and Department of Defense landfills in the western United States that contain hazardous waste. All of these waste landfills must be covered with an impermeable cover (cap) to prevent infiltration of precipitation that may leach hazardous materials out of the landfill (40 CFR 265). There is speculation that the conventional landfill cover design, a multi-layer cover, including a low-permeability compacted soil layer, is not appropriate for arid land applications. Design innovations from Department of Energy and Department of Defense sponsored research, indicate that new components and systems may have both cost and performance advantages for western landfill sites. The purpose of this project is to demonstrate the capabilities of alternative landfill cover components and systems to provide long-term containment of waste buried in hazardous and mixed-waste landfills in arid/semi-arid western climatic regions.

6.2.2 Description of the Project

Kirtland Air Force Base's demonstration involves the evaluation of advanced covers for landfills, and thus applies to any waste left in place. Since the technology under evaluation is primarily an above-ground technology, the site geology is not of principal importance. However, the site is located in arid areas where potential problems may arise from the desiccation of clay layers. The contamination problem at Kirtland includes both hazardous and mixed waste.

The Advanced Landfill Cover Demonstration Project shows promise in enhancing containment of buried waste with the construction, testing, and evaluation of a number of intermediate scale (less than one acre) innovative landfill cover designs that may be more appropriate for arid climates. One of the cover designs will be the present conventional design as governed by Environmental Protection Agency guidance. Three alternative designs will be tested for comparison against the conventional design: the Environmental Protection Agency Advanced Composite Cover, the Los Alamos Bio-Engineered Cover, and the Sandia Dry Barrier design. The test will emphasize measurement of the water balance for each design option, and generate data for runoff, erosion movement through the cover, lateral drainage, change in water storage, and evapotranspiration. Success is measured by the degree to which advanced designs address short-

comings of the conventional cap designs for the western United States.

Data collected from this demonstration project will be used to perform long-term performance assessments, provide support for designs of landfill covers in semi-arid climates, and to support cost-benefit analyses.

6.2.3 Strengths and Weaknesses of Demonstration Project

Strengths: The benefits are that the effective containment of buried wastes in a cost-effective manner is a widespread need, and the development of new waste containment technologies could make a significant contribution to resolving problems relating to long-term isolation of buried wastes in arid regions. Another positive feature is that the demonstration has a relatively low cost. Moreover, there is public understanding and support for the project as well as Environmental Protection Agency involvement. There are positive factors for commercialization of this technology that stem from the fact that every hazardous and mixed waste landfill, and many solid waste landfills, will require closure with a cover system. This demonstration may lead to a less costly, Environmental Protection Agency approved design.

Additional comments regarding the strengths of the Kirtland Advanced Landfill Cover Demonstration Project are presented in Addendum A of this document.

Weaknesses: Members of the Working Group pointed out that past experience suggests that the capping technology may not stand up under significant volumes of water and/or snow melt. Another limitation is that the demonstration is not initially at a real site (i.e., the technology will be demonstrated on a clean site). Moreover, the technology does not deal with the gas generation and off-loading problem. Another limitation is that the technology is only a containment technology and not a cleanup process. Finally, the study will not look at mass balance data that is critical to establishing overall performance features.

6.2.4 Organization and Management of Project

The lead for this demonstration project will be Sandia National Laboratories whose mission is to facilitate the transfer of innovative environmental technologies. Another key member of the project team is Los Alamos National Laboratory, which has considerable experience in demonstrating landfill capping technologies and has been working with industry and the State of New Mexico to transfer some capping technologies. The team also includes the U.S. Department of Agriculture, which has a history of development and commercialization of decision support software packages. Both the Environmental Protection Agency and Colorado State University are involved with the project. The project is led by the Integrated Demonstration Coordinator supported by an administrative staff. A program manager and technology specialist are

responsible for the planning and implementation of the demonstration. Specific technology areas are led by principal investigators.

6.2.5 Timing and Schedule for Project

Sandia National Laboratory has been developing the Advanced Landfill Cover designs and associated technologies, including field demonstrations, laboratory studies, and design software. The demonstration project will be ready to begin by January 1994, or possibly even earlier.

