

# Bechtel

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December 15, 1994

Department of the Navy - Southwest Division  
Naval Facilities Engineering Command  
Environmental Division  
1220 Pacific Highway, RM 18  
San Diego, CA 92132-5181

Attention: Joseph Joyce BRAC Environmental Coordinator

Subject: Examination of Capping as a Presumptive Remedy

Dear Mr. Joyce:

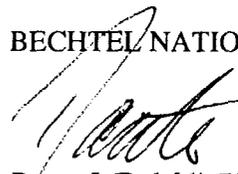
I have attached the summary letter report for a small study that was conducted to determine if it was possible to identify any differences between DOD and non-DOD sites with respect to the extent and aggressiveness of investigation methods and sampling strategies. Specifically, the work focused on approaches used in conjunction with capping as a presumptive remedy at existing landfill sites.

In spite of limitations encountered during our efforts, in general, the results were conclusive and demonstrated that there were some appreciable differences in level of investigative effort for landfill sites between Superfund-lead and DOD-lead investigations and cleanups. Specifically, soil boring and soil sampling efforts were more rigorous at DOD-lead sites. There was no difference noted for groundwater investigations and a weak trend towards more intensive soil gas sampling at DOD-lead sites. It is not known whether these apparent trends can be observed for other sites with different remedial approaches.

These apparent differences should be considered when evaluating investigative approaches proposed for MCAS El Toro.

Sincerely,

BECHTEL NATIONAL, INC.



Dante J. Tedaldi, Ph.D., P.E.  
Technical Quality Assurance MCAS El Toro



cc:

Larry Vitale, Remedial Project Manager  
California Regional Water Quality Control Board - Santa Ana Region  
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Bonnie Arthur, RPM  
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Hazardous Waste Management Division, H-9-2  
75 Hawthorne Street  
San Francisco, CA 94105-3901

Attachments

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To: MCAS El Toro BRAC Cleanup Team

From: Dante J. Tedaldi

Re: An Examination of the Presumptive Remedy Approach to Capping: A Comparison of Department of Defense Sites and Records of Decision in Region IX to Non-Department of Defense Records of Decision.

Date 15 December, 1994

I have attached the summary letter report for the research study that we recently executed out of Bechtel's San Francisco office. This study was conducted to determine if it was possible to identify any differences between DOD and non-DOD sites with respect to the extent and aggressiveness of investigation methods and sampling strategies. Specifically, the work focused on approaches used in conjunction with capping as a presumptive remedy at existing landfill sites.

The data set examined for this study was relatively small and probably not truly representative of the presumptive remedy approach. This was attributed to the fact that the concept of presumptive remedies is too recent to have made it through to the Record of Decision at many sites. However, in general, the results were conclusive and demonstrated that there were some appreciable differences in level of investigative effort for landfill sites between Superfund-lead and DOD-lead investigations and cleanups. Specifically, soil boring and soil sampling efforts were more rigorous at DOD-lead sites. There was no difference noted for groundwater investigations and a weak trend towards more intensive soil gas sampling at DOD-lead sites. It is not known whether these apparent trends can be observed for other sites with different remedial approaches.

# **An Examination of the Presumptive Remedy Approach to Capping: A Comparison in USEPA Region IX of Department of Defense Sites and Records of Decision to Non-Department of Defense Records of Decision**

## **1. Introduction**

The purpose of this study was to evaluate the procedures used during remedial investigations (RIs) of Region IX National Priority List (NPL) sites containing landfills. The study focused on two principal goals:

- When sufficient site information was available, compare the extent of remedial investigations at United States Environmental Protection Agency (EPA) lead sites versus the extent of investigation at Principal Responsible Party (PRP) or DOD-lead sites.
- Evaluate the Superfund Accelerated Cleanup Model's (SACM) presumptive remedy approach as applied to remediation of landfill sites in Region IX.

This study did not examine differences between sites in cleanup levels for specific contaminants. However, a separate study of that type would probably be useful and may require a significant level of effort to complete.