6.2.6 Estimated Costs/Funding Status

Funding for FY 1994 should be approximately \$1.2 million. Projects currently funded by the Department of Energy's Office of Technology Development include:

- Advanced Landfill Cover Designs (FY 1992 - \$200K);
- Migration Barriers for Landfills (FY 1994 - \$305 K);
- Decision Support System for Landfill Covers (FY 1994 - \$250K); and
- Dry Barrier Application for Landfills (FY 1994 - \$475K).

Funding for the demonstration is likely to remain stable for at least three years.

6.2.7 Success Measures

Success is defined as demonstrating that the advanced designs address shortcomings of conventional capping designs in the western United States (i.e., desiccation of clay layers). Collection of data from the field demonstration can begin within a year of funding, and the project has a scheduled duration of five years.

6.3 March Air Force Base Demonstration

Because of time schedule commitments, Mr. John Sabol elected not to participate in the Phase I demonstration program. The following information is provided as part the public record on the Phase I demonstration selection process.

6.3.1 Purpose and Goals of the Demonstration

The purpose of the demonstration is to compare the costs and cleanup effectiveness of alternative in situ treatment technologies to treat ground water contaminated with trichloroethylene.

6.3.2 Description of the Project

The in situ treatment system at March Air Force Base's Site 2 removes chlorinated and aromatic volatile organic compounds from ground water by converting them to a gas phase and destroying them with a photocatalytic oxidation unit. This process has three stages: (1) an air-lift pumping technique, (2) an in situ vapor stripping method, and (3) air sparging. The system is a pilot test scale, has been installed, and sampling is being conducted periodically.

The Vacuum Vaporized Well technology at March Air Force Base's Site 31 removes volatile organic compounds from ground water by combining an air-lift pumping technique with in situ vapor stripping. This technology has been demonstrated in Europe at various sites; however, it is still in the demonstration phase in the United States. (Note: an Environmental Protection Agency SITE demonstration of the well vaporizing technology was conducted at March Air Force Base on June 17, 1993.)

March Air Force Base has extensive experience in implementation of remedial alternatives. The base has used innovative technologies in the past and is planning five more to be up and running in the near future.

6.3.3 Strengths and Weaknesses of the Demonstration Project

Strengths: The benefit of the in situ ground-water treatment system at March Air Force Base is that it may be transferrable to other contaminated ground-water sites throughout the United States. If successful, it will have wide applicability across many Federal facilities and private sites contaminated with volatile organic compounds and petroleum products.

The benefit of the Vacuum Vaporized Well technology is that it represents a new generation of ground-water treatment technologies that may be faster, less expensive, and more effective. The technology can reduce treatment and disposal costs because of its sensible design and in situ remediation.

Another benefit of this demonstration project is that it involves a test-off of two alternative technologies. The technologies being

compared may have widespread applicability to commercial sites. Furthermore, March Air Force Base is a high-profile site with good local community and regulator buy-in.

Weaknesses: Members of the Working Group identified several important weaknesses regarding the demonstration: the demonstration schedule is relatively rigorous and inflexible; the clean up process focuses on hot-spots and not the entire contamination plume, which may create a public perception that March Air Force Base is attempting to circumvent CERCLA. Working Group members observed that the demonstrations may lack adequate technical evaluation plans and, consequently, it may be difficult to measure the effectiveness of the demonstrations.

6.3.4 Organization and Management of Project

Mr. John R. Sabol is Remediation Project Officer at the March Air Force Base. IEG Technologies will demonstrate the Vacuum Vaporizing Well Technology through their contractor, Roy F. Weston, Inc., in cooperation and support of March Air Force Base and the Environmental Protection Agency's SITE Program. The Environmental Protection Agency's SITE Contractor is PRC of San Diego (the contact is Roger Argus). IT Corporation is demonstrating the in situ ground-water treatment system under the SITE program.