## **2. Summary**

This study demonstrated that it is very difficult to make meaningful comparisons between NPL sites based on levels of investigative effort. A significant limitation was the differences in size or scale of the sites. However, normalization of the data to a common set of units aided in the comparison. In most instances, number of samples, wells, and soil vapor extraction points were normalized to a unit area basis.

The data set examined for this study was relatively small and probably not truly representative of the presumptive remedy approach. This was attributed to the fact that the concept of presumptive remedies is too recent to have made it through to the Record of Decision at many sites. Several other non-DOD non fund lead sites have been extensively investigated, but the documents are not available at the Superfund Information

Records Center. Further comparison with these sites could be made by reviewing the site record at local repositories or through FOIA requests.

In spite of these limitations, in general, the results were conclusive and demonstrated that there were some appreciable differences in level of investigative effort for landfill sites between DOD-lead and non-DOD investigations and cleanups. Specifically, soil boring and soil sampling efforts were more rigorous at DOD-lead sites. There was no difference noted for groundwater investigations and a weak trend towards more intensive soil gas sampling at DOD-lead sites. It is not known whether these apparent trends can be observed for other sites with different remedial approaches. (i.e., non-landfill sites).

### **3. Study Methodology**

The search for information relevant to these goals began with the objective to generate a complete list of Region IX CERCLA sites that involve investigation and remediation of landfills.

The first step was a search of EPA's Record of Decision (ROD) data base in Region IX headquarters in San Francisco, CA, which lists all CERCLA sites with signed RODs. The search used key words such as landfill and capping to generate a preliminary list of sites. Since a ROD is signed at the end of the site investigation process, the data base only included sites that were far along in the CERCLA investigation process.

An additional source of information was the *92/93 Guide to Superfund Sites* (DiGregorio 1992). This document provided additional sites that did not have signed RODs and so were not included in the ROD data base. The results of these searches were combined to produce the list of sites in Table 1.

Each site listed in Table 1 was evaluated to determine the availability of Remedial Investigation (RI) Reports and other relevant documents. The limited time-frame available for the study imposed restrictions that prevented acquiring these documents for every site listed in Table 1. Access to the Region IX Superfund Information Records Center allowed review of the complete administrative records of the non-DOD sites, but the Records Center contained microfiche copies of the supporting documents for only two sites.

No administrative records for DOD sites are available at the Records Center and these can only be accessed locally (i.e., in the vicinity of the site location) or through Freedom of Information Act (FOIA) requests. FOIA requests take too long (several months) to be useful for this study.

A limited number of remedial investigations and/or feasibility studies from several DOD NPL sites were available for review at Bechtel's San Francisco Resource Center. These

DOD sites are noted in Table 1. The Resource Center did not have the complete record for each of these sites.

RIs and related documents from a total of six sites were available for review within the time-frame of this study. The two non-DOD sites are municipal landfills, and the remaining four are DOD facilities containing landfills. Table 2 summarizes the status of these six facilities.

#### **4. Scope of Study**

The scope of the ROD data base search included sites with RODs signed between 1989 and the present. The data base provided an abstract summary of each site that guided further research, including information about the status of the site, the selected remedy, a description of each operable unit, contaminants of concern (COCs), and possible routes of off-site exposure.

Results from the ROD data base were augmented by a review of the *92/93 Guide to Superfund Sites* (DiGregorio 1992). This listing, current through 1992, characterizes each NPL site, summarizing remedial investigation activities, COCs, regulatory status and other information. Specific data available varied by site, with not all of the previous categories fully described. Comparison of the sites listed in the *Guide* with a comprehensive list of all NPL sites in Region IX indicated the *Guide* was comprehensive.

Sites using landfills only as part of the site remedy ( e.g., for onsite containment of contaminated soil) were not included. Only sites that involved land filling during actual site operations were considered for further evaluation.