6.3.5 Timing and Schedule for Project

The Site 2 demonstration project at March Air Force Base is currently in pilot phase and a one-year extension is projected. The Site 31 demonstration project at March Air Force Base is currently in pilot phase and a one-year extension is projected in November 1993.

6.3.6 Estimated Costs/Funding Status

Funding for the vacuum vaporizing well project has been adequate - it has cost \$300K for installation of the system and \$300K for sampling. Funding for the in situ ground-water treatment system has been stable. The in situ ground-water treatment system has cost \$450K for hardware and \$250-300K for sampling. Air Staff M.I.Q. has assured the base that all necessary dollars and support will be provided to complete both demonstration projects.

6.3.7 Success Measures

Direct measures of success include cost effectiveness and market acceptance of the two technologies.

As noted above, the following projects were submitted after the Working Group had completed its screening process. Consequently, the descriptions for some of the projects are not presented in the format used for the other projects.

7.0 ADDITIONAL CANDIDATE DEMONSTRATION PROJECTS

7.1 Port Hueneme Navy Construction Battalion Center

Contamination at the Naval Construction Battalion Center (NCBC), Port Hueneme, California originated primarily from fuel distribution to port during World War II. Marine diesel, gasoline, and bunker fuel leakage from fuel farm operations and some sixty underground storage tanks (USTs) over this long period of time has resulted in extensive brackish and fresh ground-water, and soil contamination. As part of an NCBC installation restoration project, USTs will be removed and 18,000 cubic yards of contaminated soil will be excavated for cleanup. Numerous UST excavation sites are in areas of shallow water tables - some brackish water and others with fresh water contain high suspended solids.

7.1.1 Purpose and Goals of the Demonstration

The purpose of the NCBC Project is to conduct side-by-side field demonstrations comparing advanced hydrocarbon remediation technologies under similar conditions. The goal is to achieve regulatory and institutional acceptance of, and transfer to industry, innovative fuel hydrocarbon remediation technologies. These demonstrations would be documented for technology transfer to "user teams" within DoD engineering and environmental organizations, which are making remedial action decisions and external transfers to industry and other Federal, State, and municipal organizations evaluating those decisions or implementing the technologies.

7.1.2 Description of the Project

The NCBC Port Hueneme Demonstration Project involves testing innovative fuel hydrocarbon remediation treatment train technologies at an ex situ soil treatment site, ex situ ground-water treatment facility(s), and in situ soil and ground-water treatment sites.

Ex situ fuel-contaminated soil treatment site demonstrations will consist of:

- **Bioremediation** - In this bioreactor demonstration, variations of highly mobile nutrient mixes will be evaluated with respect to optimizing in native soil, hydrocarbon degrading microorganism activity to quicken the pace of cleanup.
- **Low Temperature Thermal Desorption Processes** - This technology will thermally desorb hydrocarbon compounds from the soil without heating the soil to combustion temperature. Potential air polluting organic or particulate by-

products will be destroyed or concentrated using an emission-controlled treatment train of afterburners, high-energy scrubbers, fabric filters, and/or carbon absorption systems.

Technologies for demonstrating ex situ fuel-contaminated ground-water treatment and in situ soil and ground-water treatment will be identified through a multi-disciplinary peer review process. Projects from the EPA SITE emerging technology and demonstration program may be candidates for demonstration at NCBC Port Hueneme.

7.1.3 Strengths and Weaknesses of the Demonstration Project

Strengths: The strengths of this demonstration include the fact that it will be equivalent to an EPA SITE project with respect to stringent QA/QC testing, and the standardized data fields and documentation. Major benefits resulting from this technology demonstration on the California coast are applicable and transferable to a large number of coastal DoD sites and commercial industrial sites. There is strong Navy management support for this technology demonstration program. The Naval Facilities Engineering Service Center located at NCBC Port Hueneme has a strong long-standing environmental program in research, development, demonstration, technology transfer, and implementation support. The demonstration site will then be used for site visits for numerous tri-service engineering, and environmental officer short courses/seminars.

Weaknesses: There is a moderate risk that regulatory and institutional constraints could impede innovative technology demonstrations.