The primary objective of each review was to determine the level of effort involved in remedial investigation of each site in sufficient detail to allow a site-to-site comparison. Other important items of information acquired in the review of each site were:

- Designation of the response category of the site investigations. For example, identification of a remedial investigation as a fund lead site (funded by CERCLA/EPA), by PRPs or by Federal Facilities.
- Record of decision status for each site.
- Available information on any presumptive remedies being employed for the proposed or actual site remediation.

Where available this information is included in Table two.

**A. Document Review at EPA's Superfund Information Records Center (non-DOD Sites)**

The Administrative Record of each site with information available at the Records Center was reviewed, and appropriate documents selected for detailed review. The complete history of site investigations was captured and each phase of investigation summarized. Typically, these could be divided into three categories:

- Previous investigations - Including anything prior to the Phase I RI.
- Phase I RI
- Phase II RI

Not all categories were available for each site. The available categories for each site are noted in Table 2.

**B. Document Review at Bechtel's Resource Center for DOD Sites**

Bechtel does not maintain complete administrative records for these sites.

Typically, the available documents were reports describing the latest phases of site investigation. The reports also summarized previous investigations, usually with enough detail to extract the necessary information required to be useful for comparison to other sites.

## **5. Discussion of Results**

This section discusses the information acquired during the review of RI reports and related documents for the six sites

Only one site, Hassayampa Landfill, is not a fund lead or DOD site. The other non-DOD site, Fresno Landfill, is a fund lead

Table 3 summarizes the site sampling and investigation information for the six sites. Only one, Castle AFB, is currently considering the presumptive remedy approach for landfill remediation. A detailed discussion of the presumptive remedy approach at Castle AFB is included as part of the appendix to this report. The presumptive remedy approach did not seem to influence the level of effort of the RI. The presumptive remedy approach may have been added after scoping the RI was completed, since the EPA guidance for presumptive remedy policies and procedures is recent, from September 1993 (EPA 1993).

The presumptive remedy concept is apparently too new to have been applied at most of the other sites. Some sites listed may have the potential to implement presumptive

remedies in the future, but the site investigation process have not reached the appropriate point for consideration of this approach.

**A. Status of Site Investigation**

In the past, RIs conducted under CERCLA typically required several phases of site investigation taking years to complete. The SACM approach was developed to streamline this process.

The six sites reviewed in detail for this study are not all at the same point in the site investigation process. The relative status of each site must be considered when comparing the level of investigation between them. Another factor to consider is that sites that have entered the RI process relatively recently may not, due to the SACM approach, progress through the typical multi-phase RI process as they would have in the past. In particular, Yuma MCAS is still in the RI phase using the SACM and the presumptive remedy approach is being considered for the landfills.

The following table summarizes the remedial investigation status of each of the six sites:

<i>Site</i>	<i>RI Status</i>
Barstow MCLB	Phase I RI soon complete; Phase II RI probable.
Castle AFB	Phase II RI completed
Fresno Sanitary Landfill	RI completed
Fort Ord	Phase II RI completed
Hassayampa Landfill	Stage II RI completed
Yuma MCAS	Currently undergoing the RI Information on site investigation derived from work planned in the Field Sampling Plan. May be candidate for presumptive remedy approach.

## **B. Specific Comparison of Remedial Investigations between Sites**

The remainder of this section compares the level of effort of investigation at the six sites in Table 3. The table provides a summary of the number of wells, sample locations and samples collected for each site. The area of each landfill is then divided by the number of samples collected at that site to give the relative area per sample. These ratios are used as the basis of comparison between sites.

### **1. Groundwater Monitoring Wells**

Four of six sites have groundwater monitoring wells. Two sites are DOD and two sites are non-DOD. Table 3 shows the acreage per well ranges from 0.5 to 8.3 and that both extremes are found on DOD sites. The low value, 0.5 acres/well may reflect the fact that a minimum of 3 wells are needed to determine groundwater flow direction. This is true regardless of the site area, so determination of groundwater flow for a small area (in this case 1.5 acres) would produce the low value.

There was no appreciable difference in the level of effort of groundwater investigation between DOD and non-DOD sites.