7.1.4 Organization and Management of Project

This is one of several sites managed under the umbrella of the National DoD Environmental Technology Demonstration Program initiative now underway. This program includes extensive coordination and collaboration within DoD, as well as with EPA SITE and other Federal and State fuel hydrocarbon remediation laboratory studies and field demonstrations. The demonstration will be managed by the Naval Facilities Engineering Service Center. The principal investigators from DoD organizations, other Federal organizations, or industry will be responsible for the treatment project execution.

7.1.5 Timing and Schedule for Project

- Ex situ soil treatment site:
 - Bioremediation - 10/93 to 9/95
 - Low Temperature Thermal Desorption - 6/94 to 9/97

- Ex situ ground-water treatment facility - 10/96 to 9/98
- In situ soil and ground-water treatment site - 10/97 to 9/99

7.1.6 Estimated Costs/Funding Status

- Bioremediation - Approximately \$800K has been spent on site development. The Naval Facilities Engineering Service Center expects to receive \$890K in October 1993 and \$150K in June 1994.
- Low Temperature Thermal Desorption - Approximately \$200K has been spent on laboratory studies. In June 1994, an additional \$400 K is expected with follow-on funding of \$800K in FY 1995/96.
- Ex situ ground-water treatment demonstrations are expected to be in the \$1,500K range (unfunded)
- In situ soil and ground-water treatment demonstrations are expected to be in the \$2,500K range (unfunded).

7.1.7 Success Measures

Success will be measured by meeting cleanup levels acceptable to regulators and transferring technologies with performance data and design guidelines to industry.

7.2 Ellsworth Air Force Base

Ellsworth AFB is currently on the Superfund NPL and contamination investigations are underway by Air Force Contractors. Incorporating an innovative technology would fit into the current process of choosing a cleanup remedy. Project managers from Ellsworth AFB and the Environmental Protection Agency have a good working relationship with each other and the State. Air Force managers are very concerned with proper cleanup and informing the public on base activities regarding Superfund activities.

Technical review committee meetings held every three months at Ellsworth AFB are open to the public would be a good forum for explaining and reporting the innovative treatment technology. The site is five miles from the Rapid City Regional Airport which would provide easy access for out-of-state individuals to review the project on-site. Contamination at the AFB is ranges from petroleum hydrocarbons to solvents.

7.3 Black Hills Ordnance Depot

Innovative technologies would enhance the cleanup of the Depot, aiding the economic development of the area. There is a local interest in site cleanup. Innovative technologies may also enhance water

development and distribution in and around the Depot. Contamination from munitions renovation and destruction at the site may be similar to other depot sites in western states, thus innovative technologies developed at the Black hills Ordnance Depot could also be used elsewhere. Also, the depot is being looked at for inclusion on the Superfund NPL.

8.0 NEXT STEPS

The Waste Contaminants at Military Bases Working Grouping is (1) developing a strategic plan for defining key goals and activities for Phase I; (2) creating a internal peer review group of technical, commercialization, and public involvement experts to review Phase II demonstration project proposals; and (3) outlining a process for site and technology selection.

This page intentionally left blank.

9.0 Appendices

9.1 Correspondence

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

377 ABW/CC
2000 Wyoming Boulevard SE
Kirtland AFB NM 87117-5606

Western Governors' Association
Military Bases/DOIT Committee
Attn: Mr Bud Hoda
600 17th Street
Suite 1705 South Tower
Denver CO 80202

Dear Mr Hoda

I would like to express our strong support of the Advanced Landfill Cover Demonstration (ALCD) project proposed to the Western Governors' Association. Just as with most other military bases, we have numerous abandoned as well as active landfills which require closure. Using the conventional cover design, the anticipated cost of closure will be \$1 million per acre.

The ALCD project directly addresses the key issues of how to effectively and economically cover these landfills to achieve closure. In particular, the involvement of the EPA in the demonstration will facilitate the regulatory and public acceptance of the alternative cover designs. Additionally, these alternative designs are likely candidates for use at other military bases in similar climates.

We look forward to working on the ALCD project with the team of technologists and environmental restoration professionals from Sandia National Laboratories, D.B. Stephens & Associates, the EPA, and the New Mexico Environment Department, as well as with the public.

Sincerely

JAMES L. HIGHAM
Brigadier General, USAF
Commander

cc: J. Marsh, Ofc of the Secretary of Defense
J. Souby, Executive Director, WGA
D. Vacker, Ofc of the Governor of NM
D. King, Advanced Sciences
J. Nelson, Sandia National Laboratories

Sandia National Laboratories

Albuquerque, New Mexico 87185

October 22, 1993

**Gary Vest
Principle Assistant Deputy
Under Secretary of Defense
(Environmental Security)
3400 Defense Pentagon
Washington, D.C. 20301-3400**

Dear Mr. Vest:

A couple of weeks ago, Gordon Davidson and I finally got in touch with each other. Besides some discussion of his upcoming job at Capitol Environmental, we discussed how he thought Sandia could best support EPA's and other federal agencies' environmental agenda. He immediately responded that the new paradigm of industry, federal government, and national laboratory joint environmental projects in support of economic growth, as advocated by the Western Governors' Association (WGA), should receive Sandia's attention. I mentioned that we have been active in this area and have pursued three different WGA projects. These projects involve critical technology needs and have broad advocacy from the EPA, state officials, industry, and the technical community. These projects correspond to three of the focus areas of the WGA initiative--mining, base closure, and mixed waste. I indicated to Gordon, however, that Sandia and other perspective participants in the WGA initiative have been concerned by a lack of a major financial commitment on the part of the signatories of the WGA Memorandum of Agreement (MOA)--a commitment that is essential to moving the WGA concept to a reality. Gordon told me that federal agency support of the WGA MOA is now coming together and that recently, your office has committed funds to support this effort, presumably for the base closure area.

I believe it is essential for the first projects in each WGA focus area to address important needs through success oriented, well planned projects. In the base closure area, Sandia has come forward with what we believe to be a project that will satisfy these objectives. The project we have in mind involves the demonstration of alternative landfill cover technologies and systems to provide long-term containment of hazardous waste buried in landfills located in arid/semi-arid western climate regions. In working with

Mr. Gary Vest
October 22, 1993
Page 2

EPA, DOE, and DoD partners, we have learned that conventional landfill cover designs which follow EPA protocol become ineffective because of desiccation in dry climates. Recent EPA-sponsored research suggests that modifications to conventional designs are necessary in dry climates to insure that compacted soil layers remain effective. Design innovations from DOE and DoD-sponsored research indicate that new components and systems may have both cost and performance advantages for western landfill sites.

For the WGA initiative, we have the endorsement of the Kirtland Air Force Base (see attached letter) to carry out a demonstration project involving the construction, testing, and evaluation of a number of intermediate scale landfill cover designs. Alternatives using an EPA advanced composite cover, a Los Alamos bio-engineered cover, and a Sandia dry barrier layer, would be investigated. Industry partners including, D. B. Stephens & Associates, Inc., designers of a dry barrier cover system, will partner in this work. In addition, Robert Landruth, EPA's chief architect of their technical guidance documents for landfill closures, has agreed to partner in this work.

My reason for bringing this proposed project to your attention is that I am concerned that although this project addresses a major problem shared by municipalities, private industry and the federal government, it may be viewed by some as lacking the pizzazz and "high-tech" attributes of other "more permanent" remediation alternatives (e.g., bioremediation, surfactant enhanced extraction, and electrokinetics). In fact, I have recently learned that the review group responsible for ranking FY94 base closure proposals for WGA has actually screened out the landfill cover project, even though the project would support WGA's stated emphasis on the use of expedient and cost-effective containment technologies versus longer term and more costly permanent remediation. In my opinion, this action could undermine the chances that the first WGA projects prove successful and relevant.

I have attached a copy of the Advanced Landfill Closer Demonstration Project proposal we submitted to the WGA Base Closure Committee, together with a set of the vugraphs Sandia presented to the committee. Also, I have attached a copy of a letter of endorsement from Brigadier General James L. Higham, USAF, Commander, 377th Air Base Wing, Kirtland Air Force Base.