### **2. Soil Borings**

Soil borings were used as part of the site investigation at all sites. Soil samples for chemical analysis were collected from borings at five of six sites. The acres/boring ranged from 0.1 to 21. This range may reflect the effect of the landfill size (scale effect), as 0.1 acres/boring was from a very small landfill (2.1 acres) while 21 acres/boring was from the largest landfill (Fresno Municipal). In general the lowest acre/boring ratios were associated with landfills of relatively small area.

The depth of borings varied greatly, from hand auger borings at 5 feet bgs to deep borings for monitoring well installation extending several hundred feet bgs. Few deep borings were completed. Most borings did not exceed 30 feet bgs. Only borings that were sampled for soil chemical analyses are included in Table 3.

Table 3 also tabulates the total number of soil samples collected from the borings and the site area (in square feet) per soil sample. The area ranged from 1,3000 ft<sup>2</sup> (Castle AFB) to 230,000 ft<sup>2</sup> (Fresno Landfill). The mean of the area per sample data was 36,000 ft<sup>2</sup>. None of the actual values were within  $\pm 10$  percent of the mean, reflecting the large variability of the data.

As with the groundwater monitoring well data, there seem to be some scale effect involved in the area per sample, with the two largest landfills (Fresno and Ft. Ord OU2)

having the highest ratios. Soil samples were reportedly not collected at Hassayampa Landfill, the other non-DOD site.

In general, the soil boring data are indicated that soil sampling and investigation efforts were more rigorous at DOD-lead sites.

### **3. Soil Gas Surveys**

Soil gas surveys may be the best investigative method to use as a basis to compare the relative level of investigation between sites. Soil gas surveys are usually designed with regular grid spacing to cover specific areas of ground surface. Differences in the rigor of investigations at various sites should be reflected in a comparison of the area per sample ratios between the sites.

The number of soil gas samples ranged from 9 to 316 per landfill. Castle AFB had both lowest and highest numbers of samples at LF 3 and LF 5, respectively. Most landfills ranged between 20 and 100 soil gas samples collected. Typical sample depths for a regularly spaced grid soil gas survey was 5 to 10 feet bgs, but samples were occasionally taken from deeper borings (approximately 50 feet).

The area per sample ratio ranged from 1,400 ft<sup>2</sup> (Castle AFB) to 34,000 ft<sup>2</sup>(Ft. Ord). This range is an order of magnitude smaller than the range for soil samples/area, probably reflecting the regular grid spacing typically used for soil gas investigations.

The mean of the area per sample was 17,000 ft<sup>2</sup>. Six values of area per sample were below the mean, seven values above the mean, and one value equal to the mean. Four values were within 10 percent of the mean, in contrast to the soil sample ratios, which had no actual values within the 10 percent range.

Although the Fresno Landfill is on the upper-end of the range of area per gas sample, it is still within two standard deviations of the mean.

Based on the data available, there does not seem to be a clear distinction between the rigor of soil gas investigations at DOD and non-DOD sites. However, the data appear to suggest that smaller DOD landfills tended to be subjected to much more rigorous levels of soil gas survey work.

### **4. Test Pits**

Neither of investigations at the non-DOD sites used test pits. Three landfills at DOD sites used limited numbers of test pits to target specific areas of the sites for detailed investigation or to characterize soil and hydrogeology. Because of their limited use, they are not discussed further.

## 5. Miscellaneous

Other sampling and investigative techniques were used for site investigation on a case-by-case basis. These supplemental methods are listed under *Miscellaneous* in Table 3. They are not discussed in detail and no comparison was made between DOD and non-DOD sites.

## 6. Observations and Conclusions

This section presents the conclusions that could be drawn from the comparisons between DOD and non-DOD sites. Relevant observations recorded during document reviews are also noted.

The study was limited by the availability of detailed site information within the time-frame of the study, particularly for non-DOD sites. Since the investigation at Hassayampa has been limited to groundwater and soil borings without soil sampling for chemical analysis, it had limited use as a basis of comparison. Several other non-DOD non fund lead sites have been extensively investigated, but the documents are not available at the Superfund Information Records Center. Further comparison with these sites could be made by reviewing the site record at local repositories or through FOIA requests.