Mr. Gary Vest
October 22, 1993
Page 3

Based on this material, I have difficulty understanding why this highly relevant project can fall "below the line" in FY94. It may not be fancy, but it possibly can get the job done.

Sincerely,

A handwritten signature in cursive script, appearing to read "Dennis".

Dennis L. Berry, Manager
Environmental Technology Programs

Attachments

Copy to:

Brig. Gen. James L. Higham, Commander, 377 ABW, KAFB,
Col. Thomas A. Norris, 377 ABW/EM, KAFB
6600 Joan B. Woodard
6621 Jennifer Nelson
6621 John Stormont
6900 Tom Hunter

Sandia National Laboratories

Albuquerque, New Mexico 87185

October 20, 1993

John Munro
Coleman Research Corporation
95 L'Enfant Plaza S.W.
Washington, D. C. 20024

Dear John:

There are two typos I noticed on p. 14, section 5.5.2. First sentence, second paragraph: "burred" should be "buried". Third sentence, second paragraph: there should be a colon after purposes.

My principal comments regard the Weaknesses section. I'm not sure that you are asking for my comments in this area, but since I was given no opportunity to rebut the weaknesses, I will provide you with my response. I respond to each sentence in the Weaknesses paragraph below:

1. The purpose of the test is to determine how well new technologies will work at limiting water movement through a cover. The fact that previous tests on different designs indicated that they allowed some water movement seems more of a motivation for the tests rather than a weakness.
2. The demonstration is not at a contaminated site because (1) there is no need because the test doesn't involve contaminants (its physically above the contaminants), and (2) being at a clean site expedites the demonstration by reducing permitting and health and safety concerns and issues.
3. The so-called "gas generation" problem can be accounted with the alternative designs as easily as the conventional designs. Not all landfills have gas problems; those that do have to vent the gas regardless of the cover design. There is absolutely no reason gas venting cannot be incorporated into the alternative designs if necessary.
4. Being a containment technology is far from a weakness in my mind. The vast majority of buried waste and landfill sites will employ containment technologies regardless of other remediation efforts (if for no other reason than it is mandated by law).
5. The test does not have a complete mass balance approach, but is a reasonable combination of mass balance for drainage and precipitation and integrated local measurements of water content within the soil. The test as designed will be useful as evinced by the support of the developers of EPA's HELP model.

Please let me know if I can provide any other information.

Sincerely,

A handwritten signature in black ink, appearing to read "J Stormont". The signature is fluid and cursive, with a long horizontal stroke extending from the end.

John Stormont
Environmental Restoration Technologies Department

9.2 Listing of Working Group Members

WASTE CONTAMINANTS AT MILITARY BASES WORKING GROUP AS OF JANUARY 12, 1994

Julie Anderson
Hazardous Waste Management H9
U. S. EPA, Region IX
75 Hawthorn Street
San Francisco, CA 94105
(415) 744-2420
fax (415) 744-1917

Sally Benson
Lawrence Berkeley Laboratory
One Cyclotron Road
Bldg 50E/Earth Science Div.
Berkeley, CA 94720
(510) 486-5875
fax (510) 486-5686

Paul Brunner
SD-ALB/EL
3200 Peacekeeper Way, Suite 11
McClellan AFB, CA 95652-1036
(916) 643-1250
fax (916) 643-5880

Bill Burke
Umatilla Tribe
P. O. Box 638
Pendleton, OR 97801
(503) 276-0293

Olice Carter
U.S. Bureau of Mines
Tuscaloosa Research Center
University of Alabama Campus
P.O. Box L/Capstone Drive
Tuscaloosa, AL 35486-9777
(205) 759-9435
fax (205) 759-9440

DeCarlo Ciccel
Air Force Base Disposal Agency
1700 N. Moore Street, Suite 2300
Arlington, VA 22209
(703) 696-5539
fax (703) 696-8833