Specific conclusions and observations follow:

- Soil gas provides the best basis of comparison for relative level of effort of site investigation between sites. Soil gas methods are widely used at landfills and generally designed with regular grid spacing. This allows easy and accurate comparison between sites based on area per sample. Using this as an indicator, there is not a significant difference in the level of effort between DOD and the non-DOD site. However, the data appear to suggest that smaller DOD landfills tended to be subjected to much more rigorous levels of soil gas survey work.
- Soil boring investigations and to a lesser extent soil gas investigations may be subject to scale effect where larger sites tend to have greater areas per sample point.
- The DOD sites examined had more rigorous soil boring and soil sampling programs. Groundwater monitoring was relatively uniform across all sites..
- Most site investigations of landfills target similar compounds of concern (COCs), primarily metals, VOCs, and methane. As a result, investigations at different sites generally employ the same basic techniques. These are listed in Table 3. All six sites considered accepted a variety of solid waste with some chemical and potentially hazardous waste. There was no significant difference between COCs at the various sites.

Results relevant to the two primary goals of this study can be summarized as follows:

- The study was not able to definitively compare the level of remedial investigation between DOD and non-DOD sites due to the small number of documents available for review. However, distinct trends were noted; and future study could be used to confirm these apparent trends.
- The presumptive remedy approach is too new to have been considered at most sites. As a result, a precedent is not available where the presumptive remedy approach has been implemented completely.

Castle AFB is implementing a modified presumptive remedy approach at one of the base landfills. Remedial alternatives being retained for use are:

- No Action Alternative (CERCLA requirement)
- Single-barrier cap with institutional controls
- Composite-barrier cap with institutional controls
- Single-barrier cap with treatment of hot spots and institutional controls
- Consolidated landfill with liner, composite-barrier cap, and institutional controls.

## 7. References

DiGregorio, R. C., *92/93 Guide to Superfund Sites*, Pasha Publications, Inc., 1992.

USEPA, *Presumptive Remedies: Policy and Procedures*, EPA 540-F-93-047, September 1993.

Table 1  
National Priority List (NPL) Sites in Region IX with Landfills

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**DOD Facilities**

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**Luke AFB, AZ**

nine landfills  
no ROD

**Williams AFB, AZ**

one landfill  
no ROD

**Yuma AFB, AZ**

unlined landfills RI being conducted  
no ROD  
*Reviewed in Detail*

**Barstow Marine Base, Barstow, CA**

no ROD  
*Reviewed in Detail*

**Camp Pendleton, Camp Pendleton, CA**

landfills  
no ROD

**Castle AFB, Atwater, CA**

*Federal Enforcement*  
landfills  
ROD  
*Reviewed in Detail*

**Concord Naval Weapons Station, Concord, CA**

*Fund Lead*  
landfills  
no ROD

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Table 1(Continued)  
National Priority List (NPL) Sites in Region IX with Landfills

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**DOD Facilities**

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**Edwards AFB, Edwards, CA**

landfills unknown

**Fort Ord, Marina, CA**

landfills  
no ROD,  
*RI Reviewed in Detail*

**George AFB, Victorville, CA**

*Fund Lead*  
no ROD

**March AFB, CA**

*Federal Enforcement*  
seven inactive landfills  
no ROD

**Mather AFB, Sacramento, CA**

*Federal Enforcement*  
Disposal areas  
no ROD

**McClellan AFB, Sacramento, CA**

*Federal Enforcement*  
no specific mention of landfills  
no ROD

**Norton AFB, CA**

*Federal Enforcement*  
landfills and unlined pits  
no ROD

**Travis AFB, CA**

three landfills  
no ROD

**Treasure Island Hunter's Point Annex, San Francisco, CA**

landfills  
no ROD

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Table 1(Continued)  
National Priority List (NPL) Sites in Region IX with Landfills

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**Non-DOD Facilities**

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**Hassayampa Landfill, Hassayampa, AZ**

ROD  
RI available  
*Reviewed in Detail*

**Nineteenth Avenue Landfill, Phoenix, AZ**

ROD  
no RI or FS

**Tucson Intl. Airport, Tucson, AZ**

unlined pits and landfills  
ROD

**Operating Industries, Inc. Landfill, Monterey Park, CA**

ROD  
no RI/FS

**Fresno Municipal Sanitary Landfill, Fresno, CA**

no ROD  
RI/FS  
*Reviewed in Detail*

**Crazy Horse Sanitary Landfill, Salinas, CA**

no ROD  
RI/FS

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Table 2  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<i>Crazy Horse Landfill</i> <i>Salinas, CA</i> 125-acre sanitary landfill operated since 1950. Prior to 1950, it was operated as an open burning dump for 20 years. Expected to operate until at least 1999.	Fund lead	RI unavailable	FS unavailable	no ROD (expected late 1994)	VOCs, carbon tetrachloride	Soil and ground water	Unknown	NA

**Remedial Investigation Summary:**

RI not available for review.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<i>Fresno Municipal Sanitary Landfill</i> <i>Fresno, CA</i> 130-acre landfill operated by the City of Fresno from 1935 until closure in 1989.	Fund lead	Reviewed	Status not determined	no ROD signed at this time	methane, VOCs	Soil and air ground water	FS not reviewed	Ground-water contamination  Gas migration

**Remedial Investigation Summary:**

Previous work includes 43 permanent groundwater monitoring wells, 24 vadose zone monitoring wells for soil gas and groundwater, monthly monitoring of 17 perimeter gas wells, and air sampling

Current RI included air sampling, 196 temporary soil gas sampling points, seven additional permanent multi-depth gas monitoring wells, installation of 7 additional monitoring wells, each screened at 3 discrete intervals.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<i>Hassayampa Landfill</i> <i>Hassayampa AZ</i> 77-acre landfill operated from 1961 to the present. From 1966 to 1970, the type of waste disposal at the landfill was not restricted, but was mostly sanitary type material. About 3.28 M gal. liquid and 4,150 T solid wastes were approved for disposal by the Arizona Dept. of Health Services.	NA	Reviewed	Status not determined	ROD signed 09/30/92	VOCs, semi-volatile organics, pesticides and PCBs	Soil , air and ground water	FS not reviewed	Cover integrity  Air quality  Ground water contamination

**Remedial Investigation Summary:**

Previous work includes 3 monitoring wells were installed in 1981. 3 borings and vadose zone monitoring wells installed at depths of 20 to 30 feet bgs.

Current RI included 12 soil borings, 9 at site perimeter and 3 in site interior. Soil samples collected to depths of approximately 55 to 65 feet bgs. Three additional vertical and 3 angle borings drilled and sampled. Trenching to investigate disposal pits. Magnetic survey. Twelve monitoring wells installed.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<i>Nineteenth Avenue Landfill</i> <i>Phoenix, AZ</i> 213-acre site operated between 1957 and 1979, during which 9 million cubic yards of municipal refuse, solid and liquid waste, and some medical waste were disposed.	State Enforcement	no RI	no FS	ROD signed 09/29/89	VOCs	Surface water	Capping, controlling surface drainage, gas control, institutional controls, air and groundwater monitoring.	Cover integrity  Air quality

**Remedial Investigation Summary:**

RI not available for review.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<p><i>Operating Industries, Inc. Landfill</i></p> <p><i>Monterey Park, CA</i></p> <p>190-acre site was operated as a municipal landfill between 1948 and 1984. During that time, it accepted residential and commercial refuse and water-insoluble, nondecomposable inert solids. Beginning in 1976, the landfill was permitted to receive liquid hazardous waste</p>	Federal Enforcement	RI not available	FS not available	Interim RODS for leachate, gas and general site control; final remedy ROD unsigned	VOCs, metals, landfill gas	Soil and air and ground water	Capping, Leachate removal & control, Gas emission control. Final remedies not yet selected	Cover integrity, air quality, ground- water protection