Ralph de Gennaro
Friends of the Earth
530 7th Street S.E.
Washington, D.C. 20003
(202) 675-2286
fax (202) 543-4710

Ryan DuPont
Utah Water Research Lab
Utah State University
1600 Canyon Road
Logan, UT 84321
(801) 750-3227
fax (801) 750-3663

Jeff Edson
Colorado Department of Health
4300 Cherry Creek Drive, South
Denver, CO 80222-1530
(303) 692-3388
fax (303) 759-5355

Felix Flechas
Hazardous Waste Management Div.
U. S. EPA, Region IX
999 18th Street
Denver, CO 80202
(303) 293-1524
fax (303) 293-1488

Marty Gray
State of Utah/Division of
Solid & Hazardous Waste
288 North 1460 West
Salt Lake City, UT 84116-4880
(801) 538-6170
fax (801) 538-6715

Mary Grisco
Sierra Club
P.O. Box 103441
Anchorage, AL 99510
(907) 279-4966

Joe Iovenitti
Weiss Associates
5500 Shellmound Street, Suite 100
Emeryville, CA 94608-2411
(510) 450-6000
fax (510) 547-5043

Russell Jim
Project Manager ER-WM
Yakima Indian Nation
622 West 1st Street
Wapato, WA 98951-1108
(509) 877-4151
fax (509) 877-4101

Steve Johnson
Arizona Department of
Environmental Quality
3033 N. Central Avenue, 5th floor
Phoenix, AZ 85012
(602) 207-2300
fax (602) 207-2218

Nevan Kane
Bureau of Federal Facilities
Nevada Division of
Environmental Protection
333 West Nye Lane
Carson City, NV 89710
(702) 687-5872 X-3027
fax (702) 885-0868

Margaret Kelly
U. S. EPA
2800 Crystal Drive, 9th floor
Arlington, VA 22202
(703) 308-8748
fax (703) 308-8528

Lionel Koon
EML Projects
6985 Union Park Center
Suite 545
Midvale, Utah 84047
(801)568-0734
fax(801)568-0776

Matt McDermott
Dept of Env & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

Lt. Colonel Ross Miller
US Air Force CEE
Building 642
8001 Arnold Drive
Brooks AFB, TX 78235-5357
(210)536-4314
fax (210) 536-4339

Andy Paterson
Managing Director, RIMTECH
215 N. Marengo Avenue, 3rd fl.
Pasadena, CA 91601
(818) 584-9139
fax (818) 356-7414

Dana Sakamoto
Head, BRAC
SW Div - Naval Facilities
Engineering Command
Environmental Div (Code L71)
1220 Pacific Hwy, Room 18
San Diego, CA 92132-5181
(619) 532-2590
fax (619) 532-2607

Richard Schlenker
Superfund Unit Supervisor
Nebraska DEQ
1200 "N" Street
Lincoln, NE 68509
(402) 471-3388
fax (402) 471-2909

Lenny Siegel
Dir., Pacific Studies Center
222V View Street
Mountain View, CA 94041
(415) 961-8918
fax (415) 968-1126

John Smith
Air Force Base Disposal Agency
1700 N. Moore Street, Suite 2300
Arlington, VA 22209
(703) 696-5534
fax (703) 696-8833

W. Timothy Steele, Manager
Federal Facilities Unit
Arizona Dept of Env Quality
3033 North Central Avenue, 5th fl
Phoenix, AZ 85012
(602) 207-4224
fax (602) 207-4236

Dag Syrrist
Technology Funding
2000 Alameda de las Pulgas
San Mateo, CA 94403
(415) 345-2200 X-116
fax (415) 341-1400

John Wesnousky
Dept of Toxic Subst Control
CAL-EPA
Building 3, Suite 101
Sacramento, CA 95826
(916) 322-2543
fax (916) 643-6827

Peter Wood
CAL-EPA
CA Dept of Toxic Substances
8950 Cal Center Drive
Building 3, Suite 101
Sacramento, CA 95827
(916) 255-2012
fax (916) 643-0827