**Remedial Investigation Summary:**

RI not available for review.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<p><i>Barstow Marine Corps Logistics Base</i>  <i>Barstow, CA</i>            Four landfills are part of the site: CAOC 35, a 17.4 acre Class III landfill operated from 1971 to 1989; CAOC 1, used for disposal of construction debris and dried wastewater treatment sludge; CAOC 6, the original trash landfill, used between 1946 and 1952 for disposal of trash. In addition, the area was used for storing DDT and other unknown materials; CAOC 7, the drum storage and landfill areas totaling 35 acres. Landfill operations included combustion of flammable liquids on the landfill followed by covering the resulting ash with soil. Estimated volume is approximately 40,000 cubic yards.</p>	Federal Facility	Draft RI reviewed	Draft FS not reviewed	No ROD signed	VOCs, PCBs, Pesticides, and Metals	Soil and ground water	NA	NA

**Remedial Investigation Summary:**

CAOC 35: Aerial Infrared Thermographic Survey (AITS), two sampling Strata identified; 40 SOV samples at a 5-foot depth, 5 soil borings with 11 samples and 5 hand auger soil samples.

CAOC 1: AITS; Three sampling strata identified; 10 hand auger soil samples; 5 soil borings drilled and samples collected at a depth of approximately 6 feet bgs; 40 SOV samples collected at a depth of 3 feet bgs.

CAOC 6: AITS; Three sampling strata identified; Thirty two soil gas samples collected at a depth of 5 feet bgs; 10 soil samples collected at a depth of 1 foot, and 10 borings sampled at the surface and 6-foot depth.

CAOC 7: AITS; Four sampling strata identified; Seventy eight soil gas samples collected at a depth of 5 feet; 54 soil borings sampled at depths of 1 to >13 feet bgs.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<p><i>Castle Air Force Base</i>  <i>Atwater, CA</i></p> <p>Landfill 1 (LF-1) is approximately 30 acres used between 1940 and 1950 for general refuse disposal. Landfill 2 is (LF-2) unlined and received an estimated 6,000 cubic yards of general refuse and small quantities of waste chemicals between 1951 and 1953. Landfill 3 (LF-3) is a 2-acre site operated from 1954 to 1956. It accepted general refuse and some chemical waste. Landfill 5 (LF-5) is a large unlined site. Approximately 12,000 cubic yards of general waste were disposed of there between 1971 and 1977. Some trenches were reportedly used for disposal of 55-gallon drums possibly containing waste oils and solvents.</p>	Federal Facility	Draft RI reviewed	Draft FS reviewed	No ROD signed	VOCs, PCBs	Soil and ground water	<p>Capping Options Considered:</p> <p>Single barrier cap with institutional controls (ICs)</p> <p>Composite barrier cap with ICs.</p> <p>Single barrier cap with treatment of hot spots and ICs.</p> <p>Consolidated landfill with liner, composite-barrier cap, and ICs.</p>	Presumptive Remedies evaluated with various capping options

**Remedial Investigation Summary**

LF-1 Previous investigations: Geophysics; 11 soil borings to depths of 30 to 45 feet; Ten monitor wells. Phase I: Geophysics; 68 soil gas sampling points; 37 soil borings to 30 feet with soil samples collected at 10, 20, and 30 feet bgs. Phase II: 13 soil borings in specific areas of LF-1.

LF-2 Previous investigations: 3 monitoring wells and 2 soil borings. Phase I: 14 soil borings to 20 feet bgs and sampled for soil and soil gas. Phase II: One 50-foot soil boring sampled for soil and soil gas.

LF-2 Previous investigations: 2 soil borings. Phase I: 9 soil gas samples and 9 surface soil samples. Phase II: 4 soil borings.

LF-5 Previous investigations: Geophysics; 6 soil borings, 2 surface water sample locations, 8 monitoring wells. Phase I: geophysics; 144 soil gas sample locations; 81 soil borings; 8 surface soil samples. Phase II: 23 soil gas sampling points; 19 soil borings; 2 test pits.

Table 2 (Continued)  
 Summary of Remedial Investigation and Feasibility Study Status  
 Region IX Sites Containing Landfills

Site Description Non DOD Facilities	Funding Source/Mgmt	RI Status	FS Status	ROD Status	Contaminants	Affected Media	Remedial Technologies	Basis for Remedial Technology
<p><i>Fort Ord</i>  <i>Fort Ord, CA</i></p> <p>OU-2: Three inactive landfills comprise about 100 acres and were used during the past 30 to 35 years for residential and commercial waste disposal. The main landfill facility was operated as a Class III landfill. No detailed records were kept on the amount or type of waste disposed.</p>	Federal Facility	Draft Final RI reviewed	Draft Final FS not reviewed	No ROD signed for OU 2	VOCs, Metals	Soil and ground water	NA	NA

Table 3  
 Summary of Site Investigation and Sampling Information  
 Region IX Sites Containing Landfills

Site Description/Acreage	GW Wells	Acres/ Well	Soil Borings	Acres/ Boring	Soil Samples	Ft <sup>2</sup> /Sample	Soil Gas Samples	Ft <sup>2</sup> /Gas Sample	Test Pits	Acres/ Pit	Miscellaneous
<i>Fresno Municipal Sanitary Landfill</i> <i>Fresno, CA</i> 145-acre landfill operated by the City of Fresno from 1935 until closure in 1989.	50	2.9	7	21	28	230,000	196	32,000			Twenty four gas wells = 6 acres/well Also: air monitoring; residential air monitoring, drinking water monitoring, and surface soil sampling.
<i>Hassayampa Landfill</i> <i>Hassayampa AZ</i> 77-acre landfill operated from 1961 to the present.	15	5.1	21	3.6							Three gas wells = 26 acres/well Geophysics, trenching, air monitoring, surface water and sediment sampling at 5 locations
<i>Barstow Marine Corps Logistics Base</i> <i>Barstow, CA</i> CAOC 35 17.4 acres			10	1.7	16	47,000	44	17,000			Geophysics
CAOC 01 17.8 acres			15	1.2	15	52,000	40	19,000			
CAOC 06 2.1 acres			20	0.1	35	2,600	30	3,000			
CAOC 07 35 acres			54	0.6	58	26,000	84	18,000			

Table 3 (Continued)  
 Summary of Site Investigation and Sampling Information  
 Region IX Sites Containing Landfills

Site Description/Acreage	GW Wells	Acres/ Well	Soil Borings	Acres/ Boring	Soil Samples	Ft <sup>2</sup> /Sample	Soil Gas Samples	Ft <sup>2</sup> /Gas Sample	Test Pits	Acres/ Pit	Miscellaneous
<i>Castle Air Force Base</i>											
<i>Atwater, CA</i>											
LF 1      30 acres	10	3.0	60	0.5	155	8,400	80	16,000			
LF 2      1.5 acres	3	0.5	17	0.1	52	1,300	44	1,500			
LF 3      2.0 acres			6	0.3	23	3,800	9	9,700			
LF 4      10.5 acres	2	5.1	90	0.1	297	1,500	316	1,400	2	5.1	Two surface water samples
<i>Fort Ord</i>											
<i>Fort Ord, CA</i>											
OU 2      100 acres	12	8.3	13	7.7	67	65,000	130	34,000	6	16.7	Quarterly GW monitoring
Site 17    8.0 acres			11	0.7	43	8,100	14	25,000	20	0.4	Geophysics
Site 31    12.0 acres			39	0.3	119	4,400	21	25,000			Geophysics
<i>Yuma Marine Corps Air Station</i>											
<i>Yuma, AZ</i>											
CAOC 4    14 acres			2	7	41	15,000	71	8,600			Residential surface soil sampling (Number of samples not available), downgradient GW sampled with Hydropunch
CAOC 8    68 acres							134	22,000			Three groundwater samples. Surface soil samples to be collected based on in-field screening methods