Alternates

Bob Butler
Air Force Base Disposal Agency
1700 N. Moore Street, Suite 2300
Arlington, VA 22209
(703) 696-5534
fax (703) 696-8833

Bob Devany
Weiss Associates
5500 Shellmound Street, Suite 100
Emeryville, CA 94608-2411
(510) 450-6144
fax (510) 547-5043

Joe Greenblott
U.S. EPA, Region IX
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-2407
fax (415) 744-1917

Patrick Haas
U. S. Air Force
AFCEE/EST
8001 Arnold Drive
Brooks AFB, TX 78235-5357
(210) 536-4314
fax (210) 536-4330

Paul Hadley
CAL-EPA
California Dept. of Toxic
Substances Control
301 Capitol Mall, 1st floor
Sacramento, CA 95814
(916) 324-3823
fax (916) 327-4494

*Bud Hoda
McClellan Air Force Base
SM-ALC-EMR
3200 Peacekeeper Way, Suite 11
McClellan AFB, CA 95652-1036
(916) 643-0830, Ext. 377
fax (916) 643-0827

**Working Group spokesperson*

Juan Koponen
CAL-EPA
Dept. of Toxic Substances Control
P. O. Box 806
Sacramento, CA 95812-0806
(916) 255-2012
fax (916) 643-0827

Richard C. Ragaini
Technology Development
Lawrence Livermore National Lab.
P. O. Box 808, L626
Livermore, CA 94550
(510) 423-8877
fax (510) 423-9987

Charles Schultz (alt for L. Koon)
EML Projects
6985 Union Park Center, Suite 545
Midvale, UT 84047
(801) 568-0734
fax (801) 568-0776

Peter Strauss
MHB Technical Associates
1723 Hamilton Ave. Suite K
San Jose CA 95125
(408) 266-2716
fax (408) 266-7149

Observers & Advisors

Dan Casagrande
MITRE Corporation
AFCEE/EST Building 642
8001 Arnold Drive
Brooks AFB, TX 78235-5357
(210) 536-4303
fax (210) 536-4339

John Chionchio
Dave Capouya
C.M.S.
4904 Eisenhower Boulevard, Suite 310
Tampa, FL 33634
(813) 882-0396

Bill Gallant
Watkins Johnson Environmental
303 East 17th Avenue, Suite 550
Denver, CO 80203
(303) 831-8868
fax (303) 831-8708

Betsy McBride
CCEM
6265 E. Jamison Circle North
Englewood, CO 80112
(303) 279-2700
fax (303) 279-9106

Muhammad Owais
Defense Nuclear Agency
6801 Telegraph Road
Alexandria, VA 22310
(703) 325-7744
fax (703) 325-2951

Clinton Skinner
Range Management
P. O. Box 3354
University Station
Laramie, WI 82071
(307) 766-4139

Ken Smarkle
MITRE Corporation
SM-ALC-EMR
3200 Peacekeeper Way, Suite 11
McClellan AFB, CA 95652-1035
(916) 643-0531
fax (916) 643-0429

Steve Stein
Integrated Demonstration
Coordinator
Battelle - PNL
4000 NE 41st Street
Seattle, WA 98105-5428
(206) 528-3343
fax (206) 528-3552

Staff

John Munro, Ph.D
BDM Federal/Coleman Research
Corporation
950 L'Enfant Center, SW
8th Floor
Washington, DC 20024
(202) 863-0916
fax (202) 863-9259

Melinda Holland
(Facilitator)
Clean Sites
1199 N. Fairfax Street, Suite 400
Alexandria, VA 22314
(703) 739-1205
fax (703) 548-8773

Jim Lehr
Western Governor's Assoc.
600 17th Street
Suite 1705 South Tower
Denver, CO 80202
(303) 623-9378
fax (303) 534-7309

Please note that the findings of the Contaminants at Military Bases Working Group Report do not necessarily reflect the views of every member of the working group. Some members were not able to participate in the development of the report, nor were they able to fully review its contents. This report does not represent the official view of any federal agency or department, state, or other group.

**DATE
FILMED**

9/22/94

END